School-wide strategies for reducing stress and promoting healthy learning environments: Effects of interventions

Kathleen Liberty, PhD.
School of Health Sciences
University of Canterbury
Christchurch, New Zealand

Paper Presented at the 10th Educational Psychologists Forum,
Wellington, New Zealand, 26-27 November 2017[1]

Research has shown that childhood experiences shape adult lives and that experiencing adverse events during childhood can have lifelong consequences (Felitti et al. 1998). The more adverse experiences reported, the higher the risk of negative health outcomes including depression, alcoholism, obesity, cancer, heart disease, stroke, diabetes, suicide and early death (Felliti, 2009).

Adverse experiences may also produce trauma: "Trauma results from an event, series of events, or set of circumstances that is experienced by an individual as physically or emotionally harmful or threatening and that has lasting adverse effects on the individual's functioning and physical, social, emotional, or spiritual well-being" (Trauma-Informed Care in Behavioral Health Services, 2014). Events are considered traumatic if they are associated with a high risk of causing mental disorders, such as post-traumatic stress disorder (PTSD).

Risk factors for the onset of PTSD in children who have experienced traumatic events consistently include female gender, minority ethnicity and low socioeconomic status (SES), parent mental health problems, pre-existing mental health problems as well as the type, intensity, duration and the number of traumatic events (Alisic et al., 2014; Contractor, Layne, Steinberg, Ostrowski, Ford & Elhai, 2013; Shaw, Espinel & Schultz, 2012).

PTSD in children, and PTSD resulting from in-utero exposure to traumatic stress are associated with subsequent developmental delays, poorer physical health, comorbid mental health problems, suicide ideation and substance abuse, as well as increased school absences, poor learning, memory and achievement, and impaired relationships with parents, siblings, peers and teachers (Breslau, 2009; Chu & Lieberman, 2010; Delamater & Applegate, 1995; Fairbank & Fairbank, 2009; Laplante, Brunet, Schmitz, Ciampi, & King, 2008; Scheeringa, 2014). Children who have post-traumatic stress symptoms (PTSS), but do not meet formal diagnostic criteria for PTSD, are also at risk of these outcomes (Pynoos, et al.,1993; Shaw, Espinel & Schultz, 2012).

Exposure to prolonged stress can disrupt the development of the brain and neurological systems of young children (Harvard Center on the Developing Child, 2006). PTSD is

[1] *Acknowledgements*: Study Participants: Principals, teachers, children and their parents. Maureen Allan, Te Paeroa RTLB Cluster, John Bangma, Canterbury Primary Principals Association, The Rata Foundation, University of Canterbury. Michael Tarren-Sweeney, Lee Hooper, Sonja Macfarlane, and Anne Richardson from the University of Canterbury.

associated with changes to structures in the brain, notably the amygdala, hippocampus and prefrontal cortex (Blair & Raver, 2012; De Bellis & Zisk, 2014), and dysregulation of the autonomic nervous system and the hypothalamic-pituitary-adrenal (HPA) axis which control biological functions related to sensory processing, breathing, heart rate, sleep, circadian rhythm, digestion, and so forth (Gupta, 2013; Koss & Gunnar, 2017; Rees, 2014; Weems, 2015).

Studies indicate that PTSD arising in early childhood is likely to persist (Chu & Lieberman, 2010; Scheeringa, 2008). The most effective treatment for children with PTSD is individual or small-group trauma-focused cognitive behaviour therapy (CBT), and this is most suitable once children have reached the ages of 10-12 years (Barrett, Farrell, Ollendick & Dadds, 2006; Smith et al., 2013). Age and developmental status is important because children at these ages are likely to have developed to the stage of cognitive development required to differentiate thoughts, feelings, and emotions, and to be able to retrieve and discuss memories – which are typically involved in CBT (Grave & Blisset, 2004; Salmon & Bryant, 2002; Zilberstein, 2014).

Natural disasters, including earthquakes (EQs), are traumatic events associated with significant and persistent mental health effects in the exposed population that are qualitatively different from the effects of other types of trauma (Carrion, Weems & Bradley 2010; Galea, Nandi & Viahov, 2006). Unforeseen natural disasters affect the entire community simultaneously, significantly changing the types of medical and health services available. Disasters also reduce the community support that is commonly available when individual families experience a traumatic event. Disaters also can result in more than doubling of baseline rates of mental health problems affecting an entire birth cohort (Masten & Narayan, 2012; McLaughlin, Fairbank, Gruber, Jones, Lakoma, Pfefferbaum, Sampson & Kessler, 2012; Overstreet, Salloum, Burch & West, 2011). And these effects are persistent (Moore & Varela, 2010; Najarian, Sunday, Labruna & Barry, 2011; Shaw, Espinel & Schlutz, 2012; Wang, Chan & Ho, 2013).

Although it is commonly believed that younger children would be more resilient, and/or 'forget' disasters they experienced at a young age, research has shown this to be false. Rates of PTSD in young children have been reported to range from 17% post 911 to 50% 2.5 years post-Hurricane Katrina (Schreeinga, & Zeenah, 2008). Developmental delay was reported in 15% of children aged 3-5 years from disadvantaged areas of Miami, Florida (USA), 18 months after Hurricane Andrew (Delamater & Applegate, 1995). In addition to direct experience of traumatic events, children who were exposed to severe disaster-related stress in utero have been shown to be more likely to be born low birth-weight, have lower cortisol levels, and lower IQ scores and language difficulties, as well as lower school achievement (Laplante, Brunet, Schmitz, Ciampi, & King, 2008).

Earthquakes are unique natural disasters because they occur without warning, can have devastating consequences within a few seconds, and the effects are widespread throughout the community (Huang-Chih Chou et al., 2003; Guha-Sapir & Vos, 2011; Shaw, Espinel & Schlutz, 2012). Unlike other natural disasters, such as hurricanes, floods and bush fires, there is no warning to evacuate, protect one's family, or gather emergency supplies before an earthquake. Stress from unpredictable and uncontrollable events has more severe impacts on the brain, as compared with predictable and controllable sources of stress (Munroe et al., 2017; Tottenham & Sheridan, 2010).

Earthquakes also generate unique community-wide post-earthquakes stressors (Galaea, Nandi & Vaihov, 2005; Schiff, 1999; Smith, 2013). Earthquakes are invisible, as they occur beneath the surface of the earth, which makes them much more difficult to explain to children, or for children to understand, as compared to, say, hurricanes or floods, which can be seen coming (Ross & Shuell, 1993). Research has shown that children younger than about seven years do not understand the concept of chance events, and often attribute intention or purpose to such events (Piaget & Inhelder, 2014). Thus, conventional explanations for earthquakes (EQ) as 'chance' or 'accidental' which are used to reassure and help older children and adolescents, cope with disasters, are unlikely to be understood or ameliorate symptoms in young children (Prinstein et al., 1997).

Earthquakes also destroy essential public services to a far greater extent than other disasters. In other disasters, the distribution of the power, water, and sewage services is disrupted, while in earthquakes, both the distribution networks and the substations are destroyed, resulting in much more extensive damage, and more extended rebuild periods (Schiff, 1999; Huang-Chih Chou, et al., 2003). Damage to buildings is also different in earthquakes, in that the foundations of many frame and masonry buildings are destroyed, and bridges, wells, and river and stream embankments can be damaged (Smith, 2013). Earthquakes have unique impacts on health care systems because of crush injuries, respiratory impacts, and disruption of basic services due to structural damage to medical centres (Norris, Friedman & Watson, 2002; Norris, Friedman, Watson, Byrne, Diaz & Kaniasty, 2002).

Exposure to earthquakes increases the risk of post-traumatic stress disorder (PTSD) and post-traumatic stress symptoms (PTSS) in children (Kar, 2009; Overstreet, Salloum, Burch & West, 2011; Proctor, Fauchier, Oliver, Ramos, Rios & Margolin, 2007). For example, 71.6% of children aged 4-5 years had distress symptoms 8 months after the Northridge, California M6.7 earthquakes (Proctor et al., 2007); 42.6% of children in grades 1-9 had probable PTSD eight months after the M9.0 Great Japan earthquakes (Usami, Iwadare, Kodaira, Wantanabe, et al., 2012); 22.9% of children aged 6-10 who lived very near the epicentre of the M5.7 L'Aquilla, Italy, earthquakes had PTSS 12-17 months later (Feo et al., 2014); 54.2% of school children had PTSD 18 months after an M6.9 earthquake in Armenia (Goenjian, Pynoos, Steinberg, Najarian et al., 1995) and 28% of children aged 8-15 had severe or very severe PTSS 36 months after an M7.4 earthquake in Marmara, Turkey (Eksi & Braun, 2009).

Another important point is that, in the case of reactive post-traumatic stress (PTS) associated with earthquakes, parenting does not "cause" PTS. The child's fear response system, including the amygdala and the HPA axis, is automatically activated by the sensation of the earth shaking and the accompanying noise and visual signals. It is the child's bodily proprioception of an earthquake that immediately activates the HPA axis, not anything caused by parents, or a parent's reactions at the time an earthquake struck. Children experienced more than 15,000 earthquakes and aftershocks in the Christchurch area (Geonet Science, 2014), and it is the duration, frequency and intensity of earthquakes, the number of repeated HPA activations, and the timing of these events during the sensitive periods of child development that has caused the post-traumatic stress in children.

Research indicates that children can exhibit PTS symptoms independent of parenting styles (Salmon, Sinclair, & Bryant, 2007) and a recent review reported parenting contributed only between 2-5% of the variability in children's symptoms (Williamson, Cresell, Fearon, Hiller, Walker & Halligan, 2017). Two recent reviews of treatments both reported that including parents in the treatment did not have any impact on treatment outcome (Gutermann,

Schwartzkopff & Steil, 2017; Morina, Koerssen, & Pollet, 2016), and this may be because parenting behaviour is not the cause of the behaviour problems and because treatments tend not to address the biological roots of PTSD.

It has been estimated that it may take ten or more years for a community to recover to pre-disaster functioning levels after an earthquake. Interventions to improve mental health are aimed at reducing the length of time needed for recovery. As there will always be a gap between the resources available for individual treatments and the number of individuals in need, communities and researchers have sought to address this gap by providing interventions in schools. Schools, including trauma-informed schools, have implemented interventions to reduce the symptoms of PTSD on affected children. Literature reviews (Forman-Hoffman et al., 2013; Rolfsnes & Idsoe, 2011; Zakszeski, Ventresco & Jaffe, 2017) pointed out that typically schools were only the setting for traditional therapeutic interventions, which were delivered by non-school personnel to only selected children in a school, and were not whole-school strategies.

Canterbury experienced an unprecedented series of large earthquakes, beginning with an M7.1 earthquake on 4 September 2010, which disrupted the community, closed schools, destroyed much of the infrastructure and damaged family homes (McColl & Burkle, 2012). The September earthquake was followed by 7 earthquakes of $M \leq 5.0$. Then, on 22 Feb 2011 at 12:51 pm, a shallow M6.2 earthquake with an epicentre within Christchurch city limits and upward ground acceleration velocities of 27.6 -72.6 cm/s hit (Crowe, 2013; Cubrinovski, Huges, Bradley, McCahon et al. 2011; Daily Mail Reporter, 2010). The February 2011 earthquake resulted in 6600 injuries and 185 deaths, in a population of about 440,000 (McColl & Burkle, 2012; Thornley, Ball, Signal, Lawson-TeAho, & Rawson, 2013). The February earthquake was followed by more earthquakes of M5.0 or greater over the next 11 months, and approximately 14,000 aftershocks of lesser magnitude (Crowe, 2013; Geonet Science, 2014).

This series of earthquakes is unique because of the extended period over which large magnitude earthquakes were experienced and because of very strong vertical ground accelerations which lifted buildings off their foundations (McColl & Burkle, 2012; Fergusson & Boden, 2014; Reyners, Eberhart-Philips & Martin, 2014).

The earthquakes caused liquefaction across the central and eastern parts of the city, destruction of the power, water, and sewage systems, extended school closures, destruction of 10,000-15,000 family homes, damage to more than 110,000 family homes of an estimated 140,000 pre-earthquake, and caused a significant drop in the nation's gross domestic product (Chang, Taylor, Elwood, et al., 2014; Cubrinovski, Robinson, Taylor, Hughes & Orense, 2012; Ferris & Petz, 2012; Guha-Sapir, Voc, Below & Ponserre, 2012; Massie & Watson, 2011; Van Ballegooy, Malan, Elwood, et al., 2014).

The frequency, severity and short inter-quake intervals of the Canterbury earthquakes meant that residents repeatedly experienced acute events, immediate disaster responses, and longer-term consequences of the disaster in overlapping pathways. The frequency of the aftershocks impeded recovery and increased the risk of mental health problems, as well as reduced wellbeing. Some researchers believe that it is exposure to the vast number of post-disaster stressors and the duration of the exposure over years that is a contributing cause of post-traumatic stress (Kessler, McLaughlin, Koenen, Petukhova, & Hill, 2012). In 2012, more than half of the respondents to the CERA Wellbeing Survey reported that they lived in a

damaged home. There was a related loss of social housing, with 95% of social housing units sustaining damage. Subsequently, rents in available homes increased to high levels (35.7% increase from November 2010 to November 2013). Increasing house and rent prices, coupled with the loss of homes due to damage, was associated with crowding, and with more people living in substandard circumstances (CERA Wellbeing Survey, 2013, 2014). Several additional natural disasters – flood and fire – have also occurred in Christchurch neighbourhoods.

Compared with pre-earthquake levels, the demand for mental health services had increased by 700 adults and 300 children per month by March 2017 (Meier, 2017). Secondary students on the East side of Christchurch were particularly noted as suffering from mental health problems including anxiety, low self-esteem and self-harm in April 2017 (Martin, 2017; The Prime Ministers Youth Mental Health Report, 2016). As one principal described the situation in her high school: students were "regularly" self-harming. "It is no longer surprising, and it's happening with students at all year levels we work with" (Carville, 2017).

Liberty, Tarren-Sweeney, Macfarlane, Basu, and Reid (2016) studied the effects of the Christchurch earthquakes and subsequent post-disaster stressors on children's behaviour as they enrolled in five schools in the east and south parts of Christchurch, the part of the city most affected by the earthquakes. They reported a significantly increased prevalence of children with high numbers of behaviour problems and six or more post-traumatic stress symptoms as compared to a group of children who had not been exposed to the earthquakes, assessed before they started school. Their study has continued, with teachers and parents providing information on 308 children who started school in 2012, 2013, 2014, and 2015.

By the end of 2015, principals, teachers and parents in the ongoing study were reporting high levels of stress associated with very concerning child behaviour problems. Strategies implemented by schools, including, for example, programs to reduce anxiety, Positive Behaviour For Learning, mindfulness, and referrals for children to mental health services, had limited impact. Children, parents, principals, teachers, assistants, staff and school volunteers—all were feeling the effects of the accumulation of stressful events. As stress accumulates, everyone becomes less able to cope with the next trigger. In families and schools, if one person is feeling stressed and having difficulty coping, everyone around them will also feel the effects. Children were classrooms where 1 in 5 children had high numbers of PTS symptoms, and more than half of the children had arousal symptoms. That would make the classroom one with many stressors associated with many poorly behaved children who were struggling to learn, were unpredictable and often had angry, irritable or defiant outbursts. This environment would make it more likely that the effects of Trauma-Focused-Cognitive Behaviour Therapy or other psychotherapies provided to individual or small groups of children would not be maintained. An analysis conducted for the school principals indicated that 42.2% of study children showed increasing or high levels of behaviour problems.

Principals and teachers increasing concerns about children's behaviour provided the impetus for the "Reducing Stress in Schools" project. The aim of this project was to evaluate the effects of school-wide interventions designed to improve children's health.

Methods

The study utilised an interrupted time series (Bor, 2016), in which the data collected at the end of 2015 before the principals' implementation decisions served as the baseline pre-intervention. Data collected by teacher-report at the end of 2016, following the implementation of the strategies, was used to evaluate the Reducing Stress project. All procedures were approved by an institutional human ethics committee, and informed consent from schools and parents was obtained. Quality assurance processes were used to estimate validity.

Participants

A purposive sampling procedure was used to recruit schools and participants in the EQ-exposed group, similar to that used in other disaster studies (Bal, 2008; Moore &Varela, 2010). Invitations to participate in the study were sent to primary schools from neighbourhoods highly affected by the EQ in the south and east side of Christchurch, and five schools consented. Characteristics of the schools are shown in Table 1.

The participating children entered school between Term 4 2012 through Term 4 2015. Of the 308 children, 54% were boys, and 46% were girls; 74.8% were European, and 17.3% were Māori, and 82.5% were living with at least one biological parent. All attended preschool (New Zealand provides 20 hours free preschool from age 3.5 years).

Parents reported on earthquake exposure. The children were born between 2007 and 2011 and were in Christchurch through the earthquakes to the school entry. All of the children were younger than 42 months of age at the time of the first earthquake, and some were not yet born. Parents reported on additional known factors related to the seriousness of exposure: 1.7% of study children were themselves injured, and 9.7% knew someone who was injured or died. More than 66% of the children lived in a house that was damaged, 94.9% of the children experienced loss of services, water, electricity, and phone and almost 50.2% of the families reported high levels of stress. According to the Land Damage Classification categories (CERA, 2012), 17% had homes with TC3 (severe land damage) classification, 77.8% had homes with TC2 (moderate) classification, and 5% had homes with an unknown classification (social welfare homes). No participants had homes with the TC1 classification. Considering their neighbourhoods, 30.8% lived in low-, 38.0% in mid- and 30% in high-deprivation neighbourhoods. All of these are very important indicators of the severity of exposure to recognised disaster-related stressors.

Settings

The school-level characteristics are shown in Table 1 (pseudonyms are used for school names). The school decile, year levels included in the school and roll are publicly available. All schools had buildings that were damaged in the earthquakes, and some schools had ongoing repairs. At the same time, some changes were designed to increase the flexibility of the learning spaces, for example, by removing or widening doorways, as part of the innovative learning environments project (Ministry of Education, n.d.). Between 2012-2016, all schools in the project were using traditional single-cell classrooms.

Pre-Intervention, Alpha School had slightly fewer study families reporting high stress and Beta had the most parents reporting high stress. Kauri School was the only low decile school, and also had the most children with 8+ behaviour problem scores entering school.

Table 1. Characteristics of Study Schools Pre-Intervention.

Characteristic	Alpha School	Beta School	Fantail School	Tui School	Kauri School
Years (Grades)	1-6	1-8	1-8	1-8	1-6
Roll	480	350	450	450	300
Decile	High	Mid	Mid	High	Low
Study Families with High EQ-Stress	44.4%	61.2%	47.9%	52.3%	52.6%
Children with 0 Behaviour Problems	38.8%	45%	31.6%	26.4%	18.9%
Children with 8+ Behaviour Problems when starting school	16.4%	6.7%	15.8%	31.9%	48.7%

Measures

Behaviour Problems. Problem behaviours were measured by teacher report using the *Behavior Problems Index (BPI*). The BPI has been used in longitudinal studies in the United States since the 1990s (Byrd, Weitzman & Auinger, 1997; National Longitudinal Surveys, n.d.; Panel Study on Income Dynamics, 2017; Rodgers et al., 2017). Teachers had no difficulty scoring or understanding the BPI and rated each child on the 26 BPI items using a 3-point Likert scale (0=not true, 1=sometimes true, 2=often true). (For more information, see Liberty et al., 2016).

*Post-traumatic Stress Symptom*s (PTSS). Measuring the number of symptoms in children against a cut-off point is used to define PTSS in many research studies, due to the difficulties of diagnostic protocols and processes in diagnosing young children against specific PTSD criteria, particularly in post-disaster situations, when so many children are affected at the same point in time (Fairbank & Fairbank, 2009; Feo, Di Gioia, Carloni, Vitiello, Tozzi & Vicari, 2014). Fifteen or more different symptoms of PTSD in children have been identified, including irritability, anger outbursts, fear, anxiety, impulsivity, social withdrawal, sadness, difficulty concentrating and sudden mood changes (American Psychiatric Association, 2013; Scheeringa, Zeanah & Cohen, 2011).

Respondents in studies of PTSS in young children are typically the child's parent or main caregiver. However, teachers may be more reliable reporters of children's behaviour including PTSS (Chemtob, Nomura, Rajendran, Yehuda, Schwartiz & Abramovitz, 2010; Widyatmoko, Tan, Seyle, Mayawaati & Silver, 2011), because they can report more conservatively on children's symptoms, possibly due to the fact that they have a far wider experience-base of typical and atypical behaviours as compared to parents, or might have less bias (Maoz, Goldstein, Goldstein, Axelson et al., 2014).

For the present study, a 10-item screening-type subscale for PTS symptoms in young children was constructed from teacher-reported BPI items matched to the CBCL PTSD subscale items suitable for children aged 6 and younger, as described by Dehon and Scheeringa (2006). Teachers were blind as to which items were used to estimate PTS. This approach to estimating symptoms of post-traumatic stress was approved by a peer-review process (Liberty et al., 2016).

Environmental Stressors. Informal observations were conducted in the fourth term of 2015 to determine the presence, or absence, of environmental variables that were reported to be associated with stress in the literature review. These included (a) observing the colour of classroom walls, the type and density of room decorations, (b) estimating noise levels using an iPad app, SPLnFFT Noise Meter and (c) estimating light levels using an iPad app, Light meter by Vlad Polyanskiy). Teachers reported times of day that were best for learning and the times that behaviour problems were high in their classrooms, and their observations as to the causes of behaviour problems. Principals reported the overall schedule of the school day.

Reducing Stress Intervention Strategies

"Reducing Stress" Strategies consisted of a package of interventions that met the following criteria: (1) fit within the national bicultural context of New Zealand, as established by the Treaty of Waitangi; (2) suit educational considerations of conditions at study schools and within the context of learning in New Zealand schools (e.g., inclusive, Positive Behaviour for Learning, Ka Hikatea; national standards) (3) be age and developmentally appropriate (4) fit with the psychological research into the effects of natural disasters on children (5) promote wellbeing rather than focus on deficits (6) have research evidence that children's mental health and wellbeing was improved (7) fit with the biological impacts of trauma on young children.

Seventeen interventions were recommended as a package for reducing stress in schools (the interventions are listed in Table 2). The individual interventions in the Reducing Stress Strategy are described in the following section.

Improving Teacher and Principal Wellbeing

Three interventions were recommended to improve teacher and principal wellbeing.

Professional Development. Psychoeducation is a strategy that is highly recommended for all professionals post-disaster (Shaw, Espinel & Schlutz, 2012), is a component of cognitive behaviour therapy, and is acceptable within the context of professional development. Professional development would deliver information to address teachers' misconceptions, such as that the children's problems are a result of a breakdown in their teaching competence, or their parenting, or that children are 'born naughty' (Tremblay, 2010).

The recommended intervention was that professional development is provided to teachers about the effect of natural disasters and post-disaster stressors on children's behaviour and learning.

Teacher and Principal Wellbeing. Child behaviour problems predict teacher stress and classroom emotional climate (Friedman-Krauss et al., 2014). The greater the number of behaviour problems, the higher the degree of teacher stress. However, teacher health and safety is a regulatory matter for schools, and a teacher's wellbeing is a private matter that teachers may well not wish to discuss in their place of employment.

The recommended intervention was that teachers be invited to consider a range of wellbeing strategies within their school, and several suggestions about these were made.

For principals, The Reaching-In Reaching-Out Resiliency Training Programme for Service Providers (RIRO) strategies have been specifically designed for young children and their

teachers to build positive relationships toward resilience and coping skills (Pearson & Hall, 2017).

The recommended intervention for principals of strategy schools who were implementing strategies was training in RIRO, and to evaluate its suitability for the teachers during 2017.

Improve Classroom Environment

Calm-Down Room Decor. Recent studies have shown that classrooms that are overly decorated or cluttered, particularly with hanging objects or artwork, are associated with reduced concentration and learning for children with attention problems, as compared to classrooms with low levels of decorations (Barrett, Davies, Zhang & Barrett, 2015; Fisher, Godwin & Seltman, 2014). One of the symptoms of chronic stress is reduced attention, and highly decorated classrooms may exacerbate this problem.

An additional consideration is that 83% of study children saw falling objects during the earthquakes, according to their parents' reports. It is hypothesised that a hanging decoration in a fearful child's peripheral vision may be associated with an unconscious fear that objects above them will fall. The hanging decorations, flickering in the child's upper peripheral vision, may be a trigger for intrusive thoughts, a loss of concentration or other reactions associated with posttraumatic stress. Observations showed that approximately 94% of the school classrooms had hanging decorations. All of the classrooms were more decorated than the minimum recommended in the reviewed studies. However, classroom decorations can also have an instructional purpose, such as providing cues and information useful for learning (Imuta & Scarf, 2014), and displaying children's work may improve children's self-belief about the value of their work (Maxwell & Chmielewski, 2008).

The recommended interventions were to remove all hanging decorations and to remove all wall decorations above the child's eye level and to limit wall displays of instructional aids and children's work to the child's eye level and below.

Wall Colour. Studies that have evaluated wall colour have reported that children's achievement is lower in red-painted rooms compared with green rooms (Elliot & Maier, 2012) and that children feel more excited in red and purple conditions (Brooker & Franklin, 2015). Pale blue has been associated with lower levels of arousal (Küller & Janssens, 2009).

The recommended intervention was that paper of a suitable shade of pale blue be used to make a temporary wall covering to obscure the dark or intense walls of classrooms.

Light Levels. Light levels are thought to affect mood, in that brighter light is associated with increased dopamine and serotonin production (Golden, Gaynes, Ekstrom, Hamer, Jacobsen, Suppes, et al., 2005); serotonin is also hypothesised to have an important role in the overall functioning of the autonomic nervous system (Grider, Bertrand & Bornstein, 2017). Sitting next to the window on a sunny day will provide more than the 1000-lux of bright light that is associated with full alertness and better moods. Focus lighting of 1000lux at desk level has been shown to improve the reading of children in USA grade 3 who are struggling (Mott, Robinson, Williams-Black, & McClelland, 2014). Dim light may reduce hyperarousal levels and may also signal 'sleep' to the autonomic nervous systems of children who are tired, and teachers noted that turning off the lights or pulling the curtains across windows were sometimes used to quieten class activity. However, dim light is not suitable for optimum learning (Sleegers, Moolenaar, Galetzk, Pruyn, Sarroukh, & van der Zande, 2012). The lux

level needed for reading, writing, and tasks at desks or tables and for listening to teachers has been reported at 300 lux in research studies and this is the standard for learning set by the New Zealand Ministry of Education (n.d.). Observations of the level of light in the centre of the classrooms showed that 51.5% of the observations were not in the acceptable range – with light that was too dim for learning.

The recommended interventions were to (1) remove decorations from windows (2) seat children with learning problems near the window during instruction, (3) open curtains during instructional sessions and (4) turn on lights during instructional sessions.

Noise Levels. Noisy classrooms reduce children's learning and collaboration (Maxwell & Evans, 2000; Mealings, Buchholz, Demuth & Dillon, 2015; McKellin, Shahin, Hodgson, Jamieson & Pichora -Fuller, 2011). Stress-sensitive children are likely to be more sensitive to noisy classrooms, as high noise can trigger a fear reaction, and they also will speak more loudly to be heard. A noisy classroom is very stressful for teachers, as well, because the teacher must speak an average of 10 decibels louder than the class to be heard (Pereira, Tavares, & Martins, 2015), so noise levels can rise quickly. Noisy classrooms can act as a constant source of stress for children, particularly children with dysregulated autonomic nervous systems which modulate and interpret sounds from their environment (Horn et al., 2017).

A noise level within the range of 35 to 40 decibels is considered to be optimum by the Ministry of Education (n.d.). In the Strategies classrooms, the range of mean noise levels across the schools was between 61 and 71 decibels.

The recommended intervention was to reduce noise using a freely available app, Too Noisy Pro (http://toonoisyapp.com/), which could be displayed in each classroom, although only anecdotal evidence was available to support this intervention. Other possibilities, such as installing noise cancelling wall panels, were beyond the scope of this project.

Improve Child Health

Play Eat Learn. One aspect of the autonomic nervous system that is disrupted by chronic stress is circadian rhythm – the 'body clock' (Rees, 2014). According to the principals of our Strategy schools, the general timetable begins with some children arriving at school from 8 o'clock, and school starting at 9 o'clock. The times of day that teachers find the most and least productive for learning were determined through the interviews. There was a consensus that the best times for learning were approximately between 9 and 11:30 in the morning and the most difficult times for classroom behaviour were following tea and lunch breaks, and late afternoons, before the end of the school day at 3 pm. Some teachers commented that some children are already upset and frazzled by the time school begins. A common trigger was that behaviour was affected by conflict and excitement in the playground during play times in the morning and at lunch, and "this spills over into the classroom". Other teachers explained: children are tired and have done a lot already [at the time behaviour problems occur; children may not have eaten enough lunch, as some eat a lot of [the food sent with them to school by their parents] at morning teatime; there are low energy levels and high arousal, issues arising on the playground, hot or raining weather, and large gaps between eating times."

The identification of possible relationships between scheduled eating times and behaviour problems provides a key factor to understanding the context in which behavioural problems were occurring in the Strategy Schools, as circadian rhythm, a function of the autonomic

nervous system, is disrupted by PTSD. Traditionally, morning teatime and lunchtime include a time set aside to eat followed by a time to play. Circadian rhythm is affected by the time of day that eating occurs, and sufficient energy from food is needed for learning. According to Getlinger and colleagues (1996), "It is crucial that children of primary school age receive adequate meals to eliminate transient hunger, which may interfere with classroom performance. Proper nutrition has been linked to readiness to learn, decreases in discipline problems, and increased alertness in the classrooms." Thus, one important environmental context was the schedule of eating in relation to children's learning and energy levels.

Playtime is vital to children's development and learning, and having play breaks during the school day can improve children's thinking, appetite and learning. However, physical activity and eating are also body functions of the autonomic nervous system, and, in children with post-traumatic stress symptoms, these functions are highly likely to be dysregulated (Gupta, 2013; Rees, 2014). The dysregulation of the autonomic nervous system associated with PTSD means that appetite and the processing of food by the body are also affected. PTS can affect the digestion and processing of nutritional food (Chrousos, 2009; Van der Kolk, 2004; Zhang, Zhang et al., 2015). It is estimated that about 87% of New Zealand school children eat a healthy breakfast before school while 13% do not (Ministry of Health, 2013). Children who miss breakfast, or children who have dysregulated autonomic nervous systems may be missing out on the food necessary to sustain attention and maintain control over their behaviour (Adolphus et al., 2013; Wesnes, Pincock, Richardson, Helm, & Hails, 2003). One approach to assisting in the healthy re-regulation of the autonomic nervous system may be to align the activity and eating functions with normal body rhythms (Yoshizaki et al., 2013), a form of chronotherapy.

Changing the order of recess or playtime and lunch has been shown in overseas studies to be associated with more food being eaten, a calmer lunchroom atmosphere, a dramatic decrease in disciplinary problems during play time, and improvement in children's ability to pay attention in classrooms (Bark et al., 2010; Hunsberger, McGinnis, Smith, Beamer, & O'Malley, 2014). This may be because the children are not rushing their lunch to get out to the play with friends, or to claim a particularly desirable piece of play equipment, or similar reasons.

The recommended intervention involved changing the schedule of the school day – reversing the order of eating and playing for morning tea and lunch. In the USA, this intervention is called "Recess Before Lunch" or 'reverse recess.' As New Zealand schools do not use the term 'recess' and refer to "playtime', the phrase "Play Eat Learn" was invented as a name for this strategy.

Drink-to-Think, Think to Drink. Research has shown that children are often dehydrated, and dehydration can affect the growth of their brain, as well as negatively affect their thinking during the school day (Bar-David, Urkin & Kozminsky, 2005; Kempton et al., 2011; Kenney, Long, Cradock, & Gortmaker, 2015). Many children are likely to be dehydrated following play and lunch, and dehydration can contribute to poor concentration, memory and increase impulsive behaviour. Water can be drunk with lunch, but children might still be dehydrated after lunch, as children's needs for water are different to adults (D'Anci, Constant & Rosenberg, 2006; Kenney et al., 2015). The brain is comprised of up to 73% water (Department of the Interior, 2016) and water is required to think (Gowin, 2010). Research has shown that PTSD can also affect dehydration (Turnbull, 2006). When children are dehydrated, their cognitive function can be impaired. Giving children water to drink can

make an immediate and dramatic impact on their cognitive ability (Fadda et al., 2012; Fuchs et al., 2016)

The standard recommendation for children is five glasses per day (1 litre) for 5 to 8-year-olds, seven glasses (1.5 litres) for 9 to12-year-olds, 8 to 10 glasses (2 litres) for 13+ years (Gibson-Moore, 2013; Ministry of Health, 2015).

The recommended intervention is a health education programme, "Drink to Think, Think to Drink" (McClelland, Ismail, Liberty & Hooper, 2016). This programme is comprised of the following elements: Teacher Professional Development, Parent Information, a programme for students, including self-monitoring, and a transparent water bottle for each teacher (to model drinking water) and each student for in-classroom use. Each pupil received a drink bottle during the information session (Sistema Water systems). The bottle was introduced as a gift to help the child look after themselves. As this intervention was developed for this project because no suitable programme could be identified in the literature, there is no evidence to support its use. However, each component of the programme is evidence-informed.

Whole Meal+ Snack. As many children do not eat breakfast, or may eat a breakfast that is high in sugar, research into improving children's health and academic achievement has studied the effect of a mid-morning snack on children's learning (Benton & Jarvis, 2007; Smith & Wilds, 2009). These studies provide evidence that adding a high carbohydrate snack to the school day has potential benefits, particularly for children who do not eat breakfast and for those with PTS symptoms whose digestion of foods may be affected.

The recommended intervention was the introduction of a mid-morning snack consisting of complex carbohydrates (wholemeal bread) with dietary supplements from spreads (i.e., butter, marmite, vegemite) into the Play Eat Learn schedule. The composition of the recommended snack was based on nutritional analysis of foods available in the community.

Parent Strategies

Parent Information. The provision of psychoeducation through schools has shown promise for parents of children with emotional or behavioural disorders and in understanding PTSD (Lukens & McFarlane, 2004; Pollio et al., 2005). Psychoeducation is also a positive focus, rather than a deficit focus, and emphasises understanding and prevention, rather than labelling and blame, and fits within the inclusive society that New Zealand is building.

The recommended intervention was that information is disseminated to parents about the effect of natural disasters and post-disaster stressors on children's behaviour and learning.

Omega 3 Diet Supplementation. Research indicates that, on average, New Zealand children are likely to have low levels of omega 3-fatty acids (Harika et al., 2013). Biological psychiatric research indicates that stress during sensitive periods of development, such as the years from 0 to 4 years, may affect the myelination of neurons (Schuchardt, Huss, Stauss-Grabo & Hahn, 2010). Stressed neurons and dysregulation of the autonomic nervous system can cause the types of stress-related behaviours and health problems reported in the study children (Hibbeln, Ferguson, & Blasbalg, 2006). Lack of Omega 3 is associated with poor health and behaviour problems including aggression, especially in boys (Stevens, Zentall, Abate, Kuczek, & Burges, 1996).

Good neuron connectivity is vital for emotional regulation. If children do not have good brain health, this can contribute to behaviour and body stress problems (Klengel, Pape, Binder, & Mehta, 2014). A recent meta-analysis of 73 studies reported that adding Omega 3 to the diet could produce significant reductions in children's aggressive (Gajos & Beaver, 2016), and studies have shown Omega 3 can make significant reductions in behaviour problems of school-age children (Raine, Portnoy, Liu, Mahoomed, & Hibbeln, 2015).

Diet supplementation can be a contentious issue, and the decision to recommend diet supplementation for very stressed children is not one to be taken lightly. Even children eating a healthy diet may benefit from diet supplementation because their body stress may be affecting their digestion. This is because stressed neurons with little or thin myelin sheaths and dysregulation of the autonomic nervous system may reduce the body's ability to make use of the good healthy diets provided by parents as the autonomic nervous system affects digestion. An addition to the diet is recommended to help support healthy neurons and benefit the health of the autonomic nervous system.

The recommended intervention was that information is disseminated to parents of children identified by the principal as having high numbers of stress-related behaviour problems about the effect Omega 3 dietary supplement children's behaviour and learning, and that parents would be able to access 6-12 months of Nutralife Smart Bites for their child without cost.

Data Analysis Plan

The data collected by the teacher reports at the end of 2015 (Pre-Intervention) and the end of 2016 (Post-Intervention) was used to estimate the effects of the strategies. An additional analysis forcused on a sub-set of study children continuously enrolled from their enroment in school to the end of 2016. This was to exclude potential confounding of results due to children who moved.

As a rough guide to indicate differences between schools, an Implementation Score was calculated from the total number of strategies implemented, with one 'point' per strategy. Schools that modified or delayed a strategy, for whatever reason, were given a half-point for that intervention. The average intensity of interventions was also estimated by assigning one point for each school term of implementation. These points were summed to produce a "Total Implementation Score" to estimate the variation across schools in adoption of the interventions.

Results

Adoption of Interventions

The school community under the leadership of the school principal made the final decisions as to the acceptability of each intervention (Table 2). Resourcing was made available through donations to cover the costs associated with implementation. It was estimated that the first step would involve five to eight weeks for planning and initial implementation, after which time schools might see an initial reduction in problem behaviours over the subsequent six or more months.

Table 2 Implementation of Recommended Interventions

Interventions	**Alpha School**	**Beta School**	**Fantail School**	**Tui School**	**Kauri School**
Teacher & Principal Wellbeing					
Professional Development	0	√	√	√	√
Teacher Well-being	0	√	√	√	√
Principal Well-being (RIRO programme)	0	0	√	√	√
Improve Classroom Environment					
Remove hanging decorations	0	√	√	√	√
Reduce wall decorations	0	√	√	√	√
Change wall colours	0	0	0	0	0
Remove decorations from windows	0	√	√	√	√
Seat children near windows	0	0	0	0	0
Open curtains during instruction	0	0	0	0	0
Turn on lights during instruction	0	0	0	0	0
Too Noisy App	0	0	0	0	0
Improve Child Health					
Play Eat Learn Schedule	0	Term 4	½ Day	√	√
Drink to Think-Think to Drink	0	Term 4	0	0	√
Water Bottles	0	Term 4	√	√	√
Whole Meal + Snack	0	0	Parent	Parent	√
Parent Strategies					
Parent Information	0	√	√	√	√
Parent-child Omega 3	0	√	√	√	√
School Terms	0	1	3	3	3
Total Implementation Score	0	9.5	13	13.5	15

All of the schools were invited to participate in the Strategies Project in September/October 2015. Alpha School declined to participate in the strategies project, because, as the principal explained, the staff were tired of trying new things since the earthquakes and had decided to keep the status quo for 2016. Among the other schools, there were differences in the uptake of individual interventions. Beta School had wanted to participate, but the resignation of the principal and delays in finding a new principal meant that some strategies were not introduced until the fourth term.

The Too Noisy App was trialled and rejected as not suitable to activities in a collaborative classrooms. The recommended intervention of keeping the curtains open during instruction was rejected as the curtains were needed to reduce glare and sunstrike. The recommended intervention of seating children with learning problems next to the window during instruction was rejected as those spaces were hot and used for other non-learning activities. The recommended intervention of turning on the lights during instruction was rejected as the fluorescent lighting was noisy, flickered, and was not suitable.

The strategies associated with child health, including Play Eat Learn, and the water and whole meal snack programmes were more challenging for schools to implement. Although Tui and Fantail schools did not reject the strategies, the school community did not see the school as needing to be the provider of water and food in addition to their usual practices and felt that parents could support this change. Also, school budgets could not sustain the costs of sole-school provision beyond the end of the resource period and parent-provision was sustainable in these mid and high decile schools.

Effects of Strategies

Evaluation of the effects of the strategies naturally fell into two groups. Group 1, Schools Alpha and Beta, were identified as having no, or limited strategy implementation, and comprise the "Low/No Implementation Group. Group 2, Schools Fantail, Tui, and Kauri had Implementation scores of 75% or more, and comprise the "High Implementation Group."

There were very negative and concerning changes in the None/Low Implementation Group (Table 3). By the end of 2016, the proportion of children with zero behaviour problems had dropped by 33%, and the overall proportion of children in the 8+ problem group had increased by 13%, with the greatest increase in the 15+ group. The opposite was true at the High Implementation Schools.

Table 3. Percent of Children by Behaviour Problem Category at the at the end of 2015 (Pre-Intervention), and at the End of 2016 (Post-Intervention) in the Implementation Groups (same children at all time points).

Behaviour Problem Score	**Implementation Group**			
	None/Low		**High**	
	Pre	Post	Pre-	Post
Zero	46.6%	31.2%	30.9%	39.5%
1-2	17.8%	26.0%	17.0%	21.6%
3-7	15.1%	16.4%	21.2%	18.0%
8-14	11.0%	9.6%	14.5%	10.2%
15+	9.6%	13.7%	16.4%	10.8%

At the High Implementation Schools, following the first year of implementation of the Reducing Stress Strategies, and for the first time since these children began school, the proportion of children with zero behaviour problems increased to 39.5%. This indicates that the implemented Reducing Stress strategies helped these children develop or improve their self-regulation skills.

If one or two behaviour problems are considered as an acceptable level, 55.5% of the Pre-Earthquake group had Behaviour Problem scores of 0-2, and, following the first year of strategy implementation, 61.6% of children in these schools also had scores in this category.

Considering children with 8+ behaviour problem score, this also showed an impressive result. For the first time since the children entered school, the proportion of children with high behaviour problems decreased. Although there were still 21% of the children with scores in the 8+ categories, this was a decrease of 32.9%.

School-Level Results

The percent change in the 0 behaviour problems and the 8+ behaviour problems groups by individual school (Table 4, Figure 1) was examined in order to evaluate whether the change was related to strategy implementation. These data indicated that the degree of change appears to be related to the degree of implementation, with schools which implemented more of the strategies showing greater change.

The data indicate that Alpha School, which implemented no strategies, had a substantial increase in children with 8+ behaviour problems. In contrast, Beta School, and all of the high implementation schools had a decrease in the proportion of children with high behaviour problem scores. There is an observable relationship between the degree of implementation and the effect (Figure 1, black bars).

Table 4. The Percentage of Children by School in Zero and High BPI Categories (same children at both time points).

Characteristic		**Alpha School**	**Beta School**	**Fantail School**	**Tui School**	**Kauri School**
School Implementation Score		0	9.5	13.0	13.5	15
Zero Behaviour Problem Score	Pre	48.9%	50%	38.9%	29.7%	18.2%
	Post	27.6%	37%	44.4%	43.1%	30.0%
8+ Behaviour Problem Score	Pre	21.2%	22.0%	24.1%	23.1%	49.1%
	Post	37.9%	17.4%	17.7%	12.5%	36.0%

The data shown in Figure 1 indicate that the two schools with None/Low Strategy Implementation had a decrease of more than 20% each in children with zero behaviour problems (dotted bars), indicating a decrease in children with good self-regulation.

However, the opposite is shown in the High Implementation Schools, with increases relative to the estimated intensity of implementation. Tui and Kauri Schools, with the highest level of implementation, had the strongest positive change. These schools also had the most children

with 8+ behaviour problems at school entry, and the fewest children with zero behaviour problems (Table 1).

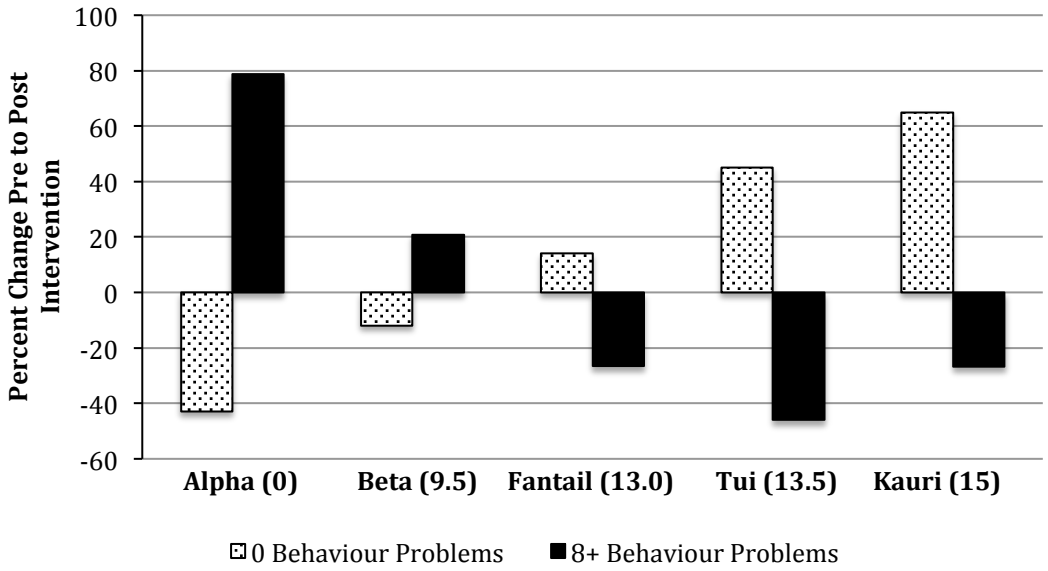

Figure 1 The Percentage of Pre-Post Change in Children with 0 and Children with 8+ Behaviour Problems in the schools, from the end of 2015 to the end of 2016. The Implementation Score for each school is shown.

Change in Prevalence of Children with Posttraumatic And Arousal Symptom

As the Reducing Stress Strategies aimed to promote calm and reduce arousal, the data were also examined to determine if the changes in the behaviour problem scores reflected changes in children with PTS and arousal symptoms. The data shown in Table 5 indicates a similar pattern to previous results, with Alpha and Beta Schools showing a reduction in children with zero scores, and Fantail, Tui and Kauri showing an increase in the children with zero teacher-reported PTS or Arousal symptoms.

Table 5. Percent Change in Children with Zero PTS and Zero Arousal Symptoms by School

Characteristic	Alpha School	Beta School	Fantail School	Tui School	Kauri School
Children with 0 PTS Symptoms	-41.7%	-18.4%	+14.7	+50%	+65%
Children with 0 Arousal Symptoms	-37.8%	-10%	+6.3%	+19.4	+44.1

Changes in Mean Scores

Changes in mean scores are calculated to show a different, complementary, impact of the strategies. Principals and teachers are more interested in the frequency of children with behaviour problems, as, in their experience of teaching children, they differentiate by the

number of children with behaviour problems in their school or classroom. An average across the school does not appear as meaningful as the number of children with behaviour problems.

The mean changes in school BPI scores, PTS, and Arousal symptoms (Figure 2) show similar patterns, with increases in the No/Low Implementation schools and decreases in the High Implementation schools (Figure 1). In the three High Implementation schools, the mean change was from 6.8 behaviour problems per pupil at the end of 2015 to 4.8 per pupil at the end of 2016 (p=0.001). This is an average reduction of 2 behaviour problems per pupil.

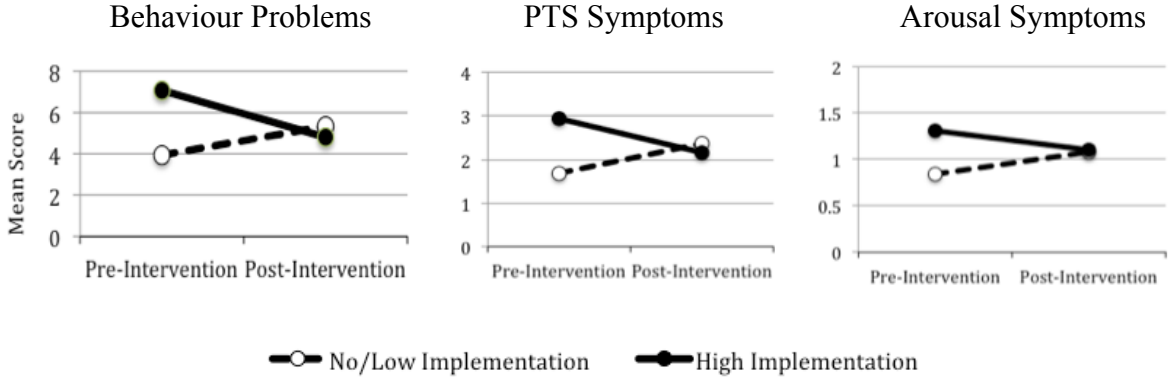

Figure 2. Pre-Post Changes in Group Means by Implementation Groups for Behaviour Score, PTS Symptoms, and Arousal Symptoms

Discussion

The results show that the implementation of the Reducing Stress strategies was associated with a 27.5% increase in the proportion of children with zero behaviour problems as rated by their teachers, in schools with high implementation levels. The schools that did not implement the strategies, or reported a low or delayed implementation, had a 33% decrease in the proportion of children with zero behaviour problems. Children with zero behaviour problems may be considered as children with strong self-regulation skills. As these are the same children followed from school entry through the end of 2016, and since such an increase has not been shown previously, this is strong support for the impact of the Reducing Stress strategies. The fact that the schools that implemented more of the interventions had greater effects gives weight to the interventions being the proximal cause of the change.

Results also show that the implementation of the Reducing Stress strategies produced a 32.9% decrease in children with 8+ behaviour problems. Over the same period, schools that had no or low implementation saw an increase of 13% in the proportion of children in the 8+ behaviour problem score categories. As these are the same children followed from school entry through the end of 2016, and since such a decrease has not been shown previously, this provides strong support for the impact of the Reducing Stress strategies, which was an average reduction of 2 behaviour problems per pupil. The fact that the school that implemented the most interventions had a larger proportionate increase in children with zero behaviour problems suggests the importance of considering Reducing Stress strategies as a holistic package. The results for Beta School also suggest that the duration of implementation is important. Considering both Beta and Fantail Schools, the results also suggest that Play Eat Learn, implemented throughout the school day and over several school terms, may be a key element in achieving additional benefits from the strategy implementation.

Limitations and Strengths

This study has limitations as it is missing experimental controls normally present in experimental designs (e.g., fidelity of intervention implementation), including quasi-experimental design (Bärnighausen, 2017), and it has not been submitted to a journal for peer review. There were also some limitations to the measures (e.g., multi-informant measures) and there was lack of randomisation (Liberty et al., 2016). It was not possible, for example, to randomly select schools in the environment of on-going aftershocks and changes announced by the Ministry of Education. Similarly, since Play-Eat-Learn involved changing the entire school schedule, and since children in all schools moved from room to room during each school day, it was not possible (nor desirable) to randomly assign classrooms.

In the present context, a RCT or tightly controlled experiment was not available for several reasons. 1) Schools had volunteered their participation and were not randomly selected, and would not accept randomisation. 2) Strategies involved the whole school, so selecting classroom-level randomisation would not be possible. 3) Random assignment undermines the authority and leadership of the school principal. 4) Planning and obtaining ethical consents for a quasi-experimental study might lead to a delay. Since behaviour had reached unmanageable levels, a delay was ethically questionable. 5) Even a wait-listed control group could be regarded as having negative consequences or ethical implications (Bor, 2016) in delaying access to the interventions, as previous results had shown that a substantial number of children had worsening problems. Other researchers in another setting, with suitable funding, may be able to conduct a RCT of the intervention strategies.

Another limitation is a lack of any conventional measure of fidelity of implementation. In controlled experiments, it is essential that interventions be implemented as precisely as possible. However, this need for precise implementation for experimental control is one of the limitations in translating interventions into the 'real world', where such tightly controlled conditions are not possible. Attempting to quantify how the schools implemented the strategies using the Implementation Score is one limitation of this study because it cannot provide assurance that the strategies were implemented as intended. In fact, it is clear in the information from principals that strategies were adjusted and adapted in each school community. For instance, the principals could have differed in how they identified children for Omega-3 supplementation. On the other hand, the principals' control is a likely contributor to the principals' decision to adopt interventions and to continue them the following year.

Another limitation in regards to the Implementation Score has to do with its sensitivity. As there were no metrics or research available for indicating the relative "weight" or importance of any given strategy, all strategies were considered to contribute equally to the effects of the intervention. While this aligns with research on protective factors, which, similar to risk factors, have a cumulative effect, rather than a weighted effect (Klasen, 2015; World Health Organization, 2014), there is no empirical evidence to support this approach to quantifying intervention implementation. For example, it may be that Play Eat Learn was less important than removing hanging decorations in reducing symptoms. With the present study, there would be no means of determining this. A factor analysis in subsequent research is advocated because such experimentation would be of enormous usefulness for schools to identify which interventions produce the greatest effects.

Most importantly, these limitations mean that there exists a strong possibility that the results obtained may be due to other factors, such as, perhaps, changes in teaching style between the

schools or natural recovery rates after a disaster, chance, or to other, unidentified events. Although it would seem unusual that children attending Alpha and Beta schools showed less "recovery" as compared to children attending Fantail, Tui and Kauri schools, as children were of similar ages, and had similar exposures to the earthquakes and post-disaster stressors, it is a possibility that cannot be ruled out. Continuing data collection during 2017 to 2018 may provide additional information relevant to this limitation.

Interpreting the results is also limited by a failure to identify a suitable comparison in the published literature. Although it is perhaps inappropriate to compare the results of this study with results of other school-based studies, particularly as the results represent only the first step of a planned three-step intervention sequence and follow-up results are not yet available, such comparisons are commonly discussed in experimental studies. Tol and colleagues (2014) conducted a clustered randomised controlled trial of the effects of a multi-tiered intervention, including universal, targeted and indicated strategies with 329 children affected by war, and found no significant reduction in PTSD symptoms, as compared to the small to moderate change in the present study. However, the intervention studied by Tol and colleagues (2014) included targeted and individual treatments. It was the hypothesis of the present study that targeted, and individual, treatments would be more effective and durable if the levels of classroom behaviour problems were reduced before the introduction of targeted interventions. Therefore, comparison with the results of Tol and colleagues' (2014) study would be more relevant following the introduction of the interventions planned for 2017 and 2018.

In searching for a comparison, Pfeferbaum, Varma, Nitema and Newman (2014), in a review of whole school interventions, identified that whole school interventions had only been studied as preventive interventions (i.e., before an adverse event), while after a traumatic event, interventions were almost entirely based on cognitive behaviour therapy and delivered in groups to targeted students. Brown and colleagues (2017) identified 36 studies, 15 of which were conducted after natural disasters. Of the studies, one group included a classroom-based programme, ERASE-Stress, but this was for older children, aged 12-15 years. A similar classroom programme was delivered to adolescents who experienced the Great Japan Earthquake and Tsunami of 2011 (Okuyama, Funakoshi, Tomita, Yamaguchi & Matsuoka, 2017). A programme for younger children was delivered following the Sichuan earthquake. This involved non-verbal arts and play activities suitable for grade four students (61.8% girls) delivered about once per month by specially trained art teachers and therapists. However, as Ho, Lai, Lo, Nan and Pon (2017) report, there were no significant results.

Zakszeski, Ventresco, and Jaffe (2017) critically reviewed school-based interventions and identified the need for new approaches because the existing approaches "incorporated largely reactive, direct services to students provided by external clinicians or researchers" (p. 316). In particular, the researchers identified the importance of the education of school personnel about the effects of traumatic events, not only in terms of improving the adoption of strategies but because "student outcomes may differentially improve and sustain when interventions are implemented by school personnel with whom students have consistent contact" (p. 317).

As this paper is prepared, no study with a similar approach to assisting a community of children affected by a long series of disasters and disaster-related events has been identified. Thus, the results are difficult to contextualise within the existing literature.

Bicultural Limitations and Strengths

This study is limited in that the interventions have not been reviewed for cultural acceptability or studied according to Kaupapa Māori processes (Macfarlane & Macfarlane, 2012; Mane, J., 2009; Walker, Eketone, & Gibbs, 2006). This is important because Maori may be especially vulnerable to the effects of traumatic events, as many experience additional adverse events associated with inequality, poverty and racism; particularly racism in housing and health services (Flett, Kazantzis, Long, MacDonald, & Millar, 2002; Marriott, & Sim, 2015). Hirini, Flett, Long, and Millar (2005). and Reid, Taylor-Moore and Varona (2014) reported that Māori are also more likely to experience traumatic events, including historical trauma.

Te Whare Tapa Whā is one Māori model of wellbeing that metaphorically rests on the four walls of a whare, as described by Mason Durie (1994: Ministry of Health, 2017a). These "walls" are Taha Tinana, Taha Wairua, Taha Whānau and Taha Hinengaro. Although these terms are not easily translated into English, they may be considered as representing the dimensions of physical health, spiritual health, family health and mental health. On the positive side, the interventions, considered as a package, provide positive support to children from professionals for health and wellbeing, which is a key to resilience for Māori (Lambert, Mark-Shadbolt, Ataria, & Black, 2012).

In terms of diet, Maori traditionally ate Toheroa (paphies ventricosa), which is high in Omega-3, and many other kinds of seafoods as a staple of their customary diet, but dietary changes in the 20th century, and the apparent collapse of some seafood habitats seem to have reduced fish and shellfish consumption (Anthoni, 2009) and may have resulted in Omega-3 deficiencies. This information may be useful in cultural responses to the suggestion of Omega 3 dietary supplement (Rei & Hibbeln, 2006).

The whare model reminds us that wellbeing is not something that can be parcelled out or divided up and that mental health is always entwined with physical health. Supporting child health is respectful, and does not have implicit blame that is inherent in some behavioural parent-training interventions.By addressing both Taha Tinana and Taha Hinengaro, the inventions in the present study indicate one possible pathway toward acceptability for Māori. This model is also a reminder that it is not sufficient when planning interventions to consider only one aspect of stress, such as psychological impacts, but strategies must seek to improve holistic wellbeing as mental health cannot be separated from physical health or other factors.

Strengths

One major strength of this study is the innovative combination of evidence-informed strategies to address the biological symptoms of PTS in the schools attended by children who had experienced a very extended period of earthquakes, floods, and other disaster-related events. In comparison with other studies, these strategies do not rely on professional clinicians for implementation and do not require teachers to engage in additional teaching activities. The innovative strategies are suitable for all children in primary school settings, and require few additional resources. All of these considerations are especially important in a community struck by disaster, with limited mental-health resources and clinicians. The quality assurance procedures are also strengths of this study.

Quality Assurance

This study was limited in experimental controls. However, quality assurance procedures suitable for schools were implemented to strengthen the study (Cuttance, 2003).

Acceptability

The quality of the interventions can be determined by their acceptability to the schools. Of the 17 interventions shown in Table 2, only wall-colour changes were not able to be implemented due to lack of suitable resources. This left 16 strategies (16 of 17, 94.9%). Of these, four interventions were rejected by the schools. Thus, four interventions (4/17, 23.5%) were rejected by teachers in all schools. All of the other recommended interventions were adopted by at least one school (12/17). Of these 12 interventions, those that were less likely to be adopted were the Drink To Think, Think to Drink programme (2 schools) and the Whole Meal+ Snack (1 school).

Considering the four schools that received recommended intereventions, the interventions for the Calm Down the school environment and Omega 3 were implemented by all of the schools. Thus, these strategies have a quality assurance associated with social valdity.

Quality assurance can be estimated using an alternative metric based on the implementation score. Overall, if all five schools had implemented all 17 potential strategies over the three terms possible, an implementation score of 20 for each school would provide an overall score of 100. Considering all of the schools, the total achieved implementation score is 51. If only the three schools who received descriptions of the strategies, and the rationale for their implementation are considered, the overall implementation score is 41.5/60 (69.2%). This gives an estimated metric as to the quality of the recommended interventions.

Social Validity

Social validity, or "consumer satisfaction" with the goals, methods and outcomes of intervention is an important quality-assurance factor in whether evidence-based practices are selected and implemented in educational settings (Cook & Odom, 2013; Kazdin, 1977; Rapp et al., 2010). Another quality assurance step was to ask principals at the end of 2016 if they planned on continuing the strategies in 2017. The principals of the four schools who had implemented strategies all said they would continue them. As the principals made this decision in November of 2016, based on their own experiences in the schools, without the benefit of the end of year data, this was a significant social validation of the goals, methods and impact of the strategies, and assisted them in the decision to continue with the strategies.

One principal shared the email received from a parent.

> *May 2016*
>
> *Hi [Principal]**
>
> *As we discussed this morning, the new play/eat arrangements are working really well for my boys. X and Y are far more pleasant in the afternoons.*
>
> *Previously after school time has been very fraught with lots of meltdowns and frustration from both boys. They would come around after a huge afternoon tea and lots of downtime, but it was very stressful for everyone.*

> *The difference over the past week has been huge. The boys were clearly tired after their first week back, but still coping well with life which is a much appreciated improvement! We've had conversations on the way home instead of tears. Afternoon tea is a pleasant shared catch up time, not a desperate attempt to shovel food into them while they argue with each other. They're much more able to independently play and get started on their own activities - even playing together without much fighting! ...has even expressed interest in completing some home learning where previously he would be 'too tired'.*
>
> *I can only put this down to the change in the eating schedule. I'm putting a lot more into their lunchboxes and it is all being eaten. They're not ravenously hungry when they get home.*
>
> *While this outcome is not the main intention of the new arrangements, I can only imagine you're receiving some of these benefits at school too.*
>
> *I'm a fan.*

Consumer Confidence in Results

Although this study is missing experimental controls that can be used to assess the efficacy of the intervention, quality assurance procedures can provide an estimation of whether the results reported on the study children (research sample) can be generalised to the school as a whole. The results were presented to the principals in March of 2017. At that time, the principals of four schools confirmed that the data from the study children matched up with their overall analysis of the behaviour in their school by the end of 2016 (the principal of Alpha School declined to participate in the discussion). This discussion also considered that the results had been influenced by teachers' perception of the strategies and their overall purpose. However, it is very unlikely that these results are due to the teachers in the High Implementation group reporting overly positive results, because, as the principals admitted, the teachers were not informed that the changes at the school, for instance, Play Eat Learn, were related to the pre-intervention teacher reports. Also, when the data were collected at the end of the year, teachers would have become accustomed to the strategies and are very unlikely to have associated them with the child's behaviour at the time they were completing the reports. In the anecdotal notes provided by the teachers during the teacher-report process, not a single note mentioned Omega 3, water bottles, scheduling changes or anything that could be construed as being related to the strategies. Finally, the changes were reported across many teachers, not just one or two. Thus, this can give some confidence that the results accurately reflect the impact of the Reducing Stress Strategies.

In May 2017, the results were shared with local principals at the invitation of the Canterbury Primary Principals Association, who had donated funding to support school implementation. Following this presentation and subsequent meetings, nine primary schools and five early childhood centres volunteered to trial the Reducing Stress Strategies in their schools to determine whether the results could be replicated. These schools serve more than 4000 pupils. At present, baseline data collection of a sample (e.g., every 5th child on the school roll) from each replication school and preschool is underway, under the leadership of the Te Paeroa RTLB Cluster, led by Maureen Allan and Liz McNaughton. Post-intervention will be collected after 12 months. In addition, a high school has expressed an interest in adapting strategies as appropriate for their age levels. Data from the replication study will provide additional evaluation of the interventions.

Implications

Controlled experiments by other researchers in additional schools are required to further examine the effects of the interventions. This is required because of the need for effective whole-school interventions for children with stress-related disorders (Zakzeski, Ventresco & Jaffe, 2017).

The results of this study are encouraging, because reducing behavioural problems associated with PTS may provide a developmental window for the improvement of the functioning of the amygdala and hippocampus, as these continue developing at least until age 18 years (Barsglini, Sartori, Benetti, Pettersson-Yeo, & Mechelli, 2014; Tottenham & Sheridan, 2010). In the Christchurch earthquakes, fear activation of the amygdala and the HPA axis occurred many times, and, most likely, more than 100 times. These repeated experiences may dysregulate the autonomic nervous system, as previously explained, and lead to PTSD, or PTS, with the symptoms expressed in children's behaviour.

Studies have shown that positive intervention results can improve brain function associated with some mental health problems, including PTSD (Davidson & McEwen, 2012, Zhu et al., 2017). The non-psychological interventions used in the present study may also be associated with improvement in brain functioning. Hydration with 150 ml water to individuals in a 30°C environment produced significant changes in the parts of the brain associated with stress, including the amygdala, and improved mood and cognitive function (Young, Johnston, & Benton, 2017).

The strategies may be helpful for children who have experienced other types of adverse events and developed similar symptoms. According to Stoddard (2014), this can include: "attachment disorder, disinhibited social engagement disorder, adjustment disorder, acute stress disorder, posttraumatic stress disorder (PTSD), and PTSD for children 6 years and younger, separation anxiety disorder, persistent complex bereavement disorder, mood disorders, disruptive behavior disorders, borderline personality, psychoses, somatoform disorders, and substance abuse disorders" (p. 243). Children with ADHD have recently been shown to have disrupted circadian rhythm (Coogan & McGowan, 2017), and omega 3 has shown promise in re-regulation of dysregulated circadian rhythm in children with attention problems associated with ADHD (Buchhorn et al., 2017).

The results suggest a role for physical and environmental characteristics of schools, in conjunction with dietary supplementation for some children, that affect stressed children's behaviour independent of various common explanations for child behaviour problems, such as socio-economic status of the children's families. As schools are part of complex systems contributing to mental health and wellbeing, future research should include the possibility that factors of the school environment, such as physical characteristics of classrooms, the daily schedule, and the availability of water and food may have a contribution to child behaviour problems beyond individual interventions or classroom management strategies.

Resilience and vulnerability to stress are intricately associated with the autonomic nervous system and brain functions (Franklin, Saab & Mansuy, 2012), although the tendency is to focus on mentation and psychological functions. As stated most eloquently by Boden and colleagues (2016), in reference to a study of positive outcomes in youth transitioning to adulthood, "Rather than a static, individual trait, resilience becomes a set of resources that are able to be enhanced by the actions of others, such as the professionals and caregiving adults

who are involved in the lives of vulnerable children, and in this way the impact of risks on later outcomes can be modified."

Based on this study, principals, teachers and parents can trial the present study's relatively simple interventions to improve children's resilience to stress. As there is a biological correlate of children's responses to disaster (Weems, 2015), it is only logical to consider biologically correlated interventions.

I hope that these conclusions motivate interest in how environmental aspects of schools affect child behaviour and mental health. I encourage educational psychologists to think broadly about how to support better mental health in schools.

References

Adolphus, K., Lawton, C. L., & Dye, L. (2013). The effects of breakfast on behavior and academic performance in children and adolescents. *Frontiers in Human Neuroscience*, *7*, 425.

Alisic, E., Zalta, A. K., van Wesel, F., Larsen, S. E., Hafstad, G. S., Hassanpour, K., & Smid, G. E. (2014). Rates of post-traumatic stress disorder in trauma-exposed children and adolescents: meta-analysis. *The British Journal of Psychiatry, 204(*5), 335-340. (inc. Supplemental Tables).

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*. American Psychiatric Pub.

Anthoni, F. (2009). Shellfish collapse in New Zealand. http://www.seafriends.org.nz/indepth/shellfish_collapse.htm

Bal, A. (2008). Post-traumatic stress disorder in Turkish child and adolescent survivors three years after the Marmara Earthquake. *Child Adolescent Mental Health, 13(*3), 134-139.

Bar-David, Y. A. I. R.,Urkin, J., & Kozminsky, E. L. Y. (2005). The effect of voluntary dehydration on cognitive functions of elementary school children. *Acta Paediatrica, 94*(11), 1667-1673.

Bark, K., Stenberg, S., & Hayes, D. (2010). Scheduling Recess Before Lunch: Exploring the Benefits and Challenges in Montana Schools. *Journal of Child Nutrition and Manage*ment. 34 (2).

Bärnighausen, T., Oldenburg, C., Tugwell, P., Bommer, C., Ebert, C., Barreto, M., ... & Sianesi, B. (2017). Quasi-experimental study designs series–Paper 7: assessing the assumptions. *Journal of Clinical Epidemiology*, *89*, 53-66.

Barrett, P., Davies, F., Zhang, Y., & Barrett, L. (2015). The impact of classroom design on pupils' learning: Final results of a holistic, multi-level analysis. *Building and Environment, 89*, 118-133.

Barrett, P., Farrell, L., Ollendick, T & Dadds, M. (2006). Long-term outcome of an Australian Universal Prevention Trial of anxiety and depression symptoms in children and youth: An evaluation of The Friends program. *Journal of Clinical Child and Adolescent Psychology, 35*(3), 403-411.

Barsaglini, A., Sartori, G., Benetti, S., Pettersson-Yeo, W., & Mechelli, A. (2014). The effects of psychotherapy on brain function: A systematic and critical review. *Progress in neurobiology*, *114*, 1-14.

Benton, D., & Jarvis, M. (2007). The role of breakfast and a mid-morning snack on the ability of children to concentrate at school. *Physiology & Behavior*, *90*(2), 382-385.

Blair, C., & Raver, C. C. (2012). Child development in the context of adversity: experiential canalization of brain and behavior. *American Psychologist*, *67*(4), 309.

Boden, JM., Sanders, J., Munford, R., Liebenberg, L., & McLeod, G. F. (2016). Paths to positive development: A model of outcomes in the New Zealand youth transitions study. *Child Indicators Research, 9*(4), 889-911.

Bor, J. (2016). Capitalizing on natural experiments to improve our understanding of population health. *American journal of public health*, *106*(8), 1388.

Breslau, N. (2009). The epidemiology of trauma, PTSD, and other posttrauma disorders. *Trauma, Violence & Abuse*, *10* (3), 198–210. doi:10.1177/1524838009334448

Brooker, A., & Franklin, A. (2016). The effect of colour on children's cognitive performance. *British Journal of Educational Psychology, 86(*2), 241-255.

Brown, R. C., Witt, A., Fegert, J. M., Keller, F., Rassenhofer, M., & Plener, P. L. (2017). Psychosocial interventions for children and adolescents after man-made and natural disasters: a meta-analysis and systematic review. *Psychological Medicine*, *47* (11), 1893-1905.

Buchhorn, R., Koenig, J., Jarczok, M.N. et al. (2017). A case series on the potential effect of omega-3-fatty acid supplementation on 24-h heart rate variability and its circadian variation in children with attention deficit (hyperactivity) disorder. *ADHD Atten Def Hyp Disord* , 1-5, https://doi-org.ezproxy.canterbury.ac.nz/10.1007/s12402-017-0240-y.

Byrd, R. S., Weitzman, M., & Auinger, P. (1997). Increased behavior problems associated with delayed school entry and delayed school progress. *Pediatrics*, *100*(4), 654-661.

Canterbury Earthquake Recovery Authority (CERA).(2012). Land Classifications.

Canterbury Earthquake Recovery Authority (CERA). (2013). *Wellbeing Survey September 2012*. Wellington: CERA

Canterbury Earthquake Recovery Authority (CERA). (2014). *Wellbeing Survey September 2013*. Wellington: CERA

Canterbury Earthquake Recovery Authority (CERA). (2015). *Wellbeing Survey September 2014*. Wellington: CERA

Carrion, V. G., Weems, C. F., & Bradley, T. (2010). Natural disasters and the neurodevelopmental response to trauma in childhood: A brief overview and call to action. *Future Neurology*, *5*(5), 667-674.

Carville, O. (2017, 26 July). Break the silience: Self-harm epidemic 'elephant in the room'. *The New Zealand Herald*. http://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=11894602

Chang, S. E., Taylor, J. E., Elwood, K. J., Seville, E., Brunsdon, D., & Gartner, M. (2014). Urban disaster recovery in Christchurch: the central business district cordon and other critical decisions. *Earthquake Spectra*, *30*(1), 513-532.

Chu, A. T., & Lieberman, A. F. (2010). Clinical implications of traumatic stress from birth to age five. *Annual Review of Clinical Psychology*, *6*, 469-494.

Chrousos, G. P. (2009). Stress and disorders of the stress system. *Nature Reviews Endocrinology*, *5*(7), 374-381.

Cook, B. G., & Odom, S. L. (2013). Evidence-based practices and implementation science in special education. *Exceptional Children*, *79*(2), 135-144.

Contractor, A. A., Layne, C. M., Steinberg, A. M., Ostrowski, S. A., Ford, J. D., & Elhai, J. D. (2013). Do gender and age moderate the symptom structure of PTSD? Findings from a national clinical sample of children and adolescents. *Psychiatry Research*, *210*(3), 1056-1064.

Coogan, A.N. & McGowan, N.M. (2017). A systematic review of circadian function, chronotype and chronotherapy in attention deficit hyperactivity disorder. *ADHD Atten Def Hyp Disord* , *9* (3), 129-147.

Crowe, C. (2013). *Canterbury Quake Live*: GeoNet Search engine for quakes. http://www.canterburyquakelive.co.nz/QuakeSearch.

Cubrinovski, M., Hughes, M., Bradley, B., McCahon, I., McDonald, Y, Simpson, H., Cameron, R., Christison, M., Henderson, B., Orense, R. & O'Rourke, T. (2011). *Liquefaction impacts on pipe networks*. Research Report 2011-04. University of Canterbury: Civil and Natural Resources Engineering. ISSN 1172-9511.

Cubrinovski, M., Robinson, K., Taylor, M., Hughes, M., & Orense, R. (2012). Lateral spreading and its impacts in urban areas in the 2010–2011 Christchurch earthquakes. *New Zealand Journal of Geology and Geophysics, 55*(3), 255-269.

Cuttance, P. (2003). Quality assurance for schools. In T. Townsend (Ed.) *Restructuring and Quality: Issues for tomorrow's schools*, 100-113. London: Routledge. 1134785658

D'Anci, K. E., Constant, F., & Rosenberg, I. H. (2006). Hydration and cognitive function in children. *Nutrition Reviews*, *64*(10), 457-464.

Davidson, R. J., & McEwen, B. S. (2012). Social influences on neuroplasticity: stress and interventions to promote well-being. *Nature Neuroscience*, *15*(5), 689-695. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3491815/

De Bellis, M. & Zisk, A. (2014). The biological effects of childhood trauma. *Child and Adolescent Psychiatric Clinics of North America, 23* (2), 185-222).

Dehon, C., & Scheeringa, M. S. (2006). Screening for preschool posttraumatic stress disorder with the Child Behavior Checklist. *Journal of Pediatric Psychology, 31(*4), 431-435.

Delamater, A. M., & Applegate, E. B. (1999). Child development and post-traumatic stress disorder after hurricane exposure. *Traumatology*, *5*(3), 4.

Department of the Interior (2016). *The water in you*. The USGS Water Science School. Department of the Interior, Washington, D.C. https://water.usgs.gov/edu/propertyyou.html

Durie, M. (1994). *Whaiora: Māori Health Development*. Auckland: Oxford University Press.

Eksi, A. & Braun, K. L. (2009). Over-time changes in PTSD and depression among children surviving the 1999 Istanbul earthquake. *Eur Child Adolesc Psychiatry, 18,* 384-391.

Elliot, A. J., & Maier, M. A. (2012). Color-in-context theory. *Advances in experimental social psychology, 45*, 61-125.

Fadda, R., Rapinett, G., Grathwohl, D., Parisi, M., Fanari, R., Calò, C. M., & Schmitt, J. (2012). Effects of drinking supplementary water at school on cognitive performance in children. *Appetite*, *59*(3), 730-737.

Fairbank, J. A., & Fairbank, D. W. (2009). Epidemiology of child traumatic stress. *Current Psychiatry Reports, 11*(4), 289-295.

Felitti, V. J. (2009). Adverse childhood experiences and adult health. *Academic Pediatrics*, *9*(3), 131.

Felitti, V. J., Anda, R. F., Nordenberg, D., Williamson, D. F., Spitz, A. M., Edwards, V., ... & Marks, J. S. (1998). Relationship of childhood abuse and household dysfunction to

many of the leading causes of death in adults: The Adverse Childhood Experiences (ACE) Study. *American Journal of Preventive Medicine*, *14*(4), 245-258.

Feo, P., Di Gioia, S., Carloni, E., Vitiello, B., Tozzi, A. E., & Vicari, S. (2014). Prevalence of psychiatric symptoms in children and adolescents one year after the 2009 L'Aquila earthquake. *BMC Psychiatry*, *14*, 270-270.

Fergusson, D. M., Horwood, L. J., Boden, J. M., & Mulder, R. T. (2014). Impact of a major disaster on the mental health of a well-studied cohort. *JAMA Psychiatry, 71*(9), 1025-1031.

Ferrris, E. & Petz, D. (2012). *The year that shook the rich: A review of natural disasters in 2011.* London: The Brookings Institution London School of Economics. Available form: http://www.brookings.edu/research/reports/2012/03/natural-disaster-review-ferris

Fisher, A. V., Godwin, K. E., & Seltman, H. (2014). Visual environment, attention allocation, and learning in young children when too much of a good thing may be bad. *Psychological Science, 25(*7), 1362-1370.

Flett, R. A., Kazantzis, N., Long, N. R., MacDonald, C., & Millar, M. (2002). Traumatic events and physical health in a New Zealand community sample. *Journal of Traumatic Stress*, *15*(4), 303-312.

Forman-Hoffman, V., Knauer, S., McKeeman, J., Zolotor, A. Blanco, R., Lloyd, S., Tant, E. & Viswanathan, M. (2013). Child and adolescent exposure to trauma: Comparative effectiveness of interventions addressing trauma other than maltreatment or family violence. Comparative Effectiveness Review Number 107, (Prepared by the RTI International-University of North Carolina at Chapel Hill Evidence-based Practice Center under Contract No. 290-2007-10056-I.) AHRQ Publication No. 13-EHC054-EF. Rockville, MD: Agency for Healthcare Research and Quality. Feb 2013. www.effectivehealthcare.ahrq.gov/reports/final.cfm.

Franklin, T. B., Saab, B. J., & Mansuy, I. M. (2012). Neural mechanisms of stress resilience and vulnerability. *Neuron*, *75*(5), 747-761.

Friedman-Krauss, A. H., Raver, C. C., Morris, P. A., & Jones, S. M. (2014). The role of classroom-level child behavior problems in predicting preschool teacher stress and classroom emotional climate. *Early Education and Development, 25*(4), 530-552.

Fuchs, T., Lührmann, P., Simpson, F., & Dohnke, B. (2016). Fluid intake and cognitive performance: Should schoolchildren drink during lessons?. *Journal of School Health*, *86*(6), 407-413.

Gajos, J. M., & Beaver, K. M. (2016). The effect of omega-3 fatty acids on aggression: A meta-analysis. *Neuroscience & Biobehavioral Reviews*, *69*, 147-158.

Galea, S., Nandi, A. & Viahov, D. (2005). The epidemiology of post-traumatic stress disorder after disasters. *Epidemiologic Reviews, 27,* 78-91 (and supplemental tables).

Geonet Science. *Canterbury Quakes*. Retrieved 14-06-14. from http://info.geonet.org.nz/display/home/Canterbury+Quakes

Getlinger M., Laughlin C., Bell, E, Akre, C, Arjmandi, B. (1996). Food waste is reduced when elementary-school children have recess before lunch. *J Am Diet Assoc, 96*, 906–90.

Gibson-Moore, H. (2013). Improving hydration in children: a sensible guide. *Nutrition Bulletin*, *38*(2), 236-242.

Goenjian, A., Pynoos, R., Steinberg, A., Najarian, L., Asarnow, J., Karayan, I., Ghurabi, M. & Fairbanks, L. (1995) Psychiatric comorbidity in children after the 1988 earthquake in Armenia. *Jour. Amer. Acad. Child & Adoles. Psychiatry, 34*, 1174-1184.

Golden, R. N., Gaynes, B. N., Ekstrom, R. D., Hamer, R. M., Jacobsen, F. M., Suppes, T., ... & Nemeroff, C. B. (2005). The efficacy of light therapy in the treatment of mood disorders: a review and meta-analysis of the evidence. *American Journal of Psychiatry, 162*, 656–662.

Gowin, J. (2010). Why your brain needs water. *Psychology Today.* https://www.psychologytoday.com/blog/you-illuminated/201010/why-your-brain-needs-water

Grave, J., & Blissett, J. (2004). Is cognitive behavior therapy developmentally appropriate for young children? A critical review of the evidence. *Clinical Psychology Review, 24*(4), 399-420.

Grider, J., Bertrand, P., & Bornstein, J. (2017). Defining roles for seerotonin in the autonomic nervous system: About this research topic. *Frontiers of Neuroscience*, journals.frontiers.org

Guha-Sapir, D. & Vos, F. (2011). Earthquakes, an epidemiological perspective on patterns and trends. In R. Spence, E. So & C. Scawthorn (Eds.) *Human Casualties in Earthquakes: Advances in Natural and Technological Hazards Research (No. 29)* 13-24. London: Springer Science+Business Media.

Guha-Sapir, D., Vos, F., Below, R & Ponserre, S. (2012). *Annual Disaster Statistical Review 2011: The numbers and trends.* Brussels: Centre for Research on the Epidemiology of Disasters. Institute of Health and Society, Universite Catholique de Louvain.

Gupta, M. A. (2013). Review of somatic symptoms in post-traumatic stress disorder. *International Review of Psychiatry, 25(*1), 86-99.

Gutermann, J., Schwartzkopff, L., & Steil, R. (2017). Meta-analysis of the long-term treatment effects of psychological interventions in youth with PTSD symptoms. *Clinical Child and Family Psychology Review*, 1-13.

Harika, R. K., Eilander, A., Alssema, M., Osendarp, S. J., & Zock, P. L. (2013). Intake of fatty acids in general populations worldwide does not meet dietary recommendations to prevent coronary heart disease: a systematic review of data from 40 countries. *Annals of Nutrition and Metabolism*, *63*(3), 229-238.

Harvard Center on the Developing Child (2006). Excessive Stress Disrupts the Architecture of the Developing Brain National Scientific Council on the Developing Child http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&ved=0CCwQ6QUoADAA&url=http%3A%2F%2Fdevelopingchild.harvard.edu%2Fresources%2Freports_and_working_papers%2Fworking_papers%2F&ei=C9xpUoT3BoKYrge27YGQCA&usg=AFQjCNGUH_k3vBBSyMjmrgJ9RNL9dvpjuw&bvm=bv.55123115,d.bmk

Hibbeln, J. R., Ferguson, T. A., & Blasbalg, T. L. (2006). Omega-3 fatty acid deficiencies in neurodevelopment, aggression and autonomic dysregulation: opportunities for intervention. *International Review of Psychiatry*, *18*(2), 107-118.

Hirini, P., Flett, R., Long, N., & Millar, M. (2005). Frequency of traumatic events, physical and psychological health among Maori. *New Zealand Journal of Psychology*, *34*(1), 20-27.

Ho, R. T., Lai, A. H., Lo, P. H., Nan, J. K., & Pon, A. K. (2017). A strength-based arts and play support program for young survivors in post-quake China: Effects on self-efficacy, peer support, and anxiety. *The Journal of Early Adolescence*, *37*(6), 805-824.

Horn, S. R., Miller-Graff, L. E., Galano, M. M., & Graham-Bermann, S. A. (2017). Posttraumatic stress disorder in children exposed to intimate partner violence: the clinical picture of physiological arousal symptoms. *Child care in practice*, *23*(1), 90-103.

Huang-Chih Chou, F., Tung-Ping Su, T., Ou-Yang, W. C., Chien, I. C., Lu, M. K., & Chou, P. (2003). Establishment of a disaster-related psychological screening test. *Australian and New Zealand Journal of Psychiatry*, *37*(1), 97-103.

Hunsberger, M., McGinnis, P., Smith, J., Beamer, B. A., & O'Malley, J. (2014). Elementary school children's recess schedule and dietary intake at lunch: a community-based participatory research partnership pilot study. *BMC Public Healt*h, *14*(1), 156-170.

Imuta, K., & Scarf, D. (2014). When too much of a novel thing may be what's "bad": commentary on Fisher, Godwin, and Seltman (2014). *Frontiers in Psychology, 5,* 1444. http://doi.org/10.3389/fpsyg.2014.01444)

Kar, N. (2009). Psychological impact of disasters on children: review of assessment and interventions. *World Journal of Pediatrics*, *5*(1), 5-11.

Kazdin A. E. (1977). Assessing the clinical or applied significance of behavior change through social validation. *Behavior Modification, 1*, 427–452.

Kempton, M. J., Ettinger, U., Foster, R., Williams, S. C., Calvert, G. A., Hampshire, A., ... & Smith, M. S. (2011). Dehydration affects brain structure and function in healthy adolescents. *Human Brain Mapping*, *32*(1), 71-79.

Kenney, E. L., Long, M. W., Cradock, A. L., & Gortmaker, S. L. (2015). Prevalence of inadequate hydration among US children and disparities by gender and race/ethnicity: National Health and Nutrition Examination Survey, 2009–2012. *American Journal of Public Health*, *105*(8), e113-e118

Kessler, R. C., McLaughlin, K. A., Koenen, K. C., Petukhova, M., & Hill, E. D. (2012). The importance of secondary trauma exposure for post-disaster mental disorder. *Epidemiology and psychiatric sciences*, *21*(01), 35-45.

Kessler, R. C., Rose, S., Koenen, K. C., Karam, E. G., Stang, P. E., Stein, D. J., ... & McLean, S. A. (2014). How well can post-traumatic stress disorder be predicted from pre-trauma risk factors? An exploratory study in the WHO World Mental Health Surveys. *World Psychiatry*, *13*(3), 265-274.

Klasen, F., Otto, C., Kriston, L., Patalay, P., Schlack, R., Ravens-Sieberer, U., & Bella Study Group. (2015). Risk and protective factors for the development of depressive symptoms in children and adolescents: results of the longitudinal BELLA study. *European Child & Adolescent Psychiatry*, *24*(6), 695-703.

Koss, K. J., & Gunnar, M. R. (2017). Annual Research Review: Early adversity, the hypothalamic–pituitary–adrenocortical axis, and child psychopathology. *Journal of Child Psychology and Psychiatry*. 10.1111/jcpp.12784

Küller, R., Mikellides, B., & Janssens, J. (2009). Color, arousal, and performance—A comparison of three experiments. *Color Research & Application, 34*(2), 141-152.

Lambert, S., & Mark-Shadbolt, M. (2012). *Māori experiences and expressions of leadership through the Christchurch Otautahi earthquakes.* Retrieved from: http://researcharchive.lincoln.ac.nz/handle/10182/5349 124

Lambert, S., Mark-Shadbolt, M., Ataria, J., & Black, A. (2012) Indigenous resilience through urban disaster: The Māori response to the 2010 and 2011 Christchurch Ōtautahi earthquakes. In: Proceedings of the International Indigenous Development Research Conference, pp.234-241. http://www.academia.edu/2489921/Indigenous_resilience_through_urban_disaster.

Laor, N., Wolmer, L., Kora, M., Yucel, D., Spirman, S., & Yazgan, Y. (2002). Posttraumatic, dissociative and grief symptoms in Turkish children exposed to the 1999 earthquakes. *The Journal of Nervous and Mental Disease*, *190*(12), 824-832.

Laplante, D., Brunet, A., Schmitz, N., Ciampi, A., & King, S. (2008) Project Ice Storm: Prenatal maternal stress and cognitive and linguistic functioning in 5 ½ year old children. *Journal of the American Academy of Child and Adolescent Psychiatry, 47*(9), 1063-1072.

Liberty, K., Tarren-Sweeney, M., Macfarlane, S., Basu, A., & Reid, J. (2016). Behavior problems and post-traumatic stress symptoms in children beginning school: a comparison of pre-and post-earthquake groups. *PLoS currents disasters*, *8*. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5419821/.

Lukens, E. P., & McFarlane, W. R. (2004). Psychoeducation as evidence-based practice: Considerations for practice, research, and policy. *Brief Treatment & Crisis Intervention*, *4*(3), 247-242.

Macfarlane A. & Macfarlane S. (2012) Weaving the dimensions of culture and learning: Implications for educators. In Kaur, B. (Ed.), *Understanding teaching and learning: Classroom research revisited*: 213-224. Rotterdam: Sense Publishers.

Mane, J., (2009). Kaupapa Māori: A community approach. *MAI Review, 3*(1), 1-9. http://www.review.mai.ac.nz/index.php/MR/article/viewFile/243/282

Maoz, H., Goldstein, T., Goldstein, B. I., Axelson, D. A., Fan, J., Hickey, M. B., Monk, K, Sakolaky, D, Diler, R., Brent, D., Kupfer, D, & Birmaher, B. (2014). The effects of parental mood on reports of their children's psychopathology. *Journal of the American Academy of Child & Adolescent Psychiatry*, *53*(10), 1111-1122.

Marriott, L., & Sim, D. (2015). Indicators of inequality for Maori and Pacific people. *Journal of New Zealand Studies*, (20), 24-50.

Martin, H. (2017, 21 April). Few schools 'well placed' to support students' mental health report shows. The Christchurch Press. http://www.stuff.co.nz/national/education/91394883/few-schools-wellplaced-to-support-students-mental-health-issues-report-shows

Maxwell, L. & Chmielewski, E. (2008). Environmental personalization and elementary school children's self esteem. *Journal of Environmental Psychology, 28(*2), 143-153.

Maxwell, L. E., & Evans, G. W. (2000). The effects of noise on pre-school children's pre-reading skills. *Journal of Environmental Psychology, 20*(1), 91-97.

McClelland, T., Ismail, R., Liberty, K. & Hooper, L. (2016). *Drink to Think – Think to Drink*. School of Health Sciences, New Zealand: University of Canterbury.

McColl, G. J., & Burkle, F. M. (2012). The new normal: Twelve months of resiliency and recovery in Christchurch. *Disaster Medicine and Public Health preparedness, 6(*01), 33-43.

McKellin, W. H., Shahin, K., Hodgson, M., Jamieson, J., & Pichora-Fuller, M. K. (2011). Noisy zones of proximal development: Conversation in noisy classrooms. *Journal of Sociolinguistics, 15*(1), 65-93.

McLaughlin, K., Fairbank, J., Gruber, M., Jones, R., Lakoma, M., Pfefferbaum, B., Sampson, N. & Kessler, R., (2009). Serious emotional disturbance among youths exposed to Hurricane Katrina 2 years postdisaster. J. *Am Acad Child Adol Psychiatry, 48*, 1069-1078.

Mealings, K. T., Buchholz, J. M., Demuth, K., & Dillon, H. (2015). Investigating the acoustics of a sample of open plan and enclosed Kindergarten classrooms in Australia. *Applied Acoustics*, *100*, 95-105.

Meier, C. (2017, 6 March). Christchurch's specialist mental health services 'on a knife edge'. The Christchurch Press. http://www.stuff.co.nz/national/health/89624342/christchurchs-specialist-mental-health-services-on-a-knife-edge

Ministry of Education (n.d.). Innovative Learning Environments. http://ile.education.govt.nz/

Ministry of Health (2013). Health of New Zealand Children. Wellington: Ministry of Health http://www.health.govt.nz/publication/health-new-zealand-children-2011-12

Ministry of Health (2015). Guidelines for fluid intake. From: *Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2-18 years): A background paper.* 72-84. Wellington: Ministry of Health.

Ministry of Health (2017). Māori health models – Te Whare Tapa Whā. Wellington: Ministry of Health. http://www.health.govt.nz/our-work/populations/maori-health/maori-health-models/maori-health-models-te-whare-tapa-wha.

Moore, K. W., & Varela, R. E. (2010). Correlates of long-term posttraumatic stress symptoms in children following Hurricane Katrina. *Child Psychiatry & Human Development, 41*(2), 239-250.

Morina, N., Koerssen, R., & Pollet, T. V. (2016). Interventions for children and adolescents with posttraumatic stress disorder: A meta-analysis of comparative outcome studies. *Clinical psychology review*, *47*, 41-54.

Mott, M. S., Robinson, D. H., Williams-Black, T. H., & McClelland, S. S. (2014). The supporting effects of high luminous conditions on grade 3 oral reading fluency scores. *SpringerPlus, 3*(1), 53.

Munro, A., Kovats, R. S., Rubin, G. J., Waite, T. D., Bone, A., Armstrong, B., ... & Oliver, I. (2017). Effect of evacuation and displacement on the association between flooding and mental health outcomes: a cross-sectional analysis of UK survey data. *The Lancet Planetary Health*, *1*(4), e134-e141.

Najarian, L. M., Sunday, S., Labruna, V., & Barry, I. (2011). Twenty-year follow-up of adults traumatized during childhood in Armenia. *Journal of Affective Disorders, 135*(1), 51-55.

National Longitudinal Surveys (n.d.). *National Longiduinal Survey of Youth 1979: Children and Young Adults*. https://www.nlsinfo.org/content/cohorts/nlsy79-children.

Norris, F. H., Friedman, M. J., Watson, P. J., Byrne, C. M., Diaz, E., & Kaniasty, K. (2002). 60,000 disaster victims speak: Part I. An empirical review of the empirical literature, 1981–2001. P*sychiatry: Interpersonal and Biological Processes, 65*(3), 207-239.

Norris, F. H., & Kaniasty, K. (1992). Reliability of delayed self-reports in disaster research. *Journal of Traumatic Stress, 5(*4), 575-588.

Okuyama, J., Funakoshi, S., Tomita, H., Yamaguchi, T., & Matsuoka, H. (2017). Mental health and school-based intervention among adolescent exposed to the 2011 Great East Japan Earthquake and tsunami. *International Journal of Disaster Risk Reduction*, *24*, 183-188.

Overstreet, S., Salloum, A., Burch, B. & West, J. (2011). Challenges associated with childhood exposure to severe natural disasters: Research review and clinical implications. *J. Child and Adolescent Trauma, 4*, 52-68.

Panel Study on Income Dynamics (PSID) (2017). Child Development Supplement. Behavior Problem Index. https://psidonline.isr.umich.edu/Guide/FAQ.aspx?Type=2

Pearson, J. & Hall, D. (2006, 2017). *Reaching In ... Reaching Out Resiliency Guidebook.* Toronto, CA: Child and Family Partnership.www.reachinginreachingout.com/resouces-guidebook.htm.

Pereira, E. R. B. N., Tavares, E. L. M., & Martins, R. H. G. (2015). Voice disorders in teachers: clinical, videolaryngoscopical, and vocal aspects. *Journal of Voice*, *29*(5), 564-571.

Pfefferbaum, B., Varma, V., Nitiéma, P., & Newman, E. (2014). Universal preventive interventions for children in the context of disasters and terrorism. *Child and Adolescent Psychiatric Clinics of North America*, *23*(2), 363.

Piaget, J., & Inhelder, B. (2014). *The origin of the idea of chance in children.)*. Psychology Press: Psychology Revivals.

Pollio, D. E., McClendon, J. B., North, C. S., Reid, D., & Jonson-Reid, M. (2005). The promise of school-based psychoeducation for parents of children with emotional disorders. *Children & Schools*, *27*(2), 111.

Prinstein, M., LaGreca, A., Vernberg, E., Silverman, W. (1996). Children's coping assistance: How parents, teachers and friends help children cope after a natural disaster. *Journal of Clinical Child Psychology, 25*(4), 463-475.

Proctor, L. J., Fauchier, A., Oliver, P. H., Ramos, M. C., Rios, M. A., & Margolin, G. (2007). Family context and young children's responses to earthquakes. J*ournal of Child Psychology and Psychiatry, 48*(9), 941-949.

Pynoos, R. S., Goenjian, A., Tashjian, M., Karakashian, M., Manjikian, R., Manoukian, G., ... & Fairbanks, L. A. (1993). Post-traumatic stress reactions in children after the 1988 Armenian earthquake. *The British Journal of Psychiatry*, *163*(2), 239-247.

Raine, A., Portnoy, J., Liu, J., Mahoomed, T., & Hibbeln, J. R. (2015). Reduction in behavior problems with omega-3 supplementation in children aged 8–16 years: a randomized, double-blind, placebo-controlled, stratified, parallel-group trial. *Journal of Child Psychology and Psychiatry*, *56*(5), 509-520.

Rapp C. A., Etzel-Wise D., Marty D., Coffman M., Carlson L., Asher D., . . . Holter M. (2010). Barriers to evidence-based practice implementation: Results of a qualitative study. *Community Mental Health Journal, 46*, 112–118.

Rees, C. (2014). Lost among the trees? The autonomic nervous system and paediatrics. *Archives of Disease in Childhood, 99*, 552-562.

Reid, J., Taylor-Moore, K., & Varona, G. (2014). Towards a social-structural model for understanding current disparities in Maori health and well-being. *Journal of Loss and Trauma*, *19*(6), 514-536.

Reis,C., & Hibbeln, J. (2006). Cultural symbolism of fish and the psychotropic properties of omega-3 fatty acids, *Prostaglandins, Leukotrienes and Essential Fatty Acids*, *75* (4–5), 227-236, ISSN 0952-3278, ISSN 0952-3278,

Reyners, M., Eberhart-Phillips, D., & Martin, S. (2014). Prolonged Canterbury earthquake sequence linked to widespread weakening of strong crust. *Nature Geoscience, 7*(1), 34-37.

Rodgers, J. L., Van Hulle, C., D'Onofrio, B., Rathouz, P., Beasley, W., Johnson, A., ... & Lahey, B. B. (2015). Behavior problems and timing of menarche: a developmental longitudinal biometrical analysis using the NLSY-Children data. *Behavior genetics*, *45*(1), 51-70.

Rolfsnes, E. & Idsoe, T. (2011). School-based intervention programs for PTSD symptoms: A review and meta-analysis. *Journal of Traumatic Stress, 24*(2), 155-165.

Ross, K. & Shuell, T. (1993). Children's beliefs about earthquakes. *Science Education, 77*(2), 191-205.

Salmon, K., & Bryant, R. A. (2002). Posttraumatic stress disorder in children: The influence of developmental factors. *Clinical Psychology Review*, *22*(2), 163-188.

Salmon, K., Sinclair, E., & Bryant, R. A. (2007). The role of maladaptive appraisals in child acute stress reactions. *British Journal of Clinical Psychology*, *46*(2), 203-210. {Main association, child negative appraisals of their vulnerability; Parent stress did not make any difference.}

Scheeringa, M. (2008). Developmental considerations for diagnosing PTSD and acute stress disorder in preschool and school-age children. *American Journal of Psychiatry*, *165*(10), 1237-1239.

Scheeringa, M. (3 January 2014). *PTSD for children 6 years and younger*. National Center for PTSD: US Department of Veteran Affairs. Downloaded from: http://www.ptsd.va.gov/professional/PTSD-overview/ptsd_children_6_and_younger.asp

Scheeringa, M. S., & Zeanah, C. H. (2008). Reconsideration of harm's way: Onsets and comorbidity patterns of disorders in preschool children and their caregivers following Hurricane Katrina. *Journal of Clinical Child & Adolescent Psychology, 37*(3), 508-518.

Scheeringa, M. S., Zeanah, C. H., & Cohen, J. A. (2011). PTSD in children and adolescents: toward an empirically based algorithm. *Depression and anxiety*, *28*(9), 770-782.

Schiff, A.J. (Ed.). (1999). *Guide to improved earthquake performance of power systems* (No.96). ASCE Manuals and Reports on Engineering Practice.

Schuchardt, J. P., Huss, M., Stauss-Grabo, M., & Hahn, A. (2010). Significance of long-chain polyunsaturated fatty acids (PUFAs) for the development and behaviour of children. *European Journal of Pediatrics*, *169*(2), 149-164.

Shaw, J. A., Espinel, Z., & Shultz, J. M. (2012). *Care of children exposed to the traumatic effects of disaster.* American Psychiatric Pub.

Sleegers, P. J. C., Moolenaar, N. M., Galetzka, M., Pruyn, A., Sarroukh, B. E., & van der Zande, B. (2012). Lighting affects students' concentration positively: Findings from three Dutch studies. Lighting Research and Technology, 1477153512446099.

Smith, K. (2013). *Environmental Hazards: Assessing Risk and Reducing Disaster.* 6th Edition. London: Routledge.

Smith, A. P., & Wilds, A. (2009). Effects of cereal bars for breakfast and mid-morning snacks on mood and memory. *International Journal of Food Sciences and Nutrition*, *60*(sup4), 63-69.

Smith, P., Perrin, S., Dalgleish, T., Meiser-Stedman, R., Clark, D. M., & Yule, W. (2013). Treatment of posttraumatic stress disorder in children and adolescents. *Current Opinion in Psychiatry*, *26*(1), 66-72.

Stevens, L. J., Zentall, S. S., Abate, M. L., Kuczek, T., & Burges, J. R. (1996). Omega-3 fatty acids in boys with behavior, learning, and health problems. *Physiology & Behavior*, *59*(4), 915-920.

Stoddard, F. J. (2014). Outcomes of traumatic exposure. *Child and Adolescent Psychiatric Clinics of North America*, *23*(2), 243-256.

The Prime Minister's Youth Mental Health Project (2016). *Localities and National Perspectives Evaluation*. Wellington, N.Z.: Social Policy Evaluation and Research Unit. available from: http://www.superu.govt.nz/ymh

Thornley, L., Ball, J., Signal, L. Lawson-Te Aho, K., & Rawson, E. (2013). Building community resilience: Learning from the Canterbury earthquakes: Final report to Health Research Council and Canterbury Medical Research Foundation. Available from: http://anzasw.org.nz/documents/0000/0000/0603/building-community-resilience-report.pdf.

Tol, W. A., Komproe, I. H., Jordans, M. J., Ndayisaba, A., Ntamutumba, P., Sipsma, H., ... & de Jong, J. T. (2014). School-based mental health intervention for children in war-affected Burundi: a cluster randomized trial. *BMC Medicine*, *12*(1), 56.

Tottenham, N., & Sheridan, M. A. (2010). A review of adversity, the amygdala and the hippocampus: a consideration of developmental timing. *Frontiers in Human Neuroscience*, *3*, 68

Trauma-Informed Care in Behavioral Health Services (2014). Treatment Improvement Protocol (TIP) Series, No. 57. Center for Substance Abuse and Mental Health Services Administration Rockville, MD. https://www.ncbi.nlm.nih.gov/books/NBK207195/#part1_ch1.s5

Tremblay, R. E. (2010). Developmental origins of disruptive behaviour problems: the 'original sin'hypothesis, epigenetics and their consequences for prevention. *Journal of Child Psychology and Psychiatry*, *51*(4), 341-367.

Turnbull, G. J. (2006). The biology of post-traumatic stress disorder. *Psychiatry*, *5*(7), 221-224.

Usami, M., Iwadare, Y., Kodaira, M., Watanabe, K., Aoki, M., Katsumi, C., Matsuda, K., Makino, K., Iijima, S., Harada, M., Tanaka, H., Sasaki, Y., Tanaka, T., Ushijima, H. & Saito, K. (2012). Relationships between traumatic symptoms and environmental damage conditions among children 8 Months after the 2011 Japan Earthquake and Tsunami. *PLoS ONE, 7*, 50721.

Van Ballegooy, S., Malan, P., Lacrosse, V., Jacka, M. E., Cubrinovski, M., Bray, J. D., O'Rourke, T., Crawford, S. & Cowan, H. (2014). Assessment of liquefaction-induced land damage for residential Christchurch. *Earthquake Spectra, 30*(1), 31-55.

Van der Kolk, B. A. (2004). Psychobiology of posttraumatic stress disorder. *Textbook of Biological Psychiatry*, 319-344.

Walker, S., Eketone, A., & Gibbs, A. (2006). An exploration of kaupapa Maori research, its principles, processes and applications. *International Journal of Social Research Methodology*, *9*(4), 331-344.

Wang, C. W., Chan, C. L., & Ho, R. T. (2013). Prevalence and trajectory of psychopathology among child and adolescent survivors of disasters: a systematic review of epidemiological studies across 1987–2011. *Social Psychiatry and Psychiatric Epidemiology, 48*(11), 1697-1720.

Weems, C. F. (2015). Biological correlates of child and adolescent responses to disaster exposure: A bio-ecological model. *Current Psychiatry Reports*, *17*(7), 1-7.

Wesnes, K. A., Pincock, C., Richardson, D., Helm, G., & Hails, S. (2003). Breakfast reduces declines in attention and memory over the morning in schoolchildren. *Appetite*, *41*(3), 329-331.

Widyatmoko, C. S., Tan, E. T., Seyle, D. C., Mayawati, E. H., & Silver, R. C. (2011). Coping with natural disasters in Yogyakarta, Indonesia: The psychological state of elementary school children as assessed by their teachers. *School Psychology International*, *32*(5), 484-497.

Williamson, V., Creswell, C., Fearon, P., Hiller, R. M., Walker, J., & Halligan, S. L. (2017). The role of parenting behaviors in childhood post-traumatic stress disorder: A meta-analytic review. *Clinical Psychology Review, 53*, 1-13.

World Health Organization. (2014). *Social determinants of mental health*. World Health Organization. http://apps.who.int/iris/bitstream/10665/112828/1/9789241506809_eng.pdf.

Yoshizaki, T., Tada, Y., Hida, A., Sunami, A., Yokoyama, Y., Togo, F., & Kawano, Y. (2013). Influence of dietary behavior on the circadian rhythm of the autonomic nervous system as assessed by heart rate variability. *Physiology & Behavior*, *118*, 122-128.

Young, H. A., Johnston, S., & Benton, D. (2017). Compensatory Autonomic Modulations Mediate Hypohydration Related Changes in Brain Functioning and Mood. *The FASEB Journal*, *31*(1 Supplement), 298-3.

Zakszeski, B. N., Ventresco, N. E., & Jaffe, A. R. (2017). Promoting resilience through trauma-focused practices: A critical review of school-based implementation. *School Mental Health*, *9*(4), 310-321.

Zhang, Y., Zhang, J., Zhu, S., Du, C., & Zhang, W. (2015). Prevalence and predictors of somatic symptoms among child and adolescents with probable posttraumatic stress

disorder: a cross-sectional study conducted in 21 primary and secondary schools after an earthquake. *PloS one*, *10*(9), e0137101.

Zhu, X., Suarez-Jimenez, B., Helpman, L., Markowitz, J., Papini, S., Durosky, A., ... & Neria, Y. (2017). PTSD exposure-based treatment changes amygdala and hippocampus resting state functional connectivity in PTSD. *Biological Psychiatry*, *81*(10), S97-S98.

Zilberstein, K. (2014). Neurocognitive considerations in the treatment of attachment and complex trauma in children. *Clinical child psychology and psychiatry*, *19*(3), 336-354.