

# **A Systematic Review of the Efficacy of Weighted Vests and Blankets on People with ASD or ADHD**

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## **INTRODUCTION**

Autism spectrum disorder (ASD) has often been described as a condition whose vast range of symptoms primarily include repetitive behaviors and poor social interaction skills (Miller-Kuhaneck, 2015, p. 766). Examples of repetitive behaviors include abnormal sensitivity to sensory stimuli, fixated interests, inflexibility to changes in routine, and repetitive speech patterns or motor movements (Miller-Kuhaneck, 2015, p. 767). Examples of poor social interaction skills include difficulties with developing relationships, nonverbal communication, and social-emotional exchanges (Miller-Kuhaneck, 2015, p. 767). The DSM-5 criteria for ASD includes having two of the four major behaviors in the repetitive behavior category and that the deficits clinically impair the client's ability to function (Miller-Kuhaneck, 2015, p. 767).

Attention deficit-hyperactivity disorder (ADHD) is a lifelong condition generally diagnosed in childhood (Attention Deficit Disorder Association, 2018). ADHD has been described as a condition that influences a person's social skills, hyperactivity, impulsivity, and attention (Attention Deficit Disorder Association, 2018). ASD and ADHD are amongst the most prevalent conditions of childhood, with one of out every fifty-nine child having a diagnosis of ASD and eleven million having a diagnosis of ADHD (Attention Deficit Disorder Association, 2018; Centers for Disease Control and Prevention, 2018).

ASD and ADHD severely affect an individual's functioning in work, school, and social contexts, in both the amount of participation and the quality of that participation in occupations typical to these environments (Attention Deficit Disorder Association, 2018; National Institute of Mental Health, 2018). Symptoms of ASD and ADHD all interfere with an individual's abilities for self-regulation, attention, and everyday functioning (Attention Deficit Disorder Association, 2018; National Institute of Mental Health, 2018).

Sensory-based treatment methods are commonly used by occupational therapists and others working with individual with ADHD and ASD (Wan Yunus, Liu, Bissett, & Penkala, 2015). Weighted vests or weighted blankets are popular sensory-based interventions used with people with these conditions. Weighted vests and weighted blankets are widely reported to have various benefits and positive outcomes with children with these conditions (Shulman, 2018). They are thought of as providing deep pressure that is reported to help clients self-regulate, diminish episodes of maladaptive behavior and anxiety or stress, and improve attention, sleep, and mood (Shulman, 2018). A series of systematic reviews have previously been performed to assess the level and quality of evidence of the available literature regarding weighted vests and weighted blankets. These previous reviews have all concluded that weighted vests and weighted blankets did not have efficacy and that limited evidence currently exists that examines weighted vests and weighted blankets (Case-Smith, Weaver, & Fristad, 2014; Taylor, Spriggs, Jones Ault,

Flanagan, & Sartini, 2017; Wan Yunus, Liu, Bissett, & Penkala, 2015; Watling & Hauer, 2015). Additionally, all four of these systematic reviews were of high quality of evidence (Case-Smith, Weaver, & Fristad, 2014; Taylor, Spriggs, Jones Ault, Flanagan, & Sartini, 2017; Wan Yunus, Liu, Bissett, & Penkala, 2015; Watling & Hauer, 2015). However, these systematic reviews focused on one specific population or one specific outcome, a more general systematic review to understand the overall efficacy of weighted vests and blankets has yet to be completed. To fill this gap, a systematic review was conducted to answer the following question: To what degree are weighted vests and weighted blankets efficacious when utilized for people with ASD or ADHD?

## **METHODS**

The methods of a systematic review were followed closely beginning with a written protocol portions of which are presented in Tables 1 and 2. The protocol is a systematic plan for identification and an appraisal of all relevant studies.

### ***Locating All Relevant Studies:***

In accordance with the protocol, the following databases were searched in February of 2018: PubMed, OTSeeker, Academic Search Premier, Health and Medical [ProQuest], OT Search, and PsycINFO. For each of the listed databases, a predetermined list of subject headings and keywords were used to generate a search sentence. The subject headings and keywords were identified by completing preliminary searches of these databases.

Once the search was conducted, studies were included if they met the inclusion criteria: (1) people diagnosed with Autism Spectrum Disorder and/or Attention Deficit Hyperactivity Disorder; (2) intervention that included a weighted item; and (3) intervention that was

implemented by an occupational therapist, physical therapist, speech language pathologist, parent, or special needs educator. Articles were excluded if: (1) athletes were the population; (2) deep pressure, compression, or exercise-related interventions were used; and (3) if clothing was mentioned. Furthermore, accepted studies were limited to those written in English, published in peer-reviewed journals, and that used a quantitative study designs other than case report, or were a systematic review.

A group of five reviewers worked independently of each other to assess each included study, with two reviewers per study. This was done by systematically determining the level of evidence and quality of evidence for each study. A unique set of predetermined questions for each study design was used to discern the quality of evidence. The reviewers then compared their independent appraisals of each study, discussed, and resolved any discrepancies. A third reviewer assisted in resolving discrepancies when necessary.

Then, summarizing of the included studies was performed following the same process of independent work completed by two reviewers, then consensus. This summary of information is available in the study description tables (Tables 4 and 5). The table includes information about the clinical significance of each included study when provided or when it could be calculated. If no measure of clinical significance was provided in the study, the minimally detectable difference (MDD) was calculated. From the study description table, practice recommendations were created using a modified version of the GRADE system.

## **RESULTS**

### ***Study Identification:***

A total of 244 studies were retrieved from conducting the search across all databases. Of these, 18 were included for the systematic

### **Terminology**

Subject headings – Indexing of terms used by databases. MeSH term is the type of subject heading that is used in PubMed (Georgia State University, 2018).

Level of evidence (LoE) - An indication of the possible validity of a study. LoE are based on study designed. The Sackett, Rosenberg, Muir, Gray, Haynes, and Richardson (1996) Level of Evidence Pyramid was used.

Quality of evidence - An evaluation of the quality of the process or methods by which a study was conducted. As with levels of evidence, higher quality of evidence is more likely to contain trustworthy and generalizable information.

Clinical significance - Whether the effect of the intervention is large enough to make a meaningful change in a person's life (Skelly, 2011).

MDD - The smallest change that can be detected by a person; the change must be greater than an error in measurement (Ability Lab, 2016).

GRADE- Formal process to assess the quality of evidence and develop evidence-based recommendations (Dijkers, 2013).

Practice recommendation- Suggestion generated by taking into account findings and quality of the research, and benefit versus cost of an intervention (Munn, 2015).

Clinical implication- Statement intended to enhance patient care, based on the results of a systematic review (Munn, 2015).

Clinical tip- Actionable, explicit guideline for the use of an intervention in practice. Intended for clinicians and clients (Munn, 2015).

These 18 studies employed a variety of designs, including four systematic reviews (SR; systematic search and appraisal of available literature on a topic), three randomized controlled trials (RCT; data collected on an experimental group and control group that are randomly assigned), one quasi-experimental design (data collected on an experimental and control group that are not randomly assigned), a one-group pretest/posttest design (data collected before and after an intervention on one group of subjects), and nine single-case designs (SCD; data collected at multiple points of the study on a single, small group of subjects).

The quality of the included studies ranged from moderate to high, with only the quasi-experimental study possessing a low quality of evidence. Detailed information on the level and quality of evidence of each included study is found in the Quality of Evidence table (Table 3).

The results of the included studies are broken up into five groups by outcomes: attention, sleep efficacy, maladaptive behaviors, adaptive behaviors, and occupational performance. The outcome groups were assessed individually to determine the clinical significance of weighted vest use for each outcome.

#### ***Attention:***

Four studies (i.e., two RCTs and two SCDs) measured the effect of the intervention on attention. The quality of these studies ranged from moderate to high. One of the RCTs had a larger sample, with fifty-five subjects per group, whereas the other RCT had 15 subjects per group. Two of the studies used a measurement tool with sound psychometric properties published in scholarly articles. The measurement tools used in the other two studies did not have published psychometric properties. The results of the RCTs showed statistically significant improvements in measures of attention, but the results were not clinically significant. This suggests that although a change was detected following the use of weighted vests, this change might not be large enough to be clinically

review after the pre-established inclusion criteria was applied. The study identification process is outlined in detail in the flowchart (Figure 1).

meaningful. The data collected from the two SCDs showed conflicting results. One of the SCDs showed that weighted vests increased attention, whereas the other showed that the intervention had no effect.

*Practice recommendations:* There is Grade A evidence in favor of using weighted vests to improve attention in individuals with ASD or ADHD. Given the quality of evidence and results of the studies, a moderate recommendation for the use of weighted vests can be made. However, the changes observed from using a weight vest or item may not be large enough to be clinically significant. With this Grade and quality of evidence, further research is likely to have an impact on our confidence in suggesting that clinicians might observe improvements in attention through the use of weighted vests. As such, these results should be applied to clients cautiously. For this outcome, the benefits of the intervention tentatively outweigh the costs and burdens the patient may experience.

#### ***Sleep Efficacy:***

Two of the included studies (i.e., one RCT and one SCD) measured sleep efficacy as an outcome. Both studies had moderate quality of evidence. The RCT had a sample size of 27, while SCD had a small sample size of 2. Seven measurement tools were used to measure sleep efficacy, five of which had published information regarding their sound psychometric properties. Information about the psychometric properties of the other two measurement tools was not available. The results of the RCT were neither statistically nor clinically significant. The SCD showed a positive change in the outcomes of number of wakings, total sleep time, time to fall asleep, and morning mood. However, the results were not clinically significant.

*Practice recommendations:* There is Grade A evidence addressing the use of weighted blankets to increase sleep efficacy in individuals with ASD or ADHD. Given the quality of evidence and results of the studies, a weak recommendation for the use of weighted blankets can be made. Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate; other alternatives may be equally reasonable. For this outcome, the costs and burdens outweigh the potential benefits.

#### ***Maladaptive Behaviors:***

Six of the included studies (i.e., one RCT, one SR, and four SCDs) addressed the reduction of maladaptive behaviors as an outcome. Maladaptive behaviors are defined as aggressive, self-injurious, or off-task behaviors. The RCT was of high quality and had a large sample size (n=110). The four SCDs ranged from moderate to high quality, and the SR was of moderate quality and reviewed 23 studies. Five measurement tools were used to collect data, three of which had sound psychometric properties that are published in scholarly articles. The other two measurement tools' psychometric properties were not available. The results of the RCT showed a statistically significant reduction in the three outcomes: time out of seat, vocalizations, and fidgets. One of the SCDs showed a reduction in maladaptive behaviors, but the remainder did not show a measurable change. Two studies found clinical significant results showing that weighted vests decreased the occurrence of maladaptive behaviors, but four of the studies found no clinical significance.

*Practice recommendations:* There is Grade A evidence supporting the use of weighted vests to decrease maladaptive behaviors. Although a majority of the included studies addressing this outcome were SCDs, the quality of evidence and

results of the RCT and SRs allow for a moderate recommendation for the use of weighted vests. Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate; other alternatives may be equally reasonable. However, with the mixed findings of clinical significance and the small sample sizes, clinicians may or may not see a decrease in the occurrence of maladaptive behaviors when using weighted vests. For this outcome, the potential benefits outweigh the potential burdens and costs.

#### ***Adaptive Behaviors:***

Six included studies (i.e., two RCTs, one quasi-experimental design, and three SCDs) addressed increasing adaptive behaviors as an outcome. Adaptive behaviors are defined as appropriate in-seat behavior and on-task behaviors. The RCTs were of moderate and high quality, the quasi-experimental study was of low quality, and the SCDs ranged from moderate to high quality. One of the RCTs used a large sample of 55 subjects per group, but the remainder of the studies used small sample sizes. Three measurement tools were used to collect data, one of which had sound psychometric properties that are published in scholarly articles. Information on the other two studies' psychometric properties was not available. The results of the RCTs showed statistically significant improvements in measures of adaptive behavior, including on-task behavior, appropriate in-seat behavior, and speed of task completion, but the results were not clinically significant. The quasi-experimental study results were not statistically or clinically significant. One of the SCDs showed a clinically significant improvement in on-task behavior, but the other 2 did not show clinically significant results.

*Practice recommendations:* There is Grade A evidence addressing the use of weighted vests to

increase adaptive behaviors. Given the quality of evidence and results, clinicians should not use weighted vests for clients with the goal of increasing adaptive behaviors. Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate; other alternatives may be equally reasonable. For this outcome, the costs and burdens greatly outweigh any potential benefits that can be gained.

#### ***Occupational Performance:***

Four included studies (i.e., three SRs and one one-group pretest/posttest design) addressed improving occupational performance as an outcome. The three SRs were of high quality, and the other study was of moderate quality. The one-group pretest/posttest design study used four measurement tools to collect data, each of which had sound psychometric properties with information available in scholarly articles. The results of the one-group pretest/posttest design study did not show statistically significant results for any outcomes, but a positive change in satisfaction with daily living and quality of life was noted. The four studies did not report any clinically significant results.

*Practice recommendations:* There is Grade A evidence supporting the use of weighted vests to increase occupational performance in individuals with ASD or ADHD. Given the quality of evidence and results, a moderate recommendation can be made for the use of weighted vests. Further research is likely to have an impact on our confidence in the estimate of effect or may change the estimate; results should be applied to patients cautiously, given that the benefits slightly outweigh the burdens and costs.

## **DISCUSSION**

### ***Clinical Implications:***

The current evidence suggests variations in the effectiveness for each outcome addressed. The use of weighted vests to improve attention had the strongest support, although only a moderate recommendation could be made. There was a high variability in the results of studies addressing the outcomes of decreasing maladaptive behaviors, increasing adaptive behaviors, and increasing occupational performance; but a majority of the studies showed a small positive effect. The outcome of sleep efficacy had the lowest support from studies included in the review. However, due to the limitations of the available evidence, clinicians should be prepared to help patients make the decision on whether to use a weighted vest or blanket or not.

#### ***Clinical Tips:***

The purpose of this systematic review was to examine the effects of weighted vests or blankets on people with ASD and those with ADHD. Some positive effects were found for attention (Grade A; Moderate quality) but not for sleep efficacy (Grade A, Low quality). Given the level and quality of evidence, further research is needed to confirm these effects. Throughout the studies, specific wearing schedules of weighted items (frequency and duration) was not consistent. More randomized clinical trials using blinded evaluation and larger samples are needed to be able to generalize the results to the whole population. Given the strength of the recommendations, it is suggested that weighted items not be amongst the first approach that clinicians use with families. However, clinicians should be prepared to help families make the decision to use or not use a weighted vest or blanket with their child. This conversation should include uncovering the family's core values, beliefs and preferences. The conversation should also detail the limited existing evidence in support of using weighted items and informing the family of alternative

intervention approaches which may have a higher level and quality of evidence. If a family chooses to try the weighted vest, a clinician should use a method to measure the outcomes of the intervention on the child (e.g., Goal Attainment Scaling).

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**Table 1. List of Search Terms**

	<b>Construct 1 ASD &amp; ADHD</b>		<b>Construct 2 Weighted Vests</b>		<b>Limits (if any)</b>
<b>Database</b>	<b>Subject Headings</b>	<b>Keywords</b>	<b>Subject Headings</b>	<b>Keywords</b>	
<b>PubMed</b>	autism spectrum disorder, autistic disorder, attention deficit and disruptive behavior disorders	autis*, “attention deficit hyperactivity disorder”, “pervasive developmental disorder”	N/A	“weighted vests” “weighted blankets”	
<b>PsycINFO</b>	autism spectrum disorders	autis*, “attention deficit hyperactivity disorder,” “pervasive developmental disorder”	N/A	“weighted blankets,” “weighted vests”	Peer reviewed journal
<b>OTSeeker</b>	NA	autis*, “attention deficit hyperactivity disorder” “pervasive developmental disorder”	N/A	“weighted vests”, “weighted blankets”	
<b>Academic Search Premier</b>	N/A	<i>autis*</i> <i>“attention deficit hyperactivity disorder”</i> <i>“Pervasive</i>	N/A	“weighted vests”, “weighted blankets”	Academic journals

		<i>developmental disorder” “Asperger’s syndrome”</i>			
<b>Health and Medical [Proquest]</b>	Autism, attention deficit hyperactivity disorder, attention deficit disorder with hyperactivity, pervasive developmental disorders	<i>autis* “attention deficit hyperactivity disorder” “Pervasive developmental disorder”</i>	N/A	“weighted vests”, “weighted blankets”	Peer reviewed, Scholarly journals
<b>OT Search</b>	Autistic Disorder, Asperger Syndrome, Child Development Disorders Pervasive, Attention deficit disorder with hyperactivity	<i>“Autism”</i>	N/A	“Weighted vest”, “Weighted blanket”	N/A

**Table 2.**

<b>Inclusion Criteria</b>			
Population	Intervention and Comparison	Outcome	Other
All ages	Weighted item	N/A	Systematic reviews, all quantitative study designs
ASD, ADHD, PDD-NOS, Asperger's syndrome, Autistic Disorder	Can be OT, PT, SLP, parent, or special educator intervention		Peer-reviewed
	Articles that include other sensory interventions but still mention weighted vests/blankets		English language
<b>Exclusion Criteria</b>			
Population	Intervention and Comparison	Outcome	Other
Athletes	"Deep pressure therapy"	N/A	Clothing
	Exercise-related interventions		Case reports
	Compression vests		

**Table 3. Quality and Level of Evidence Table**

Citation	Type of Design	Quality Criteria										Quality Level	Evidence Level	
		1	2	3	4	5	6	7	8	9	10			
Buckle, F. (2011).	Randomized controlled trial	1	0	1	1	0	1	1	1	1	0	0	Mod	Level II
Case-Smith, J., Weaver, L.L., Fristad, M.A. (2015).	Systematic review	1	0	0	1	1	1	1	1	1	1	1	High	Level I
Cox, A. L., Gast, D. L., Luscre, D., & Ayres, K. M. (2009).	Single case design	1	1	1	1	1	1	1	1	N/A	N/A	High	Level IV	
Davis, T. N., Dacus, S., Strickland, E., Copeland, D., Chan, J. M., K., Blenden, . . . & Christian, K. (2013).	Single case design	1	1	1	1	1	0	0	1	N/A	N/A	High	Level IV	
Eggleston, J. D., Landers, M. R., Bates, B. T., Nagelhout, E., & Dufek, J. S. (2018).	Single case design	1	1	1	1	0	0	0	1	N/A	N/A	Mod	Level IV	
Fertel-Daly, D. (2001).	Single case design	1	1	1	0	0	1	0	1	N/A	N/A	Mod	Level IV	
Gee, B. M., Peterson, T. W., Buck, A., & Lloyd, K. (2016).	Single case design	1	1	1	1	0	0	0	1	N/A	N/A	Mod-High	Level IV	
Gringras, P., Green, D., Wright, B., Rush, C., Sparrowhawk, M., Pratt, K., . . .	Randomized controlled trial	1	1	1	1	1	0	1	0	0	0	0	Mod	Level I

& Wiggs, L. (2014).														
Hodgetts, S., Magill-Evans, J., & Misiaszek, J. E. (2011a).	Single case design	1	1	1	1	1	0	0	1	N/A	N/A	High	Level IV	
Hodgetts, S., Magill-Evans, J., & Misiaszek, J. (2011b).	Single case design	1	1	1	1	1	1	1	1	N/A	N/A	High	Level IV	
Leew, S. V., Stein, N. G., & Gibbard, W. B. (2010).	Single case design	1	1	1	0	0	0	1	1	N/A	N/A	Mod	Level IV	
Lin, H.-Y., Lee, P., Chang, W.-D., & Hong, F.-Y. (2014).	Randomized controlled trial	1	1	1	1	1	1	1	0	0	0	High	Level I	
Lindstedt, H., & Umb-Carlsson, O. (2012).	One group pretest-posttest design	1	1	0	0	1	1	0	0	N/A	N/A	Mod	Level IV	
Quigley, S. P., Peterson, L., Frieder, J. E., & Peterson, S. (2011).	Single case design	1	1	1	0	0	1	0	1	N/A	N/A	Mod	Level IV	
Taylor, C.J., Spriggs, A.D., Ault, M.J., Flanagan, S., Sartini, E.C. (2017).	Systematic review	1	0	1	1	0	1	1	1	N/A	N/A	High	Level I	
VandenBerg, N.L. (2001).	Quasi-experimental: single system AB design	0	1	0	1	0	0	0	1	N/A	N/A	Low	Level III	
Wan Yunus, F., Liu, K. P., Y., Bissett, M., &	Systematic review	1	0	1	1	1	1	1	1	N/A	N/A	High	Level I	

Penkala, S. (2015).													
Watling, R., & Hauer, S. (2015).	Systematic review	1	0	1	1	1	1	0	1	N/A	N/A	High	Level I

**Table 4. Study Description Table, Randomized Controlled Trials**

Study	Design Type and Quality Level	Population	n in each group	Outcome(s)	Measurement (units; direction of change)	Means (SD)	p value	Clinical Significance
Buckle, F. (2011)	RCT  Mod	n = 30  Dx: ADHD  Age: 6-9 years  Additional key info: grades 1-3 at the same school	Group A: n = 15, weighted condition  Group B: n = 15, no vest condition	In-seat behavior  Speed of task completion  Attention-to-task	Time (in minutes) and percentages (through the Conners' Continuous Performance Test II; ↑= +)	In-seat behavior: Group A: 17.29 (1.23) Group B: 17.95 (1.23)  Task completion speed: Group A: 3.74 (1.45) Group B: 4.45 (1.45)  Attention-to-task: Group A: 64.21% (16.33) Group B: 61.09% (16.33)	0.09  0.2  0.5	MDD = 0.615  MDD = 0.725  MDD = 8.165

Lin, H.-Y., Lee, P., Chang, W.-D., & Hong, F.-Y. (2014)	RCT  High	n = 110  Dx: ADHD  Additional key info: N/A	Group A: n = 55, weighted condition	Attention	Conners' Continuous Performance Test II (number of omission errors; ↑= +)	Group A: 41.7 (44.9) Group B: 52.6 (52.9)	<0.05	MDD = 26.45		
			Group B: n = 55, no vest condition	Impulse control	Conners' Continuous Performance Test II (number of commission errors; ↑= +)	Group A: 23.9 (8.6) Group B: 23.3 (8.0)	<0.05	MDD = 4.0		
				Off-task behavior (measured through vocalization, off-task, time out of seat and fidgets)	Video observation (percentage of intervals during which target behavior occurred; 0-100; ↑= +)	Vocalizations: Group A: 4.82 (9.69) Group B: 5.49 (8.44)	<0.05	MDD = 4.22		
						Off-task behaviors: Group A: 35.08 (25.59) Group B: 45.81 (27.97)	<0.05	MDD = 13.985		
						Time out of seat: Group A: 0.58 (1.59) Group B: 3.22 (10.9)	<0.05	MDD = 13.23		
						Fidgets: Group A: 14.26 (15.57) Group B: 29.43 (26.86)	<0.05	MDD = 5.45		



Gringras, P., Green, D., Wright, B., Rush, C., Sparrowhawk, M., Pratt, K., . . . & Wiggs, L. (2014)	RCT	n = 73	Group A:	Total Sleep time	Actigraphy (↑ = +)	Actigraphy	<0.001	MDD = 29.85 23.05 4.4
	Mod	Dx: ASD and severe sleep problems	Weighted + Control vest, n = 27	Sleep-onset latency	Actigraphy (↑ = +)	Baseline: TST- 452.8 (59.7) SOL- 76.5(46.1) Sleep eff.- 72.7(8.8)		
		Age: 5-16 years and 10 months	Group B:	Sleep efficiency	Actigraphy (↑ = +)	Weighted: TST- 454.4(62.4) SOL- 74.3(48.7) Sleep eff.- 73.4(9.3)	<0.001	MDD= 54.8 23.8 6.45
		Additional key info: Refractory to community-based interventions.	Control + Weighted vest, n = 27	On-task behavior	Aberrant Behavior Checklist	Control: TST- 457.7(64.6) SOL- 69.9(43.8) Sleep eff.- 74.2(7.8)		
				Efficient family functioning	Short Sensory Profile Caregiver Questionnaire	Sleep Diary		
				Decrease of adverse events	Parent-report diaries	Baseline: TST- 531.8(109.6) SOL- 69.9(47.6) Time Awake - 16.7(12.9)		
						Weighted: TST- 528.9(127.1) SOL- 55.6(37.8) Time Awake - 15.6(13.4)		
						Control: TST- 513.0(154.1) SOL- 57.2(42.8) Time Awake - 14.6(13.3)		

**Table 5:**  
**Study Description Table, Other Study Designs**

Study	Design Type and Quality Level	Population	Outcome(s)	Measurement Tools (units; direction of change)	Results
Case-Smith, J., Weaver, L.L., Fristad, M.A. (2015)	SR  High	Dx: ASD  Age: 3-21  Additional key info: N/A	Evidence to support weighted vests	N/A	SIT for children with ASD and sensory processing problems demonstrates positive effects on the child's individualized goals; however, additional studies are needed to confirm these results. Randomized trials using blinded evaluation and larger samples are needed.
Cox, A. L., Gast, D. L., Luscre, D., & Ayres, K. M. (2009).	SCD  High	n = 3  Dx: ASD  Age: 5-9  Additional key info: attended the same elementary school	In-seat behavior	Video observation (in units of seconds; 0-10; ↑= +)	There was not a significant improvement of the 3 subjects' in-seat behavior when weighted vests were applied.
Davis, T. N., Dacus, S., Strickland, E., Copeland, D., Chan, J. M., K., Blenden, . . . & Christian, K. (2013).	SCD  High	n = 1  Dx: ASD  Age: 9  Additional key info: Hispanic male	Aggressive and self-injurious behaviors, specifically biting	Video observation (percentage of 10-second intervals during which target behavior occurred; 0-10;, ↑= +)	There was no difference observed in aggressive and self-injurious behaviors between the vest and no vest conditions.

<p>Eggleston, J. D., Landers, M. R., Bates, B. T., Nagelhout, E., &amp; Dufek, J. S. (2018).</p>	<p>SCD High</p>	<p>Dx: ASD  Additional key info: all male</p>	<p>Changes in lower extremity gait symmetry mechanics</p>	<p>The model statistic</p>	<p>In the current usage, the number of observed significant differences were converted to a percentage of the gait cycle (0–100%).</p> <p>Unloaded condition: 71.0 ± 29.7, 68.4 ± 19.5, and 64.1 ± 19.7 significant differences at the hip, knee, and ankle, respectively.</p> <p>Weighted conditions: During the loaded backpack condition the number of statistically significant differences at the hip, knee, and ankle were 70.4 ± 25.8 (ranging between 32 and 101), 71.5 ± 26.1 (19–99 range), and 68.9 ± 19.4 (43–101 range), respectively.</p> <p>For the WV, the number of statistically significant differences at the hip, knee, and ankle were 60.6 ± 31.8 (0–101 range), 74.6 ± 14.7 (54–95 range), and 68.4 ± 21.5 (37–101 range) respectively</p>
<p>Fertel-Daly, D. (2001).</p>	<p>SCD High</p>	<p>Dx: Pervasive Developmental Disorder  Age: 2-4  Additional key info: Participants were in preschool</p>	<p>Number of distractions  Focused attention  Duration of self-stimulating behavior (4/5 participants)</p>	<p>Observation  Timed periods of attention (↑ = +) and self-stimulating behavior in seconds (↑ = -)  Number of distractions (↑ = -)</p>	<p>Participants had lower averages for distractions when intervention was present versus baseline and intervention withdrawal.</p>

<p>Gee, B. M., Peterson, T. W., Buck, A., &amp; Lloyd, K. (2016).</p>	<p>SCD High</p>	<p>Dx: ASD Age: 3-6  Additional key info: 2 total participants that displayed sensory over-responsiveness and sleep problems</p>	<p>Amount of time needed to fall asleep  Amount of hours of sleep per night  Number of wakings per night  Morning mood</p>	<p>Amount of time it took to fall asleep (measured in minutes; 0-140; ↑= +)  Amount of hours of sleep per night (measured in hours; 0-14; ↑= - )  Number of wakings (measured in how many took place in one night; 0-5; ↑= +)  Morning mood (measured in behavioral ratings on online survey; 0-6; ↑= - )</p>	<p>Minimal improvements in four constructs of number of wakings, amount of sleep per night, amount of time it takes to fall asleep, and morning mood</p>
<p>Hodgetts, S., Magill-Evans, J., &amp; Misiaszek, J. E. (2011a).</p>	<p>SCD High</p>	<p>n = 6 Dx: ASD Age: 4-10  Additional key info: 5 males, 1 female</p>	<p>Stereotyped behaviors, individualized for each participant based on teachers' input</p>	<p>Video observation (percentage of 15-second intervals during which target behavior occurred; 0-100; ↑= -)</p>	<p>There was considerable variability in each participant's behavior. A visual inspection of data conducted by the researchers shows that weighted vests did not have an effect on stereotyped behaviors.</p>
<p>Hodgetts, S., Magill-Evans, J., &amp; Misiaszek, J. (2011b).</p>	<p>SCD High</p>	<p>n = 10 Dx: ASD Age: 3-10  Additional key info: 8 males, 2 females</p>	<p>Off-task behavior, defined as looking away from task or not participating in the intended functional manipulation of materials</p>	<p>Video observation (percentage of 15-second interval during which target behaviors occurred; 0-100; ↑= +)  Conners' Global Index-Teacher (0-3 for each domain; ↑= +)  Questionnaire for teachers and aides (Subjective data)</p>	<p>Variability was noted between each participant's behavior, but all participants had difficulty with attention-to-task. 6 out of 9 aides who completed the questionnaire found the weighted vests to be effective and would use them again.</p>

Leew, S. V., Stein, N. G., & Gibbard, W. B. (2010).	SCD Mod	n = 4 Dx: ASD Age: 2 Additional key info: all males	Joint attention Sensory-based competing behaviors	Video observation (number of competing behaviors observed per minute during a 20-minute period ; 0-14; ↑= + )	No significant effect on participants' joint attention and sensory-based competing behaviors or parenting morale
Lindstedt, H., & Umb-Carlsson, O. (2012).	One group pretest-posttest design Mod	n = 19 Dx: ADHD Age: 18-65 Additional key info: N/A	Quality and effectiveness of occupational performance Satisfaction with CATs Satisfaction with daily activities Quality of life	Assessment of Motor and Process Skills (1-4 for each item; ↑= +) The Quebec User Evaluation With Assistive Technology (12-60; ↑= +) Satisfaction of Daily Occupations (1-7 for each domain; ↑= +) The Manchester Short Assessment of Quality of Life (1-7 for each domain; ↑= +)	The frequency of performing daily occupations remained stable over the course of the study, but more participants were gainfully employed at the end of the study. Satisfaction with family relationships and performance of domestic chores decreased by the end of the study.
Quigley, S. P., Peterson, L., Frieder, J. E., & Peterson, S. (2011).	SCD Mod	n = 3 Dx: ASD, ADHD, or Asperger's Disorder Age: 4-12 years	Problem behaviors	Video observation (percentage of 10-second intervals during which target behavior occurred; 0-100; ↑= + )	Weighted vests of various weights did not have an effect on the problematic target behaviors.
Taylor, C.J., Spriggs, A.D., Ault, M.J., Flanagan, S., Sartini, E.C. (2017)	SR High	Dx: ASD Age: 4-10 Additional key info: N/A	Evidence to support weighted vests	N/A	Lack of evidence to support using weighted vests with people with ASD as treatment

VandenBerg, N. L. (2001)	Quasi-experimental à single system AB design  Moderate	n = 4  Dx: ADHD  Age: 5-6  Additional key info: two boy participants and two girl participants	On-task behavior	Observation (total amount of time in seconds each participant remained on task during each 15-minute session; 0%-90%; ↑= + )	Significant improvement in on-task behavior when performing fine motor tasks in a classroom setting when wearing a weighted vest
Wan Yunus, F., Liu, K. P., Y., Bissett, M., & Penkala, S. (2015)	SR  High	Dx: Behavioral issues  Age: 3-18  Additional key info: N/A	Efficacy of sensory-based interventions	N/A	Lack of evidence for the efficacy of sensory interventions like weighted vests
Watling, R., & Hauer, S. (2015)	SR  High	Dx: ASD  Age: 3-39  Additional key info: N/A	Challenging or problematic behavior, task engagement or on task behaviors, in-seat behavior, or effects on stereotypy, off task behavior, self-injurious behavior, and attending behavior	Goal Attainment Scaling (attainment scored on scale of -2 - +2; ↑= +)  Vineland Adaptive Behavior Scales, Second Edition (adaptive behavior score; 0-140; ↑= +)	Evidence supports the efficacy of sensory-based interventions such as weighted vest, but interventions are most effective when individualized based on clients' sensory needs.

Key: RCT- randomized controlled trial, SCD- single-case design, SR- systematic review, Dx- diagnosis ASD- autism spectrum disorder, ADHD- attention deficit hyperactivity disorder, SD- standard deviation, MDD- minimal detectable difference calculated using ½ SD, CAT- cognitive assistive technology

**Figure 1. Flowchart**

