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Consequences of Covid 19 Pandemic on Children

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ABSTRACT

The Pandemic of SARS COV 2 popularly known as 'Corona Virus19' has affected 213 countries and territories around the world since the beginning of year 2020. All the countries have focused their attention acutely on the higher fatality rate the virus has caused among the elderly and launched a scientific enquiry on why children have emerged relatively unaffected. This pandemic has already amplified existing social fractures and inequalities and it is expected that all most all countries may take 5-10 years to return to their socio-economic status of 2019. Most importantly people are losing trust in healthcare system. As the Global tally of cases crosses 28 million cases and nearly 0.9 million deaths on 10th September 2020, with the highest daily case of 300,683 on 4 September 2020 and deaths of 8513 on 17 April 2020. However, the proportion or absolute number of cases and deaths in children is not readily available at Global, National, or even at local levels. In the beginning it was estimated that the children under 14 years contributed less than 0.5% and therefore the Children were not the face of this pandemic. The sub-national data in states reporting desegregated data in USA and India indicate that the children contribute between 0.1% to 10% in the recent weeks. The pandemic of COVID-19 initially appeared to cause only a mild illness in children and immediate health impact, or mortality rates were not alarming. A few weeks following the peak of COVID-19 epidemic in the US and the European Union, a novel systemic illness called Multisystem inflammatory syndrome in children (MIS-C) has been reported with devastating effect. Most importantly children's risk being among its biggest victims, their lives are being changed in profound ways. What has escaped our attention is the long-term damage the cascading effect of COVID-19 is likely to cause in children through inadequate health services, broken medical supplies, interrupted access to nutritious food, immunization services, informal learning ,emotional bonding among peers, Anganwadi workers affectionate care especially when, and the parents are facing income loss due to loss of jobs and low opportunities of alternatives of earning livelihood. This paper is a review of the comprehensive consequences of Covid 19 Pandemic on Children. Materials & Methodology: This paper used the data from WHO dashboard, Ministry of Health & Family Welfare, GOI India or States National Health Mission websites or other websites, like John Hopkins's University, CDC Atlanta, NSSO, Google and Wikipedia etc. For Indian scenario I have used the data from a recent online publication of Indian Academy of Paediatrics, American Academy of paediatrics, small study reports in daily national and local new papers, mainly Times of India, Indian Express, The Hindu etc. Bangalore, Delhi, and Mumbai editions. Study Setting & Sampling: The review covers major states and cities setting. Being the secondary data review available data was used with no sampling.

Key words: Covid19 Pandemic, H1N1 Pandemic ,Proportion of Children cases and deaths, Lobar Consolidation, Multisystem Inflammatory Syndrome in Children (MIS-C), Paediatric Inflammatory Multisystem Syndrome -Temporally associated with SARS-CoV-2 (PIMSTS)

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Introduction:

Globally, as of 10:50am CEST, 10 September 2020, there have been about 28 million confirmed cases of COVID-19, and over 0.9 million deaths [1]. Sadly, the break-up of cases and deaths by age to know the proportion of cases in children is not available on WHO dashboard or source of other data from any country. India contributes over 4.7 million confirmed cases and 75,119, deaths as of 10th September 2020. Neither the absolute numbers nor proportion of cases in children is readily available on the Global, National Government website or State Health Mission sites.

But children's risk being among its biggest victims, as their lives are being changed in profound ways. All children, of all ages, and in all countries, are being affected, by the socio-economic impacts and, in some cases, by mitigation measures that may inadvertently do more harm than good.

The pandemic of COVID-19 initially appeared to cause only a mild illness in children. Not many countries have an account of the contribution of children to total cases. More than 74,000 American children were diagnosed with coronavirus over two weeks (8/20/20 – 9/3/20) in August, a 21% increase over the previous two weeks, a concerning trend as kids across the nation begin to strap on their backpacks and return to school. On 20th August 2020 even in states reporting cases by age, over 442,785 children have tested positive for COVID-19 since the onset of the pandemic thus children represented 9.3% (442,785/4,766,825) of all cases, Overall rate works out to be 583 cases per 100,000 children in the population. Children made up between 4%-12.1% of total state tests, and between 3.2%-17.8% of children tested were tested positive. Children were 0.4%-4.6% of total reported hospitalizations, between 0.2%-8.6% of all child COVID-19 cases resulted in hospitalization. Children were 0%-0.3% of all COVID-19 deaths, and 21 states reported zero child deaths.[2]

A recent report from Indore, Madhya Pradesh's Covid hotspot, the number of children under 12 infected by the virus has tripled in just under six weeks — from 398 on July 20 to 1,158 on 1 September 2020. They made 6.7% of Indore's Covid tally on July 20, which has now risen to 8.6%. While Indore's total count doubled during this 40-day period, the number of Covid-infected kids has shot up by nearly 300%. Interestingly, till 20 July 2020, 13% more boys were infected but since unlocked period girls outnumber boys in Covid count by 17%- 626: 532 [3].

Covid 19 in children-What we know So far:

The present knowledge about Covid 19 in children is mainly from China, USA and recently a few Indian observations. Most infected children are likely to be secondary cases and acquire the infection after exposure to a COVID-19 positive adult, although there are no longitudinal data to confirm this yet. Intra-family transmission may be important. It is doubted recently that COVID-19 is acquired by contact with infected faeces also. In a report of 10 children (from China) admitted for COVID-19 with positive nasopharyngeal swabs, 8 of 10 children demonstrated persistently positive for (RT-PCR) of rectal swabs after their nasopharyngeal testing had become negative. It appears that viral shedding from the digestive tract might be greater and last longer than that from the respiratory tract [4].

Multiple reports from China and some from USA have demonstrated that children and young adults have a milder form of the disease compared to adults. Asymptomatic, mild, and moderate infections comprise over 90% of all children who have tested positive for COVID-19 with fewer severe and critical cases (5.9%) compared to adults (18.5%). This may be due to lower number and milder infections in children and young adults may be because of lower exposure to virions, or for being isolated at home and minimal exposure to pollution and cigarette smoke contributing to healthier respiratory tracts. The distribution, maturation and functioning of viral receptors such as ACE2 may be important in

age-dependent susceptibility to severe COVID-19 [4].

Children of all ages can be infected with COVID-19, with more cases reported in younger children and infants. There is no age or sex preponderance and the median age of infection is 6.7 years (range new-born to 15 years). The incubation period in children has been reported as 2 days (range-2 to 10 days). At the time of diagnosis, 13- 15% of virologically positive children may be asymptomatic. The most common symptoms described at onset in children are fever (50%) and mild cough (38%). Fever is present in about 40% of children. Other clinical features include sore throat, rhinorrhoea, sneezing, myalgia, fatigue, diarrhoea, and vomiting. Children may have more upper respiratory symptoms than lower respiratory symptoms, and to recover in 1-2 weeks [4].

In India since the outbreak began in January 2020, the country has focused its attention acutely on the higher fatality rate the virus has caused among the elderly and launched a scientific enquiry on why children have emerged relatively unaffected. But amidst decoding this mysterious eccentricity of the virus, what has escaped our attention is the long-term damage the cascading effect of COVID-19 is likely to cause in children through inadequate health services, broken medical supplies, interrupted access to nutritious food, immunization services, informal learning ,emotional bonding among peers, Anganwadi workers affectionate care especially when, and the parents are facing income loss due to loss of jobs and low opportunities of alternatives of earning livelihood. [5]

In the largest paediatric cohort to date (2143 cases), Dong, et al. [6] describe suspected and confirmed cases based on symptoms, laboratory abnormalities, chest imaging, and RT-PCR/genomic analysis. The severity of COVID-19 can be divided into asymptomatic, mild, moderate, severe, and critical. Severe COVID-19 (included children with only mild hypoxia) accounted for 18 (2.5%), of virologically confirmed cases. Critical COVID-19 was observed in 3 (0.4%) of virologically confirmed cases, defined by the presence of ARDS or organ failure.[6]

Whilst initial reports described an asymptomatic or milder illness in children. A few weeks following the peak of COVID-19 epidemic in the US and the European Union, a novel systemic illness which clinically overlaps with Kawasaki disease with or without shock syndrome, macrophage activation syndrome (MAS) and toxic shock syndrome (TSS) was reported in children. This entity was labelled as Multisystem inflammatory syndrome in children (MIS-C) by the Centre for Disease Control and Prevention (CDC), USA and by the World Health Organization (WHO) [8,9,10]. A few cases have also been reported from India [12,13] recently. However, several countries have now reported that a small percentage of children can develop a hyperinflammatory syndrome labelled as Paediatric inflammatory multisystem syndrome - temporally associated with SARS-CoV-2 (PIMSTS). Features of this newly recognized condition may include persistent fever, evidence of inflammation, and single or multi organ dysfunction in the absence of other known infections. Some of these children may share features of Kawasaki disease, toxic shock syndrome or cytokine storm syndrome. They can deteriorate rapidly and may need intensive care support as well. The PCR test is more often negative although most of the children have antibodies to SARS-CoV-2. Although the pathogenesis is not clearly known, immune-mediated injury has been implicated [7,8,9,10].

Fever and cough were the main symptoms, the researchers reported, adding that both were reported in six of the included studies. Only one case of a 13-month-old infant reported severe symptoms like vomiting, diarrhoea, fever, and pneumonia, complicated by shock with metabolic acidosis and kidney failure that required intensive care and assisted ventilation. Two other studies which presented gastrointestinal complications from COVID-19, vomiting was described as the primary clinical manifestation. Except for the single case of severe infection, none of the

included patients required oxygen or assisted ventilation. The patients had a good medical outcome however, one death was reported in the age range of 10 to 19 years. Citing a case study, AAP added that COVID-19 infection might affect new-born acquiring the infection from the mother, suggesting a possible perinatal-peripartum transmission [2]. Most children with COVID-19 may exhibit only mild symptoms, if any, requiring only supportive care, with good prognosis and full recovery possible within one to two weeks, according to a review of studies, which presents the clinical manifestation of the disease in the young people. The research, published in the Journal of the American Medical Association, assessed 18 studies with a total of 1065 participants from China and Singapore (a brief 3-month period) who were mostly paediatric patients with the novel coronavirus infection. only one infant presented with pneumonia, complicated by shock and kidney failure, and was successfully treated with intensive care. Most paediatric patients were hospitalised, and symptomatic children received mainly supportive care with no deaths reported in the age range of 0 to 9 years, the scientists noted in the study. The current review of COVID-19 in children and adolescents' sheds light on the clinical features, diagnostic tests, current therapeutic management, and prognosis. A recent t systematic review substantiates that most children with COVID19 were asymptomatic; amongst symptomatic children, only 0.7% required mechanical ventilation [2].

A 21-day-old girl was admitted with history of tachypnoea for 1 day. She was born at 39 weeks of gestation with a birth weight of 3000 g to a primigravida mother who had an uneventful antenatal history. On contact tracing, the father and paternal grandfather were reported to be positive for SARS-CoV-2. A 2-and-a-half-month-old boy was admitted with history of fever for two days.[11] Neonatal period was uneventful, and he was exclusively breast fed. His grandfather had recently tested positive for COVID-19. However, his parents and other family members were negative for the infection. Both the infants received oxygen, broad spectrum antibiotics and syrup azithromycin (10 mg/kg/day) and syrup oseltamivir (3 mg/kg/day in two divided doses). None of the patients required ventilation [2].

Some experts suggest that children might not be as severely affected by COVID-19 because there are other coronaviruses that spread in the community and cause diseases such as the common cold, Influenza at least 3-5 times a year, their immune systems might be primed to provide them with some protection against COVID-19. It is also possible that children's immune systems interact with the virus differently than do adults' immune systems. Children under age 2 appear to be at higher risk of severe illness with COVID-19 than older children due to their immature immune systems and smaller airways, that make them more likely to develop breathing issues with respiratory virus infections. Newborns can become infected with the virus that causes COVID-19 during childbirth or by exposure to sick caregivers after delivery [11].

Indian Scene:

As per Census 2011, India, with a population of 121.1 Cr, had 164.5 million children in the age group 0-6 years and 372.4 million in the age group 0-14 years, that constituted 13.59% and 30.76% of the total population, respectively. Covid 19 cases data by age desegregation is not available daily either globally, nationally or in the States or Districts or even by basic reporting units in India. As of 9th July 2020, hardly 0.5% of total cases in India were below the age of 14 years indicating that Children are not the face of this pandemic.[12]

Age group	0-14 Yrs.	15-29	30-44	45-59	60-74	75 +
% cases	0.5	2.5	11.4	35.1	40.2	10.3

However, some of the states have started looking at the desegregated data. For example, Children below the age of 14 years account for about 15% of Covid-19 cases in Karnataka, as per state government data. Until end of day on June 1, the state had reported 3,408 cases of which 504 were children. There were 322 children (16%) among 2026 active cases on 1 June 2020 [12]. Babies as young as four-months-old are among the infected children and while some have their parents and others are alone in isolation wards, battling homesickness and coping as best as they can. They have been given toys like building blocks and caroms to play with and remain in touch with family and friends over the phone. Children appear to be far more resilient than adults.

Personal communication from Nodal officer of IDSP from Maharashtra the worst hit state indicated following break up of cases as of end August 2020

Age	0-10 Yrs.	11-20	21-30	31-40	41-50	51-60	61-70 7	71+
Cases	29444	52550	128006	154809	130416	117293	75582	10947
Cumulative	29444	81994	210000	364809	495225	612518	688100	699047
%age	4.21	11.72	18.31	22.14	18.65	16.77	10.81	1.56

Contrary to the general perception that the novel coronavirus spares most kids, hundreds of children below 14 years of age have been infected in India. And the number seems to be rising. While the case fatality rate among child cases is low to nil, what is worrying is that most kids do not show symptoms of Covid-19.[12] Out of 60 positive cases in Odisha, eight are children, Tamil Nadu, has at least 40 child Covid-19 patients below 10 years including an eight-month-old baby among more than 1,300 cases, Of Telangana's 790 cases, 30 are children under 12. Five of them are infants as young as three months. "None of them is critical. Most of them are primary contacts of people who attended the Markaz at Nizamuddin," said a doctor at Hyderabad's Gandhi Hospital, where 500 patients are undergoing treatment. Out of 418 patients in SMS Medical College in Jaipur, Rajasthan, 28 are kids below 10. "In Andhra Pradesh, 19 children have been infected including a nine-month old baby girl. In West Bengal, three children — 10 years, six years, and nine months — have tested positive for Covid-19. In Madhya Pradesh's Indore, one of the major hotspots in the country with 892 cases, 36 patients are kids, the youngest being a three-month-old baby. Most of the kids have contracted the virus from their relatives. In Bihar, six kids have contracted the virus from their parents. Similarly, UP has reported seven child cases. According to current observations only 5-6% of children become serious. Similarly, children below one year are more susceptible as their immunity is on the lower side. In Kerala, 12 children contracted Covid-19. Among them, three have been discharged [12].

1. Direct Health Consequences of Covid 19 in Children:

Children's symptoms tend to be mild and cold-like. Most children recover within one to two weeks. Their symptoms can include: Fever, Nasal congestion or runny nose, Cough, Sore throat, Shortness of breath, Fatigue, Headache, Muscle aches, Nausea or vomiting, Diarrhoea, Poor feeding, or poor appetite. Multisystem inflammatory syndrome in children (MIS-C) is a serious condition in which the heart, blood vessels, kidneys, digestive system, brain, skin, or eyes — become inflamed. Inflammation typically includes swelling of the hands and feet, often with redness and pain. caused by an immune system reaction to COVID-19. Possible signs and symptoms of MIS-C include- Fever that lasts 24 hours or longer, Vomiting, Diarrhoea, Pain in the stomach, Skin rash, Red eyes, Redness or

swelling of the lips and tongue, Feeling unusually tired, Redness or swelling of the hands or feet, Emergency warning signs of MIS-C include: Inability to wake up or stay awake, Difficulty in breathing, Chest pain or pressure, New confusion, Bluish lips or face and Severe stomach pain.

An observational study conducted at four tertiary hospitals in Mumbai from 1 May, 2020 to 15 July, 2020 of 23 patients (11 males) with median (range) age of 7.2 (0.8-14) years hospital records of patients treated for MIS-C indicated that COVID19 RT PCR or antibody was positive in 39.1% and 30.4%, respectively; 34.8% had a positive contact. 65% patients presented in shock; these children had a higher age (P=0.05), and significantly higher incidence of myocarditis with elevated Troponin, NT pro BNP and LV dysfunction, along with significant neutrophilia and lymphopenia, as compared to those without shock. Coronary artery dilation was seen in 26% patients overall. Steroids were used most for treatment (96%), usually along with intravenous immunoglobulin (IVIg) (65%). Outcome was good with only one death [12]. There was a 2-4-week lag period for MIS-C presentation post COVID-19 infection, and we should expect to see more patients from across India in the coming weeks, based on present infection trends. This preliminary data is expected to add to the meagre data on this condition from India, and assist clinicians in identifying and managing MIS-C.

Nineteen children with a median age of 6 year (IQR: 13 months – 16 years), who met the case definition of Paediatric Inflammatory Multisystem Syndrome Temporally Associated with SARS-CoV-2 (PIMS-TS). All of them presented with fever. Multi organ involvement (79%), mucocutaneous involvement (74%), cardiovascular symptoms (63%) and gastrointestinal symptoms (42%), were the other features. Elevated levels of C-reactive protein were found in all of them and most of them had evidence of coagulopathy; intensive care admissions were needed in 12 (63%) and vasoactive medications were given to 6 (31.5%) children. There were no deaths. Fewer children in this series had coronary artery abnormalities, and there was a low incidence of RT-PCR positivity with high presence of SARS-CoV-2 antibodies.[13] The male to female ratio was 1:1.4 and 9 children (47%) were less than 6 year old. Of the 19 children, 15 (79%) were tested for COVID 19 by RT-PCR and serological assays and 11 (58%) were identified as confirmed cases of COVID 19. SARS-CoV-2 was confirmed by RT-PCR alone in three children (16%), one child (6%) had evidence from both RT-PCR and serological assay, 7 children (47%) had positive serological assay alone whereas RT-PCR and serological assay was negative in 4 (27%) children. Chest radiography was performed in 15 children, of which 5 showed evidence of lobar consolidation (unilateral). Ultrasound scan of abdomen was performed in 5 children of whom one was reported suggestive of as possible appendicitis. CT chest and abdomen was performed in the same child, which showed evidence of right lower lobe consolidation. Coronary artery abnormality (dilatation without aneurysm, Z score < 2.5) was seen in three children with one of them having evidence of minimal pericardial effusion. Of the 19 children, 5 (26%) received Intravenous immunoglobulins (IVIG) alone whereas three, children (16%) were treated with steroids alone; 8 children (42%) received both IVIG and steroids and one child received IVIG and Tocilizumab. Aspirin was given in 16 (84.2%) children and two children were not given any immunomodulatory agents. All 19 children received broad-spectrum antibiotics at presentation, which were discontinued after negative culture results. No organisms were isolated from blood cultures. Median length of hospitalization was 6 days (IQR 3-13 days) and 12 (63%) children required PICU support. There was no mortality in our series. Conventionally, treatment of KD involves use of intravenous immunoglobulin (IVIG) and high dose aspirin as first line agents [12].

A preliminary data of children younger than 12 years admitted in tertiary care institutes,

including COVID-designated hospitals, of West Bengal indicated that among 41 patients (24 boys) with median (IQR) age of 1 (0.42-5.0) year. Majority of the cases, 40 (97.6%) were successfully discharged, with one death. We had six neonates with COVID-19, all of whom were born to SARS-COV-2 positive mothers and were asymptomatic. Of the rest, five patients never showed any symptoms throughout the period of isolation and while 14 (34%) were mildly symptomatic in the form of common cold and rhinorrhoea. Fever, which is perceived to be a major presenting feature of COVID-19, was seen only in 9 patients (21%). Two cases had multi-system involvement in the form of an atypical Kawasaki disease like presentation. Almost 61% of the cases had associated co-morbidities. Five (12.2%) patients needed no active management, 34% mildly symptomatic children needed nasal drops and anti-histaminic, 24.4% required oxygen inhalation, 4.9% was put on High flow nasal canula (HFNC) and 4.9% needed mechanical ventilation. Six (15%) patients required intensive care. Of the study population, only 63.41% had a positive contact history. One child died in this series due to type II respiratory failure with septic shock in a case of post adenoviral bronchiolitis obliterans and hypoxic brain injury. [12,13,14,15,16,17]

Mental Health: Although medical literature shows that children are minimally susceptible to 2019-Corona virus disease (COVID-19), they are hit the hardest by psychosocial impact of this pandemic. Adversities affecting children may be divided into three categories, viz. (a) those who are COVID-positive patients and are isolated; (b) children of COVID-positive parents and children who have lost either or both parents due to the infection; and (c) children who are in quarantine/shielding or isolated due to general lockdown. Children in different categories may face different sets of mental health issues. Being quarantined in homes and institutions may impose greater psychological burden than the physical sufferings caused by the virus. School closure, lack of outdoor activity, aberrant dietary and sleeping habits are likely to disrupt children's usual lifestyle and can potentially promote monotony, distress, impatience, annoyance and varied neuropsychiatric manifestations. Incidences of domestic violence, child abuse, adulterated online contents are on the rise. Children of single parent and frontline workers who are not accessible for days to their children being on duty suffer unique problems. The children from marginalized communities are particularly susceptible to the infection and may suffer from extended ill-consequences of this pandemic, such as child labour, child trafficking, child marriage, sexual exploitation, and death etc. The psychological problems identified in such children range from mood to conduct disorders, substance abuse, anxiety disorders and suicidal tendencies. Experiencing negative emotions, changes in moods, and changes in the sleeping and eating patterns of children put them at a greater risk of experiencing relapse of mental illness as well as exacerbating existing mental health issues.[18,19,20]. it is important for parents and caregivers to be calm and proactive, letting the child feel their emotions, check in with them about what they are hearing and doing, and by monitoring their own and their children’s behaviour.

2. Indirect Health Consequences of Covid 19 Pandemic:

i. Breastfeeding: The coronavirus disease (COVID-19) pandemic has had ramifications for the delivery of new-born nutrition and care services. So far, SARS-CoV-2 has not been detected in the breastmilk of mothers with COVID-19. Preliminary data indicates strong immunoglobulin A dominant SARS-CoV-2 immune response in breast milk of COVID-19 infected mothers. Multiple studies have shown that in India of the 25 million births, nearly 43% (11 Million) are not breastfed within the first hour and nearly 30-50 % preterm/ sick babies in neonatal intensive care units (NICU) in India lack access to breastmilk. To universalize access to human milk, the Indian government has proposed the establishment of comprehensive lactation management centres /milk banks, lactation

management units, and lactation support units at all levels of the public health system. Due to COVID-19, these centres are encountering additional challenges cutting across interventions of rooming in, breastfeeding, milk expression, and provision of donor milk and kangaroo mother care. World Health Organization recommends continuation of breastfeeding in these difficult times, with due precautions. If direct breastfeeding is not possible, milk expression should be explored. Pasteurized donor human milk (PDHM) from milk banks may be fed if mother's own milk is not available or if Mothers who are too ill to breastfeed. Guidelines by Indian Council of Medical Research (ICMR) and other professional bodies propagate similar advice. Once mothers recover, they should be supported for re-lactation PDHM compared to formula milk reduces the risk of sepsis, necrotizing enterocolitis, diarrhoea and feeding intolerance, and the length of stay in NICU. Feeding supplementary PDHM is associated with increased exclusive breastfeeding at six months of life. [16]

Many Hospitals did not recommend KMC by COVID -19 positive mothers for fear of transmission of infection via close contact. Rooming-in is difficult as COVID-19 positive mothers are shifted to COVID-19 wards/ facilities while their babies remain in the neonatal units and mothers were made to breastfeed periodically with masks, hand hygiene and physical distancing to the extent possible (not bending close to the baby) until she is confirmed negative.[16]

ii. Immunization:

a) Routine Immunization: A large number of children missed out on vaccinations due to postponement of outreach sessions and campaigns (a perpetual phenomenon promoted by GOI for last 5-6 years (in the name of IndraDhanush and its variants) and interruptions in routine vaccinations as the Strategic Advisory Group of Experts (SAGE) on immunization recommended that all mass vaccination campaigns should be discontinued but routine immunization should continue where possible. In keeping with this, the Indian government has issued guidelines advising continuation of routine immunization activities and the Indian Academy of Paediatrics –has issued guidelines for paediatricians in private practice.

91% of vaccination in India are delivered by Public health sector11 through fixed sites (24% at government/ municipal hospitals and 13% at PHC/CHC) and 54% from outreach session held at Anagnwadi centres (26%), sub centre (19%) & some places in village (9%). During this lockdown period of more than two months, routine immunization services mainly outreach sessions have been partially or fully suspended in the states leaving large number of missed children & dropout. The pandemic has extensively affected both fixed and outreach immunization sessions. Travel restrictions during nationwide lockdown to break the chain of COVID-19 transmission has limited movement of health workers and caregivers as well as interrupted vaccine and logistics supply [21,22].

The immunization activities are mainly being carried out in fixed facilities with strict guidelines on hygiene and social distancing. Reduction in outreach immunization activities is likely to have an immediate impact on vaccine coverage. However, where Health workers are involved in COVID-19 pandemic management, has resulted in decreased manpower available for routine immunization. The supply chain is also under strain due to transport disruptions. It is estimated that at least 50% of the new-borns have missed their routine immunization at least urban poor population.

b) Polio Eradication: On 25 August 2020, the Africa Regional Certification Commission, certified the WHO African Region as wild polio-free after four years without a case. With this historic milestone, five of the six WHO regions – representing over 90% of the world's population – are now free of the wild poliovirus, moving the world closer to achieving global polio eradication. Only two countries worldwide- Pakistan and Afghanistan continue to see wild poliovirus transmission. Experts feel that we may see resurgence of wild-virus polio in Afghanistan and Pakistan

due to suspension of polio vaccination campaigns. The major risk in India and in all countries still using bivalent OPV with types 1 and 3, is the likelihood of emergence of VDPVs type 1 and type 3. As polio immunization is suspended, India must anticipate the emergence and circulation of VDPVs. We will know the full picture only after the lockdown is lifted and surveillance for acute flaccid paralysis (AFP) and for polioviruses is resumed. Many Public Health Professionals also feel that Disruption of immunization services for long-term, may lead to likelihood of VPD outbreak especially in case of measles, diphtheria, and wild poliovirus (type 2). The biggest challenge is how the overstretched Field Level Workers (drawn for awareness creation, contact tracing etc) can conduct headcount survey and prepare due list to include new beneficiary (new births and migrants) and missed children during lockdown. Number of revised beneficiary as per due list/micro-plan will help in estimation of vaccine and logistics requirement at the session site. [22]

c) Adult Immunization: Prior to pandemic, less than half of adults received the vaccines recommended for their age group and the Vaccine demand declined an average of more than 60 percent across adult vaccines during height of pandemic [22]. A recent online survey of more than 3,000 US adults ages 50-79 (older adults) and more than 300 US primary care physicians indicates survey, conducted by The Harris Poll on behalf of GSK, found that many adults ages 50-79 are unfamiliar with the vaccines recommended for them and are thus unlikely to receive many of the vaccines recommended for them. Approximately 1 in 4 older adults have never heard of or are unfamiliar with the adult vaccines for shingles (27%), tetanus, diphtheria, and pertussis (Tdap) (28%), and pneumonia (30%). Many older adults say they are not likely to receive the influenza (i.e., flu) (28%), shingles (38%), Tdap (44%), or pneumococcal (i.e., pneumonia) (54%) vaccines. More than half of older adults have never heard of or are unfamiliar with the vaccines for hepatitis B (55%) and hepatitis A (56%). If this be the situation in USA, in India we hardly have any data on Adult Immunization knowledge or coverage.

Child Abuse: Another important challenge was child abuse identification and prevention during the lockdown. Children did not have access to any outside person to talk about the abuse that they face. They may be denied access to phone or any other mode of communication. Child Line services reportedly have a 50% increase in calls, many of them reporting child abuse. The government has made efforts to ensure access to critical services such as healthcare, nutrition, food security, mental health, psychosocial support, and protection against violence but the outcome is yet to be assessed.

ICDS & Nutrition Services: Drawing from a recent Lancet study, the UNICEF had warned that three lakh children could die in India over the next six months due to disrupted health services and surge in child-wasting, a form of malnutrition when the child is too thin for his/her height. India is expected to bear one of the heaviest tolls of this preventable devastation, partly because its record in managing malnutrition among children was grim even in pre-COVID-19 times. India is home to half of the “wasted children” globally, reckons the recently launched Global Nutrition Report 2020. More than a third (37.9 %) of our children under-five years are stunted, and over a fifth (20.8%) are wasted.

This nutrition insecure backdrop of India makes it dangerous to live through an extreme adversity like the current pandemic without proper planning for protection of our vulnerable population. The entire country (particularly affecting urban poor in all major cities) was in lockdown mode to contain the infection for nearly six months which has brought economic activities to a complete standstill and resulted in income losses. Mid-day meals, the main source of nutrition for millions of children had to be suspended with schools shut, and congregations banned. Some states are trying to substitute it with dry ration but sharing of food by other family members in such trying times cannot be ruled out. Overall health

outreach services have been disrupted amid the panic the virus has triggered. Services of our front-line workers, the ASHAs and Anganwadi workers, had to be diverted for COVID-19 surveillance activities. Considering that they have been the lifeline of government's nutrition programmes, this is bound to result in neglect of children and their nutrition status. Children belonging to poor households face the highest vulnerability in terms of physical growth and brain development at crucial stages of their life because of highly compromised, untimely, and unhealthy meals, poor dietary intake and weakened immune system.

Even as lockdown regulations ease and essential healthcare including antenatal care services slowly start resuming, the pandemic has already led to severe adverse consequences for mothers and children, particularly those facing socioeconomic disadvantages.

Non-Covid Illnesses of Children:

Acute respiratory Illnesses (ARI) and Diarrhoea problems are common in children, and many non-COVID-19 conditions could manifest as respiratory distress even in this COVID-19 pandemic. The current ICMR COVID-19 screening criteria might be appropriate for children coming from the hot spot areas but it does not appear appropriate for children from other area, where it led to over-testing and undue stress on the already overburdened healthcare system. In India, both children and adult are being screened, tested, and made to wait in the same isolation area till the report is available, which may lead to unnecessary exposure of children and their caregivers to COVID-19. It may also lead to delay in management of non-COVID conditions since many facilities are not available for children in common isolation area. Across the country especially in cities we are observing lesser number of paediatric consultations, admissions for common paediatric emergencies, and this requires vigilance as children might not be able to reach hospitals and we may encounter more deaths in children without COVID-19. Country and States should not forget that non-COVID paediatric emergencies are still more common even in the era of COVID pandemic. For the best-known reasons an extra-ordinary initiative of Integrated Management of neonatal and childhood illnesses (IMNCI) in 1994, is not getting it's due attention for skill building, monitoring and drug logistics, and strategy's expansion to achieve comprehensive Primary Health Care as envisioned in National Health Policy 2017.

Lessons from H1N1 Pandemic to Covid 19 Pandemic:

Both pandemic flu and SARS-CoV-2 spread by respiratory droplet, but it is thought that the mortality is higher in SARS-CoV-2 infected cases. While pandemic flu caused significant mortality in children, SARS-CoV2 mainly kills people over 60 and with comorbidities. The less severe presentation may be attributed to less exposure or sensitivity to COVID-19, different immune response mechanisms, or higher levels of antibodies to viruses than in adults due to broader exposures to respiratory infections in winter. There is some interest in the possible role of measles and BCG vaccine in providing protection against SARS CoV2; if true, India stands to gain from its recent Measles-Rubella vaccine campaign. However, we cannot be complacent, and we need to be on the lookout for severe disease in "high risk" children (immunocompromised, lung or airway disease, long term steroids, thalassemia, nephrotic syndrome etc.), in addition to continuing their ongoing management.

SARS CoV2 Conducive Temperature Theory Thrashed: Seasonality of influenza is largely dictated by temperature and it was thought initially that similar environment factors influence affect SARS-CoV-2 transmission, but both the temperature and other environmental factors have not proved to be influencing in India at least. Social determinants of health, including health equity and age-related illness, may play an important role in both pandemic flu and COVID-19 pandemic.

Vaccines:

Around 35 vaccines are speeding through human clinical trials, and experts predict that the first vaccines could become available as early as the beginning of next year. Behind those front-runners, more than 60 candidates are preparing to enter trials in the coming year. It's too early to know if any of the 'downstream' vaccines that are in clinical trials actually work, and the fact that they got into clinical trials quickly does not mean that they're going to turn out to be the best. Therefore, some of the slow and steady scientists are betting they can make stronger and cheaper vaccines as they are designing vaccines that use different approaches, like nanoparticles or T cells. They are also trying new delivery methods, such as nasal sprays, or developing vaccines that they hope can protect people for longer. As the world may need billions of doses, each researcher feels that their vaccines can meet the demand at a fraction of the cost. We also need to understand that the first wave of vaccines is a luxury good that only wealthy nations can afford. And meanwhile, there can be other vaccines that are going to be effective, maybe even more effective, and be super cheap.[23]

Education:

As the Indian education system is mostly offline classes, the situation has forced them to switch to an online system and classes for the benefits of students and empowering education. Many schools in the country suddenly switched to online classes. But the major problem in developing countries like India is most of the students do not have sources like laptops, desktops, smartphones, or tablets to attend the online classes. A report by UNICEF has revealed that the COVID-19 pandemic in India has impacted 247 million students who have enrolled in elementary and secondary education, 28 million children who were undergoing pre-school education in Anganwadi centres.[25] The lock down created unbelievably bad effect on the students' life. On the other hand, the pandemic of COVID-19 has worked as a catalyst for the educational institutions to grow and opt for platforms and techniques, which have not been used before. The education sector has been fighting to survive the crises with a different approach and digitising the challenges to wash away the threat of the pandemic [24,25].

Negative impact of COVID-19 on education: Education sector has suffered a lot due to the outbreak of COVID-19. Among many negative impacts on education the key points are [24, 25]:

i) *Educational activity hampered:* Classes have been suspended and exams at different levels postponed. Different State educational boards have already postponed the annual examinations and entrance tests. Admission process got delayed. Due to continuity in lockdown, student suffered a loss of nearly 6 months of the full academic year of 2020-21 which is going to further deteriorate the situation of continuity in education and the as students would face much difficulty in resuming schooling again after a huge gap.

ii) Sluggish cross-border movement of students: Universities in many countries such as Australia, UK, New Zealand, and Canada are highly dependent on the movement of students from China and India. It is becoming more and more clear that this cross-border movement of students will take a beating at least for the next two to three years and will lead to a major financial risk for universities in these countries who are already under financial pressure. Many parents will avoid sending students abroad for higher education due to high risk from the pandemic.

iii) Passive learning by students: The sudden shift to online learning without any planning -- especially in countries like India where the backbone for online learning was not ready and the curriculum was not designed for such a format -- has created the risk of most of our students becoming passive learners and they seem to be losing interest due to low levels of attention span. Added to this is that we may be leaving a large proportion of the student population untouched due to the digital divide that is part of many developing nations including India. We are

now beginning to realize that online learning could be dull as it is creating a new set of passive learners which can pose new challenges.

iv) *Impact on employment:* Most of the recruitment got postponed due to COVID-19. Placements for students already selected may also be affected with companies delaying taking them on board. Universities and colleges worldwide are facing a major risk in student recruitment and retention. The risk of losing students is so high that they will need to re-look at their admission practices, admission criteria and the overall recruitment process itself which will include, new methods of outreach and application process itself. Details of the employment issue is beyond the scope of this article.

v) *Unprepared teachers/students for online education:* Online learning is a special kind of methodology and not all teachers are good at it or at least not all of them were ready for this sudden transition from face to face learning to online learning. Thus, most of the teachers are just conducting lectures on video platforms such as Zoom, Google, go to meeting which may not be real online learning platform In the absence of a dedicated online platform specifically designed for the purpose, there is a risk that learning outcomes may not be achieved and it may be only resulting in engaging the students.

vi) *Reduced inter-state educational opportunity:* Some Indians lost their jobs from other countries and the pass out students may not get their job outside India due to restrictions caused by COVID-19. Many Indians have returned home after losing their jobs overseas due to COVID-19 and on return their children's education is jeopardised. Some students find it difficult to go to other states for education because of movement restriction in the current pandemic situation

vii) *Increased responsibility of parents to educate their wards:* Some educated parents can guide but some may not have the adequate level of education needed teach children in the house.

viii) *Loss of nutrition due to school closure:* Mid- day meals is a school meal programme of the Government of India which is designed to provide better the nutritional food to school-age children nationwide. The closure of schools has serious implications on the daily nutrition of students as the mid-day meal schemes have temporarily been shut that will lead to deterioration in nutrition of the some of those children and also affect their attendance to school on resumption of schools as studies have pointed out that mid-day meals are also an important contributing factor for increased enrolment .

ix) *Access to digital world:* As many students have limited or no internet access and many students may not be able to afford computer, laptop or supporting mobile phones in their homes, online teaching-learning may create a digital divide among students. The lockdown has hit the poor students extremely hard in India as most of them are unable to explore online learning according to various reports. Thus, the online teaching-learning method during pandemic COVID-19 will enhance the gap between rich/poor and urban/rural.

x) *Access to global education:* A large number of Indian students who are enrolled in many Universities abroad, especially in worst affected countries are now leaving those countries and if the situation persists, in the long run, a there will be a significant decline in the demand for international higher education.

xi) *Payment of Schools, Colleges fee got delayed:* During this lockdown most of the parents will be facing the unemployment situation so they may not be able to pay the fee for that particular time periods which may affect the private institutes [19].

xii) *Impact of Covid-19 on gaming behaviours:* The pandemic and the quarantine have increased the demand for games and gambling or the actual offerings of both activities. In children It has just seen a shift to an online space where anonymity is assured and there is a complete ease of operation. It started in March with a complete shutdown of brick and mortar casinos and sports. We are seeing children with gaming and outdoor sports habits turn to alternate sources like online gaming websites or other alternative spaces that offer games of chance or ability to

gamble on non-traditional sports and event. Gaming disorder is much like all other addictions and is caused by biological, psychological, and social risk factors. Biological risk factors are genetic and increase risk of addiction by creating differences in how a person responds to gaming behaviours. Psychological risk factors include the presence of substance use disorders and other untreated psychiatric conditions like depression and anxiety that lead to gambling as a way of coping with emotional pain. Social risk factors relate mostly to easy access to gaming and money. Combine these factors together there is an increased risk and chance of gaming become vulnerabilities to succumb to the lure of gaming. Any person can develop a gaming disorder, regardless of gender, ethnicity, social status, age, or educational background and has been reported to leading suicidal or self-harming tendencies. Many physicians also do not know that this is a disorder that responds to medication, psychotherapy, group psychotherapy, family counselling and social support. The best estimates indicate that about 40-50% who go for treatment recover enough to lead meaningful lives, like seen in obesity, diabetes, hypertension, or high blood pressure.

Positive impact of COVID-19 on education: Though the outbreak of COVID-19 has created many negative impacts on education, it has provided Indian education system an opportunity for transformation from traditional system to a new era [24, 25]:

i) *Move towards Blended Learning:* COVID-19 has accelerated adoption of digital technologies to deliver education. Educational institutions moved towards blended mode of learning. It encouraged all teachers and students to become more technology savvy. New ways of delivery and assessments of learning opened immense opportunities for a major transformation in curriculum development and pedagogy. It also gives access to large pools of learners at a time.

ii) *Rise in use of Learning Management Systems:* Use of learning management systems by educational institutions became a great demand. It opened a great opportunity for the companies those have been developing and strengthening learning management systems for use educational institutions.

iii) *Enhance the use of soft copy of learning material:* In lockdown situation students were not able to collect the hard copies of study materials and hence most of the students used of soft copies materials for reference.

iv) *Improvement in collaborative work:* There is a new opportunity where collaborative teaching and learning can take on new forms. Collaborations can also happen among faculty/teachers across the world to benefit from each other.

v) Rise in online meetings & Classes- The pandemic has created a massive rise in online regular classes, teleconferencing, virtual meetings, webinars, and e-conferencing opportunities

vi) Enhanced Digital Literacy: The pandemic situation induced people to learn and use digital technology and resulted in increasing the digital literacy.

vii) Improved the use of electronic media for sharing information: Learning materials are shared among the students easily and the related queries are resolved through e-mail, SMS, phone calls and using different social Medias like Twitter, WhatsApp, or Facebook.

viii) *Worldwide exposure:* Educators and learners are getting opportunities to interact with peers from around the world.

ix) *Better time management:* Students can manage their time more efficiently in online education during pandemics.

x) *Demand for Open and Distance Learning (ODL):* During the pandemic situation most of the students preferred

ODL mode as it encourages self-learning providing opportunities to learn from diverse resources and customized learning as per their needs. [19]

Way Forwards: Having analysed the impact of Covid 19 Pandemic on children comprehensively. Let me put a way forwards to minimize its impact:

Tips for minimizing Health Impact:

Case management: IAP has developed a logarithm for management of suspected cases of Covid 19 among children. That advocates symptomatic treatment in cases with no history of contact with case and in RTPCR or rapid Test positive cases isolation, supportive therapy, contact tracing and hospitalization and treatment with antibiotics, Oseltamivir and Respiratory support and use of Aspirin and Corticosteroids if warning signs are visible, and immunoglobulins (IVIG) for PIMS-TS that help in facilitating neutralization of virus and associated superantigens and own regulation of the inflammatory cytokines. IVIG (2 g/kg) has been used in most published series on PIMS-TS as first line therapy [8]

Mental Health: Parents, paediatricians, psychologists, social workers, hospital authorities, government and non-governmental organizations have important roles to play to mitigate the psychosocial ill-effects of COVID-19 on children and adolescents. For parents, it is essential to create a sense of normalcy at home by planning a package which should include play, academic activities, interaction with family members, creative writing, socialization through phone, video calls to friends and relatives. [18,19,20]. A summary of the activities to be encouraged are listed below:

i)Maintaining routines: Encouraging children to get up and go to bed at similar times every day., Keep up with personal hygiene., Eat healthy meals at regular times. Exercise regularly. Allocate time for working and time for resting. Make time for doing things you enjoy.

ii)*Minimize newsfeeds:* Reduce to watch, read, or listen to news that makes you feel anxious or distressed. Allow the latest information only once or twice a day if needed.

iii)*Social contact*: Encourage children to Keep in regular contact with friends by telephone and online channels.

iv)*Alcohol and drug use:* There are no evidence of any protective effect of drinking alcohol for viral or other infections. Instead they may prevent children from taking sufficient precautions to protect against infection, such as compliance with hand hygiene.

v)Screen time: Ensure children minimize their screen time (TV, Mobile phones, and computers), to 3-4 hrs a day including educational and entertainment purposes and they take regular.

vi)Video games: While video games can be a way to relax, children spend much more time on them than usual being home for long periods. Ensure children keep the right balance with offline activities.

vii)*Social media:* Review children's social media accounts to promote positive and hopeful stories. Correct misinformation wherever you see it.

viii)*Helping others:* Motivate kids to offer support to people in your community who may need it, such as helping them with food shopping, getting drugs for senior citizens, proper use of lift buttons, monitoring hand washing or use of sanitizers by visitors and vendors.

ix)*Support health workers*; Let your community children thank your country's COVID-19 warriors and participate in contact tracing, monitoring home isolation etc.

Breastfeeding and new-born care: Keeping the new-born's in crib by bed in the hospital is better except when breastfeeding, but the mother must maintain a reasonable distance from your baby when not feeding and the mother wears a cloth face mask and have clean hands with soap and water whenever takes the baby for caring. Research suggests that only about 2% to 5% of infants born to women with COVID-19 near the time of delivery test positive for the virus in the days after birth. A severely ill mother with COVID-19, may need to be temporarily

separated from new-born. It is recommended that the baby's caregivers wear face masks and wash their hands frequently to protect themselves and the baby. Frequent follow- by phone, virtual visits, or in-office visits — for 14 days is recommended. Infants who test negative for COVID-19 can be sent home from the hospital.

Non-Covid illnesses management: Opening paediatric services for general illnesses like ARI, diarrhoea, severe acutely malnourished children (SAM) through Nutrition Rehabilitation centres (NRCs), Anaemia and leukaemia's will be urgent need in post-pandemic period

Nutrition Services: To restore efficiency in the system, special rations, including nutrients like protein, good fats, vitamins, essential minerals with less sugar, need to be made readily available on an urgent basis for mothers and children, so that their weakened immunity is boosted to fight deadly infections but so far no such actions are seen being taken by either the state Governments or GOI. Government silos are abundant with 71 million tonnes of rice and wheat, pulses rotting in go downs but did not reach the need. As the numbers of vulnerable are set to soar, the country needs to expand preventive coverage of access to food and pre-empt a hunger crisis. Post the pandemic, new strategies will have to be planned out for strengthening community-based management of acute malnutrition. Structural reforms of the Nutritional Rehabilitation Centres (NRCs) will have to be considered along with a ready workforce that has to be trained to fulfil the needs of the population during and post-pandemic. This will ensure access to nutrition services for women and children, improving their health.

COVID-19 prevention tips for Health Impact:

Ensure Children Keep their hands clean: Educating kids about washing their hands often with soap and water for at least 20 seconds becomes most important now and for next few years. Inculcating the habit of handwashing frequently especially after touching surfaces likely to be touched by others, not to touch their own face, mouth, eyes etc. in the interim will take time to establish. If soap and water are not available, using a hand sanitizer that contains at least 60% alcohol, may not be a good for children and be avoided. Covering mouth and nose with elbow or a tissue when they cough, or sneeze is another practice that needs to be impressed upon. Throwing away the used tissue and washing hands immediately. Have the kids wash their hands immediately after returning home, as well as after going to the bathroom and before eating or preparing food. Showing young children how to create tiny soap bubbles by rubbing their hands together and how to get the soap between fingers and all the way to the ends of their fingers, including their thumbs and the backs of their hands will be the responsibility of parents and teachers.

Practice social distancing: Avoid close contact (within about 6 feet, or 2 meters) with anyone who is sick or has symptoms. Do not allow your child to have in-person playdates with children from other households — even if they are all feeling well. If your child plays outside, make sure he or she stays 6 feet away from people outside of your household. Do not allow your child to play games or sports that involve shared equipment, such as a basketball, or that cannot accommodate physical distancing. Postpone your child's in-person visits with older adults. Encourage your child to keep in touch with friends and loved ones through phone calls or video chats. Consider organizing virtual family meals, game nights or playdates to keep your child engaged.

Wear cloth face masks: If your child is age 2 or older, have him or her wear a cloth face mask when out in the community where it is difficult to avoid close contact with others, to prevent the spread of COVID-19. Don't place a face mask on a child younger than age 2, a child who has any breathing problems, or a child who has a condition that would prevent him or her from being able to remove the mask without help.

Clean and disinfect your home: Focus on cleaning surfaces every day in common areas that are frequently touched, such as tables,

doorknobs, hard-backed chairs, light switches, remotes, electronics, handles, desks, toilets, and sinks. Also, clean areas that easily get dirty, such as a baby's changing table, and surfaces that your child often touches, such as his or her bed frame, craft table, toy chest and toys. Use soap and water to clean toys that your child puts in his or her mouth. Be sure to rinse off the soap and dry the toys. Wash your child's bedding and washable plush toys, as needed, in the warmest possible setting. Dry items completely. Adults must wash their hands after diaper changes or handling the baby's bedding, toys, or bottles.

Keep up with your child's vaccination sessions. This is especially important for infants and young children under age 2. Keep away from general OPDs to minimize contact with sick. Do not let fear of getting the virus that causes COVID-19 prevent your child from getting his or her vaccines to prevent other serious illnesses [2].

Tips for minimizing Educational Impact: Developing countries including and India should develop creative strategies to ensure that all children must have sustainable access to learning during pandemic COVID-19 and may be for next 2-3 years or until potent vaccine is introduced in the national universal Immunization program [25]

i) *Establishment of quality assurance mechanisms and quality benchmark for online learning:* Programmes must be developed and offered for primary, secondary and by Higher education. Education Institutions (HEIs) need to contribute to India keeping in view of rapid growth of the online learning platforms

ii) *Scientific Innovations Education:* Across the globe, Indian traditional knowledge is well known for its scientific innovations, values and benefits to develop sustainable technologies and medicines and this knowledge systems in different fields should be integrated with a present-day mainstream higher education system.

iii) *Maintaining Social Distance in schools*: National and State Governments and educational institutes should plan to continue the educational activities maintaining social distancing. 30-40% students and teachers may attend schools/colleges in two shifts per day to carry on educational activities by obeying guidelines for COVID-19

iv) *Improve the Infrastructure for digital Capabilities:* At current times, access to technology and internet is an urgent requirement. Some significant issues associated with distance learning strategies like the availability and access to digital devices with internet connectivity, the need for safe learning spaces, creating capabilities for teachers, families and students to operate and navigate digital devices, and engaging lesson plans for disabled students and other marginalised groups should be addressed by Govt. and the stakeholders. The digital capabilities and the required infrastructure must reach to the remotest and poorest communities to facilitate the students to continue their education. There is a need to deploy public and private funds to fix the internet gap and ensure that students continue to learn digitally.[25]

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