



Children's Eye Health as Impacted by the Coronavirus Disease (Covid-19) Pandemic: A Systematic Review

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Abstract

There is a rapid change in the global landscape of health and development occasioned by the novel Coronavirus disease (COVID-19) pandemic. This paper explores the possible impact of the coronavirus disease (COVID-19) pandemic on the eye health of children in low and middle-income countries. With causes of childhood blindness arising from unmet eye care needs of children, coronavirus associated challenges have an advanced impact on children's eye health through direct pathological anomalies, poor uptake of immunization, travel restrictions to access care, reprioritization of health resources, weak health systems, and economic consequences. Adequate hygiene through handwashing, vigilance on toddlers, immunization of children, and accessing care for obvious pathological anomalies like conjunctivitis, measles, mumps, and rubella are all advocated for parents and caregivers to protect the eye health of children. Also, holistic interventions to the challenges of children's eye health occasioned by the Coronavirus pandemic will require evidence from health systems research to guide meaningful interventions in the protection of children's eye health. Governments at all levels must unite efforts with development partners to strengthen health systems and secure the eye health of children in a coronavirus pandemic (COVID-19) era.

Keywords: Children; Eye Health; Coronavirus Disease; Visual Impairment

Introduction

Coronavirus (COVID-19) is caused by the newly discovered Coronavirus, known as the "Novel Coronavirus" (SARS COV-2) first identified in Wuhan, China in December 2019. It is an infectious disease that affects the upper respiratory tract (sinuses, nose, throat, airways) or lower respiratory tracts (windpipe and lungs) and may spread directly or indirectly from one person to another. Although it is known to have a low mortality rate, it is highly infectious. The mortality rate ranges between 2 - 3%, as the risk of death is only higher in older people (above the age of ~60 years) and people with underlying health conditions [1]. However, since children are dependent on their parents and caregivers, it is necessary to consider the resultant effect of the coronavirus pandemic

on the health of children and their eye health in particular. There is a great impact of the coronavirus pandemic on the Health and economy of most nations around the world, especially in Africa [2]. Evidence from Coronavirus disease reports in Africa reveals that about one thousand four hundred and sixty-seven (1,467) people have died, with thirty-three thousand, two hundred and seventy-three (33, 273) recorded by April 28, 2020. And this number was recorded in about 52 out of 54 African Nations. On the same day, the Nigeria Centre for Disease and Control (NCDC) reported 196 new cases which were the highest as at then, making a total of 1728 confirmed cases and 51 deaths [3]. The burden of this condition predisposed a situation where health service provision has become already limited in most areas and will likely be further impacted

since most of the resources are directed to responding to the Coronavirus pandemic. People who are less privileged, dependents, vulnerable, as well as those with special needs or disabilities who are in remote local communities, will basically have difficulties as a result of underlying systemic anomalies that may complicate their health and elevate the total death rate, should they become infected with COVID-19. Most children with eye health challenges and visual impairments have needs that are yet to be attended and remain at the receiving end of development and learning difficulties. Inequalities in eye care utilization and accessibilities across regions and socioeconomic levels abound in several studies [3]. This review aims to explore the possible impact of the coronavirus pandemic (COVID-19) on the eye health of children in low and middle-income countries and advocate for prompt intervention as necessary.

Vision in children and causes of visual impairment

According to Pascolini and Mariotti [4], eye health challenges like visual impairment constituted a critical health concern in the year 2010 because of its uneven distribution in all regions of the World Health Organisation. Globally, the burden of avoidable blindness is about eighty percent (80%) high. It has been estimated recently that about 19 million children have visual impairment globally, and those who are blind among them are about 1.26 million [5]. Although the absolute numbers are lesser, the control of blindness among children is included as part of the principal concerns of the global goal: "The Right to Sight", which is also known as Vision 2020 and there are several reasons for this [6,7].

The United Nations Children's emergency fund (UNICEF) [8] defines a child as an individual below the age of 18 years. World Health Organisation (WHO) considers blindness in children as visual anomalies that occur during the early stage of adolescence or childhood in particular, and of which may eventually impair vision or cause blindness that is irreversible in later life, if not ameliorated [9]. The American eye health report estimates that in every five children of preschool-age who are accepted in Head Start in America, more than one of them have a visual anomaly. It becomes crucial, therefore, to detect and treat a child's visual disorder as early and quickly as possible since it impedes learning and development and eventual permanent disability if left untreated. Vision is a critical factor in a child's academic performance and might continue to affect the child's general health and wellbeing throughout life if any abnormality subsists unabated. The economic costs of vi-

sion disorders among children are significant, as they amount to about \$10 billion yearly in the United States [10].

According to Bourn, *et al.* [11], the impairment of distant vision has been estimated to be four times high in low and middle-income countries than in regions with high income when considering territorial variations. Also, the burden of visual impairment at near that are not yet addressed have been estimated to be more than eighty percent (80%) in western, eastern, and central sub-Saharan Africa, and lesser than ten percent (10%) when compared to the situation in high-income regions like Western Europe, Asia-Pacific, Australasia, and North America [12]. The amount of the different determinants of childhood Blindness change from one region to another and by time duration, although it is estimated to be within the range of 0.4/1000 to 1/1000. The causes of blindness and severe visual impairment among children in the Philippines showed that Retinopathy of Prematurity (47,7%) was the common cause of abnormality followed by retinoblastoma (11,6%). Cataract was the common cause of abnormality in the lens. About 58% of the leading causes of blindness or severe visual impairment were preventable while 57% were treatable [14]. Amblyopia was the secondary cause of uncorrectable visual impairment in 203 (9.72%) children of migrant workers in Shanghai, China [15].

In Eastern Africa, the primary cause of loss of vision was childhood factor (29,9%), and about an estimated forty percent (40%) of severe visual anomaly and blindness was of preventable origin [16]. Studies in the Sekoru district of Southwest Ethiopia showed the causes and magnitude of childhood blindness to be lens related 33%, Refractive error 17%, Glaucoma 11%, Phthisis bulbi 8%, Optic nerve 1% [17]. In one study, congenital anomalies accounted for the largest proportion (65%) of the causes of low vision among primary school children in the Kihaba District of Tanzania [18]. Refractive errors and presumed ocular toxoplasmosis were the commonest causes of visual impairment among secondary school students in the Calabar metropolis of Nigeria [19]. In Ekiti State, Nigeria, a survey revealed that the causes of blindness are largely avoidable [20]. The eye health of children assumes critical responsibility in securing their general development such as social, physical, and cognitive. Childhood blindness impacts the individual as a person, as well as the family and community. This implies that poor vision affects the development of the child, education, social life, economic burden, the family and society in general. The control of childhood blindness is closely linked to child survival [21].

Impact of coronavirus disease (Covid-19) pandemic on children's eye health

The International Agency for the Prevention of Blindness (IAPB) affirms that the novel coronavirus (COVID-19) pandemic of 2019 is vigorously revamping the working landscape of development and health partners. The impacts of COVID-19 on children's eye health are numerous, and among which includes the following.

Direct pathological anomaly

With the constant association and professional interactions existing between patients and eye care professionals while on duty, and with emerging reports of onset of Conjunctivitis occasioned by the virus, the significance of COVID-19 on eye health and eye health workers remain of critical concern, leading in some cases to direct pathological anomaly [22]. According to Mukamal [23], recent findings have revealed that coronavirus can be contagious through the eyes, just as the mouth and nose are also part of its route of spread.

When a patient who is laden with the virus talks, coughs, or sneezes at close range to another person, the Coronavirus particles can spread to the next person's face, which is at close range. The person becomes disposed to inhale the tiny droplets either through the nose or mouth. It has been reported that the droplets may find entry into the body through the exposed eyes. One who touches the eyes after having touched a body or object that is laden with the virus will eventually become infected. Coronavirus might have the possibility of causing conjunctivitis in rare occasions. However, available data shows that most eye care physicians believe that 1%-3% of people with COVID-19 will get conjunctivitis. This happens when the virus infects the conjunctiva and showing such symptoms as Redness, Swollen, and Itchy eyes. The onset of conjunctivitis does not imply the onset of COVID-19. There are several other causes such as eye irritating allergens, chemicals, and various other viruses, bacteria.

Reprioritisation of health resources and economic consequences

Furthermore, the Coronavirus pandemic has impacted the social and economic determinants of health and access to care globally. The reprioritizations of resources for health care and associated economic downturns are affecting the eye care service landscape and all partnering organizations [22]. And the overriding challenges are reflected in the way eye health is accessed among children. According to the Centre for Strategic and International Studies (CSIS), the financial gap in epidemic preparedness was estimated at

\$4.5 billion per year in lower-income countries and lower-middle-income countries (LICs and LMICs). The Overseas Development Institute (ODI) has also indicated that nations that have challenging or weak infrastructure and physical resource means will be more incapable of responding adequately to epidemics and thus remain vulnerable to it. This is quite evident as the United Nations Economic Commission for Africa (UNECA) estimates that Africa will be inundated by an unexpected increase in health spending of about \$10.6 billion due to Coronavirus (COVID-19) resulting in inflation, shortage of food supplies and pharmaceuticals [2].

Poor uptake of immunization

As UNICEF, WHO, and Gavi warns, there is a global disruption of efforts at routine vaccination against polio, diphtheria, and measles due to the COVID-19 pandemic, thus exposing more than eighty (80) million children to the risk of such diseases [24]. As nations grapple with the challenges occasioned by COVID-19, more children around the world are directly and indirectly denied access to care. For instance, COVID 19 is reported to be hindering the service of immunizing children across the globe, thereby frustrating the work of saving lives through immunization and increasing the burden of risk of measles, polio and diphtheria on children of both low and high-income nations. The global call from Gavi, the Vaccine Alliance, World Health Organization, and UNICEF before the 4th June 2020 Summit on Global Vaccine, was to reawaken leaders of nations and global partners to take responsibility by coming together to chart a sustainable pattern for the immunization programs and eliminate the negative effect of the coronavirus pandemic in most nations with low income.

Available information from the Gavi, UNICEF, World Health Organization, and the Sabin Institute reveals that about sixty-eight (68) nations have significantly experienced hampered immunization services which have affected children who are below the age of one year to the population tune of almost eighty (80) million from various nations. This disruption of immunization services on children was witnessed a worldwide magnitude and has been reputed as in March 2020 as the worst of its kind since the beginning of immunization programs (EPI) of the early 1970s. The disruptions have been from the levels of moderate to severe, and in some places there where outright suspension of the immunization services within April and March from about fifty-three percent (53%) of the 129 nations affected [25]. These disruptions make for a devastating impact on the eye health of children across the world. This is because, in most of the situations that ensued, the cornea (white

area of the eye) of the children who have the measles disease got damaged and becomes disfigured, hazy and without colour. This condition is measles keratitis, which is associated with sensitivity to even the slightest faint of light that the child so affected has excessive tearing and tends to move away from light. Also, this measles can become complicated for malnourished children and those lacking in vitamin A. The measles virus can inflame several ocular structures like the retina, optic nerve, and blood vessels, thus impairing vision. If a pregnant woman contracts the measles virus, it poses a serious risk to the life of the unborn baby and could lead to developmental complications of ocular structures like the cornea, retina, optic nerve, and others. Certain ocular dysfunctions and anomalies such as retinal degeneration, glaucoma, and cataract, in a child may be traceable to be of developmental and congenital etiologies due to Rubella when the baby was still in the womb [26].

Travel restrictions

Globally, the disruptions in vaccination affected children's access to care regarding health generally and eye care in particular. This is also instructive as most childhood blindness becomes averted through immunization against Measles, Polio, and diphtheria. The reasons for these disrupted services vary. The inabilities of most caregivers to move or travel due to restricted migration, general lockdown, restricted interactions, and information, trepidation for coronavirus disease infection are some of the reasons. Most health care human resources and personnel were in short supply and not available due to limited migrations, engagement in coronavirus response services, and unavailability of safety or protective materials. According to Gavi CEO, Seth Berkley, there has never been a time in history when most children are conditionally unavailable to receive protection from avoidable diseases than this period of the pandemic. The immense progress gained against avoidable blindness is now under threat due to COVID-19, thereby risking the resurgence of diseases already eradicated [25].

Weak health systems

COVID-19 has significantly impacted on the health services for non-communicable diseases. According to a World Health Organisation's survey released on 1st June 2020, the disruptions, occasioned by the coronavirus disease emergence into the public space, also inhibited the therapeutic and preventive assistance for non-communicable diseases (NCDs) worldwide.

A 21-day duration study on 155 nations in May 2020 was confirmatory to the fact that COVID-19 made a global impact on all, but

poor nations in particular [27]. There is a gross lack of infrastructural capacity in most African nations to handle the challenge. In Nigeria, for instance, a country of roughly over 200 million people including women and children, the NCDC claims to have the capacity to run 1,500 tests per day and had only succeeded in testing 152 people per day, according to a report on March 22, 2020 [28]. There is a disruption in the global interventions for eye care, with associated limited impact due to weak health systems prevailing in low and middle-income nations, thus rendered inefficient to deliver quality services for eye health.

Protecting the eye health of children in coronavirus (Covid-19) pandemic era

Childhood and adulthood are not the same, and so are the reasons for the emergence of certain anomalies, and blindness inclusive. It then implies that the procedure adopted to fight against blindness in adults will be very different from that of children, as it could offer little or no help. Also, in children, abuse or delay in therapeutic protocol will eventually enforce early amblyopia, but not so with adults. More so, children have smaller eyeballs and will show a different response treatment from that of adults. Sight problems in children can cause developmental delays, therefore, early detection and management are essential in ensuring children have the opportunity to develop the visual abilities they need to learn [29]. Blindness in children may cause death, and when a child is blind, there are more blind years ahead of him or her. It is critical to take cognizance of the fact that methods adopted to eliminate blindness in children in a coronavirus pandemic era will be required to help the child overcome the psychosocial trauma and associated financial challenges encountered thereby through the caregivers, family, and the society, and help position the child to face the futuristic prospects of development and fulfilling life [30]. To protect the eye health of children during the COVID-19 pandemic era will require simple procedures and measures that help to impede the risk of contracting the virus. Therefore, parents and caregivers can help so much by being vigilant about the child under their care. Protecting the face, mouth, nose, eyes, and washing of hands, of children, can hinder or impede the rate of infection of the virus.

Caregivers of toddlers should endeavor to wash their hands always, maintain adequate hygiene, and avoid sharing bathing towels, cups, toothbrushes, and other items that are likely to transfer the infection to another person. Good and adequate hand hygiene is highly encouraged. More so, relatives who suspect an ocular

anomaly in a child with measles should visit the hospital as a matter of urgency. Children who are 12 months and older should also receive MMR vaccination if they have not already done so [26]. More so, this global challenge about the epidemic situation has led to an uncommon need for personal protective equipment (PPE), testing, and clinical items thereby necessitating market scarcity for important health care deliveries. The World Health Organisation with the collaboration of other development partners has created a system that ensures that the critically needed health care materials are accessible to the lower-income nations, and have been able to deliver these items to about 172 countries within their service regions, according to a recent report, although the global demand for these supplies remains very high [31]. Furthermore, a robust and well-coordinated approach should be adopted by various governments and policymakers to promote health, prevent, and treat diseases, and also ensure that the challenges around eye health needs and those that impair vision through life due to the COVID-19 pandemic are resolved. It is also worthwhile to rehabilitate the vision where necessary to improve the visual function and reverse any impending abnormality [32]. Radical rethinking and deeper development of eye health systems have been contended as necessary approaches to reclaim the eye health of a child and achieve VISION 2020 goals [33].

Conclusion

COVID-19 has impacted the eye health of children globally and leading to visual impairments especially in low and middle-income countries, resulting from direct pathological anomalies, poor uptake of immunization, travel restrictions to access care, reprioritization of Health Resources, weak health systems, and Economic Consequences. Adequate hygiene through hand-washing, vigilance on toddlers, immunization of children, and accessing care for obvious pathological anomalies like conjunctivitis, measles, etc. are all advocated for parents and caregivers to protect the eye health children. Also, interventions towards the children's eye health in the Coronavirus pandemic era will demand a holistic approach that entails systems revamp and adaptability to meet the required needs, in a way that such responses are evidence-based and research-oriented from health systems to guide meaningful interventions in the protection of children's eye health. Therefore, governments at all levels must unite to secure the eye health of children in a coronavirus pandemic era.

Conflict of Interest

None.

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