Sensory-based interventions with adult and adolescent trauma survivors

An integrative review of the occupational therapy literature

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Abstract

Purpose – An emerging evidence base, and increased awareness of the effects of trauma on the body, advocates a sensory-based approach to treatment with posttraumatic stress and complex trauma survivors. This paper aims to identify, analyse and summarise the empirical evidence for the sensory-based interventions, which occupational therapists are using in the treatment of adult and adolescent trauma survivors.

Design/methodology/approach – An integrative review of the literature was undertaken. Both empirical and conceptual papers were included. An inductive approach and constant comparative method were used to understand and synthesise the research.

Findings – The literature search yielded 18 papers describing the types of sensory-based interventions used, sensory processing (SP) patterns and the context and evidence for sensory-based occupational therapy practice with trauma survivors. Nine of the studies were empirical and nine were conceptual and review papers. Themes identified included: atypical SP patterns; type of sensory-based intervention used with trauma survivors; and transdisciplinary treatment programmes can reduce the symptoms of trauma.

Practical implications – Sensory-based interventions with adult and adolescent trauma survivors are emerging as promising areas of practice and research in the literature. Although empirical data is limited, the sensory needs of the body in processing trauma experiences is becoming more recognised and are supported by the atypical SP patterns identified in survivors. A sensory-based, transdisciplinary approach to treatment has the potential to be effective in treating the trauma survivor.

Originality/value – With a skill base in sensory integration and occupational analysis, occupational therapists have much to offer the field of trauma studies. This review begins to address the gap in the literature, recommending more rigorous controlled outcome research with larger sample sizes, person-centred studies focussing on the trauma survivor's perspective and continuing professional development and mentorship for occupational therapists working with this population.

Keywords Sensory approach, Sensory-based treatment, Posttraumatic stress, Complex trauma, Occupational therapy, Posttraumatic stress disorder

Paper type General review

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Introduction

There is a compelling evidence base to demonstrate that traumatic experiences are relatively common occurrences among clinical and general populations (Smith *et al.*, 2016) and are associated with a number of persistent mental health difficulties including posttraumatic stress disorder (PTSD), complex posttraumatic stress disorder (CPTSD), major depressive disorders, anxiety disorders and psychosis (APA, 2013; Maercker *et al.*, 2018; van der Kolk, 2005), as well as physical illness, disease and disability (Felitti and Anda, 2010).

A traumatic incident may be a single event or may result from repeated exposure to events the individual experiences as threatening bodily harm or death to the self or another (Maercker *et al.*, 2018). Complex trauma or CPTSD often begins early in life and involves the child's caregiving system (Buxton and Turnbull, 2018). It is different from single event trauma in that it may include prolonged physical, emotional, and sexual abuse, as well as profound neglect, all of which interrupt normal development, secure attachment, leading to changes in the developing brain that persist into adulthood (Ogden *et al.*, 2006; van der Kolk, 2005). However, it is the overwhelming nature of trauma that elicits survival responses from the brain and nervous system and, if recurrent, these survival or fight/flight and freeze responses will adversely affect the development of affective, physiological and cognitive functions, as well as self-regulatory and relational capacities in the survivor (Clark *et al.*, 2015; van der Kolk, 2005, 2018).

The reasons why the effects of trauma on an individual can be so extensive still remain inconclusive. As a response to traumatic experience, especially in early life, unregulated bodily experiences replay themselves endlessly and are believed to be experienced in the body as somatic sensation (Ogden *et al.*, 2006; Fisher, 2006, 2018; van der Kolk, 2005, 2015, 2018; Koomar, 2009). This is of particular relevance for persons who experienced trauma in early life, as the brain has not developed its narrative capacity at this stage to support conscious memory processing (van der Kolk, 2005, 2015). Thus, when a trauma survivor experiences triggering events or sensations in the body, overwhelming physiological and emotional responses that occurred during the original traumatising event may reoccur, compromising the person's occupational participation, performance and potential (Champagne, 2011a, 2011b; Koomar, 2009).

The importance of the body and adopting a sensory approach to addressing the symptoms of trauma have been advocated by healthcare researchers and professionals, as worthy avenues for exploration in the nascent field of trauma treatment (Champagne and Stromberg, 2004; Koomar, 2009; Ogden *et al.*, 2006; LeBel *et al.*, 2010; van der Kolk, 2015; Warner *et al.*, 2013). Given that most of the therapeutic modalities to date focus on drug or talking therapy (Hetrick *et al.*, 2010; van der Kolk, 2018), the body's role in processing traumatic experience via the senses has been largely left out of treatment initiatives (Ogden *et al.*, 2006; Fisher, 2006; van der Kolk, 2018).

Sensory approaches and sensory-based interventions, although still emerging through the trauma-informed framework (WHO, 2017; LeBel *et al.*, 2010), have become part of the international effort for the reduction in seclusion and restraint in mental health services (Champagne and Stromberg, 2004; WHO, 2017). Sensory-based interventions address an individual's sensory system in a therapeutic manner to create change and enable adaptation to one's physical environment (Champagne, 2011a) and have been used in occupational therapy with children with behavioural issues and complex trauma histories (Fraser *et al.*, 2017; Koomar, 2009). While the evidence for the use of sensory approaches in both adult mental health (Sutton *et al.*, 2013; Machingura and Lloyd, 2017), and in the treatment of children with complex trauma (Koomar, 2009) is growing in governance, policy and practice, the specific needs of adult and adolescent trauma survivors has received less attention. In

consideration of the high prevalence of childhood trauma in mental health service users (APA, 2013; Gorey and Leslie, 1997; Rossiter *et al.*, 2015;) and the evidence evolving in the field of trauma studies indicating the pivotal role of the sensate body in treatment (Clark *et al.*, 2015; van der Kolk, 2015, 2018; Fisher, 2006, 2018), it seems appropriate to include the unique needs of the adult and adolescent trauma survivor in this enquiry.

This review intends to determine the evidence for and the extent to which sensory-based interventions are being practiced in occupational therapy with adult and adolescent trauma survivors.

The research questions for this study include:

RQ1. What sensory-based interventions are occupational therapists utilising with adult and adolescent trauma survivors?

RQ2. What is the empirical evidence to support the use of sensory-based interventions with adult and adolescent trauma survivors in occupational therapy?

Methods

An integrative literature review approach was chosen to allow for the inclusion of both empirical and conceptual literature. This approach enables the summarising of appraised research from diverse contexts in an area of emerging occupational therapy practice (Whittemore and Knafl, 2005). This enables a more comprehensive and holistic understanding of the phenomenon (Whittemore and Knafl, 2005). The paucity of research in this area did not lend itself to other systematic meta-analysis.

The stages of an integrative review, which we followed are outlined by Whittemore and Knafl (2005) and include: clearly identifying the problem, purpose or phenomenon, conducting a thorough systematic literature search, evaluating, analysing and presenting the synthesised findings and limitations of the studies selected, with conclusions.

Literature search strategy

A literature search was conducted in Medline in Ebsco, EMBASE and AMED, PsychINFO, CINAHL, Scopus and the Cochrane Library. These databases were selected as they cover the majority of peer-reviewed allied health literature. Reference lists of included papers were reviewed for additional studies and citations searched for more recent studies (Whittemore and Knafl, 2005). Boolean phrases were used. The initial list of terms was added to iteratively as new search terms or keywords were identified. These are highlighted in Figure 1. Articles published between January 1995 and June 2019 were considered, given the growing body of research on trauma and sensory-based interventions within this time frame.

The titles and abstracts of all articles from database searches were screened using the inclusion or exclusion criteria. Duplicates were removed. Full-text articles were sought when further information was required to make a selection decision. Any uncertainty was resolved by having the article reviewed by both authors and consensus was reached by discussion. This was the case for one article. Reference lists and citations of included papers were also reviewed to identify any further relevant papers. The remaining papers were examined in detail. The process of identifying studies from search to inclusion is shown in Figure 2. Because of the limited empirical research available it was decided to include conceptual papers and sensory processing (SP) studies with adult trauma survivors.

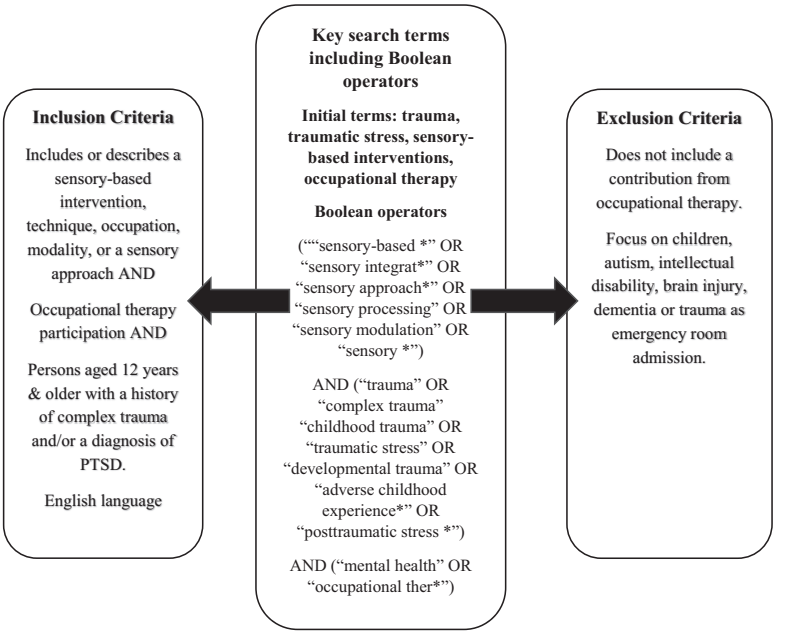


Figure 1.
Key search terms identified and criteria for inclusion/ exclusion

Analysis

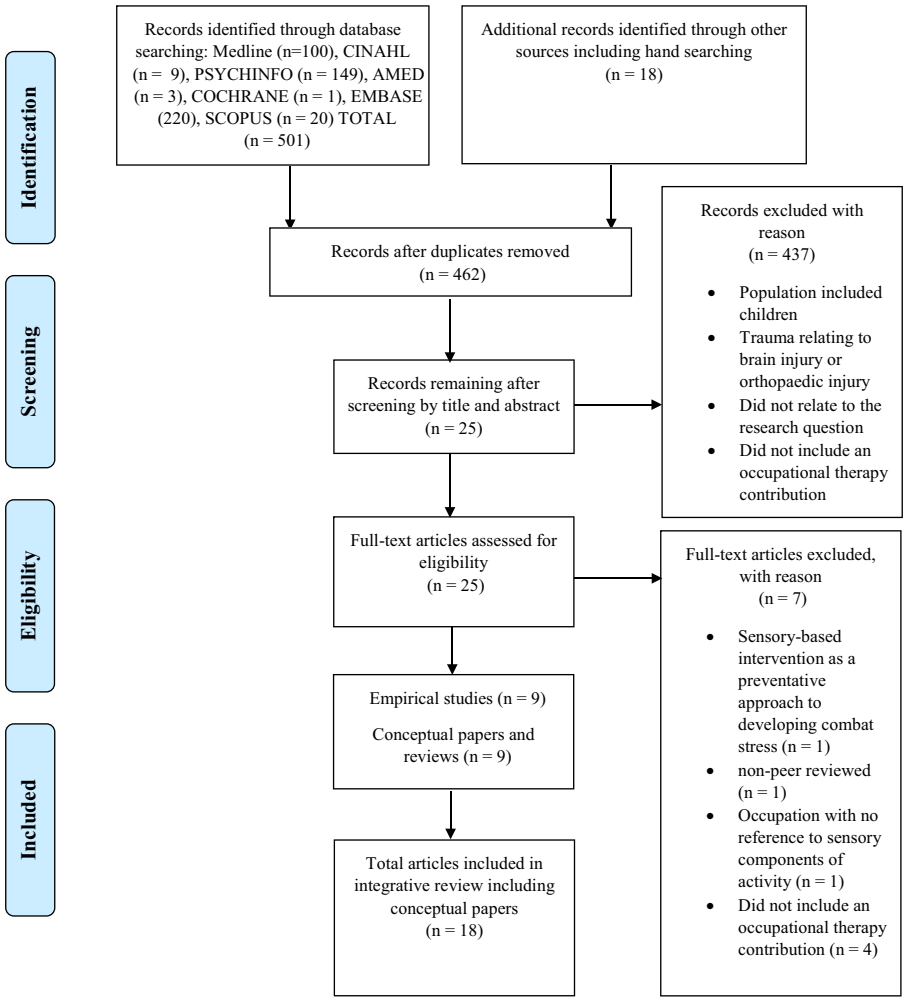
The purpose of each research study, including a description of the interventions, study design, outcome measures and analysis was extracted from the data. Following this, the core findings and limitations for each study were established. Data extracted from the conceptual papers reviewed included type, purpose, conclusive findings and recommendation. Data was extracted and summarised from both the research studies and conceptual papers. The articles were critically appraised using the McMaster University guidelines and appraisal forms for quantitative and qualitative research (Law *et al.*, 1998a, 1998b). Table I identifies and defines key terms for the purposes of this review.

To better understand the literature available, key commonalities and differences were summarised using an inductive approach: allowing the themes to be constructed based on the literature rather than using a predetermined set of criteria (Goddard and Melville, 2004). Data was sorted into categories and grouped into themes using a constant comparative method (Maykut and Morehouse, 1994). Themes observed were defined, named and extrapolated to produce three key themes.

Results

The initial search yielded 519 papers, with a total of 18 studies in the final review, including nine empirical studies and nine conceptual papers (Figure 2). Variations existed in study design, setting and geographical location. The results of the studies reviewed are summarised in Tables II and III.

Eight of the nine conceptual papers reviewed originated from the USA, compared with five of the nine empirical papers reviewed. The remaining studies and one conceptual paper originated from Canada (n = 2), Israel (n = 2) and Italy (n = 1). One of the total number of papers included an adolescent population with an age range of 12-22 years



Source: Moher *et al*. (2009)

Figure 2.
Preferred reporting items for systematic reviews and meta-analyses flowchart for literature search March-June 2019

(Warner *et al.*, 2014). One paper (Fraser *et al.*, 2017), carried out a review on both children and adolescent populations and was, therefore, included, as data specific to adolescents could be extracted. The total population across the studies was $n = 686$ and the age range for this group was 13-71 years. In the research which specifically and empirically assessed sensory processing skills, there were $n = 457$ participants (Engel-Yeger *et al.*, 2013; Engel-Yeger *et al.*, 2015; Champagne, 2011a; Serafini *et al.*, 2016), with one of these studies ($n = 1$) also including a sensory-based treatment approach and psychotherapy intervention (Champagne, 2011a). Sole Occupational Therapy intervention accounted for $n = 4$ study participants (Kimball *et al.*, 2018). N= 10 participants took part in a sensory integration (SI) treatment as an adjunct to psychotherapy treatment and $n = 10$ adolescents participated in a

Term	Definition including references
Sensory approach	Based on theory developed by Ayres (2005/1979), which address the sensory experiences of an individual to optimise well-being and function; aim to assist persons more effectively regulate their emotional and physiological arousal (Machingura and Lloyd, 2017; Sutton *et al.*, 2013)
Sensory-based interventions	Address the sensory system therapeutically to create change and/or enable adaptation to one's environment, including sensory modalities and sensorimotor activities (Champagne, 2011a, 2011b; Warner *et al.*, 2013; Sutton *et al.*, 2013)
Sensory modalities	Intervention involving specific techniques, occupation or equipment including, for example, yoga, art making, gardening, sound therapy, massage and weighted blankets (Champagne, 2011a, 2011b)
Sensorimotor activities	Promote the ability of the body to process and integrate information through movement and sensation including grounding techniques (Ogden *et al.*, 2006; Champagne, 2011a, 2011b; Clark *et al.*, 2015)
Sensory integration	The ability of the nervous system to take in information, organise it and act with the environment effectively (Ayres, 2005/1979). Also, known as Ayres SI
Sensory processing	The ability to take in information through the senses (touch, movement/balance, hearing smell, taste and vision) interpret and make a meaningful response (Champagne, 2011a; Miller and Lane, 2000)
Sensory discrimination	The ability to take in information from one's physical environment and gain perceptual awareness (Ayres, 2005/1979)
Sensory modulation	The neurological regulation of response to sensory stimuli; the central nervous systems capacity to balance and organise sensory inputs that arise both within an individual's sensory apparatus and those that arise external to the body (Sutton *et al.*, 2013), which determine how to respond to environmental demands (Miller and Lane, 2000) and engage in meaningful roles, and occupations (Koomar, 2009; Champagne, 2011a, 2011b)

Table I.
Summary of terms and definitions used

sensory motor arousal regulation treatment (SMART) with a control of $n = 21$ participants receiving psychotherapy treatment as usual (TAU). N = 215 participants were involved in transdisciplinary treatment programmes in total. The majority of participants in the papers reviewed took part in the four studies assessing SP skills (Engel-Yeger *et al.*, 2013; Engel-Yeger *et al.*, 2015; Champagne, 2011a; Serafini *et al.*, 2016).

Conceptual papers and reviews

The nine conceptual papers retrieved support a trauma-informed, sensory approach within a recovery-orientated context for the treatment of complex trauma and PTSD (Champagne *et al.*, 2010; Champagne, 2011b; Champagne and Stromberg, 2004; Fraser *et al.*, 2017; Herold *et al.*, 2016; Holland *et al.*, 2018; LeBel *et al.*, 2010; LeBel and Champagne, 2010; Warner *et al.*, 2013). Seven of the studies included a discussion of the commitment to study trauma, trauma-informed care and the establishing of best practices to address trauma consequences (Champagne *et al.*, 2010; Champagne, 2011b; LeBel and Champagne, 2010; Champagne and Stromberg, 2004; Fraser *et al.*, 2017; Holland *et al.*, 2018; LeBel *et al.*, 2010). These have led to an important policy change, including seclusion/restraint reduction initiatives with access to occupational therapy (Champagne and Koomar, 2011; Champagne and Stromberg, 2004; Holland *et al.*, 2018; LeBel and Champagne, 2010; LeBel *et al.*, 2010).

One of the notable strengths of sensory approaches emphasised in all of the conceptual papers reviewed reiterates how sensory-based interventions target intense physical manifestations of traumatic sequelae and offer a different therapeutic experience to that of conventional psychopharmacological treatment approaches. These intense physical

Table II.
Summary of study characteristics, analyses and results

Reference(s) and country	Purpose of study	Population and diagnosis	Study design	Outcome measures	Intervention	Analysis	Core finding(s)	Limitations
Champagne (2011a) The USA	To overview how PTSD, depression, SPPs influence occupational engagement and work performance	$N = 1$, female PTSD depression	Descriptive case report	AASP ACLS SMST SDT OPSRS	SMP	Descriptive	Improvement in all areas of occupational performance SMP and evidence-based CBT demonstrated how a blending of treatments can improve outcomes for individuals with PTSD/ depression	Single case study. Difficult to generalise findings Use of non-standardised outcome measure (OPSRS)
Engel-Yeger *et al.* (2013) Israel	To identify the sensory profiles of people with PTS symptoms To examine the relationship among the subcategories of PTS symptoms and SPPs	$N = 60$, 24-62 years, 30 with PTS symptoms; 30 control group and no PTS symptoms or history of PTSD 40 per cent male, 60 per cent female	Matched control	PSS-SR AASP	Assessment of SPPs	Chi-square (χ^2), *t*-test and Pearson correlations	Sensory sensitivity among people with PTS symptoms ($p < 0.001$), with lower registration ($p < 0.005$), sensation avoidance ($p < 0.001$) and lower sensation seeking ($p < 0.01$) Sensory profiles significantly related to intrusive thoughts ($r = 0.37$, $p = 0.0045$)	Subjects with PTS experienced a range of traumatic events and varied histories; difficult to generalise findings Cultural context of research and a country at war needs to be considered
Engel-Yeger *et al.* (2015) Israel	To examine SP difficulties and the impact on social/ intimate relationships in persons with PTS symptoms	$N = 60$, 24-62 years, 30 PTS symptoms 30 control group; 12 male and 18 female in each group	Matched control	PSS-SR AASP FCPRQ	Assessment of SPPs	χ^2, *t*-test, MANOVA and Pearson correlation	Sensory hypersensitivity study group, with sensory avoidance, and low registration ($p < 0.001$) People with PTS show greater fear of intimacy than healthy controls ($p < 0.01$)	"healthy" controls not assessed for history of trauma Cultural context of research No controls

(*continued*)

Table II.

Reference(s) and country	Purpose of study	Population and diagnosis	Study design	Outcome measures	Intervention	Analysis	Core finding(s)	Limitations
Harper *et al.* (2006) Canada	To use the COPM to evaluate changes in client ratings of performance and satisfaction with respect to personally defined goals To investigate whether COPM, is significantly correlated with other standardised measures used to study the PTSR outcomes	$N = 177$ adults 83 per cent female 17 per cent male; Age range 18-66 years and mean age 41 years	Time-series pre-test-post-test design at 3, 6, 12 months post discharge	COPM MPSS-SR SCL-90 TSIB-L	Assessment of the COPM for use in a PTS programme, which includes sensory-based techniques and activities such as creative art and horticulture	MANOVA and Pearson correlation	Mean COPM scores significantly improved at all test intervals ($p < 0.05$), although discharge levels at follow-up intervals not maintained Concurrent criterion validity with other standardised measures used supported COPM is an effective measure of individualised outcomes and may be used by all disciplines interested in person-centred and goal-focussed therapy as part of a PTS programme	High attrition progressively at post-test intervals may have influenced test results Sensory components part of a larger treatment programme, therefore, difficult to evaluate contribution
Kaiser *et al.* (2010) USA	To test if SI treatment combined with psychotherapy would improve symptom outcome for persons with DESNOS more than psychotherapy alone	$N = 10$, 5 study group, 5 waitlist control 3 male and 7 female Mean age 46.7 years	Pilot quasi-experimental with wait list control and Single blind assessor	SIDES AVIVI	SLP a visual, acoustic and vestibular SI intervention 12-day treatment duration	χ^2 analysis, *t*-test, Mann–Whitney test and Tukey–Kramer Multiple Comparison test	Intervention group showed improvement in trauma symptoms, specifically in analyses of SIDES scores ($p < 0.05$) on Self-perception Affect/impulse regulation Alterations of meaning	Small sample size Two of the waitlist control group did not take part in the SLP

(*continued*)

Table II.

Reference(s) and country	Purpose of study	Population and diagnosis	Study design	Outcome measures	Intervention	Analysis	Core finding(s)	Limitations
Kimball *et al.* (2018) USA	To assess the efficacy of using the WTP to modulate arousal and influence the sensory systems in persons with PTSD	$N = 4$, women with self-reported PTSD diagosis	Single-subject design and pilot study	Salivary Cortisol, QofL, PAC, PLS AASP BPI SensRS self-report	WTP (self-administered) over two-week period	SINGWIN32 single subject, mean, SD and *t*-scores	Two out of four participants significant improvement in salivary cortisol levels within normal range Participant No. 1 did not improve on any test score; no cortisol sample. PTSD diagnosis work related to noise and vibration; 3 other participants h/o childhood trauma and abuse WTP improved outcomes for 3 participants; dosage responsive Self-report showed increase in occupational engagement and performance for three participants	Small sample size, no male participation. Requires larger sample and longer treatment period Limited to two-week time scale Difficulty with recruitment Non-standardised occupational performance measures and perceived stress levels
Parker *et al.* (2007) Canada	To understand how women with a h/o childhood maltreatment experienced the WRAP programme	$N = 7$ Female 31-71 years	Qualitative	Semi structured in-depth interview	Participation in the WRAP	Constant, comparative method and technique	Three themes identified Breaking trauma-based patterns Doing therapy Understanding the healing journey as a continuous process Support for the relational focus and empowerment basis of the WRAP programme	Non-generalisable findings for male populations Small sample size High attrition rate

(*continued*)

Table II.

Reference(s) and country	Purpose of study	Population and diagnosis	Study design	Outcome measures	Intervention	Analysis	Core finding(s)	Limitations
Serafini *et al.* (2016) Italy	To examine the relationship between SPPs, alexithymia, traumatic childhood experiences and quality of life among patients with unipolar and bipolar disorders	$N = 336$, 18-65 years major affective disorder; 197 unipolar/70 male/127 female139 bipolar/ 56 male, 83 female	Cross-sectional cohort	AASP TAS CTQ BDI-11 SF-12	Assessment of SPPs	χ^2, *t*-test, MANOVA and SEM	Sensory hypersensitivity in both study groups significantly correlated with childhood trauma events ($p < 0.001$) Sensory profiles play a role in the prediction of quality of life in persons with major affective disorders	Difficult to generalise findings due study design and populations chosen No controls
Warner *et al.* (2014) The USA	To measure the effectiveness of the SMART programme with adolescents with histories of complex trauma in residential care	$N = 10$, TAU = 21 13-22 years, 28 female and 3 male	Pilot, quasi-experimental study with matched pre-post-test control design	PTSD-RI THP CBCL	Sensory motor and affect regulation Treatment (SMART) Programme	Repeated measures ANOVA	Significant reduction in symptoms pre- and post-testing ($F = 7.286$; $p = 0.011$) Somatic regulation can stabilise and promote skill building in complex trauma treatment for adolescents Collaborative team approach with SI and SM key elements of programme	Small sample size, needs further investigation with larger sample size and controls Mostly female participants Findings cannot be generalised for adolescents in community settings

Notes: AASP – Adolescent/adult sensory profile; ACLS – Allen cognitive level screening; AVI – audio visual indexes; BDI-11 – beck depression inventory; BPI – basic personality inventory; CBCL – child behaviour check list; COPM – Canadian occupational performance measure; CTQ – childhood trauma questionnaire; DESNOS – disorder of extreme stress not otherwise specified; DTA – disorders of trauma and attachment; FCPRQ – fear of close personal relationship questionnaire; MPSS-SR – Modified PTSD symptom scale-self-report; PAC – perceived ability to concentrate; PLS – perceived level of stress; PSS-SR – post-traumatic stress disorder symptom scale; PTSD-RI – post traumatic disorder reaction-index; PTSR – post traumatic stress recovery programme; QofL – quality of life; SDT – sensory defensiveness tool; SensRS – sensory responsivity scales; SI – sensory integration; SIDES – structured interview for disorders of extreme stress; SMST – sensory modulation screening tool; SM – sensory modulation; SMART – sensory motor arousal regulation treatment; SMST – sensory modulation screening tool; TAS-20 – Toronto Alexithymia scale; THP – trauma history profile; TIC – trauma-informed care; TSIB-L – traumatic stress institute belief scale-revision; SCL-90 – symptom checklist-90; SF-12 – short form 12 health Survey version 2; SPP – sensory processing patterns; TAU – treatment as usual; OPSRS – occupational performance self rating scale; WRAP – women recovering from abuse programme; WTP – Wilbarger therapressure programme

Reference and country	Purpose of study	Study design	Conclusion
Champagne (2011b) The USA	To educate occupational therapy readers on the impact of trauma, TIC and attachment disorders in mental health	Educational article for occupational therapists	Clinical innovation and scientific research is needed to help identify effective methods of assessment and intervention for people with DTA Occupational therapists require ongoing professional development and mentorship experiences to reclaim and develop their evolving role with individuals with DTA
Champagne *et al.* (2010) The USA	To educate occupational therapy readers on SM, SD principles and practice, TIC in mental health	Educational article for occupational therapists	Occupational therapists require ongoing education and training support in SM and SD Expanding role for occupational therapists as consultants in mental health for sensory-based initiatives and interprofessional training
Champagne and Stromberg (2004) The USA	To explore the efficacy and importance of trauma-informed approaches that are sensory-based, person-centred and strengthen the therapeutic relationship	Literature review expert opinion on sensory-based approaches to treatment and healthcare policy initiatives to reduce seclusion/restraint (S/R)	Sensory approaches: facilitate the individual's ability to self-organise Strengthens the therapeutic relationship Assist in a crisis that could lead to S/R Empirical research is needed
Fraser *et al.* (2017) Canada	To determine the extent and effectiveness of the research on sensory-based interventions used with children and youth who have experienced trauma To describe these interventions in relation to occupational therapy practice	A scoping review	Limited although promising evidence for the use of sensory-based approaches with children and adolescents notably when part of a transdisciplinary programme of intervention Occupational therapists are in a unique position to contribute to this area of practice
Herold *et al.* (2016) The USA	To review symptoms of PTSD and SI and make a case of how aquatic therapy may be an effective sensory modality in treating clients with PTSD	A scoping review	Aquatic therapy may be an effective sensory modality in reducing *symptoms* of PTSD. Evidence extrapolated from other studies. No studies available on PTSD and aquatic therapy in this scoping review paper Need empirical research to determine its effectiveness as research is not available

(*continued*)

Table III. Summary of conceptual papers reviewed

Reference and country	Purpose of study	Study design	Conclusion
Holland *et al.* (2018) The USA	To describe the theoretical foundation and processes of a trauma treatment and skills training programme for young adult women with histories of childhood trauma	Descriptive; The trauma treatment model of ARC and sensory-based strategies underpin the transdisciplinary, residential and day care programme. To support discharge from hospital. A single case vignette is outlined	Sensory-based strategies target the somatic manifestations of trauma and help identify and regulate emotion and arousal by sensory stimuli Sensory-based strategies include AASP to help understand and inform interventions, personalised sensory kits including weighted blankets and tactile objects incorporated into crafting and art-based activities, a sensory comfort room and groupwork Empirical research required to support evidence base for the both the ARC model and sensory-based approaches with this population and setting
LeBel *et al.* (2010) The USA	To establish the relevance of integrating sensory-based and trauma-informed interventions in the delivery of mental health services	Expert opinion on sensory approaches; state policy initiative to include sensory approaches in all state licensed mental health facilities in Massachusetts, Part 1 of a two-part study	Recognition of the high prevalence of trauma and diversity in SP among survivors TIC and sensory approaches have been strongly supported across Massachusetts mental healthcare systems Occupational therapy incorporates the use of SM interventions in a broad range of mental health services
LeBel and Champagne (2010) The USA	To provide an update on service initiatives to reduce seclusion/ restraint practices in mental health services	Expert opinion on sensory approaches. State policy initiative to include sensory approaches in all state licensed mental health facilities in Massachusetts, Part 2 presentation of audits performed	Recognises the national and international effort to change traditional cultures of care and replace them with client-centred, sensory alternatives Commitment to build an evidence base for sensory approaches with occupational therapy expertise in this area Recognises the large estimated savings, as the inception of initiatives and programmes to reduce S/R (e.g. 99% reduction in workers compensation claims)
	To explore the applications of sensory	Exploratory literature review Presents the	Restraint of clients reduced in residential units after

Table III.

(*continued*)

Reference and country	Purpose of study	Study design	Conclusion
Warner *et al.* (2013) The USA	motor approaches to the treatment of affect and behavioural dysregulation traumatised adolescents in residential care, within a sensory integrative frame of reference (Ayres, 1972, 2005)	rationale for the SMART programme for traumatised adolescents in residential care	introduction of SM strategies and SMART preliminary initiatives Require empirical evidence as data to support claims of the effectiveness of SMART is scant and correlational Recommend occupational therapy SI interventions, staff training and support and service planning

Notes: AASP – adolescent/adult sensory profile; ACLS – Allen cognitive level screening; AVI – audio visual indexes; BDI-11 – Beck depression inventory; BPI – basic personality inventory; CBCL – child behaviour check list; COPM – Canadian occupational performance measure; CTQ – childhood trauma questionnaire; DESNOS – disorder of extreme stress not otherwise specified; DTA – disorders of trauma and attachment; FCPRQ – fear of close personal relationship questionnaire; MPSS-SR – modified PTSD symptom scale-self-report; PAC – perceived ability to concentrate; PLS – perceived level of stress; PSS-SR – post-traumatic stress disorder symptom scale; PTSD-RI – post traumatic disorder reaction-index; PTSR – post traumatic stress recovery programme; QofL – quality of life; SDT – sensory defensiveness tool; SensRS – sensory responsivity scales; SI – sensory integration; SIDES – structured interview for disorders of extreme stress; SMST – sensory modulation screening tool; SM – sensory modulation; SMART – Sensory Motor Arousal Regulation Treatment; SMST – Sensory Modulation Screening Tool; TAS-20 – Toronto Alexithymia Scale; THP - Trauma History Profile; TIC - trauma-informed care; TSIB-L – traumatic stress institute belief scale-revision; SCL-90 – symptom checklist-90; SF-12 – short Form 12 health survey version 2; SPP – sensory processing patterns; TAU – treatment as usual; OPSRS – occupational performance self rating scale; WRAP – women recovering from abuse programme; WTP – Wilbarger therapressure programme

Table III.

manifestations, often leading to overwhelm and difficulty with emotional or affect regulation, interfere with the individual's ability to attend simultaneously to cognitive, emotional and behavioural functions. This appears to be the driving force for the exploration of new treatment initiatives across the literature with recommendations for a sensory-based approach to trauma intervention based on SI theory in occupational therapy (Warner *et al.*, 2013). In the absence of any firm evidence base, this quest, coupled with the reduction of reported seclusion/restraint incidents (Champagne *et al.*, 2010; Champagne and Stromberg, 2004; LeBel and Champagne, 2010; LeBel *et al.*, 2010; Warner *et al.*, 2013), appear to have led to an advocation for sensory-based approaches in the conceptual literature.

While some researchers acknowledge the need for ongoing professional development and training for occupational therapists in relation to trauma-informed care and sensory-based interventions (Champagne, 2011b; Champagne *et al.*, 2010; Fraser *et al.*, 2017) other authors, (Herold *et al.*, 2016) draw attention to possible avenues for intervention with trauma survivors, for example, aquatic therapy. All the papers conclude that more research is required (Champagne and Stromberg, 2004; Champagne, 2011b; Champagne *et al.*, 2010; Fraser *et al.*, 2017; Herold *et al.*, 2016; Holland *et al.*, 2018; LeBel *et al.*, 2010; Warner *et al.*, 2013). Interestingly, none of the conceptual papers reviewed addressed the needs or wishes of the trauma survivor from their perspective, yet all advocate person-centred, trauma-informed practice. One paper discussed a collaborative transdisciplinary person-centred programme for young adult women;

however, it did not expand on how person-centredness was measured or perceived by the participants (Holland *et al.*, 2018).

Qualitative and quantitative studies

Three key themes were identified from the research studies reviewed:

(1) atypical SP patterns;

(2) type of sensory-based intervention with trauma survivors; and

(3) transdisciplinary treatment programmes can reduce the symptoms of trauma.

Atypical sensory processing patterns

A sensory profile describes a person's SP patterns. Measured in four quadrants: sensory sensitivity, sensory avoidance, low registration and sensory seeking, the validated adolescent/adult sensory profile (AASP) (Brown and Dunn, 2002) was used in all the studies reviewed on this theme. The studies reviewed to shed light on the diversity and the commonalities of this theme. Four papers were retrieved, specifically relating to SP patterns and trauma in adults. Three papers focussed on posttraumatic stress (PTS) (Engel-Yeger *et al.*, 2013; Engel-Yeger *et al.*, 2015; Champagne, 2011a) and the fourth on bipolar and unipolar disorders and traumatic childhood experiences (Serafini *et al.*, 2016). All studies highlighted atypical SP patterns, mainly expressed in sensory sensitivity, sensory avoidance and low registration as compared to the AASP normal range values (Engel-Yeger *et al.*, 2013; Engel-Yeger *et al.*, 2015; Champagne, 2011a; Serafini *et al.*, 2016). A lower tendency for sensory seeking behaviours, was evident in three studies. In contrast, Champagne (2011a), using a single case study design and focussing on a sensory-based intervention, found no difference in sensory seeking behaviour, compared to the AASP normal range values.

Engel-Yeger *et al.* (2013, 2015) and Serafini *et al.* (2016) co-authored three papers. Both primary studies included the same experimental study design with a control group (Engel-Yeger *et al.*, 2013, 2015). Differences between the PTS group and control were manifested in all five sensory modalities (taste, vestibular, visual, touch and auditory) and activity level, with a higher number of significant differences found in the vestibular modality (movement), touch modality and most notably the auditory modality (Engel-Yeger *et al.*, 2013). In addition, Engel-Yeger *et al.* (2015) looked at close personal relational intimacy fears in individuals with PTS symptoms and found that fear of intimacy was significantly predicted by both PTS symptoms ($p \leq 0.01$) and low registration ($p \leq 0.001$). However, it is not clear how the researchers recruited their participants for the 2013 study, and no standardised tool was used in either study to ascertain previous traumatic experiences. Consideration given to life in a war zone over the past 60 years, would have revealed the control participants' exposure to some degree of traumatic stress in Israel, in their lifetime. There is, however, no discussion on this issue.

Serafini *et al.* (2016) investigated traumatic childhood experiences and their relationship with SP patterns, alexithymia and quality of life among patients with unipolar and bipolar disorders. They found that in both unipolar and bipolar groups lower registration of sensory input, as well as hypersensitivity (sensory sensitivity and avoidance patterns) correlated with enhanced childhood traumatic events. While both groups scored higher in physical neglect in childhood, bipolar subjects showed more emotional neglect and abuse, and physical neglect and this was statistically significant ($p < 0.001$) (Serafini *et al.*, 2016). The researchers also found that alexithymia played no role in differentiating unipolar and

bipolar groups nor predicting quality of life. Critically, the study design did not include a control group and, although the sample size was large, there were more unipolar subjects in the comparative analysis. In contrast to the other four studies reviewed, Serafini *et al.* (2016) did assess for other treatment regimens, including psychoactive medication, and required that subjects had been stable for at least six months prior to participating in the study.

Type of sensory-based intervention with trauma survivors

The literature shared several sensory-based interventions and techniques in addition to the "sensory room"; a therapeutic multimodal, sensory environment, which has been advocated for in much of the mental health research (Champagne and Stromberg, 2004; Holland *et al.*, 2018; Warner *et al.*, 2013).

Holland *et al.* (2018) described the sensory component of a trauma treatment programme for young adult women who had experienced chronic childhood trauma. The "sensory room" and sensory-based interventions, including a customised "sensory kit" to help regulate overwhelming sensory and emotional stimuli, formed an integral part of the transdisciplinary treatment. Although the "sensory kit" was not discussed, the use of weighted blankets and tactile equipment were incorporated into other sensory activities and occupations, which included yoga, cooking and art-making. Individual sensory treatment programmes where developed and informed by a sensory profiling assessment (AASP: Brown and Dunn, 2002).

Kimball *et al.* (2018) described a specific sensory treatment protocol, the "Wilbarger Therapressure Programme" (WTP), which for the purposes of this study involved the participants applying very deep touch pressure to their skin through using a special Therapressure™ brush and firm joint compression. Serving as their own controls for the single-subject design methodology, two of the four participants, all with a self-reported diagnosis of PTSD, showed positive change on all outcome ratings, increased occupational performance and modulation of salivary cortisol levels (Kimball *et al.*, 2018). The treatment period was two weeks duration only and there was no follow-up on participants. Although with two out of the four participants showing positive improvements, the WTP warrants further investigation.

Champagne (2011a) carried out an in-depth case study describing sensory processing patterns (SPPs), occupational engagement issues with occupational therapy assessment and intervention through the sensory modulation programme (SMP, Champagne, 2008a). The 1-1 SMP emphasises both the therapeutic use of self as an occupational therapy practitioner and person-centred practice initiatives. Champagne describes SPP, sensory modulation (SM) and sensory discrimination (SD) through a three-stage therapeutic process model for working with people experiencing disorders emerging from traumatic experience. Occupational therapy interventions and the SMP initially focussed on stabilisation and creating safety, rather than working specifically with trauma experiences. These stabilisation measures, which include sensory-based techniques and interventions have been described as "preparatory" in nature, creating the conditions within which to support clients participating in meaningful and purposeful life activities (Champagne, 2011a; Parker *et al.*, 2007). Champagne (2011a) provides the most explicit example of sensory-based treatment including sensorimotor activities, grounding techniques, integrative therapies such as aromatherapy and sensory diets in the practice of occupational therapy. However, though promising, there remains limited evidence to support the generalisability of SMP as part of routine clinical practice, given the single case study design.

Similarly, Kaiser *et al.* (2010) developed a SI protocoled treatment programme in conjunction with psychotherapy as a treatment for complex traumatic stress. Using vestibular, visual and auditory input as a "bottom –up" or body-informed approach to addressing the symptoms of adults with a history of complex trauma, Kaiser and colleagues found significant changes in total scores of self-perception and affect/impulse regulation ($p < 0.05$). The assessor was blind, although the intervention was administered by the first author, introducing significant bias. This small study, while preliminary and observational, supports clinical exploration using SI with adult populations. A 20 per cent attrition rate was noted in this small study, and the reasons for this are not adequately addressed in this instance. The studies reviewed varied in the type of sensory-based intervention or technique used including preparatory, purposeful and occupation-based activities (Champagne, 2011a; Kaiser *et al.*, 2010; Kimball *et al.*, 2018), which may form part of a transdisciplinary treatment programme (Holland *et al.*, 2018; Parker *et al.*, 2007; Warner *et al.*, 2014).

Transdisciplinary treatment programmes may reduce the symptoms of trauma

LeBel *et al.* (2010), Champagne *et al.* (2010), Champagne and Stromberg (2004), Holland *et al.*, 2018 and Warner *et al.* (2014) have all advocated a sensory-based trauma-informed framework for practice, with both transdisciplinary and 1-1 occupational therapy intervention. While descriptions of 1-1 sensory-based interventions for survivors of complex trauma are scarce in occupational therapy literature, three studies reflect a transdisciplinary approach, which included occupational therapists and led to a reduction in traumatic stress symptoms for those studied.

Programmatic interventions such as the SMART programme for traumatised adolescents in residential care (Warner *et al.*, 2014), the women recovering from abuse programme (WRAP, Parker *et al.*, 2007) and the programme for traumatic stress recovery [posttraumatic stress recovery programme (PTSR)] in adults with PTS (Harper *et al.*, 2006) all include a sensorimotor approach and a trauma-informed transdisciplinary model of working, with the SMART further emphasising the SI occupational therapy contribution to the programme.

Both WRAP and the PTSR included group work as the main vehicle for programme delivery, and the PTSR and SMART included additional individualised 1-1 occupational therapy, including SM and sensorimotor activity involving the sensory room. The WRAP, (Parker *et al.*, 2007), was the only qualitative study found to investigate the experience of female trauma survivors following intervention. Only seven participants completed the interviews from a potential 57 participants. The authors did suggest that an outbreak of the SARS virus may have been one of the reasons for the low participation rate. Three key findings deepen the understanding of the trauma recovery process among the participating women, according to the researchers; these findings involve breaking trauma-based patterns, undergoing therapy and the healing journey as a continuous process. Parker *et al.* (2007) advocate a relational empowerment-based model as a foundation for serving the mechanisms of change, as some of the self-care and grounding activities explored during the programme were continuously used by participants to enable them to "manage and cope" on what they described as their healing journey.

The PTSR programme based on the sanctuary model (Bloom, 1997) includes sensory components as support for affect-regulation and coping with relationships and everyday life (Bloom, 2006). Using a mixed method, pre- and post-test design, Harper *et al.* (2006) found a significant improvement in self-care, relationships and communication, coping with feelings

and spirituality following programme completion. However, these improvements were not maintained following discharge.

Warner *et al.* (2014), building on the SMART intervention model and methodology (Warner *et al.*, 2013), compared once weekly SMART intervention with TAU psychotherapy among an adolescent sample. Using standardised measures and a pre- and post-test assessment at six months, the results suggested the benefits of using SMART in addressing sensory issues and the symptoms of anxious and depressed mood in adolescents. Although the study sample was small and the results are preliminary, the SMART shows a promising alternative sensory approach to traditional trauma therapy with this population.

In a descriptive paper and using a case vignette, Holland *et al.* (2018) describe a trauma treatment programme, which includes a person-centred, strengths-based approach, underpinned by the attachment, regulation and competency (ARC) model. As mentioned earlier, this transdisciplinary programme includes a large sensory component based on the initiatives described by LeBel *et al.* (2010). While the single case vignette is helpful in illustrating perceived gains of the programme, there is no empirical data to support or quantify these claims.

Discussion

Sensory approaches and sensory-based interventions have a growing presence in the mental health literature, and occupational therapists are emerging as potentially key players in this field of practice (Scanlan and Novak, 2015). For survivors of trauma, interventions which address the body on a sensory level and support self-regulation, can affect an individual's engagement and participation in occupations (Champagne *et al.*, 2010). This review has explored the emerging evidence in occupational therapy for sensory-based intervention with the adult and adolescent trauma survivor. The three themes identified support the understanding of some of the factors contributing to sensory-based occupational therapy and identify those interventions currently practised with these groups.

Much of the empirical research reviewed tends to focus on symptom management as an outcome measure of treatment efficacy (Champagne, 2011a; Kaiser *et al.*, 2010; Warner *et al.*, 2014). This process of symptom categorisation, mostly using the diagnostic and statistical manual of mental disorders (DSM; APA, 2013) criteria, is not without its problems (Whalley Hammell, 2007) and raises methodological issues when outcomes are based on the diagnostics and measurement of symptoms using instruments arising from debated criteria that do not include a complex trauma framework (van der Kolk *et al.*, 2009; Maercker *et al.*, 2018). All but one study (Parker *et al.*, 2007) used DSM criteria for diagnostics and outcome measurement, with one study using participant-reported diagnosis of PTSD as the criterion (Kimball *et al.*, 2018). Therefore, the findings of studies based on these criteria (Champagne, 2011a; Engel-Yeger, 2013, 2015; Harper *et al.*, 2006; Kaiser *et al.*, 2010; Serafini *et al.*, 2016; Warner *et al.*, 2014) must be carefully considered. In addition, the use of non-standardised measurement tools such as those used by Champagne (2011a) reduces the rigour of a study. Considering the work of Harper *et al.* (2006) and validation of the Canadian Occupational Performance Measure (COPM, Law *et al.*, 2005) in a PTS programme, the outcomes for two of the studies (Champagne, 2011a; Kimball *et al.*, 2018) might have been more persuasive had such an instrument been adopted.

Given such fundamental issues with the trauma research, for the first time since 1979, the two main international mental health diagnostic systems the DSM and the international classification of diseases (ICD-11) are no longer in broad agreement over what types of PTSD exist, and the presentation of symptoms that are seen with PTSD. Now, the much-debated "complex trauma" (van der Kolk *et al.*, 2009) has been given the official diagnostic

recognition of CPTSD by the ICD-11 (Buxton and Turnbull, 2018). For a body of research to become evidence informed, there needs to be some continuity and clarity around both the concepts, the contexts within which the research is conducted and the outcome measures used. It would appear that diagnostics will continue to be an issue for both researcher and clinician for some time to come.

Implications for practice

The relative scarcity of sensory-based trauma intervention studies in occupational therapy can be observed from the limited empirical and published studies available. However, we do know that trauma-informed sensory-based service initiatives (Champagne and Stromberg, 2004; Holland *et al.*, 2018; Stoller *et al.*, 2012; Moore, 2010; Martin, 2015), sensory-based trauma therapy for children (Fraser *et al.*, 2017) and non-sensory specific interventions and occupations for adult trauma survivors (Snedden, 2012; Precin, 2011) are part of the wider occupational therapy process (Lopez, 2011). As a component of a SMP, other sensory-based interventions such as aquatic activities, horticulture, art making and sensory-enhanced yoga may be both effective and age-appropriate methods of application with adolescent and adult trauma survivors (Harper *et al.*, 2006; Herold *et al.*, 2016; Holland *et al.*, 2018; Martin, 2015; Parker *et al.*, 2007; Re *et al.*, 2014; Stoller *et al.*, 2012). However, the studies in this review do not distinguish between SI interventions, the core sensory components of an occupation or the active engagement in a meaningful occupation, as the therapeutic vehicle leading to functional change for the trauma survivor. The actual mechanisms or processes that lead to change lack clarity. Future research focussing on all of these areas and addressing the relational aspect of the therapeutic encounter is warranted with trauma survivors if an understanding of the mechanisms for change is to be reached.

Studies focussing on collaborative transdisciplinary initiatives within a trauma-informed framework support the occupational therapy role in development and sustainment of these programmes, as emphasised in the SMART programme (Warner *et al.*, 2014). Although the study sample was small and the results are preliminary, the SMART shows a promising alternative sensory approach to traditional trauma therapy for this population. More rigorous controlled outcome research with a larger sample size is required (Warner *et al.*, 2014).

A transdisciplinary approach, is not only desirable and essential to trauma-informed practice, but may also be the very foundation for the success and efficacy of an intervention (Martin, 2015). It is recommended that sensory-based treatments form part of a transdisciplinary assessment and treatment process (Fraser *et al.*, 2017; Parker *et al.*, 2007; Harper *et al.*, 2006) for the trauma survivor and be a component of trauma-informed healthcare services (LeBel *et al.*, 2010). The complex nature of trauma and its effects on an individual survivor or community may mirror the complexity required in approaching treatment and predicting outcomes for this population. A diverse and trauma educated skill-set is required (Champagne *et al.*, 2010) and each discipline can support another in further developing their expertise when collaboration is established and valued (Williams, 2017).

This collaboration extends its reach to all individuals who form part of a trauma-informed framework. It is, however, ironic that despite much discussion and policy change favouring a person-centred approach to healthcare there still remains a clear lack of qualitative studies from the trauma survivor's perspective. Parker *et al.* (2007) drew attention to the importance of ongoing support for the trauma survivor. This was the only study to emphasise how the successful use of coping skills, following exposure to trauma, can build resiliency and promote post-traumatic growth (Underleider, 2003). Both have been identified as key desirable outcomes in the treatment of trauma (Pfeiffer *et al.*, 2014; Snedden, 2012). Studies have suggested that without continued community support and a trauma-informed approach to

recovery, the benefits of resource-intensive trauma treatment programmes may not be effectively retained in the long term (Felitti and Anda, 2010; Harper *et al.*, 2006, 2008; Parker *et al.*, 2007). Parker *et al.* (2007) shed light on this potential, which lies beyond the amelioration of traumatic stress symptoms. However, the WRAP (Parker *et al.*, 2007) and the PTSR (Harper *et al.*, 2006) are both observational studies, share methodological drawbacks with no controls and high attrition rates; evaluation of these programmes remains inconclusive. Despite this, providing ongoing community therapeutic support, including a spiritual/meaning-making component (Harper *et al.*, 2006; Parker *et al.*, 2007), may be areas worthy of exploration by occupational therapy. These are themes which resonate with the profession's inherent philosophy and practice (Harper *et al.*, 2006, 2008). Occupational therapy resources, such as the Canadian model of occupational performance and engagement (Townsend and Polatajko, 2007), which are person-centred and inclusive of a "spiritual meaning making" component may provide the supportive framework upon which to base investigation and practice in the future. However, this complex phenomenon requires sensitive exploration as increased awareness of trauma brings its own personal challenges for clinicians. As Koomar (2009, p. 3) acknowledges:

> [. . .] it is a highly courageous act to open to the pain and vulnerability that comes with holding the trauma of another person, as well as to reflect on personal childhood pain that may emerge.

Other factors, which may influence outcomes are provided in the SP studies reviewed, which shared a corroboration on SPPs typical of most trauma survivors studied. However, Champagne (2011a), in a single case study design, did not find a lower tendency for sensory seeking, contrary to the other three studies reviewed (Engel-Yeger *et al.*, 2013, 2015; Serafini *et al.*, 2016). The lower tendency of sensory seeking patterns associated with trauma survivors in the research may be related to exaggerated emotional responses including pathological fear and unrealistic negative perceptions of one's environment leading to stimulation avoidance or withdrawal (Foa *et al.*, 1999; Engel-Yeger *et al.*, 2015). The single participant in Champagne's (2011a) study was a practising nurse and actively involved in the therapeutic processes of occupational therapy and psychotherapy. It is unclear if active social participation or work circumstances influenced SPPs, given that the productivity levels of the other studies participants were not reported. Furthermore, occupational therapists are required to be aware that the survival mechanisms that are inherent in the SPPs identified with the trauma survivor, may help individuals ensure a sense of personal safety and participation in daily life. According to Engel-Yeger *et al.* (2015), emotional responses such as shame, despair and hopelessness may accentuate fears of personal intimacy for the trauma survivor and this, in turn, may complicate the therapeutic relationship and any trauma treatment programme.

However, what is clearly lacking in the occupational therapy literature is high-quality empirical support for sensory-based interventions and occupations. Sample size needs to be larger, studies more longitudinal and comparative to other treatments. This research would not be without its challenges though because of the heterogeneity of the sensory-based interventions and occupations; it is difficult to compare, for example, the WTP (Kimball *et al.*, 2018), with the sensory learning programme (SLP) (Kaiser *et al.*, 2010), with sensory occupations such as art-making, yoga and cooking (Holland *et al.*, 2018). There also needs to be clarity regarding the nature and extent of trauma experienced by survivors (Serafini *et al.*, 2016; Kimball *et al.*, 2018; Van der Kolk *et al.*, 2009), the influence of SPPs (Engel-Yeger *et al.*, 2013, 2015; Serafini *et al.*, 2016; Champagne, 2011a) and the sensory-based treatments most appropriate for the different stages of the recovery process (Champagne, 2011a, 2011b; Kaiser *et al.*, 2010). Indeed, specific sensory-based interventions have been shown to support the preparatory phases in trauma treatment by assisting in creating a sense of safety or stability

for the survivor (Champagne, 2011a, 2011b; Champagne and Koomar, 2011; Machingura and Lloyd, 2017) and may also be used throughout the trauma processing phase (Harper *et al.*, 2006; Van der Kolk, 2005; Warner *et al.*, 2014) and the ongoing life journey (Parker *et al.*, 2007). More clarity on what sensory-based interventions are most appropriate for which group of trauma survivors and when to use the same is, therefore, warranted.

The interchangeable use of terms such a sensory approach, sensorimotor approach, SI approach, sensory-based approach and sensory disorders appear throughout the research reviewed. This led to some confusion for the reader. Three papers (Champagne, 2011a, 2011b; Fraser *et al.*, 2017), clearly and distinctively defined the sensory terms used. For future research purposes, and as a profession, occupational therapy may do well to clarify the terminology used and to standardise applied definitions (Fraser *et al.*, 2017; Rodger *et al.*, 2012). This might help support the profession in identifying its unique role in this practice area.

Strengths and limitations

The purpose of this integrative review was to gather and present the holistic evidence, including expert opinion in the field. However, the limited number of published empirical studies, reviews and interventions evaluated in the English language and confined to occupational therapy, restricted discussion in respect of comparison and analysis of available data and led to the dominance of some author names. A study across all the professions who use sensory-based approaches and interventions, including, for example, nursing and social work, may have yielded more information generally, but would have restricted the enquiry into occupational therapy. Furthermore, the heterogeneity of the studies and interventions presented here are a drawback to this integrative review. Notwithstanding these limitations, all the studies evaluated reported positive results, with a greater emphasis on transdisciplinary treatment than on individualised SI treatment by occupational therapists. This review can assist in policy development, and also in the critical assessment of daily practice, and the educational needs of occupational therapists (Champagne *et al.*, 2010). However, it is too limited in scope to provide a thorough systematic analysis of the empirical research available.

Conclusion

The high prevalence of trauma in adult and adolescent mental health populations, and the extensive effects of trauma on the body, indicate a need for new approaches to treatment. There is emerging evidence in support of a sensory-based approach to treatment with these groups, with individualised sensory-based assessment and treatment as part of a transdisciplinary programme, as it has the potential to demonstrate effective outcomes. Although occupational therapy research is limited at this time, with a skillset in occupational analysis and a background in SI practice the profession of occupational therapy is in a pivotal position in the evolving trauma-informed recovery movement. However, clarification and standardisation of the terms used to describe sensory-based interventions within the profession are necessary. Further training in the field of trauma studies and mentorship may be required by therapists, before claiming an active role in the development of key policy, research and services for persons with a history of trauma.

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