Sensory-based therapy

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The Research Team are unable to ensure that the information listed below provides an accurate & up-to-date snapshot of these matters

Research question: Is sensory integration, modulation, processing all talking about the same thing? Any other important terms to define?

Who might benefit from sensory support?

What is the evidence sensory support reduces the need for RRP?

What is the evidence for other more general outcomes?

Who might implement/qualifications for sensory support?

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1. Contents

2. Summary

The terminology used in the literature on sensory disorder and sensory-based interventions (SBIs) is inconsistent. The terms sensory integration, sensory processing and sensory modulation are sometimes used interchangeably in the literature and sometimes given distinct definitions. General features of these key terms can be described.

Researchers and clinicians have employed SBIs for a variety of conditions. Most of the research available relates to interventions for Autism Spectrum Disorder (ASD) or other neurodevelopmental disorders such as intellectual disabilities or attention deficit/hyperactivity disorder, schizophrenia or other mental health conditions such a bipolar, depression or obsessive-compulsive disorder. There is also research relating to interventions for cerebral palsy, Huntington's disease and dementia.

There is some evidence that SBIs can contribute to a reduction in restrictive practice. The evidence is predominantly in the domain of mental health and is predominantly related to restrictive practice in a clinical or institutional setting. However, systematic reviews show inconsistent results. Based on the evidence collected it is not possible to say with confidence that SBIs reduce the use of restrictive practice. There are many factors which contribute to an institution's use of restrictive practice that are not addressed by the introduction of SBIs.

SBIs do likely have some positive effects. There is consistent evidence that SBIs reduce distress of people with mental health conditions and lower quality evidence that distress is reduced for people with Huntington's disease and dementia. There is low to moderate quality evidence of positive effect for young people with ASD relating to some core autistic characteristics, life outcomes and cognitive, motor and social-emotional skills. There is weak

evidence showing improvement in functional outcomes for children with intellectual disability and development delay.

SBIs are usually implemented by an occupational therapist. However, other professionals can be trained to implement SBIs including nurses, psychologists and speech therapists.

3. Terminology

The literature on sensory therapies is not well organised and key terminology is not used consistently (Ouellet et al, 2021). However, rough definitions of the major concepts are possible.

3.1 Theoretical terminology

Underlying theoretical terms are often used in different ways. Brown et al (2019) provide an overview of the use of the terms **sensory integration**, **sensory processing, sensory modulation** and **sensory perception**, showing that despite considerable variation, these terms have also been used interchangeably in the literature. Based on their review, the authors propose the following definition of sensory modulation:

> Sensory modulation is considered a twofold process. It originates in the central nervous system as the neurological ability to regulate and process sensory stimuli; this subsequently offers the individual an opportunity to respond behaviourally to the stimulus (Brown et al, 2019, p.521).

They characterise sensory modulation as a combined neurophysiological and behavioural process within the larger category of sensory processing. Sensory processing also includes: receiving, organisation, perception, interpretation, registration and discrimination. They suggest sensory integration is the framework which encompasses the sensory processing sub-processes and the disorders associated with those subtypes (Brown et al, 2019).

However, we should also recognise that the process of proposing consistent definitions of these terms is largely revisionary considering the disagreement in the literature. For instance, sensory integration can refer to a neurological process, a theory or a practice depending on the researcher. Sensory processing might be used interchangeably with sensory integration (Camarat et al, 2020; Brown et al, 2019). Sensory processing is more often used in the literature related to autism, but sensory modulation is often used in the literature on mental health to refer to the same types of interventions (Brown et al, 2019; Hitch et al, 2020).

There is inconsistency in the definitions of sensory disorders as well. Diagnosis is made based on the presence of i) difficulties translating sensory information into appropriate behavioural responses and; ii) a demonstrable effect on activities of daily living (Ouellet, 2021). There is some controversy about whether sensory disorders are genuinely separate conditions or whether they are collections of symptoms associated with other conditions. The category of sensory disorders is not included in either the DSM-5 or the ICD-11 (American Psychiatric Association, 2013; World Health Organisation, 2019).

3.2 Types of sensory based interventions

Terms for therapeutic practices are also used in incompatible ways (Ouellet et al, 2021). In particular, there is an ambiguity in the use of the term **sensory based interventions**.

SBI can refer to a category of therapeutic techniques that include sensory integration therapy (SIT), auditory integration therapy (AIT), use of multi-sensory environments (MSE) and other techniques that target sensory processing difficulties. Preis and McKenna (2014) and Whitehouse et al (2020) use SBI in this way.

However, SBI can also refer to specific practices that are distinguished from SIT, AIT or MSE. Ouellet et al (2021), Basic et al (2021) and Wans Yunus et al (2015) draw the distinction between SIT and SBI based on the number of therapeutic modalities or stimuli. SBI is used to refer to techniques that use singular discrete stimuli to achieve the desired result (e.g., massage, a weighted vest). SIT on the other hand, uses multiple integrated stimuli and must include more than one sensory modality (Parham et al, 2007).

McGill and Breen (2019) note a further complication: SBI-type strategies are emerging in the context of positive behaviour support and multi-element behavioural interventions without being labelled as SBIs.

There does seem to be agreement that SBIs are based on the theoretical premise that sensory processing differences affect skill acquisition and behavioural development. By targeting sensory processing, the interventions aim to improve behavioural problems, emotional regulation, cognitive, language and social skills (Whitehouse et al, 2020).

Discrete SBIs, SIT, MSE and AIT are considered in further detail below. There are other therapeutic practices that can be included under the label SBI. Whitehouse et al also consider environmental enrichment, sensory diet and the following:

> alternative seating; blanket or “body sock”; brushing with a bristle or a feather; chewing on a rubber tube; developmental speech and language training through music; family-centered music therapy; joint compression or stretching; jumping or bouncing; music therapy; playing with a water and sand sensory table; playing with specially textured toys; Qigong Sensory Treatment (QST); Rhythm Intervention Sensorimotor Enrichment; sensory enrichment; swinging or rocking stimulation; Thai traditional massage; Tomatis Sound Therapy; and weighted vests (Whitehouse et al, 2020, p.70).

SBIs are usually implemented by occupational therapists, although speech therapists, nurses, psychologists and other professionals can be trained to implement programs (McGill & Breen, 2019).

3.2.1 Sensory-based interventions

SBI provides sensory stimuli that are specific or discrete to address behavioural problems causes by difficulties in sensory processing (Wan Yunus, 2015; Ouellet et al, 2021). The distinction between sensory-based and sensorimotor-based approaches is drawn differently in the literature. Ouellet et al (2021) says that sensory-based approaches involve a stimulus of

constant intensity, such as a weighted vest, whereas sensorimotor-based approaches include the use of movements, allowing the person to control the quantity and intensity of stimulation. In contrast, Wan Yunus et al (2015) distinguish between tactile (eg. massage, touch therapy, brushing), proprioceptive (eg. weighted vests) and vestibular (eg. therapy ball, cushions, horse riding) based interventions. Vestibular interventions involve patient movements and variation in the constancy of intensity of stimulus was not noted as a distinguishing feature of different techniques.

3.2.2 Sensory integration therapy

Sensory integration therapy (sometimes sensory processing therapy) is defined as any intervention that targets someone's "ability to integrate sensory information (visual, auditory, tactile, proprioceptive, and vestibular) from their body and environment in order to respond using organized and adaptive behaviour" (Steinbrenner et al, 2020, p.29). Steinbrenner et al (2020) regard SIT as synonymous with Ayers Sensory Integration (Ayers). Whereas Omairi et al (2022) treat Ayers as just one frequently used type of SIT.

Ayers can include equipment such as mats, swings, scooter boards and bolsters in "individually tailored sensorimotor activities that are contextualized in play at the just-right challenge to facilitate adaptive behaviours for participation in tasks and activities" (Omairi et al, 2022, p.4; Whitehouse et al, 2020). There are 10 core elements of Ayers:

- Provide sensory opportunities – intervention includes various sensory experiences (tactile, proprioceptive, vestibular) involving more than one sensory modality.
- Provide just-right challenges – sensory challenges are neither too difficult nor too easy for the individual
- Collaborate on activity choice – the participant is an active contributor to the intervention including choice of activity
- Guide self-organisation – participant is encouraged to initiate, plan and organise their own activities
- Support optimal arousal – the context should allow the child to maintain their optimal level of arousal
- Create play context – the context builds on the participants intrinsic motivation and enjoyment of activities
- Maximise child's success – activities are tailored so that the child can experience success
- Ensure physical safety – activities are tailored so that the child is safe and properly supervised

- Arrange room for engagement – the environment is organised to motivate the participant to participate in activities
- Foster therapeutic alliance – the participant is treated with respect and allowed to have their own emotional reactions to experiences (Parham et al, 2007; Wans Yunus et al, 2015; Whitehouse et al, 2020).

3.2.3 Multi-sensory environment

MSEs (also called comfort rooms, sensory rooms or Snoezelen rooms) are rooms that contain equipment used to modify the environment primarily with the aim to create sensory experiences. This includes equipment used to create lights, sounds, smells or proprioceptive and tactile sensations. The goal of an MSE is to soothe or stimulate a person with sensory needs (Unwin et al, 2022; Cameron et al, 2020).

Figure 1 Multi-sensory room

MSEs are often windowless or have covered walls. They commonly include:

> (1) projection equipment to provide changing light colours and patterns, (2) sound (music) equipment, (3) bubble tubes offering visual, audible and tactile stimulation, (4) waterbed, (5) fibre optic lighting, (6) tactile objects, (7) user-controlled switching for changing lighting and other equipment, (8) weighted blankets, (9) self-massagers, (10) rocking chair(s), (11) exercise balls, and (12) squeeze balls (Cameron et al, 2020, p.631).

Rooms might also include essential oils, scented candles, sweet or salty foods (Cameron et al, 2020). Participants can control aspects of the environment thereby reducing the unpredictability or the environment and allowing the participant to regulate their own sensory stimulation (Unwin et al, 2022).

3.2.4 Auditory integration training

AIT aims to 're-educate' the auditory processing system of the patient's brain with 2 half hour electronic music listening sessions over 10 days. This re-education process is intended to target behaviour and learning problems in people with autism (Sinha et al, 2011).

Wans Yunus et al (2015) suggest auditory integration training (AIT) is a based on the same theory of sensory integration as SIT. However, because SIT involves multiple sensory modalities (Parham et al, 2007), AIT can only be considered a related therapy rather than a kind of SIT. Other related techniques include Tomatis sound therapy and Samonas sound therapy (Sinha et al, 2011).

3.2.5 Music therapy

Music therapy is considered a type of SBI by some (Whitehouse et al, 2020; Cheung et al, 2022) and not others (Steinbrenner et al, 2020). The mechanism by which music therapy is supposed to work does involve active listening and auditory sensory experiences, though it also includes social and cognitive processes (Geretsegger et al, 2014).

4. Efficacy

Researchers and clinicians have suggested that sensory based interventions could benefit people with autism spectrum disorder, ADHD, developmental coordination disorder, cerebral palsy, down syndrome, intellectual disability, dementia, depression, schizophrenia, mood disorders, obsessive compulsive disorder (Wan Yunus et al, 2015; Sinha et al, 2011; Hitch et al, 2020; Ouellet et al, 2021).

4.1 Autism Spectrum Disorder

Steinbrenner et al (2020) and Whitehouse et al (2020) consider sensory-based interventions in their reviews of evidence-based treatments for young people with ASD.

Steinbrenner et al added Ayers to their 2020 review of evidence-based practices for children and young people with autism spectrum disorder. They note evidence of effect on communication, social skills, cognitive and academic outcomes, adaptive coping skills, challenging behaviour, and motor skills (Steinbrenner et al, 2020). However, Steinbrenner et al did not assess the evidence for efficacy in detail, but only show that Ayers meet their criteria for being considered an evidence-based practice:

> To be identified as evidence-based, a category of practice had to contain (a) two high quality group design studies conducted by two different research groups, or (b) five high quality single case design studies conducted by three different research groups and involving a total of 20 participants across studies, or (c) a combination of one high quality group design study and three high quality single case design studies with the combination being conducted by two independent research groups (Steinbrenner et al, 2020, p.24).

Whitehouse et al (2020) considered 9 systematic reviews. No evidence was found of a positive effect for assorted SBIs, AIT or sensory diet. Environmental enrichment showed a positive effect on motor skills based on moderate quality evidence.

Ayers was considered in 4 reviews which showed low quality evidence of improvement to cognition, motor skills, challenging behaviours, academic skills and community participation. Reviewers also found moderate quality evidence of a benefit to motor skills. Low or moderate quality evidence showed inconsistent or null effect on autistic characteristics such as social-communication and sensory behaviours, communication skills, play, adaptive behaviour skills, and general outcomes. 1 review found evidence that SIT may contribute to increase in stereotypical and problem behaviours (Whitehouse et al, 2020).

Music therapy demonstrated the most consistent positive effect. Reviewers found moderate quality evidence showing positive effect on social-communication symptoms, communication skills, and quality of life. Reviewers found low quality evidence showing positive effect on play, motor skills, challenging behaviours, and school readiness (Whitehouse et al, 2020).

			Core autism characteristics				Related skills and development								Education and participation				Family wellbeing				
	Interventions	No. of systematic reviews	Overall autistic characteristics	Social-communication	Restricted and repetitive interests and behaviours	Sensory behaviours	Communication	Expressive language	Receptive language	Cognition	Motor	Social-emotional/ challenging behaviour	Play	Adaptive behaviour	General outcomes[a]	School/ learning readiness	Academic skills	Quality of life	Community participation	Caregiver communication and interaction strategies	Caregiver social emotional wellbeing	Caregiver satisfaction	Caregiver financial wellbeing	Child satisfaction
Sensory-based interventions	Systematic reviews of assorted sensory-based interventions*	3					o M								o LL									
	Auditory integration Therapy	3					o M								o LL									
	Ayers Sensory Integration (ASI)	4	? L	? LL		? LM	? LL			+ L	+ LM	+ L	o L	? LL	? M		+ L		+ L					
	Environmental enrichment	1						o M		+ M														
	Music therapy	4		+ M			+ M				+ L	+ L	+ L	? LL	? L	+ L		+ M			+ M			
	Sensory diet	1													o L									

+ Positive therapeutic effect ? Inconsistent therapeutic effect o Null effect Blank cell indicates no evidence available *Combines assorted interventions practices for this category. Please see page 79 for a full list.
L = Low quality M = Moderate quality H = High quality

Figure 2 Summary of evidence for sensory-based interventions. From Whitehouse et al, 2020, p.75

Wan Yunus et al (2015) argue that there is sufficient evidence that tactile stimulation (such as massage therapy) positively affects challenging behaviours such that it can be included in clinical practice. This contrasts with both Whitehouse et al (2020) and Steinbrenner et al (2020) who note evidence that Ayers and music therapy can improve challenging behaviours, but who do not recognise evidence that discrete tactile stimulation can improve challenging behaviours.

4.2 Mental Health

Sensory profiles of people with mental health conditions differ from the norm. Brown et al (2020) found a general pattern of greater sensory sensitivity, sensation avoiding, and low registration and less sensation seeking in a group of patients with either schizophrenia, high risk for psychosis, bipolar disorder, major depressive disorder, posttraumatic stress and obsessive-compulsive. Machingura et al (2022) confirmed higher rates of low registration and sensory avoiding in a group of 41 people with schizophrenia.

SBIs are currently in use in mental health settings in Australia, including discrete SBIs and MSEs. While the evidence base is still emerging, existing studies consistently find an effect of SBIs on distress. Multiple systematic reviews over the past 10 years have concluded that SBIs are likely to contribute to a reduction in distress for patients with mental health issues in clinical settings (Scanlon & Novak, 2015; Hitch et al, 2020; McGreevy & Boland, 2020; Ma et al, 2021; Hain & Hallet, 2022). In a recent controlled trial, Machingura et al (2022) found a reduction in distress for patients with schizophrenia when comparing pre- and post-test scores. However, the effect was no longer statistically significant when compared with the control group.

SBIs are hypothesised to reduce the use of restrictive practice. State and national policies aiming to reduce the use of restrictive practice are driving adoption of and research into SBIs (Machingura et al, 2022; Baker et al, 2022; Baker et al, 2021; Hitch et al, 2020). The suggestion is that if SBIs can reduce distress and level of arousal, then fewer episodes requiring restrictive practice would occur. However, this assumption is questionable considering the effect of workplace culture and institutional/state policy on rates of restrictive practices (Scanlon & Novak, 2015). The evidence for an actual reduction in use of restrictive practice is mixed.

Scanlon and Novak (2015) reviewed 17 papers and found that of the 9 studies reporting only rates of restrictive practice use, all were using MSE type interventions. Of those studies 5 reported a reduction in rates of restraint or seclusion, 3 reported no change and 1 reported an increase.

Other systematic reviews also show inconsistent evidence that MSEs used in clinical or institutional settings can reduce restrictive practice. Haig and Hallett (2022) reviewed 6 studies which reported rates or seclusion, restraint or violence. 4 of the 6 reported any positive results: one out 6 studies found a reduction in seclusion episodes, 2 out of 6 found reductions in restraint and 1 out of 6 found a reduction in aggression. One study also found an increase in rates of seclusion. Haig and Hallett also note that all the studies reviewed had moderate to high risk of bias.

Oostermeijer et al (2021) completed a rapid review including 14 studies on the effect of MSEs on restrictive practices and found more positive results: 6 of the 14 studies found reduction in restraint; 10 of the 14 found reduction in seclusion; 3 of the 14 reported no statistically significant results; and 3 of the 14 reported an increase in restraint or seclusion.

None of the systematic reviews were able to complete a meta-analysis. The inconsistency of the evidence regarding MSEs effect on restrictive practice may relate to the unstructured and heterogeneous nature of the intervention. There may be effective MSE-based practices or protocols but existing studies have not identified them (Oostermeijer et al, 2021; Haig & Hallett, 2022).

Most research on SBIs for people with mental health conditions occurs in a clinical or institutional setting. Lack of research in community use of SBIs is a significant limitation of the existing research (Hitch et al, 2020).

Hitch et al (2020) argue that despite minimal evidence, there is at least sufficient evidence to support wider use in clinical settings due to minimal cost of implementation of many sensory based interventions (for example, the discrete SBIs described in 3.2.1 Sensory-based interventions).

4.3 Other conditions

There is some evidence that SBIs (especially MSEs, massage and music therapy) can contribute to reduction in distress and agitation for people with dementia (Livingston et al, 2014; Pinto et al, 2020; Cheung et al, 2022).

Fisher et al (2014; 2017) show minimal evidence that SBI can reduce aggression in people with Huntington's disease.

Kantor et al (2022) found positive effects of Ayers on motor skills of children with cerebral palsy. However, better quality evidence is required to draw reliable conclusions.

A 2015 meta-analysis found only weak evidence for the efficacy of SIT in improving functional outcomes for children with intellectual disability and development delay (Leong et al, 2015). Subsequent studies have shown that SIT can assist children with developmental delay when combined with a more comprehensive early intervention program (Wang et al, 2020).

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