



Multifactorial Effects of COVID-19: Medical Practice, Education and Public Health Challenges

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Abstract

The article aims to provide a brief overview of the multifactorial effects of COVID-19. The authors have tried to categorize the effects into health, financial, psychological, and educational factors. It highlights a brief overview of how Covid-19 influenced each of these factors. The expert opinions, suggestions, recommendations, and proposed solutions to tackle the multifaceted effects of the SARS-CoV-2 pandemic are also listed. Technological advances along with stringent policies and guidelines can ease the after-effects of COVID-19 on each of the above-mentioned factors and is detailed in this review.

Keywords: COVID-19; SARS-CoV-2

Introduction

The first known plague that the human race encountered was the Antonine plague which happened in 165 to 180 A.D. The Severe Acute Respiratory Syndrome (SARS-CoV) in 2003 followed by the Middle East Respiratory Syndrome (MERS-CoV) in 2012 were the epidemics of the 21st century [1]. In December 2019 pneumonia-like disease was first reported [2], and in January 2020, it

was identified as a beta coronavirus (SARS-CoV-2) and named COVID-19 [3,4]. Literature has confirmed that the transmission route is through respiratory droplets while coughing, sneezing, and few reports suggest that talking also can transmit the virus [5]. The reported incubation period of COVID-19 ranges from 0-14 days in general and in rare circumstances up to 24 days. This impacted the global economy, education, and community health. In this review,

the authors have attempted to categorize the multifactorial effects of COVID-19 based on health factors, economic factors, psychological and Educational factors. Apart from categorizing various factors (Figure 1), recommended measures and limitations of each measure have been highlighted.

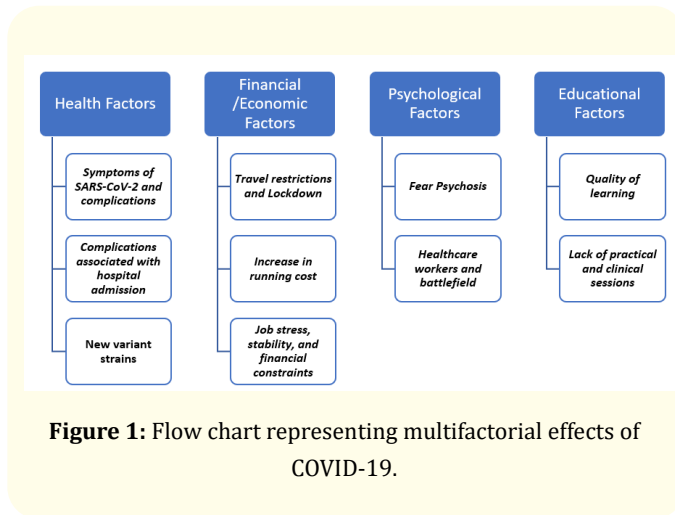


Figure 1: Flow chart representing multifactorial effects of COVID-19.

The medical health centers were limited to emergency services due to the fear of contracting and spreading the disease. The lockdown and limiting medical health services to emergency affected the economic stability of the world. A literature search was done to identify the various factors that were affected due to COVID-19. The factors are discussed in detail with recommendations on how to overcome each factor:

Health factors

Symptoms of SARS-CoV-2 infection and complications

Patients with COVID-19 can be asymptomatic, or have one or multiple symptoms such as fever, dry cough, myalgia, headache flu-like symptoms. Other symptoms include diarrhea, hemoptysis, nausea, fatigue, anosmia, and dysgeusia [6]. In some cases, with multisystem involvement, they can develop more serious symptoms such as shortness of breath, pulmonary failure or fibrosis, Rhabdomyolysis, deep vein thrombosis, and liver failure. In such cases, hospital admission is necessary [3,7]. Other recent emerging complications especially from India include Mucormycosis, mislabeled as Black fungus due to overuse of corticosteroids in treatment. CDC reported a 54% mortality rate after getting infected by

this fungus [8]. Mucormycosis is more common when industrial Oxygen is used for medical purposes rather than the use of Medical Oxygen. Aspergillosis another fungal infection has been reported after the black, white, and yellow fungus infections [9].

**Complications associated with hospital admission
Pneumonia and oxygen shortage**

Patients with low oxygen saturation or symptoms requiring them to be admitted to the hospital are at risk for developing complications. These complications include; deep vein thrombosis, muscle weakness, and joint stiffness [10].

Lingering symptoms - “Long COVID” and post-infection sequelae

The persistence of some symptoms has been reported in several recovered patients, A phenomenon that has been described as “Post COVID syndrome”, “post-acute COVID syndrome”. “Long COVID” where the symptoms last for more than 3 weeks post-infection. In cases where the symptoms continue for more than 12 weeks, it is called “chronic post-COVID syndrome” [7,11]. Tenforde., *et al.* found that at least one symptom persisted for weeks among adults who got infected with SARS-CoV-2 and that it might take weeks for complete resolution of the symptoms and restoring usual health [12]. Cough and fatigue are among the most common symptoms that persisted, as well as myalgia [13]. Another sequela caused by COVID-19 infection is vitamin D deficiency as reported by Pinzon., *et al.* [14]. Persistent tinnitus and headache, and hair loss have also been reported [5,16].

Emergence of novel variant strains and waves of infection

The global emergence of SARS-CoV-2 variants UK-B.1.1.7, South African-B.1.351, Brazil- P.1 and lately Indian variant B.1.617.2 re-named, as alpha, beta, gamma and delta respectively has increased fear among masses for morbidity and increasing deaths. With the continuous spread of COVID-19 new variants with increased transmission, different set of symptoms and increased morbidity and mortality has been observed. These variants also make the diagnosis more challenging and raises the question of the effectiveness of the available vaccines on the new strains. In fall 2020 a new variant emerged in the UK that was believed to have started in September. It was later termed as SARS-CoV-2 variant 20I/501Y.V1 (lineage B.1.1.7). With this variant being more transmissible this contributed to an increase in the cases in the UK leading to lockdown in

many parts of the country to mitigate the situation [16,17]. By the end of 2020 another new variant appeared in South Africa, SARS-CoV-2 variant 20H/501Y.V2 (lineage B.1.351), followed by SARS-CoV-2 variant 20J/501Y.V3 (lineage P.1, a branch of the B.1.1.28 lineage). in Brazil. What these new variants have in common is the multiple mutations within the S protein, raising the question of vaccine effectiveness on these strains [18]. The B.1.1.7 was more transmissible and greater mortality rates as per reports [19]. FDA has warned that the new variants can give false-negative results due to their genetic variation in the genes encoding for spike proteins [20]. The variants of concern (VOC) have raised health concerns on increasing transmissibility and mortality as with delta variants in India causing havoc with second wave of infection, imposing fresh lockdowns, increased death toll from oxygen scarcity, and challenging the healthcare system.

Vaccine hesitancy and effect

In spite of reports of Vaccine hesitancy worldwide due to common side effects reported by CDC like pain, redness, swelling on site of injection, U.A.E ranks among top countries in the world for vaccinating its population. Tiredness, headache, muscle pain, chills, fever, and nausea have been reported. Many countries developed their indigenous vaccines to give confidence to their population and meet the scarcity of global vaccine supplies. Most CDC-recommended vaccines require 2 shots except with Johnson and Johnson's Janssen only needing one shot, with varied data on vaccine efficacy [21]. The fear of side effects and efficiency is a major cause of vaccine hesitancy. The WHO and other health organizations perform public webinars and awareness drills to explain the need and concept of herd immunity that can be achieved only through vaccines. To combat the spread of the virus among vaccinated individuals and avoid sense of complacency, social distancing and mask wearing are enforced among vaccinated as well as non-vaccinated individuals to block the transmission chain.

Health measures taken by UAE to combat Covid-19 crisis:

According to statistics from Worldometer the UAE took initiative and maintained a world lead in maximizing coronavirus testing over 77,500 in terms per one million people [22]. During this year Ramdan the Emirates Fatwa Council issued five fatwas as measures to control Corona Crisis [23]. Multiple coronavirus testing facilities as drive in and normal were opened. Ras Al Khaimah economic zone carried out medical checkups in RAKEZ industrial zone

[24]. The Emirates Red Crescent Medical center in Sharjah started the medicine to home initiative benefitting the elderly people [25].

Financial/economic factors

Travel restrictions and lockdown

To prevent the spread of the virus, lockdown measures impacted the economy and was a cause of decline in business all around the world. Medical and dental centers only catered to the emergency need of patients as per the CDC guidelines [26].

In the dental field, the findings reported that one-fifth of the dentists closed their practices, and three-fourth expected a financial loss of over 70% [27]. The British Dental Association has also indicated massive financial losses due to the shutdown of dental practices in the UK [28]. Apart from the specific field of dentistry other business establishments suffered similar losses.

Increased running cost

All shut down establishments to reopen were required to follow Government specific guidelines which increased the functioning cost further burdening them [29]. The financial burden increased due to added costs on PPE, strict hygiene protocol, sanitization, and sterilization. Along with the above factors, the sterilization and preoperative safety measures became time-consuming which led to the logical fact that only a few patients could be treated in a day in medical and dental centers. The installations of safety equipment as HVAC, HEPA A/C filters, UV-light, and single-use chair covers, added to the investment cost. Less revenue to establishments led to the downsizing as paying the wages and rentals became difficult.

Job stress, stability, and financial constraints

The decrease in revenue due to the lockdown increased running costs, overhead expenses such as paying salaries, rent, which added to the financial strain. Karasek with his job demand control support model observed that stress is experienced while the job factors or support factors are affected [30]. Coping with financial strain requires social and familial support.

Recommendations to alleviate financial distress

Establishments facing profitability and cash flow issues rescheduled their business plans. Many institutions to alleviate financial distress managed working capital by increasing controllable accounts receivables and delaying accounts payable. Due to

the increase in operating costs, they increased their selling prices, cut on new spending, and as a last resort considered downsizing or salary reductions. The other recommendations from financial experts included renegotiating commitments such as rent and debt repayments with bank deferral. If government relief programs are available to avail it and to use credit facilities to purchase needed equipment and materials. The governments which do not have relief programs, schemes, and insurance policies in place, must consider introducing such programs for future pandemics and disasters. UAE Government initiated the 10 million meal campaign to help the low income families [31] was highly acclaimed and endorsed by many countries

Psychological factors

Fear psychosis

This may be because patients with underlying chronic illnesses are more vulnerable to COVID-19 infections. As per the Center for Disease Control and Prevention data, people who have chronic medical conditions (as diabetes, lung, and heart diseases) once infected with COVID-19 were prone to complications requiring admission to intensive care [32]. Thus, it is not surprising to find elevated psychological distress in those participants who cope with chronic illnesses. One of the major implications of the COVID-19 pandemic that is often overlooked is its effect on the mental health of the population. It has been reported during the pandemic that 4 out of 10 adults in the US had symptoms of anxiety or depression [33].

Healthcare workers and battlefield

Health care workers are especially affected mentally by this pandemic. Having to work during the lockdown and fear of contracting the virus and spreading it to family members are among the reasons behind this. Working non-stop for long hours with little to no leaves contribute to feeling burnt out. In a cross-sectional study done by Moreno, *et al.* out of 1422 health care workers 58.6% had symptoms of anxiety, 46% had symptoms of depression, and 41.1% felt emotionally drained [34]. Another group that is affected is young people. Shutting down of schools and universities, losing jobs among this group are some of the reasons [35]. The lack of social activities, as well as lockdown and social distancing, resulted in loneliness and depression among people [36]. Another demographic data that was associated with lower psychological distress

was being in a committed relationship [37].

Recommendations to alleviate fear among health care workers

All the above-cited factors increased anxiety and stress amongst public and health care workers. The government and the respective health organizations should arrange mandatory continuing education sessions and workshops for health care workers. In this time of uncertainty and panic, some psychological sessions on fear reduction should also be conducted by a team of trained psychologists and counselors to lower the anxiety levels among all health care providers [38] As part of the mental health care for medical staff during the COVID-19 pandemic, a study reported that when health workers were kept in contact with their families by video, stress levels decreased. It is a well-documented fact that support from family buffers untoward situations [39].

For the public and health care system forceful reinforcement from governments regarding the public policies and guidelines concerning COVID-19 as quarantine and mobile tracking App (Aarogya Setu Indian app April 2020, AIHOSN app UAE) should be mandatory. This will reduce the fear factor for the public. The AIHOSN app was launched as an initiative to reduce the spread of Covid and track positive patients. This was a very successful venture by the Abu Dhabi and Dubai health authorities to limit the number of Covid cases and boost quarantine measures. The Virtual doctor app for COVID-19 also helped the patients to know the symptoms related to COVID and clear their doubts [40].

Educational factors

Quality of learning

Shortly after announcing the need for social distancing and reducing all face-to-face contact such as teaching and training programs, the immediate impact of COVID-19 was felt on educational institutions. Schools and universities have resorted to online-based learning, which presents a challenge to both faculty and students. The sudden shift to virtual classes harmed the quality of the taught material in the initial phases till the staff was oriented to the online teaching process. Teachers have to keep up with the new online software and applications. In addition, they had to be innovative in implementing these technologies into the delivered material [41]. Students on the other hand face another level of a challenge deal-

ing with online sessions, with about 70% of the students affected worldwide [42]. Students do not engage in an online class as they do in face-to-face classes as they do not appreciate the importance of these sessions as they do in class [43]. The effect of shifting to online-based teaching is very vast and it's difficult to determine how serious it is with little data currently available and with the current situation that's constantly changing.

Lack of practical and clinical sessions

The major drawback apart from conducting fair examinations is the lack of practical and clinical sessions [44]. More innovative technology as virtual reality for medical training, Augmented reality with virtual tours, and Big data the future of eLearning can be utilized [45].

Conclusion

The article is an overview to highlight the various factors that caused a breakdown in health, economic, psychological, and educational factors. The authors attempt to encompass the overall impact of the pandemic and outline recommended solutions to negate the post covid effects. The pandemic has left a lasting transformation in areas of life and has taught us the value of bonding and family strength amidst this crisis. Innovative methods are being developed with the advancement in telemedicine, and clinical trials and flexible approach to solutions as the new normal. Robotics and artificial intelligence have made progress and are making forward in all fields. Change is the only constant. The effects of the pandemic are profound and may forever change the future for better or worse. Eventually it's up to us to make the best of the time and take up the COVID challenge.

Competing Interests

Authors declare no conflict of interest.

Acknowledgements

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