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Effect of Covid-19 lockdown on Indian children with autism

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ABSTRACT

Background: To prevent the spread of Coronavirus-19 a complete lockdown was enforced in India by March, 2020. The lockdown led to drastic negative effects on the social and communicative life of people. Among these, children and adolescents have been majorly affected. The study aims to investigate the effect of lockdown on Indian children with Autism.

Methods and Procedures: Thirty parents of children with Autism were given questionnaires to rate the performance of their children, pre- and post-lockdown. The questionnaires were analysed for development across activities of daily living (ADL), language and behavioral characteristics along with school and therapy performance.

Outcome and Results: The results revealed a significant regression in performance of children post-lockdown which was evident across all the domains assessed. Various additional issues like changes in sleep patterns, inadequate sitting behavior, attention span, concentration, limited eye contact, mood swings, laziness, clumsiness, hyperactivity and impulsivity were also noted post-lockdown, which were not very prominent before lockdown.

Conclusions and Implications: The study anticipates to help be better prepared for such situations in future. This includes involvement of better intervention which includes home-based training strategies for these children. Moreover, the study highlights impact of online therapy and schooling for children with Autism.

1. What this paper adds

Covid-19 pandemic lockdown has led to a reduced socialization, closure of schools, parks, day-care centres and overall social interaction. This led to negative impact on learning and development, especially among children. A larger impact of the same is felt among children with communication disorders, like Autism, who require additional socialisation along with intensive therapy sessions on daily basis to facilitate cognitive, language, social and emotional development. A review on literature revealed that, limited data is available on understanding the effect of lockdown on development of children with Autism, especially in India. Thus, the study aimed to explore the impact of a nation-wide lockdown, during Covid-19 pandemic, on overall development of Indian children with autism spectrum disorder. The study, thus, intends to help understand the way such lockdowns or similar situations can hamper language and social development among children with Autism. A detailed understanding of such situations will further help us prepare better for such circumstances.

The present study intends to explore effects of lockdown on children with Autism and determine its impact on overall learning and development of these children. The findings of this study further anticipate to help parents and professionals to understand and be

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better prepared for such situations in future. This can be done by devising better assessment and intervention plans along with incorporating major parental training or home-based intervention strategies in therapy sessions. Moreover, the study attempts to understand the impact of online therapy and highlights the areas which can further be improvised to suit the needs of children with Autism better.

2. Introduction

Covid-19, a disease similar to pneumonia, is a highly infectious disease which was first detected in December, 2019 (Tobias et al., 2020). This disease, also called Coronavirus-2019 infected about 334,000 people around the world along with nearly 14,000 deaths (WHO, 2020). This disease which had an outbreak in Wuhan, China (Huang et al., 2020), soon became a pandemic affecting every continent with nearly 383,000 deaths worldwide by June, 2020 (WHO, 2020). Within about one year (May, 2021), the worldwide deaths caused due to Covid-19 reached around 3216,418 (WHO, 2021).

Environmental factors play an important role in the transmission of this virus (Cassaro & Pires, 2020), including human to human transmission similar to any other respiratory disease. All the respiratory diseases can spread by droplet scattering which can lead to severe respiratory difficulties from simple cough to severe lung failure (Cassaro & Pires, 2020). Thus, in order to reduce the spread of Covid-19, following basic hygiene rules is considered most crucial. These include washing hands, sanitizing work area regularly, wearing a mask, maintaining strict social distancing and so on.

2.1. Effects of nation-wide lockdown

The impact of Covid-19 differs across countries, especially owing to the measures taken by each country to control the pandemic. In India as well, the cases of Covid-19 were rising drastically with first patient being reported on 30, January, 2020 (Ministry of Health, 2020). As these cases were spiking drastically all over the world various countries implemented “a complete lockdown” in order to ensure social distancing among people. In India also, a nation-wide lockdown was imposed from March 24, 2020 which extended up to May, 03, 2020. During this lockdown, a complete shutdown was ensured including shops, banks, industries, schools, colleges, parks, theatres, gymnasiums etc. Nothing other than the essential services were allowed to operate all across the country in order to ensure strict social distancing. Following this, a second lockdown was imposed (state-wise) owing to a second wave which hit the country in 2021.

One most important sector that has been hit during this lockdown was the economy of the country. It is seen that gross domestic product growth rate, inflation, unemployment, interest rate and industrial output have been majorly hit by this pandemic leading to a complete economic imbalance in the country (Barbate et al., 2021). Apart from this, another area which has faced a major set-back is the social and communicative life of people. Due to Covid-19 pandemic, not only the physical health but mental health also has been affected (Mazza et al., 2020).

Bivia-Roig, La Rosa, and Gomez-Tebar (2020) reported a significant decrease in the levels of physical activity as well as in health-related quality of life among pregnant women during lockdown in Valencia (Spain). The number of hours spent by these women sitting increased by 50% with 52.2% being unable to attend delivery preparation sessions due to lockdown. The decrease in physical activity included both vigorous as well as moderate levels of physical activity, including the time they spent walking. The main obstacles to their physical activity were a lack of space, fatigue due to pregnancy, and not considering exercise a priority. This change in the lifestyle bought a major negative impact on the health-related quality of life among these pregnant women.

2.2. Effect of lockdown on children

With respect to children, there have been a few cases of infections noted. However, the mental well-being of children has been majorly affected by this pandemic, (Fontanesi, Marchetti, Mazza, & Giandomenico, 2020). Various studies show that the lockdown imposed due to Covid-19 caused significant psychological problems especially among older children and adolescents. A study on Italian adolescents by Commodari and La Rosa (2020) revealed that Italian adolescents had a low perception of risk of COVID-19 along with a lower susceptibility and seriousness. However, they were aware of the restriction measures necessary to contain the spread of the virus, and agreed with the limitations imposed by the government. These adolescents showed significant psychological negative feelings about the quarantine experience which led to serious psychological impact in adolescence (Esposito et al., 2021).

Children learn and develop various skills by watching and imitating adults and peers, not only at home but in schools, playgrounds and other social gatherings (Berk, 2013). However, the lockdown has led to a reduced socialization and thus negatively affected learning among children. The pragmatic skills of language which develop through play and social interaction with people has been a major area which remains underdeveloped among children due to social restrictions like these. Moreover, demands of pandemic which led to long periods of quarantine and recovery has slowed down the language learning process among children. Closure of schools, parks and day-care centers has been affecting the young children world-wide (Fontanesi et al., 2020). The closure of schools and similar measures led to a significant social isolation, and these were considered as one of the most crucial and prominent reasons for mental health problems among children (Esposito et al., 2021). Apart from this, an increased screen time and excessive use of internet (Grecyna, 2020) also led to mental instability among children. An additional internet addiction and/or cyber bullying dangers further contributed to the after effects of lockdown. Thereby, it is worth noting that increased screen time and reduced socialization can majorly affect the development of the brain as children spend more time inside the house which can lead to issues in cognitive development among children (Franklin, 2007).
During this period of social restrictions, a large number of parents have reported personality changes among children which may include fear of strangers, nervousness, reduced attention and concentration, mood swings along with boredom and restlessness. There may also be periods of increased stress seen not only among children but for parents as well (Orgilés, Morales, Delveccio, Mazzeschi, & Espada, 2020). Lockdown has been affecting a lot of young children all over the world as they are not able to keep up to their grades in various subjects. This also creates stress and negative impact among children (Orgilés et al., 2020). Apart from academic performance in schools, children have been losing on various physical activities and motor skills due to closure of parks, clubs, swimming pools and other child recreational activities (Hillman et al., 2008). Robson (2020) noted that children have also started manifesting larger delays in intellectual development due to lockdown especially owing to lack of activities like music lessons, summer camps, visits to library and so on.

Thereby, the areas which were adversely affected among children during this lockdown can be summarized as:

1. **Screen exposure**: Longer periods of stay at home during lockdown led to an increased screen usage, through use of TV, laptop and PC, prolonged use of online gaming and streaming activities, mobile phones and so on (King, Delfabbro, Billieux, & Potenza, 2020). This increased screen time not only caused an increased risk of cardiovascular diseases (Robinson, Daly, Ridgers, & Salmon, 2015), but also led to depression (Kremer et al., 2014), adiposity (Berentzen et al., 2014; Tsujiguchi et al., 2018) and myopia (Lanca & Saw, 2020).

2. **Reduced physical activity and fitness**: Research showed that physical activity and exercise time among children and adolescents, during Covid-19 lockdown, was significantly reduced by 2.30 h per week (Pietrobelli et al., 2020). Such complications like reduced physical activities had adverse effects on the growth and development of children along with complications like mental imbalance, heart diseases, low blood pressure and so on (Gaya et al., 2011).

3. **Eating habits**: Various changes in lifestyle during lockdown led to unhealthy dietary nutrient intake and obesity among children and adolescents (Pietrobelli et al., 2020). A lack in emotional support from family and friends during lockdown also contributed to these health related issues (Mattioi, Bailerini Puviani, Nasi, & Farinetti, 2020).

4. **Psychological responses**: Mental health problems like psychosocial deprivation, social isolation, adjustment issues, boredom, mood swings, lost friend connectivity (Laursen, Bukowski, Aunola, & Nurmi, 2007; McDermott et al., 2013; Williams, Cheung, & Choi, 2000) were some of the factors which affected psychological well-being of children. These further led to depression, isolation and environmental stress among children post lockdown especially after closure of schools (Guan et al., 2020).

5. **Disrupted sleep patterns**: Due to the changes in day-to-day routine, lack of physical play and increased screen time during online schooling or due to psychological issues, children experienced disrupted or modified sleep patterns (Belmon, van Stralen, Busch, Hamsen, & Chinapaw, 2019; Janssen et al., 2020; Taylor, Williams, Farmer, & Taylor, 2015).

Apart from children, parents too showed major stress issues during Covid-19 pandemic. The reasons for stress could be economic problems in family owing to lockdown, issues with physical health of the family, difficulty handling online and home schooling for children, juggling between work-from-home and child-care issues, difficulty in educating children about the pandemic (especially social distancing, hygiene measures and lockdown) and difficulty engaging children at home while distancing them from their peers. However, it is worth noting that in spite of all the challenges, the lockdown also brought some positive changes in the lives of parents and children. One of these being the advantage of spending more time with family, especially children. But these few advantages could not outweigh the major mental health problems and economic issues being faced by most of the families during lockdown.

To conclude, various studies showed that COVID-19 pandemic lockdown had a significant impact on elementary schoolers’ physical activity, sleep, screen time and diet. Children’s behaviors worsened at a greater rate following the pandemic onset compared to pre-pandemic trends. Also, sleep timings shifted later and dietary intake increased. Compared to pre-pandemic measures, children’s physical activity, sedentary behavior, sleep, screen time, and diet were adversely altered during the COVID-19 pandemic. This accounted for an exacerbated childhood obesity. (Baten et al., 2022; Burkart et al., 2022).

### 2.3. Effect of lockdown on children with communication disorders

Communication Disorders are defined as developmental or acquired impairments which affect speech, language, and/or hearing of children and thus lead to major deficits in communication (National Institute on Deafness and Other Communication Disorders, 2010). During lockdown, like typical children major changes were noted among children with communication disorders as well. These changes were significant mainly in behaviours and learning skills of children. This, no doubt, led to an adverse effect on the overall development of these children (Coyne et al., 2020; Fontanesi et al., 2020; Masters, Taylor-Guy, Fraillon, & Chase, 2020).

The discontinuation of various services, during lockdown, led to closure of all therapy services like speech therapy, psychological/behavioral therapy, counseling, occupational therapy and so on. Also, all the schools including special schools, clubs, art, music, dance classes etc. were forced to close to help reduce the spread of infections. All of this, left parents of children with communication disorders with no option but to keep children restricted to their homes in the absence of essential therapies and socialization, thereby leading to major regression in most of the developmental areas like language, communication, behavioral and occupational skills among these children (Masters et al., 2020). Moreover, during the lockdown phase, major developmental delays, anger, frustration issues, attention and concentration issues and an overall regression in social, academic and other communicative skills were seen among children with autism, intellectual and developmental disabilities (IDD), Down’s syndrome, learning disability, receptive and expressive language delay and other communication disorders (Neece, McIntyre, & Fenning, 2020; Narzisi, 2020; Narzisi, 2020; Narzisi, 2020; Narzisi, 2020).
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Roach, Barratt, Miller, & Leavitt, 1998; Levante et al., 2021).

Cost et al. (2021) highlighted deterioration in mental health of children during the initial phase of lockdown. Children with pre-existing Mental Health issues (like autism spectrum disorders) experienced comparable changes in status of physical activity, screen time, dietary intake compared to children/adolescents without pre-existing psychiatric diagnoses. The strongest predictor of deterioration of mental health was experiencing increased stress from social isolation.

These pandemic-related changes did not only have an impact on learning-related outcomes, but also on the academic performance of children. A Flemish study pointed out that the school-closures in the context of the COVID-19 pandemic resulted in learning losses for children of the 2020 cohort compared to the previous cohort, with larger learning losses for more disadvantaged students (Maldonado & De Witte, 2021). Furthermore, a systematic review on the effect of COVID-19 related school closures showed negative effects on student achievement, especially for younger students and students from lower Socio economic status families (Hammerstein et al., 2021; Tso et al., 2022).

A study conducted among Indian children highlighted that 10% children have experienced a delay in expressive language without any medical history. A lack in peer interaction influenced the cognition that ultimately affected the language acquisition, during the lockdown. Hence, there is a need to monitor the speech and language acquisition even in those children who do not have any medical history (Ruchi B 2022).

Not only among children, increased periods of stress were noted even among parents of children with communication disorders (Baker et al., 2003). Various behavioral, communicative, occupational and psychological problems, attributed to this stress among parents (Roach et al., 1998; Woodman, Mawdsley, & Hauser-Cram, 2015). Studies among parents indicated more worries, mood-changes for parents (Asbury et al., 2021) and increased levels of parental stress (Bentenuto et al., 2021; Chan & Fung, 2021; Soriano-Ferrer et al., 2021) among parents of children with communication disorders. This further led to more emotional problems among children (Nonweiler et al., 2020). One of the major causes for this increased parental stress was discontinuation of therapy (Bentenuto et al., 2021).

2.4. Effect of lockdown on children with autism spectrum disorders (ASD)

The most common problems reported by parents of children with autism spectrum disorder, has been associated with emotional, behavioral, sleep, appetite problems as well as hyperactivity, stereotypical behavior. The frequencies of emotional and behavioral problems in the ASD group were higher than in the other groups (Guller et al., 2021). Children with ASD showed changes in scheduled routines, an increase in repetitive behaviors, and a loss of social engagement, during the lockdown (Guller et al., 2021). The coronavirus pandemic has had various consequences on these children due to a variety of situational variables. It was noted that a number of parents expressed feelings of concern, irritation, and stress while dealing with an ASD child, and others chose a variety of environmental modifications to help them cope during this period (Niveditha, 2022).

A study conducted in Hong Kong reported that children with special educational needs (SEN) were more vulnerable during the COVID-19 pandemic with risk of poor mental wellbeing and child maltreatment. These children manifested poorer mental health than typically developed children during the COVID-19 pandemic (Tso et al., 2022).

To summarize, the lockdown was a very challenging period for parents as well as children with communication disorders leading to drastic disturbances in social life, routine, behavior, physical health and mental status of children.

2.5. Need for the study

As apparent from the literature above, the nation-wide lockdown led to a reduced socialisation and lack of therapy for children with communication disorders. One such prominent group who faced major drawbacks of lockdown were children with Autism. During the lockdown, a lot of children showed regression in language and communicative skills along with increased behavioural and cognitive issues. However, it was found that this observation was limited to clinical experience and at the time of literature review, very limited research data was available for the same, especially in India.

Thus, the present study intends to explore effects of lockdown on children with Autism and determine its impact on overall learning and development of these children. This, in turn, anticipates to help parents and professionals to understand and be better prepared for such situations in future by devising better assessment and intervention plans along with incorporating major parental training or home-based intervention programs in therapy sessions. In addition, the study attempts to understand the impact of online therapy and highlights the areas which can further be improvised to suit the needs of these children better.

The aim of the study was to explore the effects of Covid-19 pandemic lockdown, in India, on development of children with Autism.

3. Methods and materials

The study follows a cross-sectional survey design which includes parents of thirty children with Autism, selected based on non-probability sampling method (which involves quota sampling technique). This sampling method involves individuals to represent the population based on specific traits or qualities. In this, only those participants are chosen which bring useful data for the purpose of the study.

Sampling Formula: \[ n \geq \frac{2(Z\alpha + Z\beta)^2 \sigma^2}{(X1 - X2)^2} = 28 \]
\[ \alpha = 1.96 @ 5\% \text{ level of significance.} \]
\[ \beta = 0.84 (80\% \text{ power}). \]

3.1. Selection Criteria

All the participants were selected from various private special schools and therapy centers located in regions of Dakshina Kannada district.

3.1.1. Inclusion criteria

- The parents residing in Dakshina Kannada for a minimum of 5 years
- The parents with a proficiency in English, in order to answer the questionnaire
- The parents who have at least one child with mild to moderate degree of Autism, within the age range of 4–14 years. The degree of Autism was measured based on the recent assessment records of the patients available at the centres, especially following the scores of Childhood Autism Rating Scale
- The child (whose parents were selected) should attended regular therapy or special school for a minimum of two years before lockdown was implemented. These therapies could be speech/language therapy, behavioral therapy, occupational therapy or special education, as per the requirement of the child.
- All parents selected belonged to middle socio-economic status
- Subjects receiving regular therapy for minimum of 2 years before the lockdown for a minimum of 4 days a week.
- Subjects who received regular online therapy and online school during lockdown period

3.1.2. Exclusion criteria

- Subjects with the history of hearing loss, physical impairments, global developmental delay and cerebral palsy
- Subjects who are irregular for the therapy or school (i.e., attended less than 4 sessions per week)

3.2. Data collection

3.2.1. Phase 1: Development of questionnaire

In order to understand the effect of lockdown on child development, a questionnaire was developed focusing on various developmental areas namely:

1. Activities of daily living
2. Speech and language skills
3. Behavioral skills
4. Academic skills
5. Performance in therapy

All the above sections were selected based on their importance in an overall development of the child. Each section consisted of various questions which followed a 4-point Likert Scale.

The questionnaire was devised by two speech and language pathologists who were experienced in this field for a minimum of 5 years. For face and content validity, the questionnaire was sent to an expert committee which consisted of, a psychologist, a special educator and an occupational therapist with an experience of minimum 10 years in the field, along with two parents of children with special needs. The expert committee reviewed the questionnaire and gave their suggestions on the same. Based on these suggestions, the questions were edited and reframed.

After the final questionnaire was framed, an essential step before using the questionnaire was to test its reliability. For this, Cronbach’s Alpha Coefficient was used. A Cronbach’s Alpha of 0.70 is considered a ‘satisfactory’ measure of internal consistency and reliability in measuring inter-item correlations which tap together to form a ‘Construct’. For this, a pilot study was conducted to measure the internal consistency of the questionnaire. The questionnaire was given randomly to twenty parents of children with Autism, who were different from the selected participants. The Chronbach’s score obtained was 0.8 which indicates a “good” internal consistency, thereby making the questionnaire good enough to be used for the study.

3.3. Phase 2: Administration of questionnaire

In the second phase of this study, the questionnaire was given to the selected parents who filled the form as per their child’s performance before and after the lockdown. To carry out this study, two questionnaires, pre- and post, were mailed to parents through an online platform. The pre-questionnaire was filled based on performance of the child before lockdown and the post was filled based on the child’s performance post-lockdown, on a 4-point Likert scale.

The responses in the questionnaire were verified, informally, by professionals (Speech pathologists, occupational therapist, psychologists and special educators) who provided therapy to these children. These professionals referred to the pre-lockdown and post-
lockdown assessment reports of these children (whose parents participated in the study) to roughly verify the responses given by parents. The ratings given by parents were in complete agreement with the professionals (and their assessment forms) in all the sections.

**Ethical Consideration:** This study was approved by the Ethics Committee at Father Muller Charitable Institution and followed the fundamental principles established in the Department. All the participants were informed about the study and were allowed to leave the study at any point if they wished to do so. The responses provided during the study were confidential and completely voluntarily. The participants could get an access to the questionnaires only if they gave their consent to participate in the study.

### 3.4. Data Analysis

The scores obtained in the questionnaires were then compared for their pre-and post-levels in order to understand the effects of lockdown on each area of development. For this, Mean scores were obtained for all the thirty participants for each question in every section. Following this, the mean scores were subjected to Paired sample t-test using SPSS (Statistical Package for Social Sciences) Version 17.0.

### 4. Results

Based on the pre-lockdown and post-lockdown questionnaires, it was noted that parents of children with Autism responded differently for the questionnaires before and after the lockdown. The results for the same are described below, based on each section of the questionnaire.

#### 4.1. Activities of Daily Living (ADL)

In this section, children were rated based on the way they responded in brushing, toileting, grooming, eating and other daily living skills, before and after lockdown. As evident from Table 1, there was a drastic regression in the mean values of pre and post lockdown ADL scores. This regression was observed for all the questions which targeted various skills like brushing, toileting, bathing, dressing and so on.

As illustrated in Fig. 1, the mean values for the child’s brushing & toileting skills indicate that these skills were most affected, whereas the child’s ability to perform physical skills (like exercises) were not affected much, post lockdown. The paired sample t-test illustrates statistical significance in the pre & post lockdown values of ADL ($p < 0.001$). This is clearly illustrated in Table 2 below.

Referring to Fig. 2, it is evident that most of the children scored average and adequate on Likert scale before the lockdown. However, the same skills regressed for most of these children and a higher percentage of children scored absent and inadequate, post lockdown. Thus, it was noted that children with Autism regressed in almost all the areas of ADL. This is evident from Fig. 2 which clearly shows more negative responses (absent and inadequate) post-lockdown for all the questions.

#### 4.2. Language characteristics

In this section, children were rated based on the way they responded for various language areas like labelling, following commands, imitation of sounds/words/sentences, answering questions, use of negations, affirmations and so on. Similar to ADL, language also showed a similar regression among children with autism post-lockdown. As illustrated in Table 3, there was a drastic regression in the mean values from pre to post lockdown, across all the questions. This indicates that there was a deterioration in the child’s ability to understand and use language post lockdown.

As illustrated in Table 3, the mean values for the child’s ability to follow commands & use affirmations indicate that this area was most affected, whereas the child’s ability to imitate sounds/words/sentences, perform/respond to greetings, answer questions, requesting & turn taking ability were the were the least affected post lockdown. The paired sample t-test illustrates statistical significance in the pre & post lockdown values of language characteristics ($p < 0.001$). This is clearly illustrated in Table 2 above.

Fig. 4 shows a general decrease in performance of all language areas as most of the responses appeared on absent and inadequate side

| Table 1 |
| --- |
| **Mean values of Pre & Post Lockdown ADL for Children with Autism.** |
| Questions | Mean for Pre-lockdown scores of 30 participants | Mean for Post-lockdown scores of 30 participants |
| Q1 | 2.8 | 1.6 |
| Q2 | 2.1 | 1.6 |
| Q3 | 2.2 | 1.7 |
| Q4 | 2.3 | 1.7 |
| Q5 | 2.5 | 1.7 |
| Q6 | 3.3 | 2.4 |
| Q7 | 2.9 | 2.1 |
| Q8 | 3.3 | 2.2 |
| Q9 | 2.7 | 1.7 |
| Q10 | 2.9 | 2.5 |
In this section, children were rated based on their behavioral and cognitive skills before and after lockdown. Similar to other areas, in behavioral scores also there was a drastic regression noted in the mean values from pre to post lockdown among children with autism. This is evident in Table 4.

Fig. 5 illustrates that sitting behavior & eye contact were most affected whereas feeding skills were least affected post lockdown. The paired sample t-test illustrates statistical significance in the pre & post lockdown values of Behavioral characteristics ($p < 0.001$). This is clearly illustrated in Table 2 above.
Fig. 3. Graphical representation comparing Mean values of Pre & Post Lockdown for Language skills among Children with Autism.

Table 3
Mean values of Pre & Post Lockdown Language scores for Children with Autism.

| Questions | Mean for Pre-lockdown scores of 30 participants | Mean for Post-Lockdown scores of 30 participants |
|-----------|--------------------------------------------------|--------------------------------------------------|
| Q1        | 3                                                | 1.5                                              |
| Q2        | 2.9                                              | 2.1                                              |
| Q3        | 3.5                                              | 2.1                                              |
| Q4        | 3                                                | 2.1                                              |
| Q5        | 2.4                                              | 1.1                                              |
| Q6        | 2.4                                              | 1.6                                              |
| Q7        | 3.2                                              | 2.1                                              |
| Q8        | 3.4                                              | 2.1                                              |

Fig. 4. Graphical representation on Likert scale for language skills compared Pre- and Post-lockdown.

Table 4
Mean values of Pre & Post Lockdown behavioral scores for Children with Autism.

| Questions | Pre-Lockdown | Post-Lockdown |
|-----------|--------------|---------------|
| Q1        | 72           | 1.5           |
| Q2        | 81           | 1.8           |
| Q3        | 75           | 1.5           |
| Q4        | 105          | 2.3           |
| Q5        | 87           | 2.1           |
| Q6        | 99           | 2.2           |
| Q7        | 108          | 2.533333      |
Fig. 6 shows that children with autism showed better responses for some questions before the lockdown and these responses regressed post-lockdown. Most of the responses were noted towards negative side after lockdown, though the same responses were more positive before the lockdown.

4.4. School performance

The school performance of children with Autism was examined through performance in assignments, crafts and activities like aerobics, yoga and group tasks done pre- and post-lockdown. Similar to other areas, school performance was also seen to have regressed post-lockdown. This is illustrated clearly in Table 5, through the mean scores achieved by these children pre-and post-lockdown in various questions.

It is evident in Fig. 7 that the child’s ability to co-operate with his classmates as well as communicate his wants & needs were most affected whereas his response to physical activities in school was least affected post lockdown. The paired sample t-test illustrates statistical significance in the pre & post lockdown values of school performance (p < 0.001, t = 41.228). This is clearly illustrated in Table 2 above.

Among children with Autism, the school performance showed that responses were more towards average and inadequate before lockdown but these shifted towards absent and inadequate categories post-lockdown. This indicates regression in their performance when compared to the pre-lockdown percentage scores. This is illustrated in the Fig. 8.

4.5. Performance in therapy

In this section, the response scores of children with Autism during tasks done in regular therapy were compared to those done in online sessions. For children with Autism, online therapy seemed to be very difficult. No doubt, the online sessions helped parents gain a better control over children and also learn strategies required to teach children. But an overall performance surely indicated a regression among children especially in their language, behavioral and concept generalization skills. The mean values of pre- and post-lockdown are represented in Table 5.

Fig. 9 shows that the child’s pragmatic skills were most affected whereas the child’s behavior was least affected post lockdown. The paired sample t-test illustrates statistical significance in the pre & post lockdown values of therapy performance (p < 0.001, t = 26.819). This is clearly illustrated in Table 2 above.

Fig. 10 illustrates that among children with Autism, therapy performance showed more responses towards average and inadequate before lockdown but these shifted towards absent and inadequate categories post-lockdown. This indicates regression in their performance when compared to the pre-lockdown percentage scores.

4.6. Comparison across the developmental areas

As evident from Table 7, the Mean values show an overall regression in all sections. Maximum regression has been noted in school performance, followed by therapy performance & linguistic skills, behavioral problems & ADL respectively. This is clearly illustrated in Fig. 11.

5. Discussion

The study focused on comparing various areas of development in children with Autism, before and after lockdown. The results clearly indicated that there was a significant regression seen among children with Autism, across all domains, after the Covid-19 lockdown. The study co-relates with the previous literature which highlighted a significant adverse effect on the overall development of children with communication disorders (Coyne et al., 2020; Fontanesi et al., 2020; Masters et al., 2020).

The present study revealed an overall regression specifically in behavioral areas along with academic, linguistic and
Fig. 6. Graphical representation on Likert scale for behavioral skills compared Pre- and Post-lockdown.

Table 5
Mean values of Pre & Post Lockdown School Performance for Children with Autism.

| Questions | Pre-Lockdown | Post-Lockdown |
|-----------|--------------|---------------|
| Q1        | 3.3          | 2.2           |
| Q2        | 3.5          | 1.7           |
| Q3        | 2.3          | 1             |
| Q4        | 2.7          | 1.6           |
| Q5        | 1.8          | 1             |
| Q6        | 3.2          | 1.7           |
| Q7        | 2.1          | 1.5           |
| Q8        | 3.2          | 2.3           |
| Q9        | 2.5          | 1.3           |

Table 6
Mean values of Pre & Post Therapy Performance for children with Autism.

| Questions | Pre-Lockdown | Post-Lockdown |
|-----------|--------------|---------------|
| Q1        | 3.5          | 2             |
| Q2        | 3.4          | 2.3           |
| Q3        | 3.6          | 1.8           |
| Q4        | 2.5          | 1.5           |
| Q5        | 2.7          | 1.4           |

Fig. 7. Graphical representation comparing Mean values of Pre & Post Lockdown for School Performance among Children with Autism.
communication deficits seen among children with Autism. The results are in-line with studies done in other countries which found major regression in social, academic and other communicative skills among children with autism, intellectual and developmental disabilities (IDD), Down’s syndrome, learning disability and children with receptive and expressive language delay (Neece et al., 2020; Narzisi, 2020; Narzisi, 2020b; Roach et al., 1998; Levante et al., 2021).

The study highlighted that, like other countries, in India also one of the major causes of mental health problems among these children was closure of schools and therapy centers (Hammerstein et al., 2021; Tso et al., 2022; Maldonado & De Witte, 2021). The study adds on to the current literature on children with Autism which reported obvious regression among these children, which were

Fig. 8. Graphical representation on Likert scale for school performance compared Pre- and Post-lockdown.

Fig. 9. Graphical representation comparing Mean values of Pre & Post Lockdown for Therapy Performance among Children with Autism.

Fig. 10. Graphical representation on Likert scale for therapy performance compared Pre- and Post-lockdown.
most evident in emotional and behavioral areas (Guller et al., 2021) along with loss of social and pragmatic skills which led to increased irritation, stress and mental problems among parents too (Niveditha, 2022).

1. Among Activities of Daily Living, it was noticed that children with autism revealed a significant regression post-lockdown. This could be attributed to limited socialization and difficulty learning these adaptive skills without professional guidance. This group of children also showed increased issues in sensory areas, owing to lack of therapy and absence of sensory integration therapy. Also, parents reported a clumsy and uninterested attitude of children throughout the day. This could be due to restricted movements and limited change of environment during the lockdown (Fontanesi et al., 2020). Some parents revealed increased activity level and restlessness among children. An important finding of the study is disturbance in sleep pattern noted among these children throughout the lockdown period. Increased screen time due to online schooling, online therapy and frequent playing with gadgets or watching TV could be the reasons for these changes (Belmon et al., 2019; Janssen et al., 2020).

2. The language section showed a regression post-lockdown for children with Autism. Among various language areas, the complex areas of language (like negation, possessives etc.) were seen to have more regression when compared to simple labelling of items. Children with autism also showed significant regression in command following, responding to basic as well as complex commands. Lack of task generalization, greeting skills and significant problems in pragmatic skills were noted. Moreover, most of the parents had difficulty in teaching children to play with sibling and performing tasks like art and craft with concentration. Lack of training in pragmatic skills, social interaction with peer group in school and other environments and a lack of speech therapy clearly accounts for these changes.

3. Significant behavioral changes were seen among all the children in this group. Children manifested a regression in sitting behavior, attention span, concentration, eye contact and regression in responding to name call, along with behavioral changes like mood swings, clumsiness, hyperactivity and impulsivity.

5.1. Effects of Online Schooling and online therapy

Due to complete lockdown in the country, the only way to continue the training for children with communication disorders was through online school and therapy sessions.

During these online sessions, children with Autism showed difficulty completing assignments and understanding them. They enjoyed crafts well but needed help of parents for most of the things that they did independently earlier. A lack of reinforcement and limited interaction with peer group led to disinterest towards online schooling. Also, difficulty following extra-curricular tasks was noted during online schooling, though these children enjoyed being in front of the screens. These children also showed an increased difficulty in understanding concepts and reduced communication during online schooling. Also, among these children, communicative needs and wants seemed to have reduced drastically in spite of parents constantly trying to create situations to understand and generalize various concepts. Increased screen time led to more stereotypical behaviors and disrupted sleep patterns (Belmon et al., 2019; Janssen et al., 2020; Taylor et al., 2015). Moreover, children lost interest in performing extra-curricular skills and follow daily

![Comparison across sections](image-url)

Fig. 11. Graphical representation comparing overall Mean values of Pre & Post Lockdown for all the sections among children with Autism.
living skills on regular basis. The study also found that for online schooling and therapy sessions to work out successfully, parental participation, educational status of parents, economic background, access to good internet, availability of good phones/laptops and therapy materials were some of the important parameters.

**Strengths of the study.**

- The study is one of the preliminary attempts to understand the effect of lockdown on Indian children with Autism.
- The study highlights effects of lockdown on children with Autism and determines its impact on overall learning and development of these children. This helps professionals to be better prepared for situations like these in future.
- The study marks the impact of online therapy, schooling and increased screen exposure on children with autism.

**Limitations of the study**

- The study is based only on ratings provided by parents and does not measure the responses by professionals in detail.
- The study included a small sample size.
- The educational background of parents, availability of therapy materials or experience of parents in training their children were not taken into consideration.

**Clinical implications of the study.**

The findings of this study highlight the impact of lockdown on children with Autism and how the reduced socialisation can hamper the development of these children. This further helps parents and professionals to understand and be better prepared for such situations in future by devising better assessment and intervention plans along with incorporating major parental training or home-based intervention strategies in therapy sessions. This highlights that parental knowledge of therapy skills, involvement and control over children are important parameters which can prevent such regression in future. Moreover, online therapy and schooling should be accompanied with more social interaction and generalisation of techniques to better suit the needs of children with Autism.

6. Conclusion

The present study compared pre- and post-lockdown performance of children with Autism across various communicative areas, namely, activities of daily living, language and behavioral characteristics along with comparison of performance during sessions taken personally and online during the lockdown. An overall regression was noted across all the communicative areas.

Further studies are required to understand the effects of lockdown on typically developing children and their comparison to children with communication disorders. Also, future studies can focus on more areas of development to be accessed in order to understand regression among these children during lockdown. The study can also be extended to include children from different parts of the country to understand how lockdown has affected children across the country.

**CRediT authorship contribution statement**

- **Dr Ramandeep Kaur:** Writing – original draft, Formal analysis, Writing – review & editing.
- **Tamanna Boobna:** Writing – original draft, Praseena Kallingal: Statistics and data analysis (supporting).

**Declaration of Interest**

None.

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