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Streamlining Care for Children with Autism Spectrum Disorder

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NURS-749A NP Qualifying Project: Manuscript Development

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April 23, 2021

Abstract

Background: Autism spectrum disorder (ASD) is a chronic and developmental disorder that affects about one out of every 65 children in California, and one in 59 children in the United States. Children with ASD have difficulty communicating and interacting with others, and experience oversensitivity to new stimuli and environments.

Problem: In healthcare settings, children with ASD experience numerous challenges related to lack of adequate knowledge and education of staff regarding ASD, and lack of appropriate environmental and sensory resources which reduce quality of care provided to this population.

Objective: To analyze and evaluate the evidence regarding effective staff education and toolkit implementation, along with sensory room and items, and the potential impacts that these interventions can create to help mitigate this issue.

Methods: To help guide the project and literature search, a PICOT question was designed and used to search across relevant databases and journals using applicable key terms to identify studies from 2012 to 2020. Selected studies were analyzed using John Hopkins Nursing Evidence-Based Practice Tools by Dang & Dearholt (2017).

Results: Initial search resulted in 4157 studies across the databases and 2097 results across the journals. After applying further criteria and removing duplicates, final yield was five articles. Analysis of the five studies identified guidelines/interventions addressing behavioral and social concerns, healthcare staff knowledge and education, and sensory and environment.

Conclusions: All five selected studies highlight the need and importance of implementing an educational toolkit for staff, and sensory room for children with ASD to streamline their care within healthcare settings.

Keywords: *Children with Autism Spectrum Disorder, Healthcare staff education, Autism sensory room, Streamlining care for children with Autism*

Introduction

About one out of every 65 children in California, and one in 59 children in the United States are diagnosed with ASD (Centers for Disease and Control Prevention [CDC], 2018; Nevison & Parker, 2020). These children may have frequent visits to healthcare settings but can face numerous challenges in the quality of care they receive. This is primarily due to not having the care provided tailored to their unique needs. Deficiencies in care can relate to the lack of education of staff and providers as well as the limited resources that healthcare organizations offer to children with ASD. The purpose of this paper is to analyze and evaluate the evidence on interventions that can help streamline the care provided to children with ASD within healthcare settings, including implementing toolkit and staff education and sensory room.

Background

Autism spectrum disorder (ASD) is a developmental disorder that affects both communication and behavior (National Institute of Mental Health [NIMH], 2018). It is referred to as a “spectrum” disorder since there is a wide variation in the type and severity of symptoms, and defined as a “developmental disorder” because many of its symptoms tend to appear during the early developmental stages (NIMH, 2018). In the United States, one in 59 children live with ASD compared to one in 68 in 2012, an increase of 15% in incidence nationally (CDC, 2018). In California, approximately one in 65 children live with ASD compared to about one in 85 in 2009, an increase of 30% in incidence statewide (Nevison & Parker, 2020). Despite high prevalence and incidence of ASD among children and their frequent visits to healthcare settings, there is minimal support to streamline their care, resulting in lower quality of care and increased healthcare costs (Autism Speaks, 2018; Berglund et al., 2017). In the absence of effective interventions and support, the total cost of caring for children with ASD can rise to \$461 billion

by 2025, about four to six times greater than for children without ASD (Autism Speaks, 2018). This cost is mainly due to interruption of care and workflow related to special needs and behaviors of these children, including acting out their needs instead of verbalizing them which could be mistaken for aggression or violence (Autism Speaks, 2018).

People with ASD can experience some common signs and symptoms related to ASD, such as difficulty communicating and interacting with others, failure to listen to and respond to others, being overly focused and getting upset by changes in a routine (NIMH, 2018). Healthcare settings could also involve long periods of waiting and a great deal of touch and sound which may be difficult for these children to tolerate (Benich et al., 2018; Berglund et al., 2017). Additionally, a general lack of staff knowledge and training regarding how to care for children with ASD can further delay their care and lower their quality of care (Benich et al., 2018; Berglund et al., 2017; Muskat et al., 2015). Thereby, children with ASD may experience difficulty and challenges when interacting and socializing with others within healthcare settings (Berglund et al., 2017). Currently, there are minimal guidelines for staff to follow when caring for these children, resulting in limited knowledge and difficulty to properly care for these patients. Furthermore, there are limited resources and items for children with ASD within healthcare settings to help them reduce their stimuli and to relax, including while waiting to be seen for their appointments. In the absence of streamlining the care for children with ASD, staff's knowledge regarding providing care for these children could be less than sufficient, quality of care can be reduced, and cost of healthcare could be four to six times higher than what it should be. To help streamline their care, shortcomings regarding limited knowledge of staff and availability of educational toolkit to guide staff when caring for children with ASD, along with the need for a sensory room to address the oversensitivity to healthcare stimuli must be

addressed. Thus, this project focuses on developing and implementing an educational toolkit to guide and educate staff as well as implementing a sensory room to help mitigate the sensory problems these children could face.

Review of the Literature

Prior to conducting a literature search and review to examine the available evidence on ASD, the following PICOT question was designed to guide the search: In children (individuals under the age of 18) with Autism Spectrum Disorder who visit healthcare settings (P), how does utilizing an educational toolkit and a sensory room (I), as compared to no educational toolkit and sensory room, (C), affect staff knowledge and delays in care (O) within a period of three months (T)?

Two search strategies were undertaken from August 2020 to November 2020 utilizing key terms related to PICOT to explore current evidence regarding ASD. The primary key terms used include: “Children with autism spectrum disorder,” “Child* Auti*,” in combination with “Clinic* Guid*,” “Sens* or Room*,” “Item* or Toy*,” and “Toolk*.” First, a search of these primary key terms was conducted in Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, Cochrane Database of Systematic Reviews, and PsycINFO. During this initial database search, only peer-reviewed and/or systematic reviewed and/or meta-analysis and/or quality improvement journals published in English between 2012 to 2020 were considered. This resulted in total of 4157 search results across the mentioned databases. Second, a complete search was performed on these selected journals: SAGE Journal of Autism, Autism and Developmental Disorders, Developmental and Behavioral Pediatrics, American Journal on Intellectual and Developmental Disabilities, Focus on Autism and Other Developmental Disabilities. This resulted in 2097 search results across these journals using the same key terms

as databases. To help narrow the search results further, these inclusion criteria were established: (1) population had to be individuals under the age of 18 with ASD, and (2) involved intervention(s) and/or suggestion(s) for intervention(s) and/or quality improvement(s). After applying these criteria and removing duplicates within the databases and the journals, five articles were selected (see Appendix).

Results

All five selected studies underwent critical appraisal and analysis using Johns Hopkins (JH) Nursing Evidence-Based Practice Appraisal Tools (Dang & Dearholt, 2017). Level of evidence ranged from Level I-B (for randomized control trial [RCT]) to Level IV-B (for clinical guidelines developed utilizing experts' opinions), where B stands for good quality for that level of evidence. Berglund et al. (2017) developed clinical guidelines for practice improvements utilizing surveys and questionnaires to obtain experts' opinions, analyzed using JH Non-Research Evidence Appraisal Tool resulting in level IV- B rating. The remaining four studies were analyzed using JH Research Evidence Appraisal Tool. Padmanabha et al. (2018) and Parsons et al. (2018) both performed RCTs resulting in Level I-B ratings. Schoen et al. (2018) conducted a systematic review of research studies, including RCT and nonrandomized studies, resulting in level II-B rating. McIntosh et al. (2015) conducted a nonrandomized simulation study resulting in Level II-C rating.

Among the five selected studies, Berglund et al. (2017) was the only study that worked directly on developing clinical guidelines to address the needs of the children with ASD within healthcare settings. The guidelines developed were aimed to address some of the difficulties that children with ASD can experience in healthcare settings, including ineffective communication with staff, overreacting to sounds/noise, and difficulty adapting to healthcare environment

(Berglund et al., 2017). The suggested guidelines developed to address some of these shortcomings were: (1) involving parents and guardians in the planning and caring for their children, (2) improving communication between the staff, the children and their parents by using plain and concrete language instead of symbolic and abstract language, (3) making an individualized comprehensive plan that includes both the child's preparation and the entire program for the child's visit, and (4) using pictures to communicate with the children and showing them what they would experience during their visits (Berglund et al., 2017). In terms of educating staff, McIntosh et al. (2015) developed simulation-based training to educate staff on behavioral needs and symptoms of ASD in children. This study found that educating staff through simulation-based training can indeed help staff to recognize unique behavioral needs of children with ASD and to address them effectively to improve their quality of care. Padmanabha et al. (2018), Parsons et al. (2018) and Schoen et al. (2018) worked on addressing the behavioral and social aspects along with sensory and environmental concerns of children with ASD through different interventions. Padmanabha et al. (2018) developed home-based sensory interventions (HBSI) which includes utilizing items such as therapy balls, sensory toothbrush, pictured flashcards, lighting toys and coloring books. HBSI showed 32.3% improvement on Parent-rated 10-item likert scale questionnaire (PRILS-10), 18.1% on Children's Global Assessment Scale (CGAS), and 15.8% on Pediatric Quality of Life Inventory 4.0 (PedsQLTM). Parsons et al. (2018) studied the effectiveness of the Therapeutic Outcome By You (TOBY) Application, a tablet-based information technology application that is available for download and use on iPad. Use of TOBY Application showed to be effective in helping to address children with ASD's needs using behavioral, educational and developmental tactics with a focus on four major skill areas, including language and social. By utilizing Council for Exceptional Children (CEC)

quality indicators and standards for an evidence-based practice guideline, Schoen et al. (2018) found that studies surrounding Ayres Sensory Integration (ASI) intervention support ASI being an evidence-based practice that can help improve children with ASD to better respond to sensory stimulation.

Discussion

The five identified studies provided to be valuable in terms of different aspects of streamlining the care for children with ASD within healthcare settings. All five studies pointed out some type of behavioral and social concerns related to children with ASD, and their impacts on working with others and quality of care received. Findings of these five studies are significant in helping to streamline the care provided to children with ASD within healthcare settings. All studies that focused on staff knowledge and education agreed that there is a need for educating staff about the special needs of children with ASD, and that the level of healthcare staff knowledge and education is limited in providing high quality of care to these children. Studies differed in their approaches for educating staff, from simulation-based training and case studies to utilizing experts' opinions in developing clinical guidelines to help guide the staff when caring for children with ASD. Studies that focused on sensory and environmental needs found that having a quiet and relaxing area would be helpful for these children. One study identified using specially made sensory equipment, including toys and brushes, to be helpful. Two studies found technological interventions, including TOBY Application and ASI to be helpful.

Most of the study findings were expected, including the limited knowledge of staff regarding behaviors and social interactions of children with ASD and the effectiveness of education and guideline on improving knowledge and care of these children, and the need for addressing these children's environmental and sensory concerns, including quiet environment

with minimal sound and ability for light adjustment and sensory toys to provide adequate care. Therefore, the findings of the studies help to answer the PICOT question by guiding the development of the educational toolkit to improve staff knowledge that can enhance the quality of care provided, and a sensory room to minimize noises and to allow children to control their environment (i.e., adjustable light and sensory toys) to address the behavioral and social concerns, including overreacting to sounds/noise that could lead to delays in receiving proper care. Although there are limitations associated with some of the studies, including lack of adequate size and homogeneity of samples studied, the overall strength of the studies, including methods of study, data analysis and measured outcomes, provide sufficient reasons to recommend the findings for the proposed changes in practice (i.e., implementing educational toolkit and sensory room and items).

While some of the included studies were done in other countries, characteristics of children with ASD are similar worldwide and therefore, the findings of the studies can still relate to children in the United States and can be generalizable to other healthcare settings as well. Moreover, while most studies related to children with ASD, findings of the studies regarding staff knowledge and education, and sensory and environmental needs and interventions can still apply to adults with ASD as well. For instance, having a quiet and relaxing environment for reducing stimuli, and using simulation and case studies to educate staff can be useful for any age group diagnosed with ASD. It is important to note that future studies are needed to assess the implementation of some of these interventions, including HBSI in clinical settings to see how it could really impact children with ASD within healthcare settings instead of home.

Implications and Recommendations for Clinical Practice

The overall evidence from the studies suggest that special precautions and education are needed to help meet the needs of children with ASD by addressing their unique behavioral and social concerns, including their needs to control their environments (i.e., light and sound), to have the environment resemble their routines at home, and to have specialized sensory tools and quiet areas to help them reduce stimuli. Additionally, studies identified that training sessions, case studies, and simulation training could be useful for educating staff, including healthcare practitioners. Regarding addressing their sensory and environmental needs, different studies found different approaches to be effective, such as ASI, HBSI and TOBY Application.

The findings illustrate that staff knowledge regarding behavioral and social needs of children with ASD should be improved, and these children's sensory and environmental needs should be addressed within healthcare settings to improve their quality of care. Therefore, the findings of these studies can help guide the implementation of an educational toolkit that can be available as a resource to educate staff regarding how to properly approach and care for children with ASD. The educational toolkit can include posters and badge-friendly informational guidelines that outline the steps and measures needed to be taken by staff when caring for this population, including involving parents and child routines in the care as well as using non-abstract language to communicate with children. Moreover, findings of the studies can also help implement sensory and environmental interventions, such as a sensory room with adjustable light and reduced noise to help minimize the stimuli for these children. Overall, these interventions could help to streamline and improve the quality of care provided to children with ASD, and to minimize delays in their care due to lack of providers' knowledge in meeting these children's needs.

Conclusion

The number of children diagnosed with ASD in California and United States have increased. These children have special behavioral, social, and sensory needs that can make them experience many challenges within healthcare settings. The special needs of these children along with the lack of proper education and knowledge of staff cause a decline in quality of care and increase in preventable healthcare cost. Therefore, there is a need for a quality improvement project to streamline the care provided to children with ASD by implementing evidence-based educational toolkit and sensory room that could help to address the unique needs and behavior of these children. The success of these implementations can help streamline the care provided to children with ASD throughout healthcare settings.

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Appendix

Purpose of article or review	Design / method / Conceptual framework	Sample / Setting	Major variables studied (and their definitions)	Measurement of major variables	Data analysis	Study findings	Level of evidence (critical appraisal score) / Worth to practice / Strengths and weaknesses / Feasibility / Conclusion(s) / Recommendation(s)
<p>APA Reference: Berglund, I. G., Björkman, B., Enskär, K., Faresjö, M., & Huus, K. (2017). Management of children with autism spectrum disorder in the anesthesia and radiographic context. <i>Journal of Developmental & Behavioral Pediatrics</i>, 38(3), 187-196. https://doi.org/10.1097/DBP.0000000000000432</p>							
<p>To develop guidelines to improve the care and preparation of children with ASD during anesthesia and radiology procedures.</p>	<p>Modified Delphi method, including distribution of questionnaire and utilizing expertise of participants recruited nation-wide. No conceptual framework noted.</p>	<p>N= 30 initially n= 21 completely participated and included in expert panel. These participants worked with children with ASD and were considered to be experts. Setting: Anesthesia</p>	<p>IV: Questionnaire DV: Guidelines</p>	<p>Experts' answers to questionnaires analyzed using Delphi method.</p>	<p>A list of items was created from a previous survey and the literature. In the first round, the items with less than 60% agreement were discarded. Items were merged, and a new list was created.</p>	<p>Final guidelines consisted of 14 items and a checklist of 16 factors. 8 of the items received a full 100% consensus for inclusion. 5 areas covered by items and checklist are: planning involving parents/guardians, features in the environment, use of time, communication, and health care</p>	<p>Level IV – B Worth to practice: The guidelines developed in this study are relatively general, feasible and could be useful in providing high quality, patient-centered care. Strengths and weaknesses: Utilized perspectives of experts across varying professions throughout several hospitals. Participants are considered to possess adequate knowledge and expertise of children with ASD. Moreover, the guideline could be utilized in other healthcare settings as the guidelines are general. Weaknesses are related to diversity of participants as most participants were female nurses (did not match national gender breakdown of profession) and no parents' expertise</p>

		and radiology departments in Sweden			<p>Rounds 2, 3 and 4 were performed similarly and responses less than 80% agreement were removed from the guidelines.</p> <p>The guidelines include final results of the list that received more than 80% consensus.</p>	<p>professionals.</p> <p>Involving parents/guardians and refraining from using abstract/symbolic language were identified to be very important.</p>	<p>were utilized to develop the guidelines.</p> <p>Feasibility and conclusion: Relatively feasible and easy to implement guidelines that could potentially help to better prepare and care for children with ASD. Although setting of this study is anesthesia and radiology, guidelines developed could be applied to other healthcare settings (also pointed out by authors).</p> <p>Recommendation: The implementation of all of these guidelines and their effectiveness needs to be evaluated in real practice (it has not been done yet). Although parts of these implementations have been deemed effective already.</p> <p>Include in the project</p>
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Definition of abbreviations: ASD: Autism Spectrum Disorder

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<p>APA Reference: McIntosh, C. E., Thomas, C. M., Allen, R. A., & Edwards, J. A. (2015). Using a combination of teaching and learning strategies and standardized patient for a successful autism simulation. <i>Clinical Simulation in Nursing, 11</i>(3), 143–152. https://doi.org/10.1016/j.ecns.2014.11.008</p>							
<p>To describe the development and evaluation of a simulation-learning module and/or learning strategies to introduce nursing students to individuals with ASD by preparing them on how to care for a patient with ASD in crisis in a controlled environment.</p>	<p>Three faculty in a nursing program with experience in simulation development, implementation, and evaluation, with one faculty also being expert in ASD diagnostics and behavior, developed a simulation training for nursing students in a nursing program.</p> <p>Before participating in simulation, students were provided case</p>	<p>N= 27 students in their last semester of the senior BSN program participating in the simulation in groups of three to four.</p> <p>All N= 27 students participated in the debriefing sessions, in the same groups of three to four students.</p> <p>Setting: Ball</p>	<p>IV: simulation-learning module</p> <p>DV: Assessment, communication, prioritization of tasks, and use of critical thinking (problem solving and decision making)</p>	<p>Nine-item survey done by students after completion of simulation to see if outcomes were achieved, and to identify shortcomings and changes needed to improve the simulation in the future.</p>	<p>No statistical tools (i.e., mean, median, mode, t- test, ANOVA) or software were identified to have been used in this study.</p> <p>Analysis of students' involvement was based on their levels of conversation with either the patient with ASD or his mother, maintenance of a safe environment</p>	<p>The simulation and survey thereafter showed that communication with patient with ASD could be challenging, and while students agreed communication with his mother could have been effective and helpful, only few students communicated with his mother and utilized her as a resource as</p>	<p>Level II, C</p> <p>Worth to practice: This study identified the effectiveness of a simulation learning module on knowledge of students when caring for individuals with ASD. Therefore, it could provide benefits on teaching healthcare staff effectively on how to provide quality of care to patients with ASD.</p> <p>Strengths and weaknesses: This is the first stimulation dedicated to teach nursing students about caring for individuals with ASD. Moreover, staff did not provide grades or pass or fail to participating students to allow for a nonthreatening learning activity to the students. Additionally, to treat</p>

	<p>study and lecture to educate basic information about ASD and to allow students to apply principles of communication, assessment, prioritization, critical thinking decision making and problem solving to this population.</p> <p>No conceptual framework noted</p>	<p>State University, School of Nursing</p>			<p>and removal of the dangerous items from patient's reach, assessment and addressing patient's chief complaint (in this case the head wound), discussing the health history and discharge plans with the patient and his mother, and active decision making and/or working to resolve problems with other students in the same group.</p> <p>Faculty observations</p>	<p>part of his care.</p> <p>Moreover, most students had hard time understanding the meaning of patient's behaviors and way of interaction resulting in inadequate assessment and prioritization, delays in care and discharge of this patient.</p> <p>Regardless, all students agreed that preparation via case study and lecture materials before simulation along with this simulation allowed them to better understand and appreciate</p>	<p>every student the equal, same faculty member conducted the debriefing session for each group of students, same patients was used, and students were given as much time as needed.</p> <p>Weakness could relate to lack of giving adequate time for students during simulation (only 10-minute allocated). Moreover, this simulation was performed in groups of three to four (potentially not allowing all students to interact and learn) and not utilized actual patient with ASD (individual portraying patient was staff working with individuals with ASD but did not have ASD).</p> <p>Feasibility and conclusion: ASD Simulation could be a helpful way of educating staff on how to care for patients with ASD and can help with identifying staff's strengths and weaknesses when caring for these individuals. Performing simulation to educate staff could be feasible depending on the setting and finding individual(s) to portray</p>
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					<p>and assessment of students' performance was another important analysis tool as it was one of the ways to effectively evaluate the students' performance and the effectiveness of teaching materials along with identifying areas to make changes to the simulation for ongoing program evaluation in the future.</p>	<p>people with ASD, and to be more aware on how to communicate and care for this population.</p> <p>Moreover, students stated that this simulation provided them with additional opportunity to use their critical thinking, communication, and prioritizing strategies more effectively.</p>	<p>as patients and finding time for staff to participate.</p> <p>Recommendation:</p> <p>Prior to simulation, provide information via case studies, lecture and written information about ASD and quiz staff to assess their knowledge so during the simulation they could be prepared and apply what they have learned to the simulation. Moreover, increase the length of simulation to more than 10 minutes to allow adequate time for students to demonstrate success with outcomes. Additionally, recording the simulation sessions and reviewing them with participants could better help them understand their strengths and mistakes to improve, and to reenforce teaching and learning strategies on ASD.</p> <p>Include in the project</p>
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Purpose of article or review	Design / method / Conceptual framework	Sample / Setting	Major variables studied (and their definitions)	Measurement of major variables	Data analysis	Study findings	Level of evidence (critical appraisal score) / Worth to practice / Strengths and weaknesses / Feasibility / Conclusion(s) / Recommendation(s)
<p>APA Reference: Padmanabha, H., Singhi, P., Sahu, J. K., & Malhi, P. (2018). Home-based sensory interventions in children with autism spectrum disorder: A randomized controlled trial. <i>The Indian Journal of Pediatrics</i>, 86(1), 18-25. https://doi.org/10.1007/s12098-018-2747-4</p>							
<p>To determine the viability and short-term effectiveness (12 weeks) of HBSI in children with ASD with sensory processing abnormalities .</p>	<p>12-wk, parallel group, pilot, randomized controlled trial (RCT).</p> <p>Randomly assigned children with ASD to SI group who receive HBSI by the parents/caregivers, and ST group who would not.</p> <p>No conceptual framework noted.</p>	<p>N=185 children with ASD between 3–12 y of age, with sensory processing abnormalities were screened for eligibility.</p> <p>N=40 children met criteria.</p> <p>n=21 randomly assigned to SI group and n=19 to ST group.</p> <p>The study was conducted in</p>	<p>IV: HBSI (pre-designed structured activities to be performed using home-based items and a sensory kit, including blankets, sofa, bed, soft toys, sensory brushes, flash cards and lighting)</p> <p>DV: Physical health, emotional functioning, and social functioning, including</p>	<p>PRILS-10: Help measure reduction in common sensory abnormalities</p> <p>CGAS and PedsQL: Help measure changes in overall wellbeing and health-related quality of life (i.e., behavioral and emotional health and functioning as well as physical)</p>	<p>Data was analyzed using IBM-SPSS 21.0 version.</p> <p>T-test was used for parametric variables; MannWhitney U test was used for nonparametric variables, and Chi-square/Fischer exact test for dichotomous variables.</p>	<p>Overall, there was improvement on PRILS-10, CGAS and PedsQLT M respectively in SI group.</p> <p>Findings suggest HBSI activities are feasible and suggested to have a beneficial part in reducing the severity of</p>	<p>Level I - B</p> <p>Worth to Practice: HBSI is relatively feasible and effective to be implemented to help improve the overall wellbeing and health-related quality of life in children with ASD.</p> <p>Strengths and Weaknesses Major strengths include, being the first pilot-RCT on sensory interventions in children with ASD tried in real world settings from a developing country (India), exclusively included ASD children who had sensory abnormalities, and rigorous compliance checks to ascertain the effectiveness of interventions. The limitations are, PRILS-10 was a self-designed questionnaire, a standardized objective measure could have improved measurement of outcome,</p>

		the Neurodevelopmental Clinic, at Department of Pediatrics, Postgraduate Institute of Medical Education and Research, Chandigarh and Prayaas, Rehabilitation center for handicapped children	sensory outcomes, such as improvement in eye contact (Avoiding), respond when called by name (Sensitivity), decline in sensitivity to loud noises (Avoiding), decline in tendency to stand in proximity to others (Seeking), and decline in hyperactivity (Seeking)			sensory abnormalities in children with ASD and are associated with improvement in overall wellbeing and health-related quality of life in these children.	duration was short-term (12 wk) trial, long-term effects of the interventions are uncertain, majority of the study population was children 3–9 years old, and observational bias could have played a role (parents in SI spent more time with children than ST and knew about the interventions). Feasibility and Conclusion: Feasible and effective to use HBSI in settings, including short-term (12 week) implementation. Recommendation: A double blinded RCT study with longer-term follow-up to better assess the changes in severity of sensory abnormalities needs to be developed. Include in the project
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Definition of abbreviations: HBSI: Home-Based Sensory Interventions; ASD: Autism Spectrum Disorder; IV: Independent Variable; DV: Dependent Variable; SI: Sensory Intervention; ST: Standard Therapy; PRILS-10: Parent Rated 10-Item Likert Scale; CGAS: Children's Global Assessment Scale; PedsQLI: Pediatric Quality of Life Inventory

Purpose of article or review	Design / method / Conceptual framework	Sample / Setting	Major variables studied (and their definitions)	Measurement of major variables	Data analysis	Study findings	Level of evidence (critical appraisal score) / Worth to practice / Strengths and weaknesses / Feasibility / Conclusion(s) / Recommendation(s)
<p>APA Reference: Parsons, D., Cordier, R., Lee, H., Falkmer, T., & Vaz, S. (2018). A randomised controlled trial of an information communication technology delivered intervention for children with autism spectrum disorder living in regional Australia. <i>Journal of Autism and Developmental Disorders</i>, 49(2), 569-581. https://doi.org/10.1007/s10803-018-3734-3</p>							
To explore the effectiveness of tablet-based ICT intervention (TOBY app), to supplement the existing therapies, on improving visual motor, imitation, language and social skills in children with ASD, aged between 2 and 6 years living in regional	Parallel RCT design. Participants (children 2-6-year-old with ASD and their families) were randomly assigned to either intervention group (Ipad with TOBY) or control group (Ipad without TOBY) to do 20 min of therapy per	N=59 participants (children 2-6 year old with ASD and their families) recruited and completed the study. N=29 randomized to intervention group (using TOBY) and N=30 control group (not using TOBY) Study took place in Australia,	IV: TOBY application on tablet DV: Visual motor (i.e., perception and discrimination of sensory cues, such as color and shape), imitation (includes copying an action, design, or pre-speech sounds), language (recognition and production of	Primary measures: MSEL was used to assess and measure visual motor, and expressive and receptive language skills CSBS used to assess and measure imitation and social skills Secondary measures: ToP (internal control, creative use	Data were organized and analyzed using SPSS 24. Descriptive statistics were used to describe the sample. Independent t-tests for continuous data and Pearson's χ^2 tests for categorical data were used to compare demographic and outcome measure	For hypothesis one, the expressive language subscale of the MSEL was the only statistically significant difference between the intervention and waitlisted groups between baseline and post intervention. For hypothesis two and three, when all the participants' scores were	Level I - B Worth to Practice: TOBY app could be relatively feasible and provide benefits in language and social skills to children with ASD. Strength and Weakness: This study resembled replicating real world as it provided minimal level of support and reminders to enforce use of TOBY (allowed individuals to do it by themselves as they would in real life). Moreover, this study utilized effective recruitment method, including snowballing technique and randomization of participants. Weakness includes participants dropout and not using TOBY app as recommended for the recommended time (they used less than half of time recommended, 11 minutes instead of 20 minutes)

Australia.	day with the TOBY app. No conceptual framework noted.	involving only those living outside of major cities (regional areas) as defined by the Australian Standard Geographical Classification System	object names), and social skills (interpersonal skills, such as joint attention) of children with ASD.	of objects, intrinsic motivation, and ability to give and read social cues) POM (for pragmatic language) SPT (non-verbal play Activities)	differences between groups at baseline. Shapiro–Wilks tests were conducted to test for normality. Independent t-test and Mann–Whitney U for group comparison using the randomization allocation as grouping variable	pooled and measured over time, statistically significant improvements were shown in receptive and pragmatic language and social skills and these gains were maintained, thus suggesting skill acquisition when utilizing TOBY app.	<p>Feasibility and Conclusion: This study provided good overview and outlook on effectiveness of TOBY app. TOBY could be relatively feasible to implement provided the setting could afford the technology.</p> <p>Recommendations: To improve its utility, children need to comply with directions and usage time (might need to come up with better engagement methods to keep the children engaged and involved in using the application).</p> <p>Include in the project</p>
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Definition of abbreviations: ICT: Information Communication Technology; TOBY: The Therapeutic Outcome By You; MSEL: Mullen Scales of Early Learning; CSBS: Communication and Symbolic Behavior Scales; POM: Pragmatic Observation Measure; ToP: Test of Playfulness; SPT: Symbolic Play Test

Purpose of article or review	Design / method / Conceptual framework	Sample / Setting	Major variables studied (and their definitions)	Measurement of major variables	Data analysis	Study findings	Level of evidence (critical appraisal score) / Worth to practice / Strengths and weaknesses / Feasibility / Conclusion(s) / Recommendation(s)
<p>APA Reference: Schoen, S. A., Lane, S. J., Mailloux, Z., May-Benson, T., Parham, L. D., Roley, S. S., & Schaaf, R. C. (2018). A systematic review of Ayres Sensory Integration intervention for children with autism. <i>Autism Research, 12</i>, 6-19. https://doi.org/10.1002/aur.2046</p>							
To utilize CEC Standards for Evidence-based Practices in Special Education to evaluate and determine whether ASI intervention meets the criteria for an evidence-based practice for children with ASD	A systematic review of research studies that examine effectiveness of ASI intervention for children with ASD. No conceptual framework noted.	Articles on ASI for children with autism from 2006 to 2017 worldwide (No specific setting mentioned) Initial search (removing duplicates and applying “Sensory”): N= 478 After stage 1: N= 19 studies After Stage 2: N=6 studies; After Stage 3: n= 3 studies (2 RCT and 1 nonrandomized)	IV: CEC criteria for evidence-based practices in Special Education DV: Characteristics of ASI studies	CEC Standards for Evidence-Based Practices in Special Education (a set of evidence-based practice standards used to evaluate intervention studies)	3 stages: Stage 1: extensive database search for relevant studies using search terms related to sensory integration and autism interventions conducted in CINAHL, Cochrane Reviews, Cochrane Trials, Embase, ERIC, Medline, and PsychINFO databases. Stage 2: Selection of studies using specific inclusion	One RCT study met 100%, the other RCT met over 85%, and nonrandomized study met over 50% of CEC QI for evidence-based practice and all had positive outcomes regarding effectiveness of ASI on children with ASD. ASI intervention meets criteria for evidence-based practice for 4–12 year-old children with ASD, according to	Level II – B Worth to Practice: ASI could be valuable to children with ASD to reduce stimulation and sensory overload as it meets the criteria for evidence-based practice. Strengths and Weakness: Compared to other reviews of sensory integration intervention, this study used a manualized approach to thoroughly identify studies that explain the key characteristics and use of ASI intervention exclusively (excluded those that did not meet the criteria for ASI). Moreover, studied identified had more narrowly defined population (children with ASD between the ages of 4 and 12 years), and research question is specific to the evidence-based criteria set forth

				<p>criteria related to methodology and description of the intervention (i.e., peer-reviewed scientific literature, written in English and is consistent with ASI theory)</p> <p>Stage 3: Evaluation of included studies using CEC standards to determine whether ASI intervention meets the criteria for an evidence-based practice for children with ASD.</p>	<p>the CEC Standards for evidence based practices in Special Education.</p>	<p>by CEC.</p> <p>Weakness includes that this study does not utilize other evidence-based practice guidelines although states it was considered (i.e., Frank Porter Graham, Child Development Institute).</p> <p>Feasibility and Conclusion: Implementing ASI as outlined in the studies could be beneficial and evidence-based practice but could be somewhat difficult to do, depending on the budget and setting approval and finding those certified to help.</p> <p>Recommendation: Adhere closely to ASI intervention addressed in this study to ensure the delivery of evidence-based practice.</p> <p>Include in the project</p>
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Definition of abbreviations: CEC: Council for Exceptional Children; ASI: Ayres Sensory Integration; QI= Quality Indicators