PSYCHOLOGY AND EDUCATION (2021) 58(5), ISSN 1553 - 6939
Article Received: 22th November, 2020; Article Revised: 26th March, 2021; Article Accepted: 26th April, 2021

The puzzle of Autism in the time of COVID-19 pandemic: "Light it up Blue"

Sarah Musa[1*], Ismail Dergaa[1], Ossama Mansy[1]
[1] PHCC, Primary Health Care Corporation, Doha, Qatar
*smusa@phcc.gov.qa

ABSTRACT

Background: COVID-19 pandemic has brought significant challenges in the life of children with ASD and their families. Restrictive containment measures and the ensuing disruption to daily routines is a particular source of concern in these vulnerable children, resulted in lifestyle, behavioral and psychosocial implications. Limited access to essential services such as speech and occupational therapy which are difficult to deliver through telehealth may contribute to regression of autism symptoms. Identifying perceived needs, dimensions of impact and strategies to cope is critical to accommodate the negative sequalae of the pandemic on children with ASD.
Aim: This review aims to generate important insights into the anticipated challenges faced by children with autism and their families as a result of COVID-19 restrictions. The secondary aim is to propose comprehensive, resilient, multi-component coping strategies that support children with autism and their families.
Methods: A systematic literature search was conducted on PubMed, ScienceDirect, Medline and Scopus from inception to 14 March 2021. The current report is an executive summary of data regarding challenges and coping strategies during COVID-19 pandemic for children with autism and their families.
Results: The literature reviewed indicates that the ongoing COVID-19 pandemic has undoubtedly led to shifting social situations and disruption of behavioral, mental, physical and social domains which have impacted individuals with ASD and their families. To mitigate the effect of the pandemic on this vulnerable population, implementation of structured multi-level and multi-component child/parent-centered interventions are of paramount importance and will assist in translating perceived negative impacts into opportunities to adapt and cope.
Conclusion: Children with ASD are uniquely vulnerable to the disruption caused by COVID-19 pandemic. Transition into in-home behavioral and learning interventions is particularly challenging time for those children and their families. Barriers to essential services such as speech and occupational therapies, combined with loss of routine and predictability has widened the gap between needs and provided care. Parents, teachers and health care should aim to work collectively for a broadened approach that is child/parent centered to compensate for most of disrupted vital support and services. Practical evidence-based resources that support and guide ASD caregivers is likely to reduce anxiety and restore a sense of routine during the pandemic. Ongoing care is essential for those children in order to maintain behavior and prevent symptoms regression that contribute to better prognosis and lowered health care costs.

Keywords
ASD, behavioral, speech therapy, occupational therapy, remote telehealth, coping

Introduction

Autism spectrum disorder (ASD) refers to a group of neurodevelopment disabilities characterized by varying degree of impaired social communication and interaction in addition to restricted and repetitive pattern of behaviors, interests or activities **(World Health Organisation, 2020)**. It is estimated that one in every 160 children worldwide has an ASD **(Jensen et al., 2021)**. In 2013, the Diagnostic and Statistical Manual of Mental Disorders, 5th ed. (DSM-5) has replaced the previous subgroups of Autistic disorder, Asperger syndrome, Pervasive Developmental Disorder Not Otherwise Specified, and Childhood Disintegrative Disorder with the single umbrella term of ASD **(Ousley, Cermak, 2014)**. Individuals with ASD often have co-occurring medical, developmental and mental conditions such as fragile X syndrome, epilepsy, depression, anxiety, and attention deficit hyperactivity disorder (ADHD) **(Faras, Al Ateeqi, Tidmarsh, 2010)**. ASD core features are vastly complicated by these conditions, producing more complex characteristics, hence, challenging diagnosis and management. As a result, children with ASD exert a wide range of intellectual functioning, ranging from extreme impairment to superior levels that contributes to the heterogeneity of presentation **(Faras, Al Ateeqi, Tidmarsh, 2010)**.
People with ASDs and their families are frequently subjected to significant emotional and

financial burdens as a result of these disorders **(World Health Organisation, 2020)**. Early and constant interventions must be accompanied by broader actions aimed at physical and psychosocial services that are more accessible, inclusive and supportive. For instance, evidence-based behavioral interventions such as applied behavioral analysis (ABA), positive reinforcement and parental skills training programs, are widely effective strategies that provide meaningful opportunities to improve communication, cognitive deficit and social behavior. Implementation of such strategies should be tailored to address the contextual need of ASD children and their families in order to ensure optimum wellbeing and quality of life for both **(Paul, 2008)**.

On March 11, 2020, the World Health Organization (WHO) declared the novel coronavirus (COVID-19) outbreak to be a global pandemic **(World Health Organisation, 2020a)**. The pandemic has altered the way our local community and global society operate, disrupting daily routines and limiting access to essential physical and mental health services **(Dergaa et al., 2021; Varma et al., 2021; Varma, Abubaker, Dergaa, 2020; Varma et al., 2020; Varma et al., 2021a)**. Concerns about COVID-19 rapid escalation and global spread have resulted in increased levels of psychological distress among the general population, as well as a higher risk of symptoms exacerbation among people with pre-existing mental health conditions **(Trabelsi et al., 2021; Trabelsi et al., 2021a; Musa et al., 2021)**. Young individuals with ASD are among the most vulnerable, with a higher risk of negative consequences accordingly. Lack of access to essential therapies and health services, as well as limited support for literacy, social, and emotional matters, could be factors **(Moreno et al., 2020)**. Lockdowns and other restrictive precautionary measures have resulted in educational system constraints, loss of social support networks, and limited access to health care services **(Varma et al., 2021)**. Speech and language therapy, physical and occupational therapy, behavioral interventions, and psychological support are critical services for children with ASD that require multiple and frequent face-to-face interactions **(Moreno et al., 2020)**. Although telehealth and remote consultation provide alternative platform to ensure undisrupted access to essential care, children with ASD as a result may experience worsening of symptoms, further behavioral challenges and overall decline in mental well-being.

In light of known sensitiveness in making transitions and adjustment to changes, perhaps it is not surprising to encounter greater negative sequalae among those children in particular **(Mutluer et al., 2020).** Furthermore, due to their limited reasoning and comprehension abilities, people with ASD may have difficulty understanding and following rules about social distancing, infection control and tolerating extended periods of home isolation. Wearing face mask is another challenging barrier and can be uncomfortable for ASD individuals who have sensory processing disorders making them overly sensitive to texture, scent or pressure on face. The ongoing pandemic is projected to exert long-term influence on children with ASD and their families in terms of academic challenges, socioeconomic disadvantages, and caregiver burden.

Therefore, this article aims at exploring the multi-dimensional impact of COVID-19 pandemic on children with ASD and their families/caregivers, together with the provision of comprehensive, multilevel, parental-centered coping strategies that will assist adapting into the ‘new norm’.

1. Impact of COVID-19 on children with ASD and their Families/Caregivers

As a result of COVID-19 pandemic, children with ASD and their parents have undergone significant changes due to school closure and social isolation. An observational cross-sectional study found that parents of children with ASD were more likely to report changes in their child’s behavior as compared to control group (72.1% vs. 30.1%). Anxiety (41.7%), irritability (16.7%), obsession (11.1%), hostility (5.6%), and impulsivity (2.8%) were the most reported behavioral changes. More than half of the parents of ASD children reported that quarantine has adversely impacted emotion management as compared to control group (55.8% vs. 28.6%) **(Amorim et al., 2020)**. In both groups, caregivers have reported higher mean anxiety scores among themselves than their children, with statistically significant differences ($p < 0.05$). However, ASD children had higher mean levels of

anxiety (5.67 ± 2.78) than their typical peers (3.64 ± 2.70), as did their caregivers (7.37 ± 2.37) versus those of control group (5.55 ± 2.37). Social isolation (41.4%), inability to play outside (13.1%), routine changes (11.1%), boredom (9.1%) and remote school classes (7.1%) were amongst the main challenges related to ASD children. Parents have reported that child teaching, dealing with children's behavior, maintaining routines, keeping children occupied and social isolation as critical barriers for situation control **(Amorim et al., 2020)**. In line with previous study, Colizzi M et al. in their investigation of the impact of the COVID-19 pandemic on ASD individuals found that 78.1 % and 75.7 % of ASD families had increased difficulties managing daily activities, particularly free time and structured activities **(Colizzi et al., 2020)**. Individuals with ASD who previously experienced behavioral problems two times were more likely to exhibit severe impairment outcomes as compared to those with no history of the same **(Colizzi et al., 2020)**. Older age and living with a separated or single parent were associated with milder behavioral problems, whereas lack of indirect school support during an emergency inclined to increase the likelihood of more severe behavior problems **(Colizzi et al., 2020)**. Similarly, Asbury et al. reported that functional, social and behavioral difficulties were increasingly conveyed by parents of children with ASD in a qualitative-based research. Factors that contributed to these difficulties include fear of symptoms regression, sadness about compromised general care and lack of knowledge to support their children developmental needs. Furthermore, a lack of space for children to expend energy has resulted in psychomotor agitation and worsening of food-related unusual behaviors such as food selectivity/restriction, binge eating, and odd eating patterns **(Asbury et al., 2020)**. Another parent-reported survey was conducted in Turkey (age range 3-39 years) to better understand the way ASD individuals perceived and responded to pandemic measures **(Mutluer et al., 2020)** indicated that 55 % of parents were challenged with inclined aggressiveness in their children, 26% reported increased or newly developed tics, 29% noted deterioration in communication skills, 44 % and 33 % reported sleep and appetite changes, respectively. According to the Beck Anxiety Index, 25% of caregivers of people with ASD had no anxiety, 29% had mild anxiety, 21% had moderate anxiety, and 25% had severe anxiety symptoms **(Mutluer et al., 2020)**.

According to a SPARK online survey of 3,502 caregivers, majority of parents and caregivers have reported disruptions in special education (80%), speech and language therapy (88%), physical and occupational therapies (84%), and applied behavior analysis (14%) **(White et al., 2021)**. Due to these disruptions, three-quarters of all parents reported extreme or moderate stress, which was more marked among preschool-aged children.

Regarding the effectiveness of online/telehealth services, benefit was reported as low (<50%) across all service and therapy types **(White et al., 2021)**. Perhaps, due to the nature of therapies needed by those individuals that necessitate interactive play, peer-to-peer interactions, and reinforcers, which are harder to deliver remotely. The British Columbia, Autism Community Training (ACT) in collaboration with researchers at Simon Fraser University have conducted an online survey to portray the impact of COVID-19 on mental health, quality of life and service needs in families of children with ASD **(Fong et al., 2020)**. Majority of the parents have reported worsening of their child's anxiety, tantrums, daily routine, and sleep quality. Over a third of parents expressed concerns about their family's safety, and nearly 10% of them have considered placing their child in foster care **(Fong et al., 2020)**. Most of the parents reported that care provided by the Ministry of Children and Family Development (MCFD) and the Ministry of Education in response to COVID-19 was insufficient to meet their needs. On the other hand, three families expressed positive impacts of the pandemic on their children, for instance, one parent reported that her son "has sort of thrived with COVID-19

as the day-to-day social demands have lessened due to quarantine." **Figure (1)**

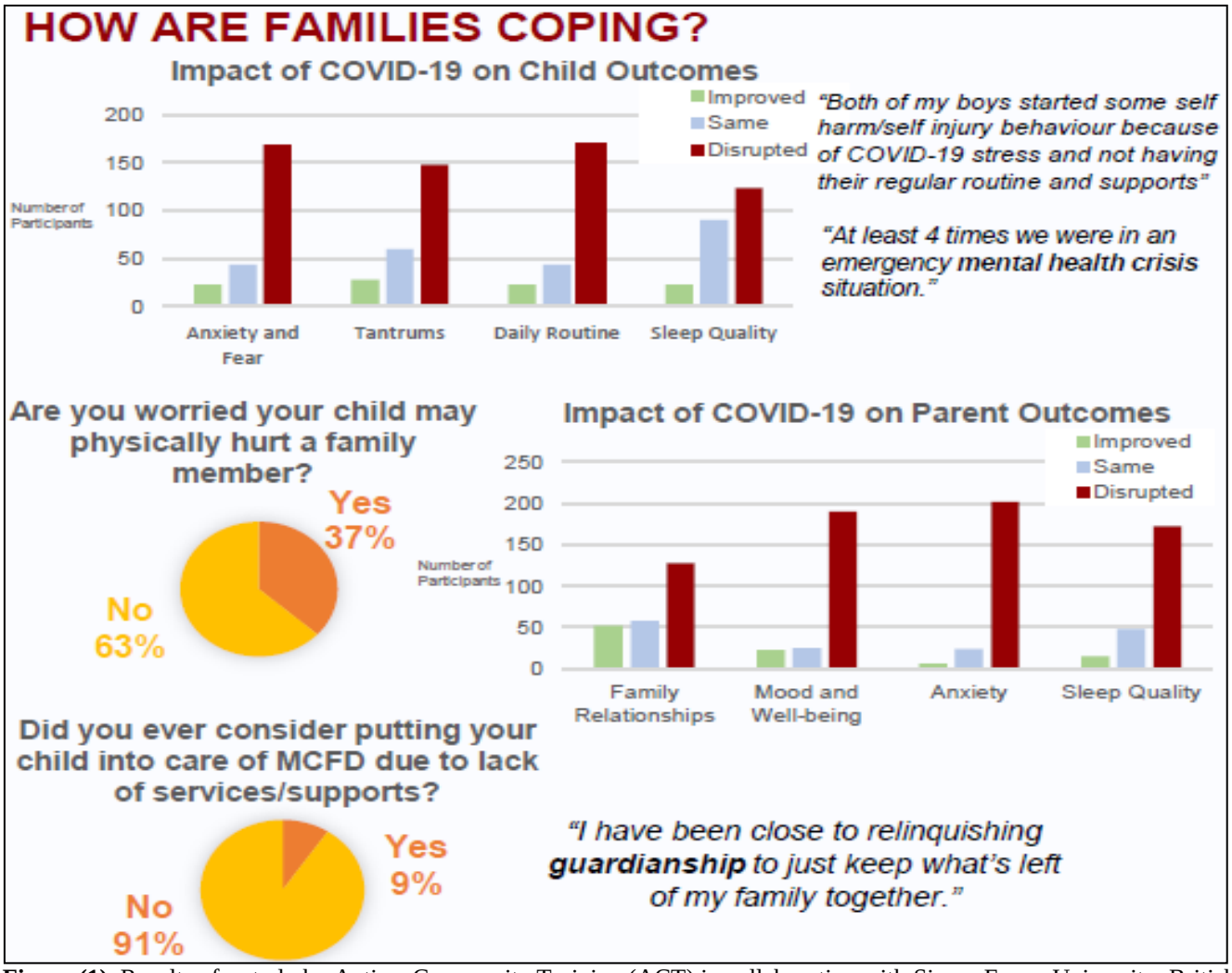

Figure (1). Results of a study by Autism Community Training (ACT) in collaboration with Simon Fraser University, British Columbia, July 30 –September 26, 2020 (Fong et al., 2020)

Another longitudinal online survey in Ireland looked at the impact of COVID-19 restrictions on parents of children with ASD (N=119, 18 years and under) **(O'Sullivan et al., 2021)**. Social skills difficulties (22.7 %), returning to school (17 %), leaving the house (15.9%), going to public places (15.9%), adhering to social distancing and public health guidelines (26.13 %) were the most anticipated challenges as reported by those parents **(O'Sullivan et al., 2021)**. There has been a noticeable decline to self-regulate emotions in 34.2%, social skills in 32.9% and motivation to engage in activities in 17.8% of children with ASD. The most common challenging conduct among those children were repetitive (48.7%) and rigid (37.81%) behavior, followed by verbal protests, acting out (towards others and environment), and self-injury**.** On the other hand, 29% of children showed improvement in daily living skills such as household chores, food preparation, communication and academic skills **(O'Sullivan et al., 2021).**

2. Strategies to support autistic children and their families through and beyond lockdown

In order to help children with ASD and their families, it is extremely important as an initial step to correctly recognize those children's needs and their abilities to cope with lockdown-related disruption. Parent's creativity, resourcefulness and ability to maintain a positive attitude are directly correlated with their children's behavioral outcomes **(Patel et al., 2020).** Focusing on

parental well-being and providing solutions to prevent behavioral regression such as breaking household items, head banging and rocking excessively, will reduce parental frustration and enhance better child functioning. Due to the clear impact of COVID-19 outbreak particularly on parents of those children, it is imperative to plan a parent-focused strategy and provide psychosocial support along with practical guidance.

2.1. Talk with your child about COVID-19

It is critical to discuss the coronavirus with children in order to ensure receiving the information they require without being overly alarmed. Always communicate in ways that are appropriate for the child's preferences; for example, visual communication would be extremely beneficial to children who have social communication difficulties. Visual and social stories would help caregivers throughout the pandemic to explain what is going on e.g., germs are making people sick, and what to do e.g., wash our hands, cover our cough, etc. **(Saxena, Saxena, 2020)**. Children with ASD can be easily distracted, especially when their daily routines are disrupted, which can lead to regression of behaviors or increased levels of anxiety and stress **(Catalano, Holloway, Mpofu, 2020)**. Parents/caregivers should be a source of reassurance and positivity to their children while allowing time for them to express themselves or talk about their feelings and concerns.

2.2. Managing the "New Normal" for Your Child and Your Family

Quarantine, social isolation, home confinement, and school closures have all resulted in significant shifts in daily routines, distinctively for children with ASD who are known to have transition difficulties **(Berard et al., 2021; Byrne, Longphuirt, 2020)**. Families can, however, create a new normal by incorporating activities that address social-communication skills, sensory issues, behavioral responses into daily routines that facilitate building essential competences and promote interaction with entertainment. Initially, parents/caregivers are recommended to identify the baseline skill or routine to target and with picture illustration, each task is to be broken down into explicit small steps that are easily understandable and followed. In order to enhance the executive functioning and meet the desirable outcomes, length and format of such activities should be planned in aspects that are appropriate to the age and need of the child **(Berard et al., 2021)**.

2.2.1. Visual schedules

Visual schedules are a type of intervention that can help people with ASD stick to a routine, transition between activities, learn new skills, and lessen their reliance on caregivers for daily tasks **(Knight, Sartini, Spriggs, 2015)**. A visual schedule is a sequence of photographs, videos, line drawings, symbols, text, or another visual format that shows the user what they must do. The schedule lists a series of visually presented tasks in the order in which they must be completed. This gives the user a visual template and a list of expected behaviors. Visual schedules can help people become more independent during specific activities, improve functional living skills like cleaning and cooking, teach academic, play, and social skills, increase on-task behavior, reduce tantrums and other disruptive behaviors, and make transitions easier **(Knight, Sartini, Spriggs, 2015)**.

2.2.2. Outdoor activities

Outdoor activities for children with ASD provide a pleasant change of scenery as well as a positive outlet for negative energy **(Thomas, 2014)**. Benefit of such activities like Hopscotch is not only confined to gross motor skills, however, hoping and jumping would encourage the child to obtain balance and coordination skills as well. Children will also have the chance to practice taking turns, following instructions and social interaction. Tic-tac-toe is another simple example that helps ASD children to develop their fine motor skills, logical understanding, spatial orientation and a strategy in a fun environment. Further activities such painting with ice cubes, ice block treasure hunts, obstacle courses, marching bands, hide and seek, bubbles, and outdoor yoga, will help those children with sensory integration, fine motor skills and joint attention difficulties. Other activities to consider are gardening, cookie

cutters, bird feeders, and sorting of natural items such as leaves, flowers, and rocks to engage ASD children with their environment **(Notbohm, Zysk, 2010)**.

2.2.3. Indoor activities

Art and craft activities involving everyday items found in the home can help children with ASD integrate their senses and can be an effective way to improve a child's attention span, self-expression, and reduce anxiety-related worries **(Martin, 2009)**. Sensory activities can help children with ASD cope with the new normal of not being able to go out, especially during lockdown **(Ingersoll, Dvortcsak, 2009)**. Making sensory bottles or collages, drawing and coloring, exercise routines, making a family kindness jar, reading a book, playing games, and keeping a diary are just a few examples. Furthermore, storytelling is an important tool that allow those children to develop imagination and confidence in speaking loudly. Whenever possible, change your voice tone and make associated sounds while reading. Also, pay attention to your child's cues; for example, if they are pointing or looking at something, point to it and talk about it **(Mastrangelo, 2009)**. Furthermore, taking a virtual field trip to the zoo, aquarium, or museum while interacting with your child by asking questions is critical for stimulating curiosity and exploration (**Martin, 2009)**. No matter what activity is planned, the primary challenge lies in structuring age and functional appropriate communication. For instance, older children could benefit from writing essays, conducting internet searches, crossword puzzles and discussing how interest can lead to a career. In general, a single well-designed activity would provide a number of related benefits, such as improved motor skills, hand-eye coordination, attention, and learning about their various senses **(Ingersoll, Dvortcsak, 2009; Mastrangelo, 2009)**.

2.3. Maintaining therapy from home

Disruptions in services and therapies are one of the most difficult situations for families with children who have ASD. In fact, 63 % of families with children with ASD have experienced severe service and therapy disruptions **(White et al., 2021)**. Although some people will manage using remote services, we know that not everyone will be able to use certain services and therapies at this time.

2.3.1. Speech Therapy

According to a recent survey, sixty-four percent (64%) of parents with ASD child reported speech therapy as the most disrupted service during COVID-19 (Simons Foundation, 2020). For this reason, parents should consider generating good alternatives with no delay by creating an environment which triggers child's language and speech most efficiently through stimulating activities **(Notbohm, Zysk, 2010)**. The aim is to create a shared conversation depending on adopted method of communication whether verbal, visual or gestured. Examples of motivating strategies are listed below **(The New York City Department of Education, special-education-supports)**.

- Sing and dance to songs you know and sing them often. Stop at expectant parts and look at your
- child expectantly; allow time for your child to fill in the blanks and model the words you want your child to use.
- Provide options: even if you know exactly what your child wants to think about, give them the opportunity to make a decision. "Do you want the apple or the banana?" you can ask as you show both items. Allow enough time for your child to look at both items and make a decision. Again, take advantage of this opportunity to elicit language in a variety of ways.
- Use agreed-upon daily schedules and routines to create a predictable environment.
- Assist your child in practicing or preparing a presentation to their peers or family on a topic that interests them.
- Play games with your child to help them make connections between different topics or strategy games. You can play Apples to Apples, Scattegories, Charades, or Battleships, for example.

- Assist your child in creating games like Jeopardy based on what they're learning in school or what they're interested in.
- Be clear about your expectations for their participation and establish ground rules. If they're visibly upset, talk about what's bothering them and explain everyone's point of view.
- Assist your child in making connections between what they learn in various subjects. Are there any connections between the topics?

Children with ASD or other developmental disabilities often have trouble communicating-verbally or non-verbally with others due to impairment in their cognitive function. Negative consequences may result accordingly, leading to frustration, aggressive physical behavior or even self-harm. This reflects the importance of innovation and quick responsiveness by caregivers to contain the 'transition' period in more effective way. For instance, parents/ caregivers of those children should always maintain a channel of communication to meet their children's needs and establish a safe and supportive environment. **(Table.1) (Patel et al., 2011)**.

2.3.2. Occupational Therapy

Children with ASD require continuous accessible services that focuses on their participation and skills development for everyday life. Occupational therapy ensures the provision of a holistic, integrative, family-centered approach that help to self-regulate emotions and maximize independence. Improving quality of life through augmented complex effort combining fine motor, visual motor and perceptual skills would be the mainstay mission. However, the evolving COVID-19 crisis made these services even more difficult to deliver. Disruption of face-to-face, interactive therapy sessions which are only effective when done frequently, would cause delays in these areas. Hence, in order to ensure skills development and behavioral control, parents must be able to accommodate these assistances into their children's everyday activity **(Lloyd, MacDonald, Lord, 2011)**. It is important to address every child's needs according to age and intellectual abilities. Trying to introduce the child to confidently use scissors and cut labeled lines or shapes, gluing skills, pencil grasp, hand weight bearing exercises such as wheelbarrow walks, crab walks, push-ups, and crawling, playing with Lego, Playdoh play, roll into balls, make a snake, press with stamps, hide and find pegs, or crawling are examples of such activities. Art therapy such beading, lacing, ripping paper to make a collage, and hole punching provides an opportunity for self-expression and boost hand-eye coordination, in addition to fine motor skills. Working on visual attention is another advantage of occupational therapy, for example, using an index finger card or ruler to isolate one line or word at a time while reading. Visual-motor integration with optimum perceptual function can be best developed through handwriting skills **(Kurtz, 2007)**. Limitation in self-regulation and sensory processing is a core feature of ASD children. Inability to control thoughts, emotional responses, actions and level of alertness/attention combined with atypical sensory processing dysfunction manifested as hypo or hyper-responsiveness often led to anxiety, fear and avoidance within a certain environment **(Jorquera-Cabrera et al., 2017)**. It could also lead to delay in the development of other skills, such as language and social responsiveness. Sensory integration therapy is a clinical based intervention that helps to organize information from the physical body and the environment via the integration of visual, auditory, taste, tactile, vestibular and proprioceptive inputs. Examples of such activities are listed below (**Table 2).**

Table (1). Key ideas to illicit language and speech in children with ASD

Key idea	Description
Wait time	Give opportunity to choose the activity, book or game and explain why they made their choice. Rather than anticipating their needs, have them verbally request desired items.
Praise	“Great job using first and next in your story” vs. “Good job".
Self-talk	Talk about what you're seeing, hearing, and doing while you're doing the craft or working on a project with your child. "I'm gluing the red paper under the yellow paper," for example.
Descriptive talk	Discuss and describe the materials you'll be using in your child's craft or other activity. Describe the objects or items you're looking at or manipulating. "The glue is sticky," "The paint is wet," or "My sticky fingers are getting stuck on the paper," for example.
Model speech	If your child speaks in two- or three-word sentences, you can repeat what they've said and then model a longer sentence with more words. This can be done while reading stories, preparing lunch, playing games, or cleaning, for example.
Expand speech	This strategy will assist your child in speaking in full sentences. Expansions are when you take their sentences and repeat them without changing any of the words, grammar, or vocabulary. If they say, "I paint boy," for example, you can respond, "Yes, you painted the boy."
Extend sentences	This strategy can aid in the extension of their sentences as well as the introduction of new vocabulary and concepts. Extensions are similar to expansions, but they go one step further. You're not only repeating and expanding their vocabulary, but you're also introducing new information. If they say, "paint fell," for example, you could respond, "Yes, the yellow paint fell on the floor."

Table (2). Key areas to illicit self-regulation and sensory processing in children with ASD

Key idea	Description
Calming activities	Play games e.g., red light, green light, freeze dance to reinforce structure and require waiting / turn-taking. Yoga, meditation, and belly breathing will help children gain greater control over their physical bodies, thoughts, and emotion. Begin by counting to five slowly while sitting still with your eyes closed.
Energizing activities	Push-ups on the floor or against the wall, jump on a mini trampoline, do jumping jacks, or play hopscotch. Running, yoga, karate, gymnastics, biking, and climbing/hanging from playground equipment are all examples of organized sports activities. Consumption of crunchy foods (e.g., popcorn, pretzels, carrots, apples, etc.)
Tactile sensitivities	Gradually introduce your child to various textures, starting with the least messy and progressing to the messiest. (Shaving cream or finger paints are messier than playdough.). When holding hands or giving hugs, use firm pressure rather than a light touch.
Attention and focus	When doing structured activities e.g., homework/studying, choose a location in the house with few distractions, break down instructions into simple 1-2 step directions, have the child repeat directions to reinforce understanding, take breaks, and use a reward chart with stickers for positive reinforcement.
Toilet training	Look for signs of readiness, such as discomfort when wet/soiled or staying dry for several hours at a time; dress your child in easy-to-manage clothing (e.g., sweatpants); create a schedule based on wetness patterns; use charts for positive reinforcement; and celebrate each success.
Shoe tying	Use a method like the bunny ear method, which uses two loops, or the wrap-around technique, which involves making a single loop and then wrapping the other string around and tucking it through. It's also a good idea to practice knots on a jump rope or a pipe cleaner to make it easier and more enjoyable.
Dressing	Dress-up clothes or dolls, assist with the zipper, for example, but allowing the child to pull it up. Assist your child in putting each leg into his/ her pants but allow him/her to pull his or her pants up independently. Place a button halfway through the hole and allow your child to pull it all the way through. When putting on shirts or jackets, teach your child to look for the tag first to identify the front.
Hand washing	Teach your child how to wash their hands properly with soap and water, as well as how to scrub, rinse, and dry their hands.

3. Remote school learning

Since the eruption of the pandemic, virtual learning has grown at an exponential rate all over the world. Adaptive alternatives have been initiated to overcome the existing gap, however, for children with ASD or learning disabilities who are known to struggle with communication and interaction, behavioral control has been of a great challenge. In addition to the limited effective support available for those children, online learning faces further barriers such as lack of necessary equipment, internet access and accessible materials **(Vaz et al., 2015)**.

The situation is even worse for children living in low and middle-income countries, rural and poor regions in which wider disparities and health care inequalities have placed an undue burden on individuals with disabilities and their families. Gradual lifting of restriction with introduction of blended learning has generated a new hope **(Yi, Dixon, 2021)**, however, a return to remote learning due to ongoing second waves of COVID-19 is a potential source of concern. Children with ASD, depending on disease severity, are likely to require additional attention either in academic performance or adherence into COVID-19 precautionary measures. For this reason, it is tremendously imperative for parents or caregivers of ASD children to gain the adequate knowledge and skills that would prepare them to be the fundamental providers of an enabling learning environment **(Vaz et al., 2015)**. Promising atmosphere necessitates limited distractions and continuous guidance during the course of the learning sessions. For example, setting up dedicated space, providing step-by-step explanations, starting slow and progress throughout, keeping regular contact with school are examples of strategies that would help in avoiding unfavorable behavior **(Spain et al., 2021)**.

Conclusion

In conclusion, the present review indicates that social isolation and the drastic change to routines brought about by the COVID-19 pandemic have led to significant consequences in terms of physical, psychosocial and behavioral health as well as added additional distinctive forms of challenges among children with ASD and their families/caregivers. This review has highlighted the adverse effects of prolonged quarantine on children with ASD and their families/caregivers, including but not limited to daily challenges, managing structured activities and free time, remote learning and therapy, sensory processing difficulties and increased behavior dysregulation. Considerable evidence suggests that in light of existing socio-behavioral and communication constraints, children with ASD are more susceptible to experience behavioral problems, anxiety, dysregulation of emotion, sleep and attention during this time. Families of ASD children are also at greater risk of mental health abnormalities due to their limited resources in coping with such situation. Therefore, establishing a collaborative parent-teacher-health care approach is the key for delivering an effective home-based service that are designed to overcome the impact of restrictions and at the same time fulfill the physical, mental and psychosocial needs of those children. Even if most care resources must shift to virtual/remote delivery, it is essential to prioritize access to adequate resources such education, healthcare, ASD-specific support, financial and parental support. Ongoing provision of care is critical for those children to maintain behavior, prevent symptoms regression and minimize healthcare related costs. Multidisciplinary and multi-levels care that brings families, teachers and care providers together is vital to ensure a shared decision-making process and personalized care tailored to each child's needs.

Acknowledgements

None

Declaration of interest statement

The authors declare that they have no competing interests. The authors alone are responsible for the content and writing of this article.

Funding

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

References

[1] https://www.who.int/news-room/fact-sheets/detail/autism-spectrum-disorders [Accessed on 04.04.2021]

[2] Jensen, K., Noazin, S., Bitterfeld, L., Carcelen, A., Vargas-Cuentas, N. I., Hidalgo, D., Valenzuela, A., Roman-Gonzalez, A., Krebs, C., Clement, V., Nolan, C., Barrientos, F., Mendoza, A. K., Noriega-Donis, P., Palacios, C., Ramirez, A., Vittet, M., Hafeez, E., Torres-Viso, M.,

Velarde, M., … Autism Working Group in Peru (2021). Autism Detection in Children by Combined Use of Gaze Preference and the M-CHAT-R in a Resource-Scarce Setting. *Journal of autism and developmental disorders*, *51*(3), 994–1006. https://doi.org/10.1007/s10803-021-04878-0

[3] Ousley, O., & Cermak, T. (2014). Autism spectrum disorder: defining dimensions and subgroups. *Current developmental disorders reports*, *1*(1), 20-28.

[4] Faras, H., Al Ateeqi, N., & Tidmarsh, L. (2010). Autism spectrum disorders. *Annals of Saudi medicine*, *30*(4), 295–300. https://doi.org/10.4103/0256-4947.65261

[5] Paul R. (2008). Interventions to improve communication in autism. *Child and adolescent psychiatric clinics of North America*, *17*(4), 835–x. https://doi.org/10.1016/j.chc.2008.06.011

[6] WHO Director-General's opening remarks at the media briefing on COVID19 – March 2020. URL: https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-may-2020. [Accessed on 04.04.2021].

[7] Dergaa, I., Varma, A., Tabben, M., Malik, R. A., Sheik, S., Vedasalam, S., ... & Chamari, K. (2021). Organising football matches with spectators during the COVID-19 pandemic: what can we learn from the Amir Cup Football Final of Qatar 2020? A call for action. *Biol Sport*, *38*(4), 677-681.

[8] Varma, A., Dergaa, I., Ashkanani, M., Musa, S., & Zidan, M. (2021). Analysis of Qatar's successful public health policy in dealing with the Covid-19 pandemic. *Int J Med Rev Case Rep*, *5*(2), 6-11.

[9] Varma, A., Abubaker, M., & Dergaa, I. (2020). Extensive Saliva based COVID-19 testing–the way forward to curtail the global pandemic?. *J Med Res*, *6*(6), 309-310.

[10] Varma, A., Dergaa, I., Zidan, M., & Chaabane, M. (2020). Covid-19:"Drive thru swabbing hubs"–safe and effective testing for travellers. *J Med Res*, *6*(6), 311-312.

[11] Varma, A., Dergaa, I., Mohammed, A. R., Abubaker, M., Al Naama, A., Mohammed, S., Rafique, M. A., Manu, L., Vedasalam, S., Parveze, P., Hammouda, O., & Ammar, A. (2021). Covid-19 and diabetes in primary care - How do hematological parameters present in this cohort?. *Expert review of endocrinology & metabolism*, 1–7. Advance online publication. https://doi.org/10.1080/17446651.2021.1909472

[12] Trabelsi, K., Ammar, A., Masmoudi, L., Boukhris, O., Chtourou, H., Bouaziz, B., ... & Hoekelmann, A. Globally altered sleep patterns and physical activity levels by confinement in 5056 individuals: ECLB COVID-19 international online survey. *Biology of Sport*, *38*(4), 495-506.

[13] Musa, S., Al Baker, W., Al Muraikhi, H., Nazareno, D., Al Naama, A., & Dergaa, I. (2021). Wellness Program Within Primary Health Care: How to Avoid "No Show" to Planned Appointments?–A Patient-Centred Care Perspective. *Physical Activity and Health*, *5*(1).

[14] Trabelsi, K., Ammar, A., Masmoudi, L., Boukhris, O., Chtourou, H., Bouaziz, B., ... & ECLB-COVID19 Consortium. (2021). Sleep quality and physical activity as predictors of mental wellbeing variance in older adults during COVID-19 lockdown: ECLB COVID-19 international online survey. *International journal of environmental research and public health*, *18*(8), 4329.

[15] Moreno, C., Wykes, T., Galderisi, S., Nordentoft, M., Crossley, N., Jones, N., Cannon, M., Correll, C. U., Byrne, L., Carr, S., Chen, E., Gorwood, P., Johnson, S., Kärkkäinen, H., Krystal, J. H., Lee, J., Lieberman, J., López-Jaramillo, C., Männikkö, M., Phillips, M. R., … Arango, C. (2020). How mental health care should change as a consequence of the COVID-19 pandemic. *The lancet. Psychiatry*, *7*(9), 813–824. https://doi.org/10.1016/S2215-0366(20)30307-2

[16] Mutluer, T., Doenyas, C., & Aslan Genc, H. (2020). Behavioral Implications of the Covid-19 Process for Autism Spectrum Disorder, and Individuals' Comprehension

of and Reactions to the Pandemic Conditions. *Frontiers in psychiatry*, *11*, 561882. https://doi.org/10.3389/fpsyt.2020.561882

[17] Amorim, R., Catarino, S., Miragaia, P., Ferreras, C., Viana, V., & Guardiano, M. (2020). The impact of COVID-19 on children with autism spectrum disorder. Impacto de la COVID-19 en niños con trastorno del espectro autista. *Revista de neurologia*, *71*(8), 285–291. https://doi.org/10.33588/rn.7108.2020381

[18] Colizzi, M., Sironi, E., Antonini, F., Ciceri, M. L., Bovo, C., & Zoccante, L. (2020). Psychosocial and Behavioral Impact of COVID-19 in Autism Spectrum Disorder: An Online Parent Survey. *Brain sciences*, *10*(6), 341. https://doi.org/10.3390/brainsci10060341

[19] Asbury, K., Fox, L., Deniz, E., Code, A., & Toseeb, U. (2020). How is COVID-19 Affecting the Mental Health of Children with Special Educational Needs and Disabilities and Their Families?. *Journal of autism and developmental disorders*, 1–9. Advance online publication. https://doi.org/10.1007/s10803-020-04577-2

[20] White, L. C., Law, J. K., Daniels, A. M., Toroney, J., Vernoia, B., Xiao, S., SPARK Consortium, Feliciano, P., & Chung, W. K. (2021). Brief Report: Impact of COVID-19 on Individuals with ASD and Their Caregivers: A Perspective from the SPARK Cohort. *Journal of autism and developmental disorders*, 1–8. Advance online publication. https://doi.org/10.1007/s10803-020-04816-6

[21] Fong, V., Birmingham, E., Pugh, D., Larocci, G. (2020) The impact of COVID-19 on mental health, Quality of life and service and support needs in families of children with autism Spectrum Disorder: preliminary findings. Simon fraser university. https://www.actcommunity.ca/category/news/page/2

[22] O'Sullivan, K., Clark, S., McGrane, A., Rock, N., Burke, L., Boyle, N., Joksimovic, N., & Marshall, K. (2021). A Qualitative Study of Child and Adolescent Mental Health during the COVID-19 Pandemic in Ireland. *International journal of environmental research and public health*, *18*(3), 1062. https://doi.org/10.3390/ijerph18031062

[23] Patel, J. A., Nielsen, F., Badiani, A. A., Assi, S., Unadkat, V. A., Patel, B., Ravindrane, R., & Wardle, H. (2020). Poverty, inequality and COVID-19: the forgotten vulnerable. *Public health*, *183*, 110–111. https://doi.org/10.1016/j.puhe.2020.05.006

[24] Saxena, R., & Saxena, S. K. (2020). Preparing children for pandemics. In *Coronavirus Disease 2019 (COVID-19)* (pp. 187-198). Springer, Singapore.

[25] Catalano, D., Holloway, L., & Mpofu, E. (2018). Mental Health Interventions for Parent Carers of Children with Autistic Spectrum Disorder: Practice Guidelines from a Critical Interpretive Synthesis (CIS) Systematic Review. *International journal of environmental research and public health*, *15*(2), 341. https://doi.org/10.3390/ijerph15020341

[26] Berard, M., Rattaz, C., Peries, M., Loubersac, J., Munir, K., & Baghdadli, A. (2021). Impact of containment and mitigation measures on children and youth with ASD during the COVID-19 pandemic: Report from the ELENA cohort. *Journal of psychiatric research*, *137*, 73–80. Advance online publication. https://doi.org/10.1016/j.jpsychires.2021.02.041

[27] Byrne, G., & Longphuirt, E. N. (2020). The psychological impact of quarantine on children with autism spectrum disorder. *Irish journal of psychological medicine*, 1–2. Advance online publication. https://doi.org/10.1017/ipm.2020.117

[28] Knight, V., Sartini, E., & Spriggs, A. D. (2015). Evaluating visual activity schedules as evidence-based practice for individuals with autism spectrum disorders. *Journal of autism and developmental disorders*, *45*(1), 157–178. https://doi.org/10.1007/s10803-014-2201-z

[29] Thomas, B. (2014). *How to Get Kids Offline, Outdoors, and Connecting with Nature: 200+ Creative activities to encourage self-esteem, mindfulness, and wellbeing*. Jessica Kingsley Publishers.

[30] Notbohm, E., & Zysk, V. (2010). *1001 great ideas for teaching and raising children with autism or Asperger's*. Future Horizons.

[31] Martin, N. (2009). *Art as an early intervention tool for children with autism*. Jessica Kingsley Publishers.

[32] Ingersoll, B., & Dvortcsak, A. (2009). *Teaching social communication to children with autism: A practitioner's guide to parent training and a manual for parents*. Guilford Press.

[33] Mastrangelo, S. (2009). Harnessing the power of play: Opportunities for children with autism spectrum disorders. *Teaching Exceptional Children*, *42*(1), 34-44.

[34] White, L. C., Law, J. K., Daniels, A. M., Toroney, J., Vernoia, B., Xiao, S., ... & Chung, W. K. (2021). Brief report: impact of COVID-19 on individuals with ASD and their caregivers: a perspective from the SPARK cohort. *Journal of autism and developmental disorders*, 1-8.

[35] https://www.schools.nyc.gov/learning/blended-learning/activities-and-supports/special-education-supports/speech-therapy-supports

[36] Patel, D. R., & Merrick, J. (2011). Neurodevelopmental disabilities: introduction and epidemiology. In *Neurodevelopmental Disabilities* (pp. 1-13). Springer, Dordrecht.

[37] Lloyd, M., MacDonald, M., & Lord, C. (2013). Motor skills of toddlers with autism spectrum disorders. *Autism : the international journal of research and practice*, *17*(2), 133–146. https://doi.org/10.1177/1362361311402230

[38] Kurtz, L. A. (2007). *Understanding motor skills in children with dyspraxia, ADHD, autism, and other learning disabilities: A guide to improving coordination*. Jessica Kingsley Publishers.

[39] Jorquera-Cabrera, S., Romero-Ayuso, D., Rodriguez-Gil, G., & Triviño-Juárez, J. M. (2017). Assessment of sensory processing characteristics in children between 3 and 11 years old: a systematic review. *Frontiers in pediatrics*, *5*, 57.

[40] Dhawan, S. (2020). Online learning: A panacea in the time of COVID-19 crisis. *Journal of Educational Technology Systems*, *49*(1), 5-22.

[41] Vaz, S., Wilson, N., Falkmer, M., Sim, A., Scott, M., Cordier, R., & Falkmer, T. (2015). Factors Associated with Primary School Teachers' Attitudes Towards the Inclusion of Students with Disabilities. *PloS one*, *10*(8), e0137002. https://doi.org/10.1371/journal.pone.0137002

[42] Yi, Z., & Dixon, M. R. (2020). Developing and Enhancing Adherence to a Telehealth ABA Parent Training Curriculum for Caregivers of Children with Autism. *Behavior analysis in practice*, *14*(1), 1–17. Advance online publication. https://doi.org/10.1007/s40617-020-00464-5

[43] Spain, D., Mason, D., Capp, S. J., Stoppelbein, L., White, S. W., & Happé, F. (2021). "This may be a really good opportunity to make the world a more autism friendly place": Professionals' perspectives on the effects of COVID-19 on autistic individuals. *Research in Autism Spectrum Disorders*, *83*, 10174