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## *Overview*

# **Effects of COVID-19 pandemic on education and society**

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**Abstract:** This paper sheds light on the impact of the COVID-19 pandemic on society and the surrounding environment, with a special focus on education and the social aspect. Specifically, how the pandemic has disrupted education systems across the globe by forcing the closure of primary and secondary schools, colleges and universities is discussed. Since it is not only the students who were affected by this worldwide health emergency, the impact on educators and parents, as well as all aspects of the education system, including admissions, assessments and evaluations, is also debated. These facets are discussed while emphasizing the shifts that many organizations underwent to maintain operations while adhering to the announced governmental restrictions related to the circulation of the pandemic. Specifically, the needs to rapidly implement significant modifications to their usual practices and standard operational processes and convert their existing teaching materials to another format to make them appropriate for online delivery are highlighted and discussed.

**Keywords:** COVID-19, impact, education, social, response measures

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## **1. Introduction**

The coronavirus disease (COVID-19) is an infectious disease caused by a virus named the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). SARS-CoV-2 is a member of a large family of viruses called coronaviruses that includes themselves, i.e., a group of pathogens belonging to the Coronaviridae family. These include a set of germs that cause a variety of syndromes ranging from mild headaches, muscle aches or chest aches, to severe conditions like the severe acute respiratory syndrome and the Middle East respiratory syndrome.

The first infections from SARS-CoV-2 were discovered in Wuhan in Hubei province, China, and

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they were reported in December of 2019 [1]. The World Health Organization (WHO) declared the spread of COVID-19 as a pandemic on March 11, 2020, making it the first global crisis since the 2009 swine flu pandemic, which was caused by the H1N1 influenza virus [1]. Since then, the virus has neither ceased to spread all over the world nor ceased to mutate to form different variants, causing a worldwide public health emergency.

The COVID-19 epidemic has been far more than a health problem. It has wreaked havoc on the basic foundations of society all across the world. The pandemic's social and economic outputs, for example, plummeted in 2020, which included shutting down or limiting economic operations, consequently destroying jobs and livelihoods and increasing poverty, particularly among the already vulnerable. The consequences of these have, indeed, hampered progress toward gender equality. Women and girls have been subjected to increased violence and forced child marriage, and women have borne a disproportionate share of job losses and increased domestic care responsibilities.

The pandemic's devastation has already had a significant impact on several aspects, among which is the quality of education. In this regard, the United Nations reported that, "in 2019, only 59% of children of grade three age were proficient in reading. The pandemic is projected to cause an additional 101 million children (roughly 9% of those in primary and lower secondary school) to fall below the minimum reading proficiency threshold, increasing the total number of students falling behind to 584 million in 2020. This wipes out the progress achieved in education over the past 20 years" [3]. The pandemic has also had a significant impact on people's mental health. Working from home, temporary unemployment, home-schooling children and a lack of physical interaction with other family members, friends and coworkers are all new realities that have required us to take care of our mental as well as physical health.

The aim of this paper is to provide an overview of the impacts of the COVID-19 pandemic on society and the surrounding environment; with a special focus on education and the social aspect, we highlight the mitigation strategies adopted by the affected bodies.

In light of the above, the paper is structured as follows. In Section 2, a description of the high-level structure of SARS-CoV-2, as well as its evolution, transmission modes and worldwide spread will be given. How the virus has disrupted education, as well as the shift witnessed by this sector, will be discussed in Section 3. In Section 4, the social impact will be discussed, briefly shedding light on economic issues, social, racial and ethical disparities and focusing more on the groups that were more impacted by the pandemic. Finally, Section 5 concludes the paper.

The literature search was performed independently by both authors in PubMed and Scopus databases. The main search terms used included: SARS-CoV-2 or COVID-19 and education or school closure and economic issues or economic impact and psychological impact or emotional behavior and social problems and domestic violence. The authors selected the references based on the subject of the review and the relevance of the findings.

## **2. SARS-CoV-2 virus**

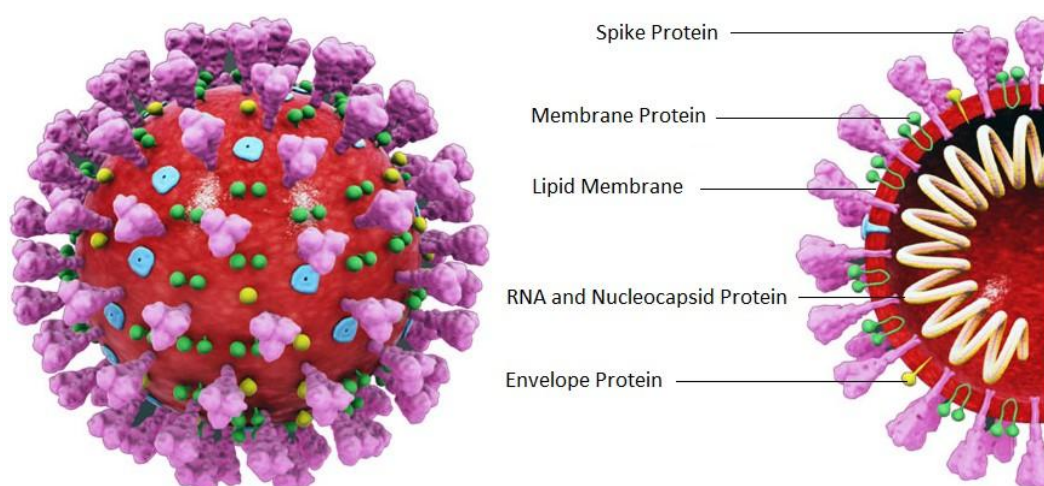
### **2.1. Terminology and the high-level structure of SARS-CoV-2**

During the initial outbreak in Wuhan, several names were given to the virus, including the "coronavirus" and the "Wuhan coronavirus". However, in January of 2020, and in accordance with the WHO's 2015 guidance [4] against the use of geographical locations, animal species or groups of people in disease and virus names, the WHO recommended the use of the 2019 novel coronavirus (2019-nCoV) as a provisional name for the virus [5]. The human coronavirus 2019

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(HCoV-19 or hCoV-19) was also used in some articles to refer to the virus [6]. It was on February 11, 2020 that the official name SARS-CoV-2 was adopted.

The name “coronavirus” takes its origins from its Latin meaning, which is “virus with a crown”, where, specifically, the word “corona” means “crown” and stems from the microscopic structure that resembles a solar corona. It refers to the appearance that coronaviruses have from the spike proteins sticking out from the membrane, as can be seen in Figure 1. As illustrated, the virus has four different proteins and a strand of ribonucleic acid (RNA). The spike proteins are considered as the most prominent features, and they are crucial to the biology of the virus. Among the different parts of the virus, it is the spike protein that attaches to a human cell to infect it, allowing it to replicate itself inside the cell and spread to other cells. Figure 1 also shows two other proteins residing in the membrane between these spikes; these are the “envelope protein” and the “membrane protein”. They both provide structural integrity. The fourth protein, i.e., the “nucleocapsid”, resides inside the membrane and acts as a scaffold surrounding the RNA nucleotides making up the virus.



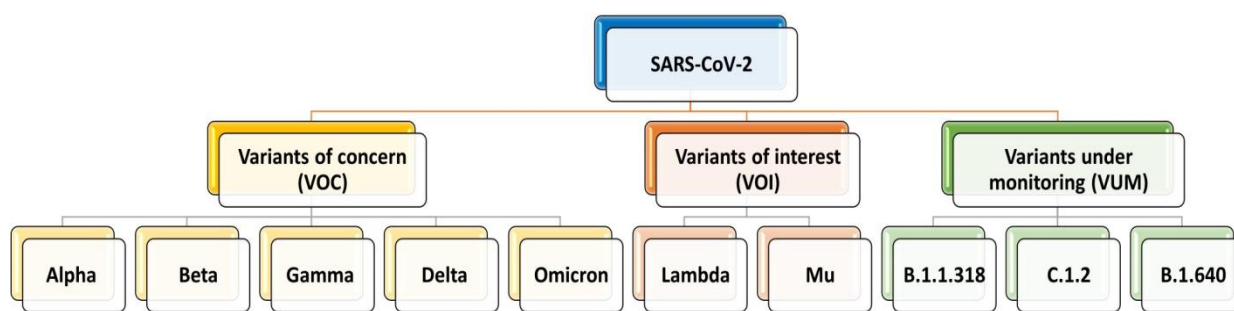
**Figure 1.** Structure of the SARS-CoV-2 virus. Source: [7]

The spike protein part plays vital role in the process of virus invasion. Because of such importance, constantly monitoring mutations causing changes to the spike protein is a crucial task performed by scientists who sequence the virus for research. This task is called genomic surveillance, and it has shown that SARS-CoV-2 has undergone several evolutions [8].

## 2.2. Evolution of SARS-CoV-2

SARS-CoV-2, as with any other virus, has been undergoing several genetic changes and mutations. Its evolution, as well as the genetic lineages that have been formed, have been monitored by the WHO and its collaborators and assessed since January 2020. Some of the witnessed changes have little-to-no impact on the properties and spread of the virus. Nevertheless, some other mutations may affect the SARS-CoV-2's properties, such as how fast and easily it spreads, the severity of the illness it causes and the performance and effectiveness of treatments against it, including therapeutic medicines, vaccines, diagnostic tools and various other public health and social measures. These mutations increase the risk posed by SARS-CoV-2 to human

health by giving it selective advantages, as transmissibility has increased together with the ability to evade the host immune response. The variants of SARS-CoV-2, specifically the ones that have posed an increased risk to global public health, have been categorized by the WHO into variants of interest (VOIs) and variants of concern (VOCs); this was first introduced in late 2020. Such a categorization permits the prioritization of global monitoring and research and ultimately serves to inform the ongoing response to the COVID-19 pandemic. Figure 2 shows the categorization of the SARS-CoV-2 variants. It is to be noted that there is a third category named variants under monitoring (VUM), which represents the “SARS-CoV-2 variant with genetic changes that are suspected to affect virus characteristics with some indication that it may pose a future risk, but evidence of phenotypic or epidemiological impact is currently unclear, requiring enhanced monitoring and repeat assessment pending new evidence” [9], as defined by the WHO. The belongingness of each variant to each category is based on a specific working definition, and it provokes a set of actions to be taken by the WHO and its member states [9].



**Figure 2.** Categorization of the SARS-CoV-2 variants

To track the spread of these variants, detect new variants and monitor the trends of circulating variants, many countries use genomic surveillance programs. Collecting such information via such programs will improve our understanding of which variants are circulating in a specific country, how quickly variants emerge and which variants are most important to characterize and monitor. It also allows a better understanding of how variants might impact public health.

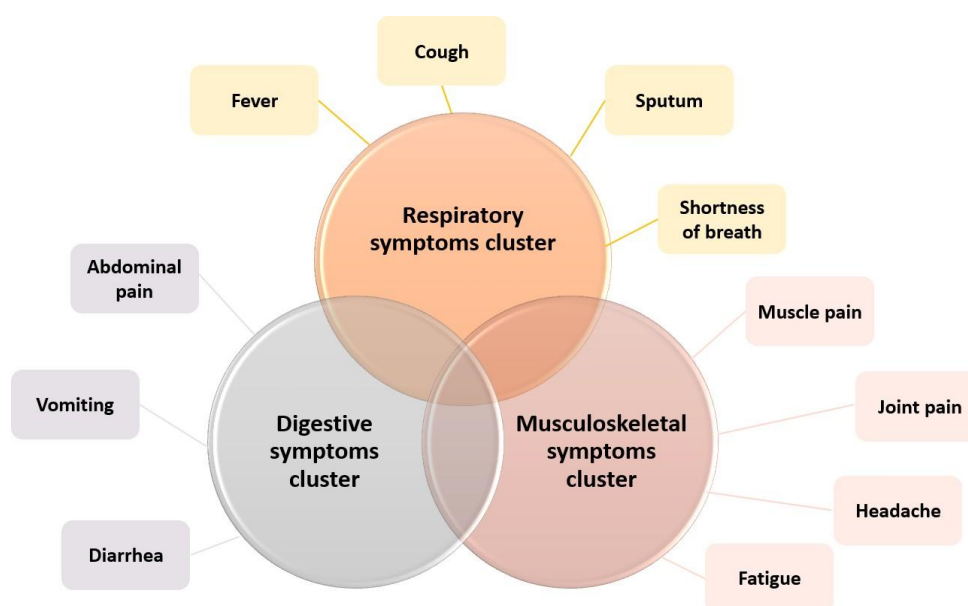
### 2.3. Symptoms and transmission modes

People who have been infected with SARS-CoV-2, independently from the specific form of the virus variant, have reported almost the same set of signs and symptoms. They experience mild to moderate symptoms, but also severe symptoms in some cases, such as respiratory illness [9,10]. The most reported signs and symptoms include headache, loss of smell (anosmia) and taste (ageusia), nasal congestion and a runny nose, coughing, muscle pain, a sore throat, fever, diarrhea and breathing difficulties [1].

People with the same infection may exhibit different signs and symptoms, and they may change over time. Some other infected people may only have a few symptoms, while some others may have no symptoms at all. These signs of infection can be categorized into three common clusters, as shown in Figure 3 [1].

In the cases in which people exhibit severe symptoms, COVID-19 can lead to severe conditions like grave pneumonia, conditions related to organ failure, such as lasting lung and heart muscle

damage, nervous system problems and kidney failure, and possibly death. Older people together with people who have existing medical conditions, such as cardiovascular disease, diabetes, cancer, chronic obstructive pulmonary disease, obesity or severe obesity, asthma or thalassemia, are those who are more likely to become seriously ill and require particular medical attention; and, the risk increases with age. According to the WHO, signs and symptoms of the virus may show up on people within 2 to 14 days after exposure. The period of time corresponding to after the exposure and before exhibiting the signs is called the incubation period. During this period, which may vary from person to person, any infected individual with the coronavirus can still spread SARS-CoV-2, even before experiencing the symptoms.



**Figure 3.** Different clusters of the COVID-19 signs and symptoms

The virus that causes COVID-19 spreads easily among people. It spreads from person to person through droplets and very small liquid particles released from an infected person's mouth or nose by coughing, sneezing, speaking, laughing or breathing. These droplets and particles can be inhaled by other people or land on their eyes, nose or mouth. The virus may also be transmitted by touching a surface with the virus on it and then touching one's mouth, nose or eyes. In some circumstances, the virus can be transmitted when a person is exposed to tiny infectious particles that can linger in the air and accumulate in indoor places, especially places where many people gather and there is poor ventilation [11]. This is why several preventive measures have been set to reduce the chances of being infected. These measures include getting vaccinated, wearing a mask in public, hand hygiene and avoiding touching the eyes, nose or mouth with unwashed hands, practicing good respiratory hygiene, ventilating indoor spaces, physical distancing, avoiding crowded places and managing potential exposure duration [12,13].

These signs and symptoms, as well as the transmission modes, were witnessed by many infected people in numerous countries all over the world, and this was since the first appearance of the virus in Wuhan. Also, the different prevention measures were advised by the WHO to the public and were communicated and adopted by different countries.



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## 2.4. Origins and the worldwide spread of the virus headline

Since the very beginning of the COVID-19 crisis in December of 2019, a major question has been raised about the source of the virus and how it was transmitted to human beings. The initial cases of SARS-CoV-2 infections were first discovered and reported in Wuhan, China. However, the origin of the viral spread to human beings remains ambiguous. There were various hypotheses around the source of SARS-CoV-2 [14,15]. Some of these considered that the Huanan Seafood Wholesale Market was the initiator of the virus circulation, while some others focused on the fact that visitors may have introduced the virus to the market [16]. Some other hypotheses were around the zoonotic origin of the virus. This is because, in the past, numerous infectious disease outbreaks have been traced to viruses hosted by birds, pigs, bats and other animals that mutated to become dangerous to humans. Based on this, it was speculated that there was a potential spillover from bats, making them a possible reservoir for the virus. This speculation was mainly allied with the sequencing of the virus following the description of the very first clinical cases, which revealed that there is a close similarity, at the genome level, between SARS-CoV-2 and bats' coronavirus, which belongs to the lineage b of betacoronavirus [15]. However, there has been no evidence yet of a direct transmission of bat coronavirus to humans [17–19].

Another assumption was centered on the zoonotic spillover principle and the hunt for the intermediary host, which was assumed to be an exotic animal hosting the origin of SARS-CoV-2, which mutated and was then transmitted to humans, causing illness. Zoonotic spillover occurs when the pathogen from an infected animal host enters a human host, either directly from a natural reservoir, via an intermediate animal host or indirectly from virus in the environment [20]. Since then, the Malayan or Sunda pangolin, *Manis javanica*, has been designated as a probable intermediate host [21,22]. Also, this speculation was based on the affinity between the SARS-CoV-2 spikes and the pangolin angiotensin-converting enzyme 2 (ACE2) receptor, which is not limited to this species [23].

Despite the efforts that have been made so far regarding studying the source of the virus, the origin of SARS-CoV-2 remains elusive. What also remains unclear is whether the virus became pathogenic before or after the spillover event [5,14]. Investigations and research studies on these major questions continue, and they may reveal how and why the coronavirus evolved to cause a worldwide public health emergency, or a pandemic.

COVID-19 has not stopped spreading since its first appearance in Wuhan, as SARS-CoV-2 and its mutations have been observed in many countries and independent territories. According to the WHO, globally, as of 7:57 pm CET on March 16, 2022, there have been 460,280,168 confirmed cases of COVID-19, including 6,050,018 deaths. As of March 13, 2022, a total of 10,712,423,741 vaccine doses have been administered [24]. The statistics in terms of confirmed cases, deaths and vaccinations are presented in Table 1.

**Table 1.** Globally, as of 7:57 pm CET on March 16, 2022, there have been 460,280,168 confirmed cases of COVID-19, including 6,050,018 deaths, reported to the WHO. As of March 13, 2022, a total of 10,712,423,741 vaccine doses have been administered. Source: WHO COVID-19 Dashboard.

Geneva: World Health Organization, 2020. Available online: <https://covid19.who.int/> (last cited: March 16, 2022)

WHO region	Cumulative confirmed cases	Cumulative confirmed deaths	Cumulative total vaccine doses administered
Africa	8501208	170634	279569999
Americas	149185071	2663778	1671462750
South-East Asia	56586444	770289	2583697206
Europe	189964699	1910254	1507087483
Eastern Mediterranean	21466737	338737	661956824
Western Pacific	34575245	196313	4008571856
Other	764	13	77623
Total	460280168	6050018	10712423741

The rapid increase in the global COVID-19 cases has prompted the need for fast and immediate countermeasures to control and limit the catastrophic effects of the outbreak. These countermeasures include the requirement of facial coverings and/or mask wearing, the adaptation or closure of schools and businesses, limitations and restrictions on public and private gatherings, restrictions on domestic movement and public transportation, stay-at-home orders and international travel restrictions (entry restrictions, quarantining and testing).

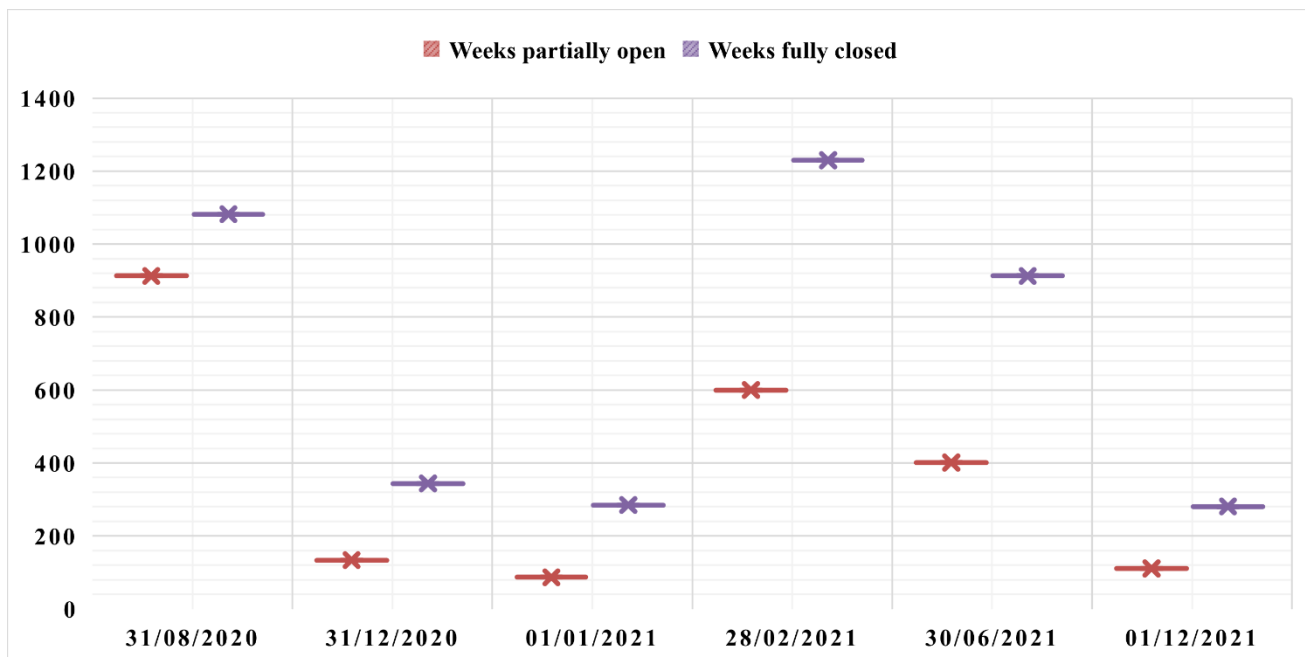
The spread of the virus has had several impacts on society and the surrounding environment that have affected people all over the globe. In what follows, we mainly focus on the impact on education, as well as on the social aspect. These facets will be discussed while emphasizing the shifts that many organizations underwent to maintain operations while adhering to the announced governmental restrictions tied to the circulation of the pandemic.

### 3. Impact on education

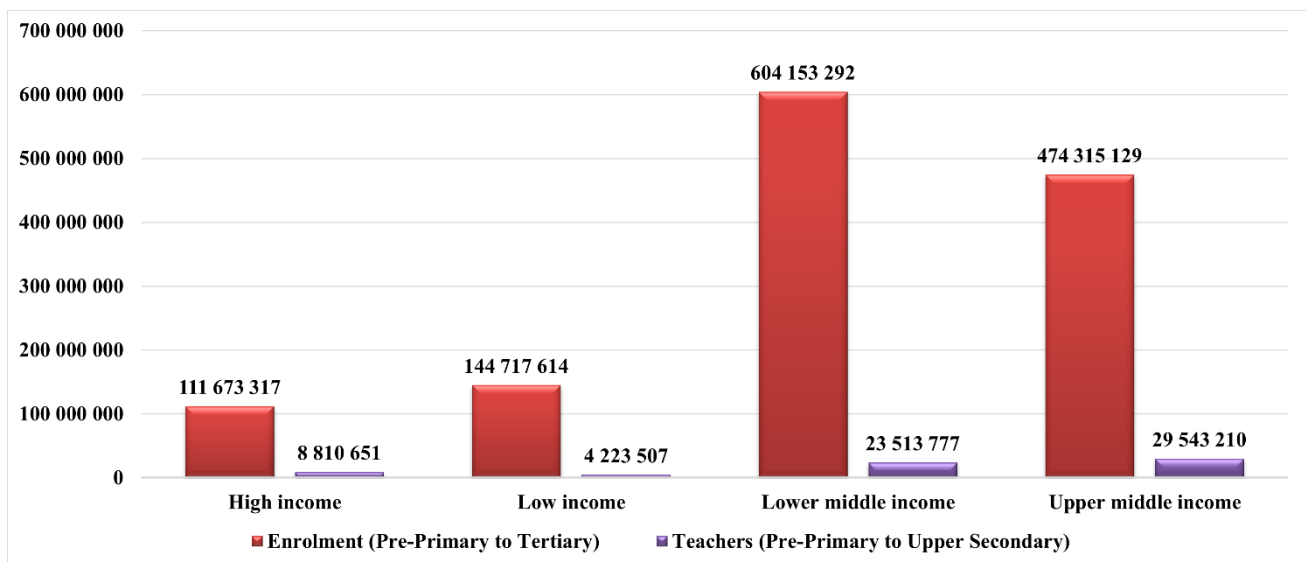
Since its outbreak in December of 2019, the pandemic has disrupted education systems across the globe. Most countries have been forced to provisionally close primary and secondary schools, colleges and universities, which was considered as one of the possible actions to take to control the spread of the virus because crowds can be avoided. At the start of the pandemic, governments announced the closure of the educational organizations for a short period of time; however, gradually, these closures were prolonged several times amid uncertainty as to when to reopen. Figure 4 shows the number of weeks that schools around the world were fully closed/partially open due to COVID-19 during the period of August 2020 to December 2021.

This worldwide health emergency has affected not only students, but also educators and parents, as well as the entire education system, including admissions, assessments and evaluations. In this regard, the United Nations Educational, Scientific and Cultural Organization (UNESCO) reported that more than 1.5 billion students and youth across the planet are or have been affected by school and university closures due to the COVID-19 pandemic [25]. Figure 5 shows the number of students and teachers affected by school closures in April of 2020 in different World Bank country income groups. These closures meant that educational organizations needed to rapidly implement significant modifications to their usual practices and standard operational processes, and to convert their existing teaching materials to another format that is appropriate for online delivery.





**Figure 4.** Number of weeks that schools around the world were fully closed/partially open due to COVID-19 during the period of August 2020 to December 2021. Source: UNESCO map on school closures (<https://en.unesco.org/covid19/educationresponse>) and UIS, December 2021 (<http://data.uis.unesco.org/>)



**Figure 5.** Number of students and teachers affected by school closures (April 1, 2020) due to COVID-19. Source: UNESCO map on school closures (<https://en.unesco.org/covid19/educationresponse>) and UIS, accessed in December of 2021 (<http://data.uis.unesco.org/>)

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### 3.1. Switching to online learning

With the switch to online learning, several terms belonging to the family of collaborative systems and platforms, such as Zoom, Microsoft Teams, Blackboard Learn, Blackboard Collaborate and Classin, have been incorporated into our everyday lexicon and use. These collaborative systems have been broadly used for both personal and organizational purposes, mainly to affect education, training programs and virtual meetings, as well as to maintain contacts and interactions with family and friends who are generally within the person's network [26,27]. This switch was made possible by the rapid diffusion of these platforms, together with the different available cloud-based infrastructures, as this allowed people to maintain their collaborations and interactions while adhering to the governmental measures related to social distancing and self-isolation [27].

Although online teaching and learning are not considered as a new mode of delivery for many educational bodies, the reality of shifting from face-to-face class to online learning presented a challenge for tutors, students, parents and governments. This is, for some bodies, mainly due to the lack of information and communication technology (ICT) infrastructure, internet access, educational resources, skills and money [28]. Additionally, online learning can sometimes be difficult or even impossible to implement for some courses, such as laboratories, sports, nursing, clerkship, dance, music and art. Apart from the difficulty of administering some courses online due to their practical and applied nature, assessments and evaluations have also been impacted by COVID-19. Despite these collaborative systems that support online delivery, the assessment aspect has been considered as insufficiently advanced [29]; hence, there is another challenging task. Taking into consideration the nature of courses, and whenever possible, tutors have worked on changing and adapting their assessment types to fit the online mode. Yet, there remains difficulty in the assessment and evaluation of laboratory tests, practical tests and performance tests. Additionally, it is challenging to monitor how students are taking their online courses, and it is more difficult to ensure that they are not cheating when they are taking their online exams [28]. Besides, students who do not have an internet facility, or have difficulty maintaining a stable internet connection, will have fears and worries concerning their assessments and evaluations.

The new online format for courses, including their associated assessments and evaluations, which were either further adapted for some courses or built from scratch for some others, in addition to the collaborative systems and platforms and the required infrastructure that had to be made available for some educational bodies, had to be prepared as quickly as possible to ensure the continuity of education. Table 2 shows the percentage of countries that have made an effort to ensure learning during school closures via the use of different modalities of distance learning, including a combination of TV, radio and the Internet, in April of 2020.

Another concern is the difficulty for some parents, children and students to acquire computers and other information technology (IT) equipment, as well obtain access to the Internet at home, to be able to take part in distance learning. Some parents do not have the sufficient and required skills in terms of ICT infrastructure and IT equipment to help their children in the event of technical problems. Likewise, some tutors and staff members struggle with difficulties in the area of technology and experience a lack of infrastructure availability. Some of them had to familiarize themselves with the available online teaching platforms to be able to use them in their daily work.

**Table 2.** Percentage of countries using remote education delivery methods during school closures due to COVID-19. Source: UNESCO map on school closures (<https://en.unesco.org/covid19/educationresponse>) and UIS; obtained in December of 2021 (<http://data.uis.unesco.org>) for April 1, 2020

WHO region type: World Bank country income grouping (July 2020)	Existence of TV as a distance learning modality in the country	Existence of radio as a distance learning modality in the country	Existence of an online distance learning modality in the country	Existence of distance learning modalities (combination of TV + radio + Internet) in the country vs (Non-existence)
High income	41%	5%	54%	79% (21%)
Low income	35%	35%	30%	77% (23%)
Lower middle income	38%	26%	37%	95% (5%)
Upper middle income	39%	19%	43%	93% (7%)

Because the pandemic has had an impact on teaching, assessment and evaluation, the support services provided by the educational bodies had to be, promptly restructured and implemented. Several educational organizations had to establish a task force composed of members from various units, such as human resources, tutors, facility management units, health units, student affairs, admission services and other members from other relevant units [30]. The main responsibility of the task force is to build and implement strategies dealing with the health crisis that is driven by COVID-19 to guarantee, as much as possible, the continuity of educational activities via virtual learning. From a practical standpoint, the task force organizes regular meetings with some other subcommittees, which have also been formed specifically for the outbreak, to make informed decisions as the pandemic evolves. It was important to sensitize all involved parties, including the parents, children, students and staff members, that the aim is to move forward together during this extremely difficult time.

The task force had to take several actions due to the increase of COVID-19 positive cases, which impacted several activities, such as the organization and running of workshops, conferences and other events, as these were either canceled or postponed for an unknown period of time. To avoid crowds as much as possible, all kinds of meetings, except urgent ones, had to be either rescheduled or conducted virtually through the use of collaborative systems.

The task force and the educational bodies' authorities had to ensure that the online course materials, together with the associated instructions and services, were made available at the students' disposal as quickly as possible to support academic continuity. Students had to be reassured regarding the flexibility that would be required when encountering difficulties related to attending online courses or taking online exams due to sickness or any disturbance. Relevant members from educational bodies had to frame flexible assessment guidelines to ensure that students were not at a disadvantage, and that the outbreak would not adversely affect their exam grades, which is indeed a major worry of students. As for the courses that are difficult to teach online due to their nature, the educational authorities had to either grade students based on the work that they had completed just before the crisis, or suspend classes until the situation returned to normal.

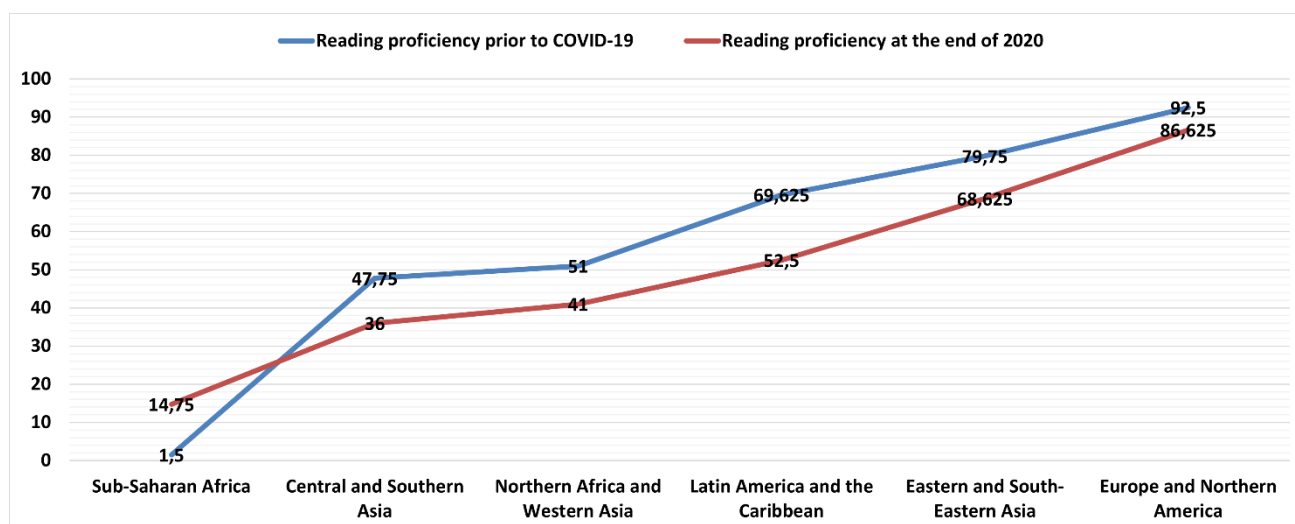
What has also been impacted by the outbreak, along with teaching and evaluations, is tutee admissions. Admission officials had to make the admission procedures more flexible by accepting applications via online platforms from potential tutees, and by offering them more flexible enrollment processes, such as adding flexibility around entry dates and ways of supporting them.

### 3.2. Inequality in accessing information and communication technology

Although online delivery has been a good opportunity to continue education during the wake of the pandemic, it has emphasized the inequalities in education [31]. Students living in rural areas and those who are part of a disadvantaged family may lack access to digital technology and infrastructure, the Internet and educational resources [32]. In some cases, it is possible that they do not have access to sufficient assistance, as they may not benefit from the IT equipment provided by their educational body, if available; this is because, for instance, the number of computers available for borrowing by students in need is limited. Some teaching organizations are well equipped in terms of digital technology and educational resources and materials, while others may have either lower-quality ICT infrastructures or eventually lack the appropriate digital infrastructure required for virtual teaching and learning.

The educational institution closures and switch to the online mode brought difficulties to some tutees, parents, families and tutors. Some parents were facing issues related to understanding the new methodology of teaching, while some others were either not very technically proficient or digitally illiterate. Consequently, they were not able to assist and guide their child taking online classes; specifically, when refereeing to children who may have high dependence on parents. These children need assistance and supervision in their online learning process and regarding their usage of digital devices and applications [33]. Access to the Internet or the reality of facing its disturbances is also another difficulty for some tutors, tutees and families.

It should be noted that there were already inequalities before the pandemic in terms of accessing quality education between students living in urban and rural areas, and between tutees who are part of families with a relatively high or low socioeconomic status. The health crisis, via the closure of educational institutions, further exacerbated the inequalities between tutees [34]. Figure 6 shows the percentage of change in reading proficiency for grades one to eight prior to COVID-19 and at the end of 2020. Globally, the percentage of adequately reading-proficient students prior to the pandemic was 54.5% but, at the end of 2020, the percentage dropped to 45.25%.



**Figure 6.** Percentage of change in reading proficiency for grades one to eight from 2019 to 2020.

Source: United Nations: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all (<https://unstats.un.org/sdgs/report/2021/goal-04/>)

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### 3.3. International students, researchers and staff

The preventative measures taken by different countries to limit the spread of the virus had both direct and indirect impacts on the international students, researchers and staff. The European Migration Network and the Organization for Economic Co-operation and Development have identified a set of factors that have contributed to placing international students in a vulnerable situation. These factors are elucidated as follows [35]. (i) Due to the implemented protective measures against the spread of the pandemic, national administrations and higher learning organizations had a reduced capacity to implement the required procedures to facilitate the mobility of international students. For instance, the processing of visa applications was delayed and the processing of new applications or renewal of residence permits was hindered or suspended; the same problems occurred for the admission procedures. The partial or complete closures of certain national administrative bodies, universities and other educational organizations had a major impact, introducing uncertainty within the international students' admission procedures. In some cases, such an uncertain situation and the delay or breach in running the administrative procedures may have compromised the students' ability to pursue an international education. (ii) The pandemic has also impacted the ability of international students to support themselves financially during their studies. This can be explained by the fact that students often rely on part-time jobs, which were negatively affected. Specifically, the abrupt downturn in economic activity in many countries had a major impact across many sectors, which has had a strong impact on international students who consequently faced either the loss of their part-time jobs or a reduced or lost income. Consequently, students may have had difficulties with continuing their studies, finding a job or starting a business following their graduation. Furthermore, students' families in their respective countries of origin may have also endured financial difficulties that hampered their ability to support their children's studies abroad. In [36], it has been reported that this situation affects not only prospective international students, but also international students who are already in the host countries and are obligated to prove that they have sufficient resources to support themselves throughout their studies. (iii) Nations across the globe closed international borders to mitigate the outbreak [37]. Educational authorities across the world were asking their international students not to travel overseas, or even to return to their country of origin, as they may put themselves at high risk of getting infected. Due to the government travel restrictions, many international students were unable to return to their homes, which potentially left them in some uncertain legal situations.

While educational bodies were closing their campuses, it must be considered that many international students, researchers and staff members did not have any other off-campus living accommodations. Staying on campus during the health crisis, presented several challenges for administrators, as they had to ensure the disposal of several amenities for those non-national occupants, such as food, living accommodations, safety services and other indispensable services.

In response to these circumstances, some countries had to amend or adapt their admission processes for immigration purposes at the national level [35]. As for the enrollment and admission procedures, educational institutions had to implement flexible procedures such as extending deadlines, offering application procedures online, introducing temporary concessions and prioritizing the processing of student visas once offices began to reopen. To mitigate the financial impact of COVID-19 on the international students, researchers and staff, several countries introduced temporary measures, such as increasing maximum working hours, opening access to national funds or incorporating financial programs that could be managed at the local level.

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### 3.4. Mental and physical health

The global health crisis has disrupted the lives and routines of many people across the world. The worldwide health emergency, with the rapid increase of infected cases, has created a sense of insecurity and feeling of anxiety about what is going to happen. The closures of educational bodies have negatively affected the mental and physical health of children, students, parents and tutors around the world [31]. For instance, in [38], it has been reported that, during the period of school closure, the levels of anxiety, depression and stress were high among students, leading to unfavorable effects on their ability to learn, as well as their psychological health. Students, whether they were citizens attending school far from home or international, were not only worried about their health, safety and education, but they also had huge concerns regarding the well-being of their families [39]. Indeed, their concerns were about their careers, which might have been strongly affected by the pandemic. This might be due to the postponement of graduations or the impacted economic situation in many countries.

As a response to these matters, and because the safety and well-being of students and staff members should be considered as the highest priority, educational authorities increased their support for mental health. This was achieved by updating their health guidelines and providing remote assistance and lectures to offer strategies for managing stress while coping with the pandemic. Any member of an educational body who has been experiencing feelings of anxiety about COVID-19 should be provided with proper psychological support in a timely manner [39]. Further details about the impact of the pandemic on mental and physical health will be given in the following section.

## 4. Social impact

The social impact of the COVID-19 pandemic shares some similarities with past natural disasters. However, there are also major differences that should be considered to understand the effects on the society and individuals [40,41]. The first difference is that natural disasters affect specific regions of a city, state or even a country. Therefore, it is possible for unaffected individuals or countries to be available to help the victims of the natural disaster. A second difference is that it is typically possible to predict, with reasonable accuracy, the duration of the natural disaster. The third and maybe most critical issue is that the help and support measures to deal with a natural disaster rely on extensive collaborative efforts from many groups of persons [42].

In the case of the COVID-19 pandemic, these three aspects are very different. First, the disease affects practically all countries around the world. This makes it very difficult to establish effective modalities of collaboration between countries, except in the case of scientific research. The second point is the uncertainty about the duration and consequences of the pandemic [40,41]. The third issue is that groups of persons were not allowed to act together due to the social isolation measures and restrictions on human contact. Psychological and social well-being is affected significantly by stay-at-home orders, social distancing and other safety precautions needed to contain the pandemic that recommend the avoidance of social gatherings [43]. In addition, the social impact is also associated with the individual fear of becoming sick, as well as the need to deal with friends and family becoming infected and possibly dying alone from COVID-19.

### 4.1. Economical issues

In the current scenario, COVID-19 has affected all sectors of the society. There has been a large global loss that cannot be estimated precisely [44]. Many countries control the production of several



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items, including medicines, machines, motor vehicles, computers and mobiles. In general, the different components of a product are manufactured in many countries and assembled in other countries. This is globalization. The process is like a chain wherein progress stops if a single link in the chain breaks. The world was severely affected economically as a consequence of the decrease in industrial production [45]. The precise economic burden of the pandemic is very difficult to measure, but it has certainly affected almost every country in the world.

In 2020, the World Bank estimated that global growth would shrink by nearly 8%, with the poorest countries feeling most of the impact. The United Nations reported that the pandemic cost the global economy around 2 trillion dollars in 2020 [44]. Significant travel reductions imposed by several countries have resulted in millions of dollars in losses for airlines and the tourism industry [45]. Another important issue has been the shortage of medicines, disinfectants, masks and other products, which has driven up prices for these items by several times [44]. In addition, hospitals and healthcare facilities have been facing several difficulties and financial issues when it comes to providing assistance for patients, especially during COVID-19 waves [44]. Many countries banned the attendance of classes in schools, colleges and universities for very long periods, and millions of the students could not get a good quality of education [44]. It is very difficult to assess the extent of this loss in terms of money, but it has already caused great harm to students and their families.

## **4.2. Social, racial and ethnic disparities**

Another relevant social issue intrinsically associated with the COVID-19 pandemic is the crucial role of social, racial and ethnic disparities in worse outcomes [46–49]. Historically, pandemics have been experienced unequally, with higher rates of infection and mortality among the most disadvantaged communities, particularly in those countries that are more socially unequal. Accordingly, the risks of SARS-CoV-2 infection and the adverse outcomes of COVID-19 have been distributed inequitably, disproportionately affecting vulnerable populations [50,51]. Besides already well-recognized clinical and biological factors, social, racial and ethnic disparities have contributed to morbidity and mortality [46–49]. COVID-19 has been considered to be a syndemic [52]. According to Singer et al. [53], a syndemic shows the adverse interaction between diseases and social conditions, mostly due to the health inequality caused, among other factors, by poverty, societal differences, violence and structural racism.

## **4.3. Groups more impacted**

Besides these general aspects of the pandemic, particular groups have suffered a more intense mental health impact, including frontline healthcare workers, the elderly, children, adolescents, the LGBTQ+ community, homeless individuals and those in economically vulnerable positions, those in rural communities, foreigners and psychiatric patients [54–57]. Indeed, the emotional stress linked to the pandemic conditions may have aggravated previous psychiatric conditions or precipitated their symptomatology [58]. Another critical aspect is that, due to physical distancing, many elective appointments were canceled and mental health support systems were not functioning in the same way, even though remote assistance significantly increased during this period of the pandemic [59]. In the next paragraphs, we summarize the impact on frontline healthcare workers, elderly individuals, children, adolescents and patients with pre-existing mental disorders.

Healthcare workers are, for the most part, psychologically resilient professionals, who have been

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*STEM Education*

trained and are experienced in dealing with illness and death [60]. However, the mental health and psychological well-being of this group prior to the pandemic was already being identified as a major healthcare issue, as evidenced by the growing incidence of stress, burnout, depression, drug and alcohol dependence and suicide across all groups of health professionals in many countries [61]. This scenario has worsened during the pandemic. The frontline healthcare workers have suffered great pressure and stress. The novel nature of SARS-CoV-2, limited treatment options, insufficient personal protective equipment and other medical supplies, extended workloads and other emerging concerns are major sources of stress [40]. Healthcare workers exposed to virus-related work are 1.7 times more likely to develop psychological distress and post-traumatic stress disorder compared to non-exposed workers [62]. A systematic review and qualitative meta-synthesis revealed the importance of developing clinical guidance specific to supporting frontline healthcare workers [63]. This guidance should be developed in consultation and collaboration with the healthcare workers themselves. Interventions to prevent and treat mental health distress in healthcare workers need to be implemented, and their timing, effectiveness and acceptability must be carefully evaluated [63].

Age has been shown to be the strongest risk factor for severe COVID-19 disease [64]. More than 80% of deaths occurred in people older than 65 years of age [65]. Social isolation has been associated with increased risk of depression and anxiety in the elderly [66]. However, many studies have shown a more significant impact on the mental health of younger people (<35 years), women, those with low income and the unemployed than on that of the elderly [67,68]. These studies were carried out earlier during the pandemic via online surveys.

Surveys completed during the later stages of the pandemic showed a significant negative impact on mental health, highlighting the difference in impact of acute versus chronic stress on older adults, especially the elderly [69]. The study by Tyler et al. [70] evaluated the mental health of older adults across 33 countries during the COVID-19 pandemic. The authors reported a total of 256 (31.1%) cases of different degrees of depression and 128 (15.5%) cases of different levels of anxiety among a total of 823 individuals aged 60 years or older. The study included data from 33 countries, and it was found that being separated from family and close friends was a predictor of depression and anxiety [70]. The study showed geographic differences. Europe and Central Asia exhibited the highest levels of depression, followed by Latin America and the Caribbean, North America, Sub-Saharan Africa and East Asia and the Pacific. For anxiety, the top three regions were the same as those detected for depression [70]. Table 3 shows the distribution of depression and anxiety cases by geographic region according to the study by Tyler et al. [70].

**Table 3.** Distribution of depression and anxiety cases in Europe and Central Asia, Latin America and the Caribbean, North America, Sub-Saharan Africa and East Asia and the Pacific for individuals aged 60 years or older according to the study by Tyler et al. [70]

Global Regions	Depression	Anxiety
Europe and Central Asia	121 (47.2%)	52 (40.6%)
Latin America and Caribbean	68 (26.6%)	40 (31.3%)
North America	58 (22.7%)	33 (25.8%)
Sub-Saharan Africa	6 (2.3%)	3 (2.3%)
East Asia and Pacific	3 (1.2%)	0 (0%)
Total	256	128

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A COVID-19 coping study [71] showed a higher prevalence of anxiety, depression and loneliness than the pre-pandemic period. In addition, these three conditions were strongly associated with increased alcohol consumption in older adults [71].

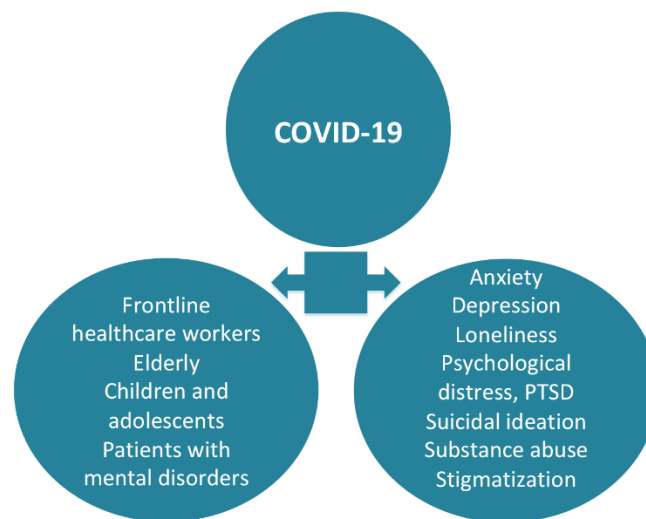
The pandemic has significantly affected children and adolescents [72]. School closure, changes in routines, social isolation, the need to stay at home, continuous use of technologies and the remote classrooms were some factors that influenced the lifestyle habits and behaviors of children and adolescents [73]. As expected, different responses to stress occurred according to the stage of childhood development. However, children from all development phases have presented high rates of depression, anxiety and post-traumatic symptoms [74–76]. Family and community conditions significantly affected children's and adolescents' lives. Relevant issues include family stress, conflict related to finances and parental psychopathology and the associated practices [72,74]. A study with college students from Nigeria found that most of the students reported depressive symptoms (61.9% of 307 participants), whereas about a third of the sample presented anxiety (38.7% of 192 participants) or both depressive and anxiety symptoms (33.7% of 167 participants) [76]. In general, the prevalence of anxiety and depressive symptoms is significantly influenced by socio-cultural and socio-economic contexts [74]. An underprivileged economic situation of the country, a loss of jobs of parents, an increased incidence of adolescent sexual abuse and school closures have probably contributed to the high rates of anxiety and depressive symptoms in Nigerian college students [76].

Two other aspects have played significant roles in the pandemic, especially in the lives of children and adolescents: the essential role of school and the problem of domestic violence. Studies have shown that the school helps students to maintain routine habits, including those related to nutrition daily activities, and it even protects against domestic violence [77]. The stay-at-home measures placed those most vulnerable to violence and abuse in close proximity to their potential abuser. This may lead to a persistent increase in the risk factors for domestic violence. The cause of this increase has been associated with traditional factors of domestic violence, which became more prevalent during the pandemic. The risk factors include social isolation, more attempts by abusers to exert power and coercive control, unemployment, economic distress, marital conflict and substance use and abuse [78,79]. The victims of domestic violence are more frequently women, children, adolescents and elderly individuals. The high financial stress associated with the pandemic likely disproportionately impacted victims and survivors of domestic violence in the long term. As an example, the pandemic's disproportionate impact on unemployment among women, which is estimated to be four times higher for women compared to men, along with their increasing responsibility for childcare and homeschooling, may have contributed to domestic violence [80]. Table 3 shows reported cases of domestic violence during the first months of the pandemic.

**Table 3.** Total number of reported cases of domestic violence from March 2020 to August 2020 according to the continent (data obtained from <https://dataunodc.un.org/content/covid-19>)

Continent	Cases of domestic violence, number (percentage)
Europe	77226 (49.8%)
Latin America	58928 (38.0%)
Africa	13026 (8.4%)
Oceania	4807 (3.1%)
Asia	1086 (0.7%)
Total	155073

Several studies have evaluated the impact of the pandemic on the mental health status of individuals with a pre-existing psychiatric disorder. The uncertainty, fear and social distancing exacerbated pre-existing psychiatric diseases and precipitated their symptomatology [55]. In addition to their higher vulnerability to many stressors, individuals with mental disorders faced worsening medical follow-ups due to the suspension of some elective appointments [58]. These individuals reported increased distress, anxiety, loneliness and depression [81,82]. Previous research has highlighted the strong association between loneliness and anxiety and shown that increased loneliness was associated with a higher score for affective symptoms related to depression [82]. In addition, McPherson et al. [83] reported that the loneliness experienced at the beginning of lockdowns was a risk factor for clinically significant depression. On the other hand, schizophrenic patients may have had delusions and hallucinations related to the pandemic and been less likely to get the vaccine or adhere to other preventive measures [55]. Figure 7 summarizes the impact of COVID-19 on vulnerable populations.



**Figure 7.** Societal, emotional, psychological and behavioral effects of COVID-19 on vulnerable populations. PTSD: post-traumatic stress disorder

## 5. Conclusions

In all countries, whether small or large, developing or developed, the COVID-19 pandemic has had significant health, social and economic consequences, as well as severe impacts on education, and many more aspects and sectors. These consequences will persist for some time to come. By witnessing and living through such circumstances and consequences, it has been a sharp reminder that everyone everywhere should have access to quality and affordable services in the areas of health, education and technology, as well as many other areas. The pandemic through which we have been living since 2019 has highlighted the necessity for the government to develop policies, plans and institutionalized mechanisms to ensure societal protection for everyone, particularly the poor and vulnerable.

The pandemic has highlighted the need to reduce poverty and inequality and promote long-term development and progress, social inclusion and cohesion, democracy and just and peaceful societies. Policymakers, implementation systems and partners need to alter their perspectives and look ahead in order to help shape the lives and ensure the survival of future generations. The shifts brought about

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by the pandemic, which occurred in all systems and ordinary living patterns around the world, without exception, should not be overlooked or taken for granted.

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