Coronavirus disease (COVID-19) prevention and treatment methods and effective parameters: A systematic literature review

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A B S T R A C T

Background and objective: The coronavirus disease 2019 (COVID-19) outbreak was first identified in Wuhan in December 2019, which was declared a pandemic virus by the world health organization on March 11 in 2020. COVID-19 is an infectious disease and almost leads to acute respiratory distress syndrome. Therefore, the virus epidemic is a big problem for humanity healthy and can lead die in special people with background diseases such as chronic obstructive pulmonary diseases, chronic heart failure, diabetes mellitus, and kidney failure. Different medical, social, and engineering methods have been proposed to face the disease include treatment, detection, prevention, and prediction approaches.
Methods: We propose a taxonomy tree to investigate the disease confronting methods and their negative and positive effects. Our work consists of a case study and systematic literature review (SLR) to evaluate the proposed methods against the virus outbreak and disease epidemic.
Results: Our experimental results and observations demonstrate the impact of the proposed medical, prevention, detection, prediction, and social methods for facing the spread of COVID-19 from December 2019 to July 2020.
Conclusion: Our case study can help people have more information about the disease and its impact on humanity healthy and illustrate effective self-caring methods and therapies.

1. Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was identified as the infectious disease and first generation of COVID-19 that was inspired SARS. The virus was first identified in Wuhan in December 2019 with common clinical symptoms including fever, dry cough, and tiredness, which are different for people in age categories (such as adults and pediatrics). Other disease's clinical symptoms were included fatigue, muscle or body aches, headache, the new loss of taste or smell, sore throat, congestion or runny nose, and nausea or vomiting diarrhea. China researchers confirmed the mutated second-generation with mild symptoms or without clinical symptoms. The World Health Organization (WHO) announced the virus outbreak and alerted all countries about 30 January 2020. At this time, 24 July in 2020, the disease led to the death of 807 K people and 23.3 M new cases in all the world; however, 15 M patients with COVID-19 were recovered (Anonymous, 2020c).

COVID-19 epidemic is challenging that affects people's quality of life due to the virus's negative impact on humanity's health and its other problems, such as increasing poverty rate, global financial and job crises. The virus penetrates the upper-lower respiratory system and can lead to lung infections and chronic obstructive pulmonary since COVID-19 is a severe danger to people's health with background diseases. Environmental sustainability, lifespan, and pathogenic are the particular characteristics of the virus in increasing the probability of its epidemic in the coming years in all the world (Kumar & Morawska, 2019; Pan, Cui, & Qian, 2020). Therefore, various medical, social, and engineering methods have been proposed to face the COVID-19 outbreak that consists of therapy, prevention, detection, prediction approaches (Pan et al., 2020). The therapies' methods and antibody solutions have been proposed to treatment and prevention from infecting the disease, whereas they are not yet the definitive approaches against COVID-19 (Di Lorenzo et al., 2020; Saghazadeh & Rezaei, 2020). Quarantine has been proposed as a prevention method against the

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disease outbreak, where a city is prone to the spread of the virus for one and two months (Peak et al., 2020). Social distance and quarantine methods had an impressive effect on reducing the probability of infected the disease, which are depended on the individual, ethnic, cultural, and demographic habits (Thu, Ngoc, & Hai, 2020). Some case studies and observations demonstrated the negative impact of social distance and quarantine on mental health, such as depression and stress disorders (Graves & Karabayeva, 2020). Also, COVID-19 infected people (CIP) almost suffer the psychological damages after recovering caused by anxiety and worry about re-infected or transfer the disease to others. According to the proposed different disease confronting methods in various fields of therapy, detection, and prediction, a systematic literature review of the issue can significantly affect researchers' management process (Tranfield, Denyer, & Smart, 2003).

The research spectrum is pervasive for providing the disease confronting methods and solving the challenges caused by the spread of the virus. Researchers reviewed various proposed methods and provided the case studies, systematic mapping surveys (SMSs), and SLRs in a specific field of facing COVID-19. In contrast, an overview is invisible to investigating the virus's approaches confronting and solving its problems in different aspects. The provided systematic mapping surveys and systematic literature reviews often focused on specific issues such as evaluating the impact of artificial intelligence algorithms, machine learning-based applications (accurate image processing and voice detection), medical and behavioral sciences methods against the disease epidemic (Suri et al., 2020). Therefore, an overall review can help evaluate the issue from different angles and give more information to people about self-caring and facing COVID-19.

This paper proposes a taxonomy tree for evaluating different proposed ideas against the virus and their positive and negative impacts on people's lives in various aspects. Our SLR reviews the issue based on the proposed taxonomy tree and investigates the disease epidemic's useful parameters and its problems considering the tree levels. Our research evaluates the treatment, prevention, detection, and prediction methods for facing the spread of COVID-19 extracted from the content from authoritative scientific sources such as IEEEXplore, Science Direct, Elsevier, and Google Scholar. Our motivations for providing SLR include:

- Epidemic COVID-19 and its negative impact on people's quality of life in all the world
- Expanding the filed of the proposed ideas against the virus outbreak
- Lack of an overall review in provided case studies, SLRs, and SMSs in various aspects
- The positive impact of the review in various angles on people's level of awareness for self-caring and facing the disease

An overall review has to investigate many proposed approaches to confront COVID-19 disease and the virus outbreak, whereas the previous SLR-based case studies focused on the particular fields of facing methods such as different observations of PCR's tests. It can give researchers a comprehensive view about finding various study's areas at a glance that can help them achieve the aim of their favorites for presenting a new facing the disease method in the desired branch. An overall review can also help governments for general assignment the confronting COVID-19 epidemic approaches to decide about managing the issue for year-ahead. Moreover, we propose a taxonomy tree covering the roots of many proposed methods for facing the virus outbreak and their side effects. After that, we use a method to categorize the case studies based on the proposed taxonomy tree to analyze the approaches according to the classifications. It is facilitated the research about the issue and presenting a new method or improving a method.

We classify the related studies to the COVID-19 outbreak into three baseline categories, including treatment, prevention, and effective parameters in spreading the virus. In contrast, other SLRs paid attention to details of a confronting method without considering a root for the issue.

Hence the previous SLR can only inform the researchers about a particular branch of studies, whereas our SLR reviews the issue from different aspects. The research challenges during or post-pandemic, which also can see in previous studies, including:

- Finding the related case studies to the purpose field for achieving more information
- Finding reliable information between the mass of published manuscripts and registered datasets
- Providing a new idea with more benefits after analyzing and introducing the previous approaches' advantages
- Managing the hidden damages after recovery and applying restrictions rules, and therapies' injury of post-pandemic

We report the information based on the presented experimental results and observations in the published papers selected due to their highly cited and novelty and accepted in reputable journals. Our work focuses on the virus confronting methods and potential problems after applying them to a humane society, which our main contributions as the following:

- Providing a new-of-the-art taxonomy tree for evaluating the issue based on three baseline fields of treatment, and prevention facing methods, and the effective parameters in the COVID-19 outbreak
- Providing a systematic literature review based on the proposed taxonomy tree
- Covering detection, prediction, and management approaches against the disease according to three heads of treatment, prevention, and effective parameters
- Supporting future scopes according to economic damages, treatment's injuries, and people's physical and mental damages after recovery and regarding social distancing's rules in post-pandemic

The remainder of this paper is organized as follows. The second section reviews previous studies on different proposed approaches for facing COVID-19. The third section describes our method for researching and collecting information. Section fourth focuses on investigating the proposed ideas based on the taxonomy tree. Section fifth presents a discussion and comparison of the case studies, and the sixth section concludes the paper.

2. Related work

In this section, we examined the related survey reviews to the proposed methods for facing the COVID-19 outbreak that is focused on specific fields, such as investigating the impact of artificial intelligence-based confronting approaches.

The virus is a big problem and dangerous for people with background diseases due to increasing the probability of getting an acute disease, leading to death. Bansal Bansal (2020) provided a literature search about the impact of underlying cardiovascular (CV) disease on getting infected COVID-19 and the patient's worsening. This work utilized PubMed and Google search engines for collecting information and dataset to analyze the issue. The observations and experimental results demonstrated deteriorating the patient's condition with a CV to get COVID-19 compared to the patients without background diseases. Diabetes mellitus and hypertension are likewise the background diseases that are increased the probability of getting acute COVID-19 and death for patients with them. Parveen et al. Parveen, Sehar, Bajpai, and Agarwal (2020) studied the relationship between the probability of getting acute the disease for patients with diabetes and hypertension and people without background diseases using two databases of PubMed and Cochrane. The experimental results and observations demonstrated a direct dependency between severity, ICU care requirement, death, and patients with hypertension infected to COVID-19. In contrast, the acute conditions were not observed for patients with diabetes. The case study

achieved the result that was led to suggest employing fast detection methods and ICU care for patients with diabetes and hypertension according to their negative impact on CIP's health status.

More awareness about the coronavirus disease family and its disease complications can help people for self-caring and healthcare rules. Ortiz-Prado et al. Ortiz-Prado et al. (2020) conducted a comprehensive literature review of clinical, molecular, and epidemiological characterizations of the SARS-CoV2 virus and COVID-19 to present more information on the virus ability in creating a risk for people's life quality in all the world. The case study reported the measurement of the concentration and the number of cells in blood cells before and after getting the disease, such as plasma, erythrocytes, leukocytes, and thrombocytes. It is useful for researchers to propose a novel treatment method and develop an antibody with minimal serology time.

The rapid and accurate detection of the disease has an impressive effect on reducing the probability of acute respiratory syndrome and death caused by penetrating the virus into the lower respiratory system. Investigating the efficiency of detection tools can help propose a suitable diagnostic tool for fast and accurate detecting of the disease (Udugama et al., 2020). Udugama et al. (Udugama et al., 2020) provided a review article to evaluate all of the proposed detection tools and inform the researchers, health, and medical staff for utilizing them according to their ability to diagnose COVID-19. The laboratory tests significantly affect detecting the disease and screening the patients with common initial symptoms. The observations illustrated that serological tests were urgently needed to accurately diagnostic COVID-19 and help fast screening the disease infected people (Bastos et al., 2020). Bastos et al. (Bastos et al., 2020) evaluated the impact of various serological tests on detecting the virus using databases of Medline, bioRxiv, and medRxiv, which consists of enzyme-linked immunosorbent assay (ELISA), lateral flow immunoassay (LFIA), and clinical laboratory improvement amendments (CLIA) tests. The matching antibody was measured to diagnose the disease that ELISA used to detect human immunodeficiency virus (HIV) before COVID-19 to achieve a result from the tests. The results of LFIAs proved the lower sensitivity of commercial kits than non-commercial tests and higher sensitivity at least three weeks after symptom onset than the first week. Various clinical symptoms were identified to detect the disease, which is different in adults and pediatrics.

Katal et al. Katal, Johnston, Johnston, and Gholamrezanezhad (2020) investigated imaging's characteristics for diagnosing the infection in pediatrics caused by getting COVID-19. This work reviewed the issue and analyzed the previous studies using online monitoring the databases of Medline, Scopus, Google Scholar, and Embase, which consists of the results of pediatrics CT. Chest CT observations illustrated that ground-glass opacities (GGO) and consolidations were almost seen as CT's anomalies. The case study proved a balancing requirement between the risk of radiation and the need for chest CT according to the higher sensitivity of pediatrics than adults in facing x-ray. Ming-Yen et al. (Ng et al., 2020) studied CT and chest radiologic's roles in detecting COVID-19's infections based on retrospective observations in Shenzhen and Hong Kong cities. Imaging patterns showed that GGOs were almost available in the peripheries, and also were not seen pleural effusions and lymphadenopathy in all cases. The case study demonstrated higher sensitivity of CT in diagnosing the disease's infections than chest radiographs.

Proving and guaranteeing health safety increased people's mental health in various social positions when community health is threatened by spreading a dangerous virus similar to COVID-19 (Haghani, Bliemer, Goerlandt, & Li, 2020). The issue consists of evaluating the ensuring of healthcare professionals' occupational safety, biosafety of laboratories and facilities, social safety, food safety, and mainly mental/psychological health and domestic safety. Haghani et al. (Haghani et al., 2020) proposed analyzing the literature on COVID-19 about investigating providing community health against the disease epidemic from different aspects such as cyber safety, economic safety, and supply-chain safety.

Table 1
A summary of the related works.

Reference	Main topic	Publication month	Covered years
(Bansal, 2020)	Background disease (cardiovascular)	March	2020
(Parveen et al., 2020)	Background disease (diabetes and hypertension)	June	2020
(Ortiz-Prado et al., 2020)	History of COVID-19	May	2020
(Udugama et al., 2020)	Detection tools	March	2020
(Bastos et al., 2020)	Detection with laboratory tests	June	2020
(Katal et al., 2020)	Detection of the infections (CT)	July	2020
(Ng et al., 2020)	Detection of the infections (CT and radiologic)	February	2020
(Haghani et al., 2020)	Health safety	May	2020
(Egbert et al., 2020)	COVID-19's injuries	July	2020
(Rodriguez-Morales et al., 2020)	COVID-19's symptoms and injuries	March	2020

Various symptoms were identified in patients with COVID-19, which are not persistent for all infected people such as fever, dry cough, and tiredness. Also, acute respiratory distress syndrome (ARDS) was detected as the disease's injury, and brain abnormalities were identified as the damage of COVID-19 for people's health, which refers to any atypical feature in the brain functioning, structure, or biochemical levels. Egbert et al. Egbert, Cankurtaran, and Karpiak (2020) reviewed typology and topography of the disease's injury in adults with COVID-19 utilized from databases (PubMed, Google Scholar, and ScienceDirect) for collecting information about the issue. According to neurologic symptoms, this work employed the neuroimaging methods, including investigating brain white matter's discharges (WM) using computed tomography (CT) and magnetic resonance imaging (MRI) besides the collected information from the databases. The observations demonstrated brain abnormalities injury for a third of acute/subacute COVID-19 patients, which it was proved the importance of the neuroimaging for the disease infected people. Rodriguez-Morales AJ et al. (Rodriguez-Morales et al., 2020) investigated various symptoms and injuries of the disease, including fever, dry cough, dyspnea, ARDS, and polymorbid in CIP. Also, they evaluated the detection tools' role in the probability of people's recovery or death. Case fatality rate (CFR) illustrated the disease's dangers for peoples' health and alerted countries for Equipping therapeutic and health facilities.

Table 1 demonstrates a summary of the related survey reviews on the various ideas against the COVID-19 outbreak based on the proposed methods and publication months in 2020. The previous SLRs and survey studies focused on a particular issue with more details, explaining and analyzing it, and helping researchers for awareness of its advantages and weaknesses. Nevertheless, the case studies restricted to a particular field at a specific time interval, while the COVID-19 outbreak is a big persistent problem for people's health in all the world and also are not yet proposed the definitive approaches against COVID-19. Providing new techniques is challenging for the introduced benefits and disadvantages in the special issue such as LFIA serology tests' highlight role in diagnosing the disease, whereas an oral saliva test was proposed to detect COVID-19 with more advantages than LFIA. An overall review can evaluate the disease and the virus outbreak in different aspects and examine each category's pros and cons in general. Also, its investigation is easier than the reviewed SLR with a particular field. Also, presenting new approaches does not create a vacuum in the introduced advantages and weaknesses by an overall review.

According to the previously provided survey reviews, we present a systematic literature review for informing more information to people and researchers about various the disease confronting approaches from
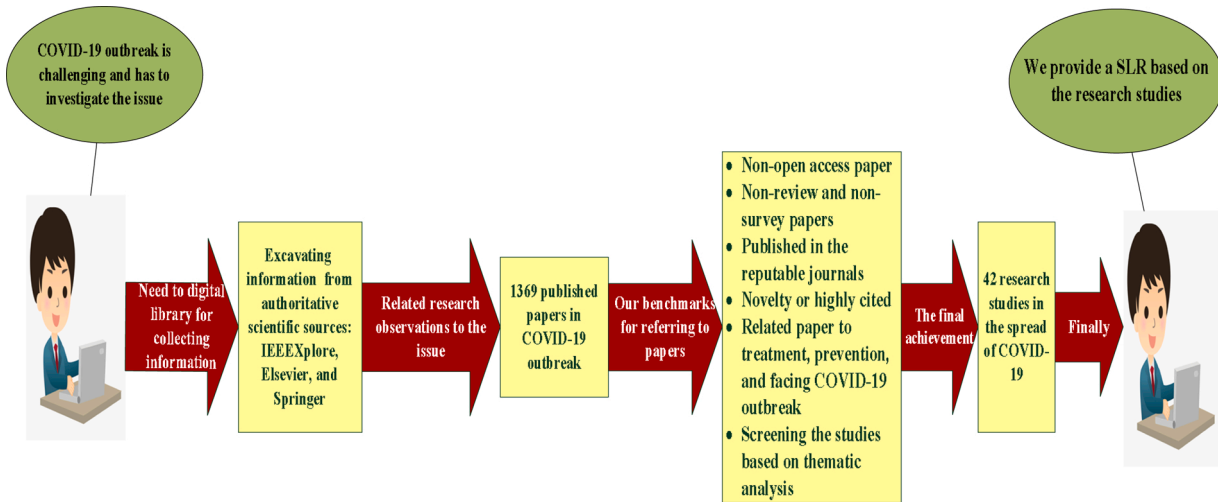
Fig. 1. The stages of our research method.

different angles that our reasons for SLR are including:

- Lack of investigating the case studies against COVID-19 in different aspects
- Classifying the issue and propose a taxonomy tree
- Providing SLR based on the taxonomy tree

3. Our research method and information collection

We describe the stages of our research and information collection methods to provide SLR for investigating the proposed ideas against the COVID-19 outbreak. This section demonstrates our review method for extracting content from the digital libraries and classifying the proposed approaches for facing the disease epidemic in SLR (Bansal, 2020; Parveen et al., 2020; Suri et al., 2020; Tranfield et al., 2003).

Our work utilizes particular keywords to find the intended ideas and case studies that define (Bansal, 2020; Bastos et al., 2020; Egbert et al., 2020; Haghani et al., 2020; Katal et al., 2020; Ng et al., 2020; Ortiz--Prado et al., 2020; Parveen et al., 2020; Rodriguez-Morales et al., 2020; Udugama et al., 2020):

- ("COVID-19") AND (("treatment") OR ("prevention"))

Our SLR reviews the issue based on planning the analytical questions (AQ) and evaluating the proposed ideas to achieve appropriate responses to the questions that are followed:

- AQ1: Is the COVID-19 outbreak a problem in all the world, and why?
- AQ2: Are environmental and cultural factors effective in facing or spreading COVID-19?
- AQ3: Which research domain can be more effective in confronting the COVID-19 outbreak?
- AQ4: What is the basis for deciding about effective approaches against the virus outbreak?
- AQ5: Why the spread of COVID-19 is an open issue to continue the research path?
- AQ6: What are the future scopes of Covid-19 treatment and prevention methods?

The virus was first identified in December 2019, and it became a persistent problem for humanity's health and people's quality of life in all the world. Therefore, the researchers focused on the issue after diagnosing the disease, and the first published idea was proposed in December 2019. Our research domain reviews the published papers in December 2019 to July 2020 using the digital libraries, in which our SLR
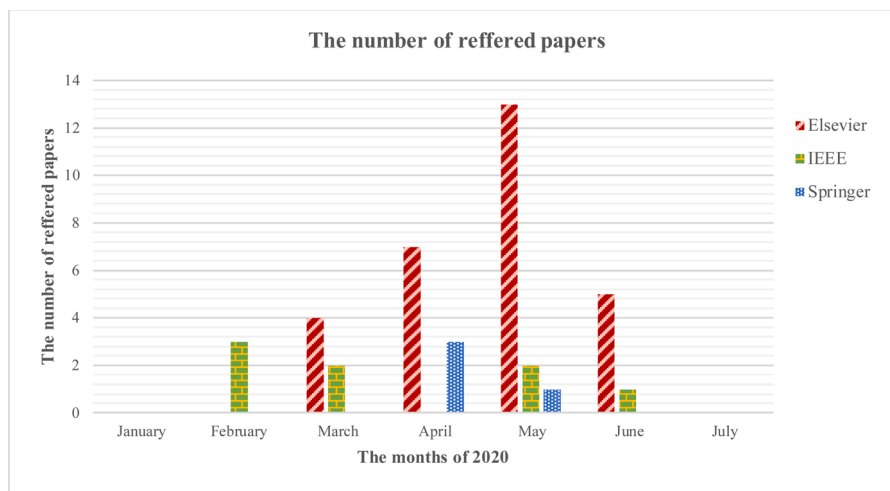

Fig. 2. The number of referred papers depending on digital library.

refers to the published case studies from December to July in 2020. We utilized the paper's concepts about the disease's background, and the virus transmission methods in the introduction section, published in December 2019. According to our research method's stages and benchmarks, the published papers are selected from January to July 2020. Fig. 1 shows the stages of our research and collecting information, which demonstrates the investigating digital databases of IEEEXplore, Springer, and Elsevier to access valid scientific documents. Our SLR covers three main categories of treatment, prevention, and effective parameters in the spread of COVID-19. Its research domain is vast, including approximately 1369 published research papers from December 2019 to July 2020. We try to select the case studies in this research domain to analyze the issue from different angles. Finally, we extract the content from thirty-nine research papers published in reputable journals, as shown in Fig. 1.

We select forty-two research papers for referring the proposed methods, experimental results, and observations in the provided SLR after the researching process. Our research method screens 42 studies from 1369 published papers based on the thematic analysis approach, including investigating their title, abstract, and conclusion concepts. Fig. 2 illustrates the number of referred articles depending on IEEE and Elsevier's digital databases, from January to July 2020. According to the field of the reviewed case studies, we utilize the information of published papers by comparing between Elsevier, IEEE, and Springer, as shown in Fig. 2.We consider the restrictions to research and collect the relevant case studies include:

- The case studies accepted in December 2019 to July 2020
- The case studies cover the issue from different angles
- The case studies demonstrate the positive and negative impacts of the disease fronting methods on people's life
- The case studies only focus on presenting a treatment or prevention method against the COVID-19 outbreak

Our SLR reviews the proposed ideas of the case studies that are published with the characteristics as following:

- The case studies were not open access
- The case studies were not SLR or SMS
- The case studies were not indexed as the blacklist journals
- The case studies were not written in other languages, except for English
- Screening the published papers based on the thematic-analysis approach in the field of treatment, and prevention confronting methods, and effective parameters in the spread of COVID-19

4. Classifying our review based on a taxonomy tree

In this section, we present different proposed methods to face the virus outbreak and its problems. The researchers investigated the issue from the various aspects and proposed different approaches for solving the disease epidemic's challenges. Since the research spectrum is pervasive in this field and the studies' domains have to classify to present a regular and comprehensive SLR. We propose a taxonomy tree for covering the issue from different angles, shown in Fig. 3.

The root of the tree demonstrates the main challenge that its solutions are investigated in different aspects. We classify the proposed approaches against COVID-19 into three categories of treatment, prevention, and the effective parameters of the virus outbreak, illustrated in level one of the tree. The treatment and prevention methods consist of detection and experimental, and medical and non-medical approaches, respectively, as shown in level two of the taxonomy. The detection methods include laboratory tests, voice detection, and CT, and also the proposed non-medical approaches are categorized into the prediction and facing solutions. We demonstrate the virus facing methods that consist of personal and social recommendations in level

four of the tree. We distribute the social recommendations into quarantine and social distance methods, and also, their positive and negative impacts on people's life are mapped on the leaves of the tree. Our review maps the dependent approaches to distributed classifications in level three of the taxonomy tree on the leaves, such as accurate image processing, respiratory sound, and rRT-PCR test.

After introducing the proposed taxonomy tree, we review the case studies against the spread of COVID-19 based on the presented categories, as shown in Fig. 3.

We analyze the issue based on three main categories of effective parameters in the spread of COVID-19, treatment, and prevention methods for confronting the disease, including detection and therapy approaches. This tree covers the heads of all studies in the domain of the issue to investigate the effective parameters in the virus outbreak (Individual, ethnic, cultural, and social habits and environmental factors), prevention and detection's role in facing the disease, and various therapies' impact on improving patients' with COVID-19 considering the treatment's injuries. We also evaluate the damages and their impact on people's mental and physical health after recovery and applying restriction rules, including quarantine, social distance, and self-caring that the taxonomy tree helps cover them.

4.1. Treatment methods

Dong et al. Dong, Hu, and Gao (2020) evaluated the impact of INF-α, lopinavir/ritonavir, ribavirin, chloroquine, and arbidol drugs in recovering COVID-19 infected people (CIP) and estimated duration of treatment due to their dosage prescriptions. The experimental results demonstrated that the required duration of treatment is ten days in exchange for prescribing INF-α, lopinavir/ritonavir, ribavirin, chloroquine, and arbidol considering the antivirals included in the guidelines for COVID-19 therapy.

Sallard et al. Sallard et al. (2020) investigated the impact of type 1 interferons (INT-1) on the disease's detection and treatment according to the first cytokines produced during a viral infection. The immune system generates interferon families (α, β, ε, ω, and κ) as the proteins that are alerted to people's immune system. The INFs-based drugs have antiviral effects besides activating the immune system. The studies analyzed the impact of interferon families in the disease treatment that the role of IFN-β in the treatment of multiple sclerosis is still debated.

Touret et al. (Touret & de Lamballerie, 2020) investigated the negative and positive impacts of chloroquine prescription on therapy of the disease infected people. The previous studies demonstrated the treatment effect of hydroxychloroquine and chloroquine as the antivirus drug for the therapy of malaria and autoimmune diseases such as lupus. Nowadays, the drug is widely used to treat COVID-19, whereas the harmony between the therapeutic and toxic doses is essential. Chloroquine and hydroxychloroquine have to use based on the subject to strict rules because the margin between the therapeutic and toxic dose is narrow and can lead to cardiovascular disorders.

Voisin et al. Voisin et al. (2020) examined the impact of prescribing hydroxychloroquine (HCQ) and azithromycin (AZ) on patients with COVID-19. The case study analyzed the efficiency of prescribing HCQ + AZ on COVID-19 infected people with fifty-five median age and background diseases, including hypertension and diabetes, according to the drug's negative impact of increasing QT congenital disorder that can lead the increasing risk of an irregular heartbeat. One of HCQ and AZ's side effects is a growing QT that can be dangerous for people with latent congenital QT. Since this work proposed cardiac monitoring regularly performed, and hospital settings allow them to do it safely, patients are treated with HCQ + AZ. The result demonstrated the positive impact of prescribing HCQ + AZ drugs for patients with COVID-19 whiteout occurring heart attacks.

Li et al. Li et al. (2020) discussed the current potential therapeutic approaches and the clinical value of blood transfusion-related technologies against COVID-19. As shown in this work, the laboratory test

illustrated reducing the number of lymphocytes in the blood of the patients with COVID-19, whereas the number of peripheral blood leukocytes remains stable and nature. The study explained that the disease's clinical and external symptoms occurred between three to seven days caused by respiratory system pneumonia and internal infections. Also, the disease can negatively affect people's digestive system and leads to its infection, according to the study's achieved result. Visibility of multiple ground-glass shadows (GGO) in the chest city determined the tissue infection of lungs caused by penetrating the virus into the respiratory system. The symptoms of severe acute respiratory syndrome coronavirus 2 almost occurred after a one-week infection.

Xu et al. Xu et al. (2020) prescribed tocilizumab as a treatment method for patients with COVID-19 and analyzed the drug's impact on the probability of infected people's recovery. The case study proved reducing the number of lymphocytes in peripheral blood (approximately 85 %) and increasing C-reactive protein before treatment with tocilizumab. As shown in the study's laboratory tests, prescribing tocilizumab reduced CRP in 84.2 % of patients. The number of lymphocytes returned to normal in 52.6 % of patients on the fifth day after treatment without any noticeable adverse reactions caused by therapy with tocilizumab. The observations and results demonstrated a patient's recovery with acute respiratory syndrome coronavirus 2, on average, 15.1 d after giving tocilizumab.

Panwar et al. Panwar, Gupta, Siddiqui, Morales-Menendez, and Singh (2020) proposed a neural network-based detection method that is employed nCOVnet for detecting the infection tissues of lungs in chest CT. The proposed idea can help to fast and accurate disease detection by analyzing visual indicators found in the chest radiography imaging of COVID-19 patients. The virus is identified in COVID-19 infected people in under 5 s by employing the proposed method that fast detection has an impressive effect in treatment and reducing the probability of death induced by getting the disease.

Fan et al. Fan et al. (2020) proposed an artificial intelligence-based method for detecting lower respiratory system infections caused by penetrating the virus into the lungs in chest CT. The study employed patent scale application and infection segmentation deep network (Inf-Net) for classifying and multi-class labeling of different types of lung infections to diagnose the disease accurately. This method improved the identification of infected regions by providing Inf-Net, which was utilized implicit reverse attention and explicit edge-attention. The proposed neural network could detect the objects with low-intensity contrast between infections and normal tissues. Inf-net quantified the infected regions, monitoring the longitudinal disease changes, and mass screening processing.

Ozturk et al. Ozturk et al. (2020) presented the application of advanced artificial intelligence-based, a novel method to accurate and automatic detecting COVID-19 in patients using chest CT. This work utilized DarkNet for raw chest X-ray image classifying in the face of binary and multi-class with high accuracy achieved to classification accuracy of approximately 98.08 % and 87.02 % for binary classes multi-class cases. The study can help fast the disease diagnosis to enhance the probability of COVID-19 infected people's recovery using initial screening and cloud computing to screen patients immediately. This work's highlight feature is automatic image processing and diagnosing the disease without expert radiologists. It is ready to be tested with a larger database according to a lack of expert radiologists in deprived areas involved in COVID-19.

Tan et al. Tan, Lian et al. (2020) utilized ultrasound for detecting between features of COVID-19 and community-acquired pneumonia (CAP) using a review method the statistical population, including the disease patients and CAP patients. The experimental results and observations demonstrated the differences between modified lung ultrasound (MLUS) score and high-resolution computed tomography (HRCT). The correlation between MLUS and HRCT had a significant effect in diagnosing COVID-19 and CAP, and also MLUS scoring system was used for evaluating the severity and treatment effect of COVID 19. The values of

MLUS and HRCT were increased in case of facing COVID-19 and CAP that the results demonstrated increasing their values for the disease compared to acquired pneumonia.

Kulkarni et al. Kulkarni, Down, and Jha (2020) focused on the efficiency of point-of-care lung ultrasound (POCUS) inaccuracy diagnosing, clinical utility, and physical practicality in the intensive care unit (ICU) for the disease infected people with acute symptoms. The case study proposed POCUS instead of chest CT to check the patient's condition and symptoms with respiratory Syndrome Coronavirus 2 because the intubated transfer is critically high risk. Also, patient moving increased the probability of getting the disease for other healthcare staff, patients, and visitors, whereas patients with COVID-19 have to move from ICU to radiology for CT scan of lungs. Other benefits of utilizing POCUS consist of test cheap, not use ionizing radiation, and the results are available instantly compared to CT, as shown in this case study.

A. Kavsak et al. Kavsak, de Wit, and Worster (2020) investigated the experimental results and laboratory tests for providing a detection method based on blood plasma concentrations. First, the case study evaluated the result of the complete blood count (CBC) test, which consists of investigating the number of leukocytosis, thrombocytopenia, and lymphocytopenia cells. CBC tests can help diagnose infectious diseases such as respiratory tract infections caused by penetrating the respiratory system's virus. The disease is diagnosed where the three CBC findings are inadequate, whereas lymphocytopenia below the reference interval or absolute count is unclear. In the acute phase of the disease, the condensation of protein is highly in COVID-19 infected people. Also, inflammatory biomarkers are widely seen in the c-reactive protein (CRP) test, demonstrating sensitive inflammation and tissue damage biomarkers. The laboratory tests illustrated reducing post-convalescent plasma transfusion and CRP levels after seven days of the infected person's recovery.

Soraya et al. (Soraya & Ulhaq, 2020) evaluated various laboratory tests and their impacts on diagnosing the infected COVID-19 that are included the number of leukocyte, neutrophil, thrombocyte, and lymphocyte in addition to CRP and procalcitonin (PCT) and D-dimer levels. This case study utilized the random-effect model (REM) instead of the fixed-effect model (FEM) adjacent to heterogeneity. The observations demonstrated a significant reducing leukocyte, neutrophil, platelet, lymphocyte, and thrombocyte counts for COVID-19 pneumonia compared to other types of pneumonia. The laboratory tests also showed that leukocyte, neutrophil, D-dimer, and CRP increased for acute COVID-19 than non-acute the disease.

Caccialanza et al. Caccialanza et al. (2020) studied people's diet situation and its impact on the probability of getting COVID-19 that the case study proposed a pragmatic protocol for early nutritional supplementation of the non-acute disease situation in infected people. Getting the disease reduced the desire to consume food for infected people and led to malnutrition that was decreased the body's immune system against COVID-19. This work provided nutrition, including high-calorie dense diets in various consistencies with highly digestible foods, oral supplementation of proteins, and prescript intravenous infusion of the multivitamin, multimineral trace elements. The observations demonstrated the positive impact of recommending suitable nutrition in facing the disease.

Sher et al. Sher, Rabkin, Maldonado, and Mohabir (2020) examined COVID-19 infected people's clinical symptoms admitted to the intensive care unit (ICU). The study demonstrated acute respiratory distress syndrome (ARDS) for hospitalized patients in ICU who have been proposed psychiatry manage hyperactive delirium, such as complicated by environmental factors. The distress syndrome was managed by providing psychiatry with the prescription of a combination of high-dose melatonin, suvorexant, guanfacine, intravenous haloperidol, and intravenous valproic acid. The case study could help patients with COVID-19 reduce and manage the delirium caused by hospitalized in ICU and the acute disease status in a long time using a systematic approach including prophylaxis, screening, diagnosis, and treatment.

Table 2
The analyzing treatment methods.

References	Main context	Case study	Advantage	Weakness	New finding
(Dong et al., 2020)	INF-α lopinavir/ritonavir ribavirin chloroquine arbidol	Therapy	-Treatment	-Uncertainty for therapy all of the patients with COVID-19	-Ten days for the patient's recovery
(Sallard et al., 2020)	type 1 interferons (INF-1)	Therapy	-Treatment -detection - antiviral effects	-Uncertainty for therapy with INF-β	-Antiviral effects of interferons
(Touret & de Lamballerie, 2020)	Hydroxychloroquine Chloroquine	Therapy	-Treatment - antiviral effects	-Uncertainty for therapy all of the patients with COVID-19 - The narrowing margin between the therapeutic and toxic	-The harmony between the therapeutic and toxic dose
(Voisin et al., 2020)	Hydroxychloroquine (HCQ) Azithromycin (AZ) HCQ + AZ	Therapy	-Treatment -Effective for patients with background diseases	-High risk for people with congenital disorder QT	-Cardiac monitoring in regularly
(Li et al., 2020)	Plasmapheresis Lymphocytes counts Leukocytes counts GGO	Therapy	-Treatment -Detection	-Uncertainty for therapy all of the patients with COVID-19 -Need to plasma	- Plasmapheresis
(Xu et al., 2020)	Tocilizumab Lymphocytes counts CRP	Therapy	-Treatment -Detection	-Uncertainty for therapy all of the patients with COVID-19 -Without obvious adverse reactions	-Therapy method without noticeable adverse reactions
(Panwar et al., 2020)	Neural networks (NNs) nCoVnet Chest CT	NNs-based detection	-Accurate detection -Rapid detection	- X-rays	-Detection under 5 seconds
(Fan et al., 2020)	Artificial intelligence (AI) Inf-Net Multi-class labelling Chest CT	AI-based detection	-Accurate detection -Rapid detection	- X-rays	-Infection segmentation deep network (Inf-Net)
(Ozturk et al., 2020)	Artificial intelligence DarkNet Binary classification Multi-class classification Chest CT	AI-based detection	-Accurate detection -Rapid detection	- X-rays	-Binary classification
(Tan, Lian et al., 2020)	Ultrasound MLUS HRCT	Ultrasound and CT-based detection	-Detection -Low cost	-Computational complexity	-Accurate detection with ultrasound
(Kulkarni et al., 2020)	Ultrasound Point-of-care ICU	Ultrasound-based detection	-Non-move the patient from ICU -Increasing health safety in hospital - Not use ionizing radiation -Low cost	-Highly efficiency in ICU	-Accurate detection with ultrasound
(Kavsak et al., 2020)	Laboratory tests CBC CRP	Laboratory tests-based detection	-Accurate detection	-Costly -Time overhead	-Transferring plasma after 7 days of the infected person's recovery
(Soraya & Ulhaq, 2020)	Laboratory tests PCT REM	Laboratory tests-based detection	-Accurate detection	-Costly -Time overhead	-Distinguish between acute and non-acute COVID-19
(Caccialanza et al., 2020)	Nutritional supplementations	Side therapy	-Side treatment -Accelerate recovery	- Nutritional supplementations	-The negative impact of malnutrition before and during the disease - A pragmatic protocol
(Sher et al., 2020)	Psychiatry ARDS ICU Melatonin Suvorexant Guanfacine Haloperidol Valproic acid	Side therapy	-Side treatment - Psychiatry in ICU	-Always not access online psychiatrist	-Detecting ARDS in ICU for patients with COVID-19

4.1.1. Analysis of the reviewed treatment methods

We classify the treatment methods-based reviews and define the studies' characteristics, including the main context, advantage, weakness, and new finding, as shown in Table 2. The main context of the upper-reviewed treatment studies mostly focused on detection methods to accurate and fast diagnosis patients with COVID-19 due to a significant effect of detecting in reducing the probability of patient's death.

Table 3 demonstrates the evaluation parameters in introducing the ability of the presented treatment-based studies. The parameters consist of cost, accuracy, treatment ability, detection ability, direct COVID-19 treatment, and time overhead. The treatment methods most focused on increasing accuracy, treatment ability, and detection ability.

4.2. Prevention methods

Wu et al. Wu et al. (2020) proposed an antibody against COVID-19 and studied its impact on patients with COVID-19 and negative COVID-19. The study utilized four point-of-care (POC) lateral flow immunoassays (LFIA) such as ALLTEST 2019-nCoV IgG/IgM Rapid Test. The results determined suitable time and time dependency between

Table 3
Comparison of the existing evaluation factors in treatment methods.

References	Cost	Accuracy	Treatment ability	Detection ability	Direct COVID-19 treatment	Time overhead
(Dong et al., 2020)	×	×	√	×	√	×
(Sallard et al., 2020)	×	×	√	×	√	×
(Touret & de Lamballerie, 2020)	×	×	√	×	√	×
(Voisin et al., 2020)	×	×	√	×	√	×
(Li et al., 2020)	×	×	√	√	√	×
(Xu et al., 2020)	×	×	√	√	√	×
(Panwar et al., 2020)	×	√	×	√	×	×
(Fan et al., 2020)	×	√	×	√	×	×
(Ozturk et al., 2020)	×	√	×	√	×	×
(Tan, Lian et al., 2020)	×	√	×	√	×	×
(Kulkarni et al., 2020)	×	√	×	√	×	×
(Kavsak et al., 2020)	√	√	×	√	×	√
(Soraya & Ulhaq, 2020)	√	√	×	√	×	√
(Caccialanza et al., 2020)	×	×	√	×	×	×
(Sher et al., 2020)	×	×	√	√	×	×

diagnosis and seroconversion using the four POC rapid tests. The seroconversion was different for getting COVID-19 with pneumonia compared to patients without pneumonia symptoms. During antibody development and detection in the blood, it was shorter for the disease infected people with lung infections than without pneumonia. The proposed method of developing antibodies demonstrated its efficiency on COVID-19 infected people with pneumonia, whereas other methods have to test for patients without pneumonia to reduce seroconversion. Considering the observations, the response time was three weeks for developing antibodies and became detectable in the blood, and also serological testing could be a detection method for diagnosing patients with COVID-19.

Korth et al. Korth et al. (2020) investigated antibody development on three categorize of healthcare workers, including high-risk-group, medium-risk-group, low-risk groups that the classification was based on their contact percent with COVID-19 infected people. The result demonstrated increasing during the time of seroprevalence for intermediate-risk-group compared to the high-risk-group, whereas the study is not a definitive result for deciding about requirement time to develop antibodies in various groups of healthcare workers. The environmental, nutrition, and local hygiene standard factors can affect the probability of getting the disease or developing antibodies. The case study proved that the antibody is not still the definitive prevention method against COVID-19, according to the impact of different parameters in determining the required time for antibody development and becoming detectable in the blood.

Jacofsky et al. Jacofsky, Jacofsky, and Jacofsky (2020) studied the impact of background information about the COVID-19 antibody on appropriately and responsibly returning to work and community activity. The case study investigated three types of antibodies founded in plasma and extracellular fluid, including secreted antibodies into the blood and mucosa, facilitate phagocytosis, and antibody activation of the complement system. The antibodies' function is different and effectively strengthens the various parts of the body's immune system. The time of seroconversion has an impressive effect in determining the body's immune system's resistance for different persons that this case is not still definitive. Nevertheless, the case study illustrated the positive impact of information about the antibodies in deciding social distancing and personal protective equipment. Also, this work can help to risk-based classifying workforce members, such as people with background diseases.

Maqbool et al. (Maqbool & Khan, 2020) proposed an evaluation method to analyze the health resources for implementing social distance and public health. The case study classified public health and social distance implementations barriers based on the decision-making trial and evaluation laboratory (DEMATEL) method. The health resources have a significant effect on implementing and managing social and health measures against COVID-19, such as medical equipment, personnel, and financial dealings. People's awareness of the disease can help to social distance and self-caring that lack of Commitment from public or public resilience would increase transmission rates. This work analyzed the impact of the barriers factors (such as lack of safety commitment from the public, poor safety culture, and lack of door to door services during the quarantine period) in implementing prevention measures in the form of statistical calculations.

Abel et al. (Abel & McQueen, 2020) found a relationship between social distance (2 m) and individual and social health care. The case study's results demonstrated strict health protocols by reducing the determined social distance. Also, countries' cultural and economic infrastructures significantly affected social distancing's rules, quarantine, and self-caring. The tolerating and accepting the rules were harder for countries' people with poor conditions, including weak economies, weak infrastructures, etc. Hence the probability of getting COVID-19 was increased in the countries with inappropriate cultural and economic infrastructures.

Huynh Huynh (2020) examined the role of cultural and demographic factors regarding social distancing rules for facing the virus outbreak using drawing the data from the reported information from Google COVID-19 community mobility. The result demonstrated that some cultural habits were recognized as the barriers of implementing social distance such as people gathering in public locations of retail and recreation, grocery and pharmacy, parks, transit stations, workplaces. The case study added the control variable as the wealth status and gross domestic product (GDP) per capita and suggested some effective communications to face the disease epidemic by emphasizing uncertainties. This work utilized two databases of the Google trackback and the extended Hofstede to collect dataset about the gathering of people in the cities' public location to alert people regarding social distancing.

Feng et al. Feng, Marchal, Sperry, and Yi (2020) investigated the effective environmental factors in the spread of COVID-19 to provide social distance according to these factors. The case study determined the safe distance margin between any two defined longer 6-foot people due to different environmental wind velocities and ambient relative humidity (RH). This work employed a validated computational fluid-particle dynamics (CFPD) model for providing the guidelines of social distancing by simulating the transient transport, condensation/evaporation, and deposition of the virus-laden droplets emitted by coughs. According to the dependency between unstable environmental factors in the COVID-19 outbreak, the safe distance margin is not still definitive for accurate determining social distancing that self-caring methods (such as people wear masks and other face coverings) have to consider for preventing and facing the disease

epidemic besides regarding social distance.

Jia et al. Jia et al. (2020) traced population migration between China's cities to investigate the impact of traveling to Wuhan from the time the virus identification using a mobile network. The case study demonstrated the negative effect of migration between cities at risk of the virus outbreak on increasing the probability of getting the disease and death caused by penetrating the virus's respiratory system and pneumonia. This work can help to provide prevention methods (Quarantine and social distance) against the virus outbreak according to the critical and normal situations of the cities that are determined due to received information from the mobile network. The study proposed an artificial intelligence-based social distancing method using the online monitoring situation of the cities.

Oosterhoff et al. Oosterhoff, Palmer, Wilson, and Shook (2020) investigated the direct relationship between social distancing and effective parameters such as age range using multiple linear regression. The case study proved unique associations between adolescents' motivations, such as engaging in a perceived amount of social distancing, anxiety symptoms, depressive symptoms, burdensomeness, and belongingness, and regarding social distancing. The result demonstrated that accepting social distance and quarantine rules is challenging for adolescents according to their anxiety, depressive, burdensomeness, and belongingness symptoms. This work proposed an approach that includes understanding adolescents' motivations to engage in social distancing to solve the challenges caused by defined constraints of social distance and quarantine.

Tuli et al. Tuli, Tuli, Tuli, and Gill (2020) proposed an improved mathematical model to analyze and predict the cities' situation to alert people and the government about the disease epidemic. The case study utilized machine learning-based methods to predict the potential threat of COVID-19 in countries worldwide and achieved a better fit to develop a prediction framework using generalized inverse Weibull distribution. The case study's observations and results are deployed on the cloud computing platform for accurate and real-time predicting the disease epidemic's growth situation. This work also presented an excellent study platform to create opportunities and setup grounds for further practical applications. The study achieved statistically better predictions than the Gaussian model using the Robust Weibull model based on iterative weighting.

Meinzen-Dick et al. (Meinzen-Dick, 2020) studied the dependency between jobs, sessions, physical proximity requirements, and rural meetings habits such as forming groups for irrigating in Nepal and India. The case study proposed employing information communication technologies (ICT) and educating villagers to utilize ICT instead of physical proximity in quarantine and social distance rules in the spread of COVID-19. Nevertheless, the observations demonstrated inequality in ICT accesses, which it is not restricted to poor and rich categorizations and consists of different between employing it in women and men. This inequality was dependent on economic and ethnic cultures that were challenging for regarding social distance's restrictions.

Schneider et al. (Schneider & Council, 2020) focused on different methods and online resources available for distance learning as an approach regarding quarantine and social distancing' rules to prevent getting infected with the disease. Distance learning positively impacted therapeutic aids for reducing going patients to the hospital and the probability of the virus transmission investigated on dermatology trainees with sharing online learning resources.

Young et al. (Young & Schneider, 2020) evaluated the impact of various technologies on reducing physical communications and social distancing such as telemedicine, social media, mobile applications (apps), chatbots, and biosensors/wearables. The case study considered the particular rules and different social distancing restrictions for risky patients such as HIV in facing COVID-19. This work prioritized providing remote services based on the disease (such as patients with HIV and patients with different cancers) and habitats (city, metropolitan, and village). The risky patients prioritize getting distance medical advice compared to normal patients (such as patients with common cold) due to their higher sensitivity against COVID-19.

Garg et al. Garg, Chukwu, Nasser, Chakraborty, and Garg (2020) provided a state-of-the-art the internet of things (IoT)-based approach for tracing the contact to follow the moving infection cases, including vehicles, moving things, animals, and patients with COVID-19 or vectors without symptoms, which can lead to transfer the virus to others and epidemic the disease. This work utilized radio frequency identification (RFID)'s highlight role in determining risky locations and managing the spread of COVID-19 by alerting people via cellphone-based applications and social media. It was not restricted to identify automated digital contact tracing using mobile service-provider application and their law employing. The case study presented a new IoT and blockchain-based commotional method for monitoring moving risky cases and reported information from the different stations for managing the virus outbreak by considering personal privacy.

Hanumanthu et al. rekha Hanumanthu (2020) presented deep learning and machine learning-based approaches to diagnose and predict the situation of the COVID-19 outbreak to inform the governments and people for deciding about management and control of the virus outbreak and self-caring. The study compared the efficiency of other approaches based on statistic, mathematical, and machine learning algorithms to forecast and predict the disease epidemic. This work demonstrated that more information about people's background diseases (chronic obstructive pulmonary diseases, chronic heart failure, diabetes mellitus, and kidney failure) could help present the forecast and predict highly accurate models.

A. Mujawar et al. Mujawar et al. (2020) examined biosensor tools' efficiency in low-level detection and prediction of COVID-19 to manage the disease epidemic and decide about confronting methods. Employing the nanotechnology-based detection and prediction tools is affordable, rapid, selective, and sensitive for managing health care against the virus at now and a next-generation non-invasive disease diagnostics methodology. According to the case study result, utilizing personalized healthcare management-related analytical tools provided access to better health for everyone. Also, this study has been useful the employing applications based on the internet of medical things (IoMT), artificial intelligence (AI), and IoT for bioinformatics analysis, rapid detection, and prediction.

David et al. Davide et al. (2020) examined the impact of social distance and quarantine approaches against the disease epidemic on patients with obsessive-compulsive disorder (OCD). The result included investigating symptoms of patients with OCD before and after quarantine using the Yale-Brown Obsessive-Compulsive Scale (Y-BOCS) test that observations demonstrated increasing the severity of symptoms after quarantine. The case study proposed various methods to reduce the severity of symptoms for patients with OCD during quarantine, such as online consultations and digital psychiatric management. This work explained different effective parameters, including lack of psychiatric visits during the quarantine, the inadequacy of the living physical space, or financial concerns caused by the COVID-19 pandemic in deteriorating severity for patients with OCD.

Tan et al. Tan, Hao et al. (2020) proposed a method to investigate the positive impact of the target management and psychotherapy on people's mental and physical health in the workplace in the spread time of COVID-19. Psychological parameters reduced people's immune system resistance against the disease that are included event Scale-Revised, depression, anxiety, stress Scale- 21 (DASS-21), and insomnia severity index (ISI). The case study demonstrated no remarkable difference in the psychiatric symptoms between workers/technicians and executives/managers. This work presented the negative parameters in the severity of psychiatric symptoms, including marital status, physical symptoms, poor physical health, and viewing return to work in the workforce. Reducing psychiatric symptoms was caused by employing confidence instilled by psychoneuroimmunology (PNI) prevention measures before the resumption of work, as shown in this work's

Table 4
The analyzing prevention methods.

References	Main context	Case study	Advantage	Weakness	New finding
(Wu et al., 2020)	Antibody IgG/IgM Rapid Test POC LFIA Seroprevalence	Prevention	-Likely to prevent COVID-19 -Detection	-Uncertainty for preventing COVID-19	-Suitable time for seroconversion −3 weeks to develop antibody
(Korth et al., 2020)	Antibody Categorization Seroprevalence	Prevention	-Likely to prevent COVID-19 -Detection	-Uncertainty for preventing COVID-19	-Increasing during the time of seroprevalence for the low-risk group
(Jacofsky et al., 2020)	Antibody Plasma	Prevention	-Determining a time to begin to return to work -Detection	-Uncertainty for the issue	-Risk-based classifying workforce
(Maqbool & Khan, 2020)	Social distancing Health resource Statistical calculations	Prevention	-Managing social distancing and quarantine	- Dependency on cultural factors	-Relationship between health resource and social distancing
(Abel & McQueen, 2020)	Social distancing Cultural and economic Health-caring	Prevention	-Managing social distancing and quarantine	- Dependency on cultural and economic factors	-Relationship between social distancing, cultural and economic infrastructures
(Huynh, 2020)	Social distancing Cultural and demographic factors GDP	Prevention	- Managing the gathering of people -Facing the COVID-19 outbreak	-Dependency on cultural factors	- Relationship between managing the gathering of people and social distancing
(Feng et al., 2020)	Social distancing Environmental factors RH	Prevention	-Determining the safe distance margin	-Dependency on individual habits	- Relationship between environmental factors and safe distance margin
(Jia et al., 2020)	Social distancing Quarantine Mobile network	Prevention	-Prediction-based social distancing	-Dependency on community factors	-Intelligent social distancing
(Oosterhoff et al., 2020)	Social distancing Quarantine Multiple linear regression	Prevention	- Reducing the probability of getting the disease	-Dependency on cultural factors and age suffering	-Relationship between age suffering and social distancing
(Tuli et al., 2020)	Social distancing Weibull distribution Cloud computing	Prediction	- Reducing the probability of getting the disease - Accurate and real-time predicting	-Computational complexity	-Creating good study platform
(Meinzen-Dick, 2020)	Social distancing ICT	Prediction	- Reducing the probability of getting the disease	- Dependency on cultural factors and economic	-Relationship between cultural factors and social distancing
(Schneider & Council, 2020)	Social distancing Distance learning Online resources	Prediction	- Reducing the probability of getting the disease	-Online learning resource constraints	-Distance learning and dermatology trainees
(Young & Schneider, 2020)	Social distancing Distance advice Risky patients	Prediction	- Reducing the probability of getting the disease	-Online resource constraints	-Relationship between social distancing rules and risky patients
(Garg et al., 2020)	Social distancing RFID IoT Blockchain	Prediction	- Reducing the probability of getting the disease	-Personal privacy law	-Relationship between moving infection things and the virus outbreak
(rekha Hanumanthu, 2020)	Prediction Self-caring Deep learning Machine learning	Prediction	-Prediction -Detection -Managing the disease outbreak	-Dependency on demographic factors	-Machine learning-based prediction model
(Mujawar et al., 2020)	Prediction Artificial intelligence IoT IoMT	Prediction	-Prediction -Detection -Rapid and accurate prediction	- Power consumption	-Nanotechnology-based tools
(Davide et al., 2020)	Quarantine OCD Y-BOCS	Prevention	-Detection - Online consultations - Digital psychiatric	-Dependency on economic damages	-Relationship between quarantine and OCD
(Tan, Hao et al., 2020)	Psychotherapy DASS-21 PNI	Prevention	-Detection - Reducing the probability of getting the disease	-Dependency on individual habits	-Relationship between Psychological parameters and prevention

observations.

4.2.1. Analysis of the reviewed prevention methods

Our reviews classify three categories of treatment, prevention, and effective parameters in the spread of COVID-19 in level one of the taxonomy tree analyzed the treatment methods in Section 4.1. We categorize the prevention methods and define the studies' characteristics, including the main context, advantage, weakness, and new finding, as shown in Table 4. The main context of the examined prevention studies mostly focused on social distancing methods due to lack of providing

definition approaches for therapy and antibody against COVID-19 and its significant effect in reducing the probability of getting the disease and transmission.

Table 5 demonstrates the evaluation parameters in introducing the ability of the presented studies in the prevention category. The parameters consist of definitive prevention method, detection ability, prediction ability, time overhead, and negative impact. The reviewed prevention methods most investigated the effective parameters regarding quarantine and social distance rules and their positive and negative effects.

Table 5
Comparison of the existing evaluation factors in prevention methods.

References	Definitive prevention	Detection ability	Prediction ability	Time overhead	Negative impact
(Wu et al., 2020)	×	√	×	√	×
(Korth et al., 2020)	×	√	×	×	×
(Jacofsky et al., 2020)	×	√	×	√	×
(Maqbool & Khan, 2020)	√	×	×	×	√
(Abel & McQueen, 2020)	√	×	×	×	√
(Huynh, 2020)	√	×	×	×	√
(Feng et al., 2020)	√	×	×	×	√
(Jia et al., 2020)	√	×	√	×	√
(Oosterhoff et al., 2020)	√	×	×	×	√
(Tuli et al., 2020)	√	×	√	×	√
(Meinzen-Dick, 2020)	√	×	×	×	√
(Schneider & Council, 2020)	√	×	×	×	×
(Young & Schneider, 2020)	√	×	×	×	×
(Garg et al., 2020)	√	√	√	×	×
(rekha Hanumanthu, 2020)	√	√	√	×	×
(Mujawar et al., 2020)	√	√	√	×	√
(Davide et al., 2020)	√	√	√	×	√
(Tan, Hao et al., 2020)	√	√	√	×	×

4.3. Effective parameters in the spread of COVID-19

Contreras et al. Contreras, Villavicencio, Medina-Ortiz, Biron-Lattes, and Olivera-Nappa (2020) investigated the different effective parameters in the spread of COVID-19, such as geographical, behavioral, or economic factors, different sub-groups among a population. This work proposed a multi-group SEIRA-based general method to illustrate heterogeneous populations' impact on the virus outbreak and test it numerically. The case study opened the horizon of vision about the effective parameters in the COVID-19 outbreak that can help people better understand the disease epidemic's evolution and better public-health policies to control it. The observations and numerical results demonstrated a significant effect of individuals interact that is affected worldwide health emergency. The information about the ways of the virus transmission can help the governments provide the control and management approaches to face the disease epidemic and people's self-caring.

Chakraborty et al. Chakraborty and Maity (2020) determined the various types of restricted commutations and migrations affected by the spread of COVID-19, such as limiting large gatherings and maintaining complete or partial lockdown, etc. One possible way of the virus transmission is transferring via different types of wildlife such as civet, bat, wolf pup, pangolin, etc. That its purchase, sale, and trade are temporarily prohibited. The case study also illustrated the positive impact of the COVID-19 outbreak on improving natural environmental health caused by implementing the rules of social distancing, quarantine, and restricting trade and changing wild animals' environment.

Yang et al. Yang et al. (2020) proposed a susceptible-exposed-infectious-removed (SEIR) and artificial intelligence-based method to investigate the migration's impact on the spread of COVID-19 using collecting a dataset of population migration data before and after January 23. The case study demonstrated that removing the quarantine restrictions led to the second peak of Hubei's disease. SEIR-prediction model has estimated the probability of starting the next peak of the disease outbreak, in which governments can be utilized for applying restriction rules and quarantine before being in alert mode.

Aguilar et al. Aguilar, Faust, Westafer, and Gutierrez (2020) investigated the transmission's role of asymptomatic carriers and patients without acute clinical symptoms in the spread of COVID-19. They proposed minimizing people's in-town or out-of-town migrations approaches, including quarantine, social distance, and lockdowns to guidelines in individual and social health behaviors. The study presented a mathematical model for achieving a numerical reporting about the migration's impact of asymptomatic carriers and patients without acute clinical symptoms in the virus outbreak that was reduced the risk of their transmissions.

Huff et al. Huff and Singh (2020) presented a people's screening method based on providing periodical tests with priority placed on groups with high-frequency exposure to positive patients (such as health care workers) according to the migration's negative impact of asymptomatic carriers and patients without acute clinical symptoms. The results of periodical tests and observations demonstrated that asymptomatic cases' PCR tests were almost positive and had a highlighted role in the virus outbreak compared to patients with clinical symptoms.

Varga et al. Black, Bailey, Przewrocka, Dijkstra, and Swanton (2020) studied the probability of COVID-19 outbreak in different workplaces. Also, they estimated the percent of the virus outbreak by asymptomatic carriers or patients with various symptoms that were identified as common clinical symptoms, including fever, dry cough, and tiredness. The asymptomatic carriers and patients with different clinical symptoms contributed to the spread of the virus, which observations demonstrated their highlight role in health centers. Screening healthcare workers reduced effective health workforces and health services to patients, which remains a challenge. According to the high risk of asymptomatic carriers between healthcare workers, screening in health centers reduced the virus outbreak's probability and was required.

Guan et al. Guan, Deng, and Zhou (2020) focused on the role of cultural factors and psychological perspective in the COVID-19 outbreak. They analyzed them to understand better and manage the proposed methods to face the disease epidemic. The case study included the national culture influencing collective actions and norms, integrating insights from cultural psychology, and orientating internalized culture such as thinking style, regulatory focus, and values. The study aims to analyze the role of national culture in applying to other cultural settings. Some personal and social-cultural behaviors have an impressive effect on the spread of COVID-19. The harmful individual and social behaviors consist of prioritizing personal interests over public benefits and defying collective coping actions, such as escaping from quarantine, hoarding essential hygiene products, or concealing health information.

Velraj et al. (Velraj & Haghighat, 2020) studied various environmental parameters in the spread of COVID-19 and their role in the disease epidemic. The observations demonstrated increasing the probability of getting the virus via airborne droplet nuclei. The study proved air condition's highlight role in the virus outbreak that cold and dry weather had an impressive effect in the spread of COVID-19, according to investigate the relationship between the weather condition and increasing the rate of patients in India. According to the weather's significant effect on transferring the virus, this work presented heating, ventilation, and air conditioning (HVAC) systems approach against the COVID-19 outbreak with recommending the suitable relative humidity

Table 6

The analyzing effective parameters in the spread of COVID-19.

References	Main context	Case study	Advantage	Weakness	New finding
(Contreras et al., 2020)	Geographical factors, Behavioral factors, Economic factors Numerical test	All effective parameters in the spread of COVID-19	-Reducing the probability of COVID-19 outbreak	-Dependency on economic factors	-Relationship between epidemic and geographical, behavioral, or economic factors
(Chakraborty & Maity, 2020)	Migration Restricting large gatherings Restricting trade and wildlife migration	Environmental effective parameters in spread of COVID-19	-Reducing the probability of COVID-19 outbreak	-Dependency on communications and migrations	-Relationship between epidemic and restricting trade and wildlife migration
(Yang et al., 2020)	Migration Quarantine Social distancing Artificial intelligence	The migration and quarantine's role in the COVID-19 outbreak	-Reducing the probability of COVID-19 outbreak	-Dependency on communications and migrations	- Predicting the relationship between epidemic, migration, and removing quarantine restrictions
(Aguilar et al., 2020)	Migration Quarantine Social distancing Mathematical model	The migration's role of asymptomatic carriers and patients without acute symptoms	-Reducing the probability of COVID-19 outbreak	-Dependency on communications and migrations	-Relationship between epidemic and asymptomatic carriers and patients without acute symptoms migrations
(Huff & Singh, 2020)	Migration Quarantine Periodically tests	The migration's role of asymptomatic carriers and patients without acute symptoms	-Reducing the probability of COVID-19 outbreak	-Dependency on communications and migrations	-Relationship between epidemic and asymptomatic carriers and patients without acute symptoms migrations
(Black et al., 2020)	Migration Quarantine HCW tests	The migration's role of asymptomatic carriers and patients without acute symptoms	-Reducing the probability of COVID-19 outbreak	-Dependency on communications and migrations	-Relationship between epidemic and asymptomatic carriers, patients without acute symptoms migrations, and workplaces
(Guan et al., 2020)	National culture Cultural psychology Harmful individual	National culture effective parameters in spread of COVID-19	-Reducing the probability of COVID-19 outbreak	-Dependency on harmful individual	-Relationship between epidemic and national culture
(Velraj & Haghighat, 2020)	Weather condition Environmental parameters HVAC	Weather conditions' impact on COVID-19 outbreak	-Reducing the probability of COVID-19 outbreak	-Dependency on weather condition	-Relationship between epidemic and weather condition
(Rahman et al., 2020)	Economic damages Management Machine learning algorithm	Facing economic damages caused by quarantine	-Reducing the economic damages and management it	-Dependency on power economic	-Improving lockdown coverage with dynamic clustering

Table 7

Comparison of the existing evaluation factors in effective parameters in the spread of COVID-19.

References	Cultural factors	Environmental factors	Individual factors	Prevention ability	Management ability
(Contreras et al., 2020)	√	√	√	√	√
(Chakraborty & Maity, 2020)	×	√	×	√	√
(Yang et al., 2020)	√	×	√	√	√
(Aguilar et al., 2020)	√	×	√	√	√
(Huff & Singh, 2020)	√	√	√	√	√
(Black et al., 2020)	×	√	√	√	√
(Guan et al., 2020)	√	×	√	√	√
(Velraj & Haghighat, 2020)	×	√	×	√	√
(Rahman et al., 2020)	√	×	√	√	√

in the range of 50 %–60 %.

Rahman et al. Rahman et al. (2020) focused on providing a solution for facing and managing economic damages caused by quarantine against the virus outbreak. Its highlight role in reducing the disease epidemic's probability compared to provide definitive antibody or treatment method. This work proposed a data-driven dynamic clustering framework for investigating damages and the quarantine's problems to manage the issue using analyzing uncooperative civilians' role in improving the rate of getting infected COVID-19. The case study identified lockdowns and reduce its coverage using dynamic clustering, which its impact was investigated in Malaysia. The observation and experimental results demonstrated improving approximately 50 % for lockdown coverage that was estimated based on employing the machine learning algorithm

4.3.1. Analysis of effective parameters in the spread of COVID-19

Our reviews classify three categories of treatment, prevention, and effective parameters in the spread of COVID-19 in level one of the taxonomy tree that are examined the treatment and prevention methods in Section 4.1 and 4.2, respectively.

We classify the effective parameters in the spread of COVID-19 to two categories of environmental and cultural factors and define the studies' characteristics, including the main context, advantage, weakness, and new finding, as shown in Table 6.

Table 7 illustrates the evaluation parameters in introducing the presented studies' ability in the disease epidemic category's effective parameters. The parameters consist of cultural factors, environmental factors, individual factors, prevention ability, and management ability. The reviewed effective parameters in the spread of the disease considered all the effective parameters that are led to the virus outbreak or reducing the epidemic probability.

We compare the existing literature's based on treatment, prevention, and detection abilities in Table 8, which is demonstrated the common abilities in the reviewed studies.

Table 8
Comparison of the existing literature's based on treatment, prevention, and detection.

References	Prevention ability	Treatment ability	Detection ability	Direct COVID-19 treatment
(Dong et al., 2020)	×	√	×	√
(Sallard et al., 2020)	×	√	×	√
(Touret & de Lamballerie, 2020)	×	√	×	√
(Voisin et al., 2020)	×	√	×	√
(Li et al., 2020)	×	√	√	√
(Xu et al., 2020)	×	√	√	√
(Panwar et al., 2020)	×	×	√	×
(Fan et al., 2020)	×	×	√	×
(Ozturk et al., 2020)	×	×	√	×
(Tan, Lian et al., 2020)	×	×	√	×
(Kulkarni et al., 2020)	×	×	√	×
(Kavsak et al., 2020)	×	×	√	×
(Soraya & Ulhaq, 2020)	×	×	√	×
(Caccialanza et al., 2020)	×	√	×	×
(Sher et al., 2020)	×	√	√	×
(Wu et al., 2020)	×	×	√	×
(Korth et al., 2020)	×	×	√	×
(Jacofsky et al., 2020)	×	×	√	×
(Maqbool & Khan, 2020)	√	×	×	×
(Abel & McQueen, 2020)	√	×	×	×
(Huynh, 2020)	√	×	×	×
(Feng et al., 2020)	√	×	×	×
(Jia et al., 2020)	√	×	×	×
(Oosterhoff et al., 2020)	√	×	×	×
(Tuli et al., 2020)	√	×	×	×
(Meinzen-Dick, 2020)	√	×	×	×
(Schneider & Council, 2020)	√	×	×	×
(Young & Schneider, 2020)	√	×	×	×
(Garg et al., 2020)	√	×	√	×
(rekha Hanumanthu, 2020)	√	×	√	×
(Mujawar et al., 2020)	√	×	√	×
(Davide et al., 2020)	√	×	√	×
(Tan, Hao et al., 2020)	√	×	√	×
(Contreras et al., 2020)	√	×	×	×
(Chakraborty & Maity, 2020)	√	×	×	×
(Yang et al., 2020)	√	×	×	×
(Aguilar et al., 2020)	√	×	×	×
(Huff and Singh, 2020)	√	×	×	×
(Black et al., 2020)	√	×	×	×
(Guan et al., 2020)	√	×	×	×
(Velraj & Haghighat, 2020)	√	×	×	×
(Rahman et al., 2020)	√	×	×	×

5. Discussion and comparison

In the previous sections, we explained the research method and reviewed the various case studies about COVID-19 outbreak problems. This section discusses the issue and compares the categorized methods according to the proposed taxonomy tree using responding to the analytical questions presented in Section 3. Some of our responses are including:

- AQ1: Is the COVID-19 outbreak a problem in all the world, and why?

The disease epidemic is a problem worldwide due to the virus's specific feature and the lack of definitive treatments or antibodies to face the COVID-19 outbreak.

Its lifespan and transmission ways lead to an epidemic worldwide and remain the challenge of confronting the virus outbreak. Fig. 4(a)–(b) show the disease's epidemic in the world that only white locations of the world map are clear points. The statistic of COVID-19 new cases proves the disease epidemic in most country in the world, as shown in Fig. 4(b). COVID-19's daily statistics and reported information of WHO demonstrate that the virus outbreak continues in all the world according to lack of a definitive therapy or antibody and the virus's specific features, including mutability, sustainability, and compatibility with the environment (Anonymous, 2020b, 2020c). The researchers confirmed the second generation of the virus with different clinical symptoms and identified it as an intelligence-based virus, which WHO announced this. Also, starting the next disease peaks in various cities and countries proves COVID-19 persistence until antibody delivery.

- AQ2: Are environmental and cultural factors effective in facing or spreading COVID-19?

As shown in Fig. 5, the cultural factors significantly affect increasing or reducing the probability of getting the disease according to the published papers focused on the issue in approximately 42 %, demonstrating the importance of these factors in the COVID-19 outbreak.

- AQ3: Which research domain can be more effective in confronting the COVID-19 outbreak?

The classified prevention methods consist of facing, predicting, and deploying antibodies that Fig. 6 shows the maximum attention of approximately 61 % for recommending social distancing compared to antibody and prediction approaches. We estimate the efficiency percent of confronting methods due to the number of published papers in 2020.

According to the result, recommending social distancing and observing its rules have an impressive effect in reducing the probability of the disease infected people and facing the COVID-19 outbreak.

- AQ4: What is the basis for deciding about effective approaches against the virus outbreak?

Our SLR examined the issue from different angles, considering the proposed taxonomy tree and analyzed its efficiency based on three main categories include treatment, prevention, and effective parameters in the spread of COVID-19. Their subcategories cover the evaluated parameters for determining a suitable method from three main classifications. Fig. 7 demonstrates that researchers' attention is approximately 52 %, 28 %, and 20 % for treatment, prevention, and effective parameters in the disease epidemic categories. Our observations illustrate the importance of treatment methods compared to other approaches against COVID-19. However, social distancing has a significant role in confronting the virus transmission.

Nevertheless, quarantine and social distancing approaches depend on cultural, ethnic, and individual habits, and also their implementation in society can lead to psychological injuries. Regardless of the issues,
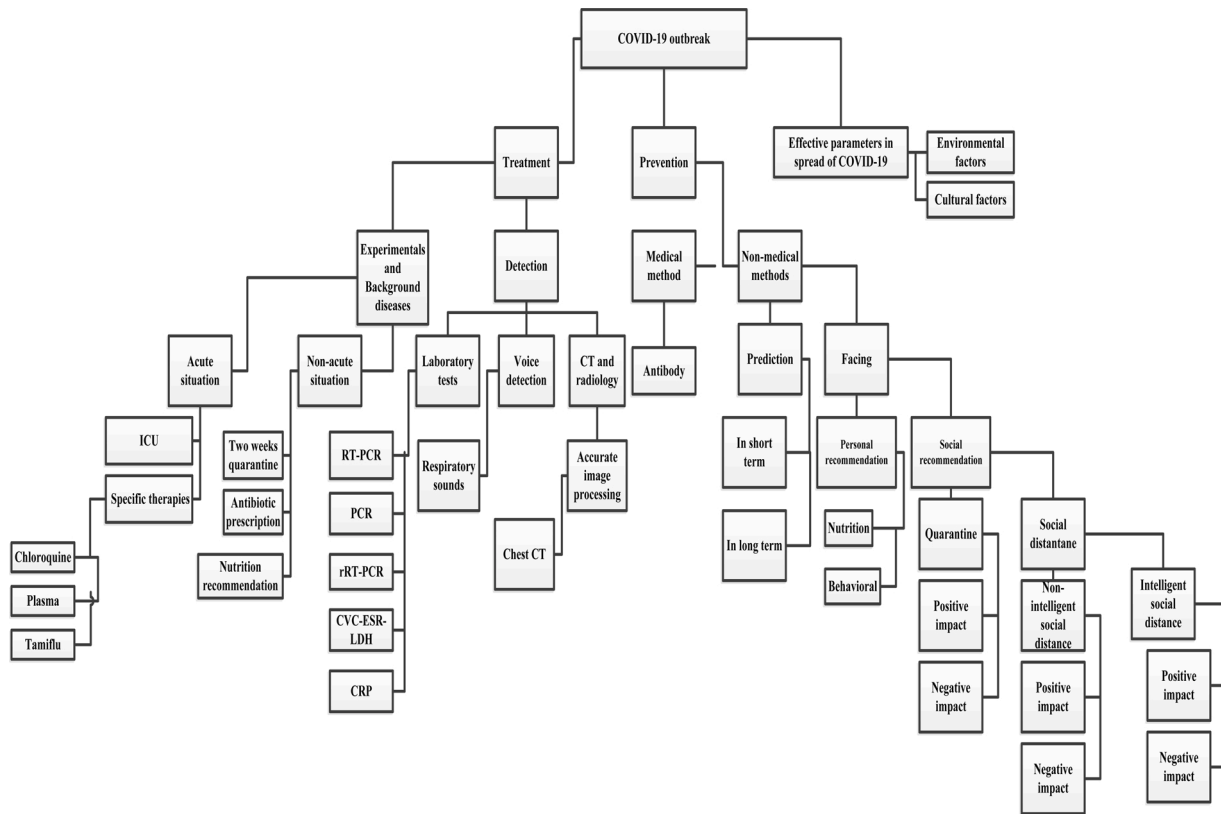
Fig. 3. A taxonomy tree for classifying the case studies.

patients with COVID-19 need a definitive therapy method to recover their health. Providing a definitive antibody assures people about health safety against the virus in the future.

We estimate the efficiency percent of confronting categorized case studies according to the number of published papers in the field of treatment, prevention, and effective parameters in the spread of COVID-19 in 2020.

- AQ5: Why the spread of COVID-19 is an open issue to continue the research path?

So far, the researchers have not proposed a definitive method for patients' therapy or providing a definitive antibody to health safety guarantee against the disease in the future. The virus's specific characteristics lead to its sustainability in the environment worldwide and daily, increasing the number of patients with COVID-19, as shown in Fig. 8.

Fig. 9 demonstrates the statistics of the number of dead people caused by getting the world's disease. The observations illustrate the fluctuations in the number of people killed with COVID-19 that depend on population, cultural, and individual factors of the newly involved countries with the disease.

As shown in Figs. 7 and 8, COVID-19 is a persistent and severe problem that can lead to people's deaths and economic crises worldwide.

- AQ6: What are the future scopes of Covid-19 treatment and prevention methods?

The virus's next-generation confirmed by WHO, and the researchers

identified with new clinical symptoms, including the patients without symptoms or with different mild symptoms. Growing up, death and new cases' daily statistics illustrate the dangerous and negative impact of the disease on humanity's mental and physical health and a big problem for governments worldwide. COVID-19 was identified as an intelligence-based virus with mutability, which leads to a challenge for providing a definitive therapy or antibody.

According to the reviewed case studies, the disease's damages and treatment injuries remain for year-ahead post-epidemic. These include economic damage, therapy's injury, physical health damages after recovery, and people's mental health problems (such as depression and traumatophobia). Therefore, this problem is an open issue and future scope to continue the research path to achieve a definitive confronting approach against COVID-19 and improve the virus's effects after clearing the world. According to the observations, analyzing the reviewed studies, and COVID-19's daily statistics, we mention the reasons for the issue as a future scope:

- Identifying and confirming the next generation of the virus without initial clinical symptoms or with different mild symptoms
- Observing the next peaks of the virus outbreak in different countries in all the world
- Providing a definitive treatment or antibody
- Challenging providing a definitive treatment or antibody caused by identifying the next generation of the virus with different characteristics
- Economic damages induced by the downturn, medical, health, and cleaning's costs in post-pandemic

We collect a dataset of the related statistics to COVID-19 include the
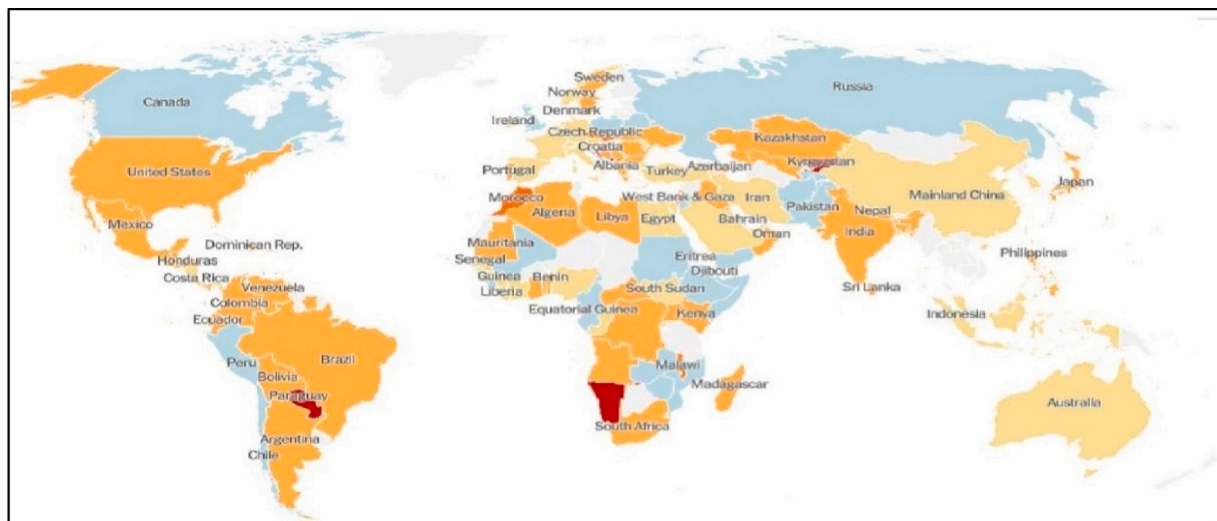
(a)
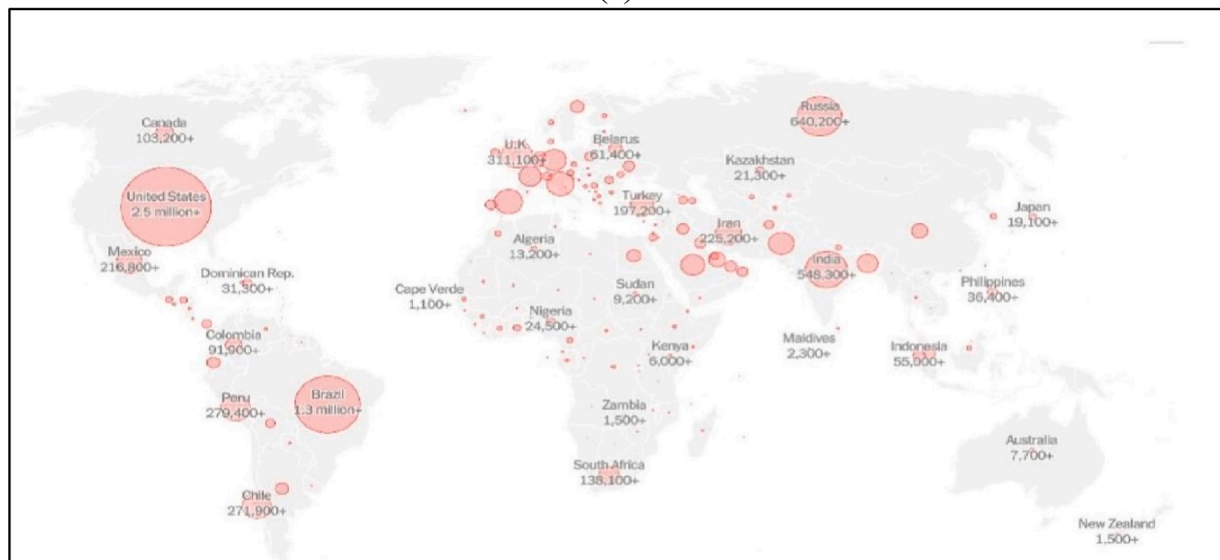
(b)

Fig. 4. COVID-19 new cases mapping in all the world (Anonymous, 2020a) (a) Displaying the severity of the disease based on color (b) The statistic of COVID-19 new cases on the world map.
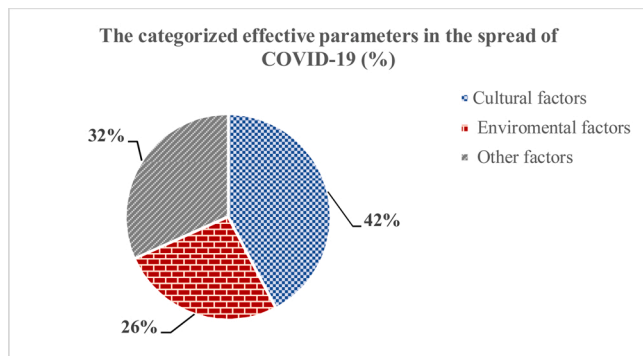

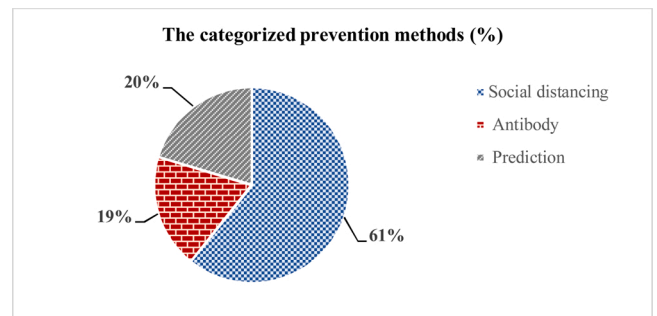**Fig. 5.** Effective parameters in the spread of COVID-19 (%).

Fig. 6. The impact of the categorized prevention methods against COVID-19 outbreak (%).
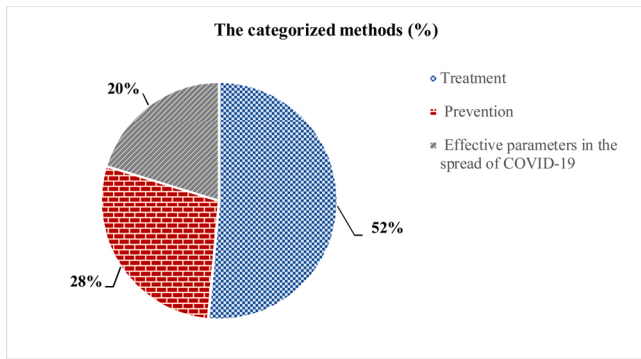
Fig. 7. The impact of the categorized methods against COVID-19 outbreak (%).

number of patients, dead people, and recovered cases using online monitoring the digital stations that are reported daily information about the disease in all the world. We shared the dataset on GitHub (Anonymous, 2020d) (https://github.com/yasamanhosseini/SLR-COVID-19).

6. Conclusion

Nowadays, COVID-19 is a big problem for humanity's health and economy according to the negative impact of the virus on people's quality of life, leading to acute respiratory diseases, death, and financial crises worldwide. The virus's special characteristics lead to its sustainability and transmission between people in a long time and increase the probability of getting the disease for now and ahead years. The researchers proposed many different methods to face COVID-19. In contrast, they have not until achieved a definitive therapy approach or antibody against the disease since the aim of case studies is almost presenting the disease confronting method for reducing the negative impact of the consequences caused by the COVID-19 epidemic and providing a survey review to manage the crisis induced by the outbreak whereas an overall review is invisible in the previous studies. We proposed the taxonomy tree for classifying the case studies to investigate the issue in various aspects. Our work consists of a systematic literature review that was examined the studies based on the taxonomy tree for covering the issue from different angles. Our observations demonstrated that researchers paid more attention to treatment and social distancing
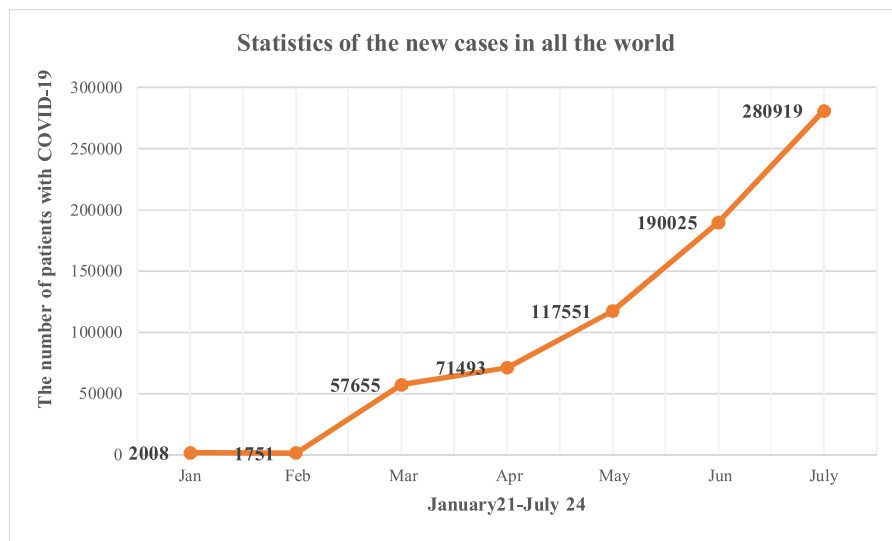

Fig. 8. The Statistics of the detected new cases of patients with COVID-19 in all the world (Anonymous, 2020a).
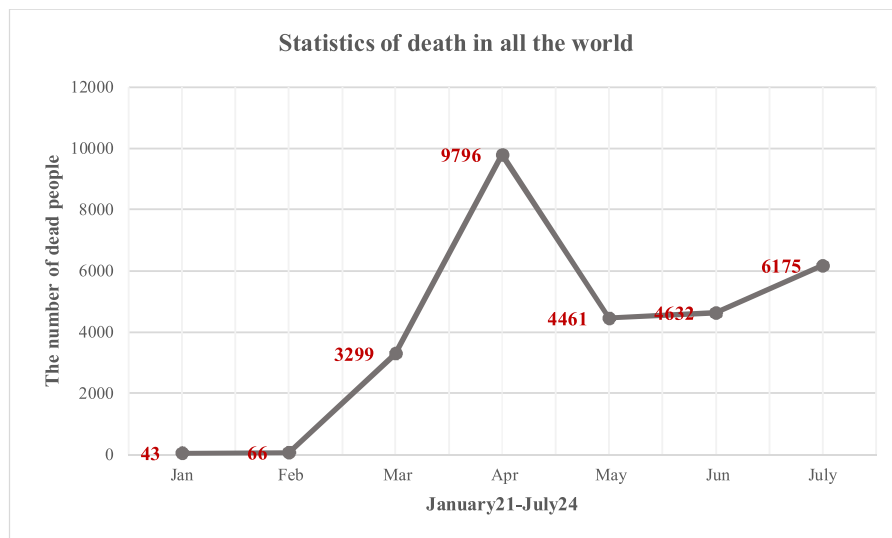

Fig. 9. The Statistics of the dead people with COVID-19 in all the world (Anonymous, 2020a).

recommendation categories according to the number of published papers in these fields in 2020. Our SLR can help people and government control and implement health advice and self-caring by informing them about the issue.

Declaration of Competing Interest

The authors report no declarations of interest.

References

Abel, T., & McQueen, D. (2020). The COVID-19 pandemic calls for spatial distancing and social closeness: Not for social distancing. *International Journal of Public Health, 65*, 231. Apr 1.

Aguilar, J. B., Faust, J. S., Westafer, L. M., & Gutierrez, J. B. (2020). *A model describing COVID-19 community transmission taking into account asymptomatic carriers and risk mitigation.* medRxiv. Jan 1.

Anonymous https://www.nytimes.com/interactive/2020/world/coronavirus-maps.html#map.

Anonymous https://www.worldometers.info/coronavirus/?utm_campaign=homeAdvegas1?.

Anonymous https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200724-covid-19-sitrep-186.pdf?sfvrsn=4da7b586_2 (Accessed on 24 July 2020).

Anonymous https://github.com/yasamanhosseini/SLR-COVID-19.

Bansal, M. (2020). Cardiovascular disease and COVID-19. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews.* Mar 25.

Bastos, M. L., Tavaziva, G., Abidi, S. K., Campbell, J. R., Haraoui, L. P., Johnston, J. C., et al. (2020). Diagnostic accuracy of serological tests for covid-19: Systematic review and meta-analysis. *BMJ, 370.* Jul 1.

Black, J. R., Bailey, C., Przewrocka, J., Dijkstra, K. K., & Swanton, C. (2020). COVID-19: The case for healthcare worker screening to prevent hospital transmission. *Lancet, 395*(10234), 1418–1420. May 2.

Caccialanza, R., Laviano, A., Lobascio, F., Montagna, E., Bruno, R., Ludovisi, S., et al. (2020). Early nutritional supplementation in non-critically ill patients hospitalized for the 2019 novel coronavirus disease (COVID-19): Rationale and feasibility of a shared pragmatic protocol. *Nutrition*, Article 110835. Apr 3.

Chakraborty, I., & Maity, P. (2020). COVID-19 outbreak: Migration, effects on society, global environment and prevention. *Science of the Total Environment*, Article 138882. Apr 22.

Contreras, S., Villavicencio, H. A., Medina-Ortiz, D., Biron-Lattes, J. P., & Olivera-Nappa, Á. (2020). A multi-group SEIRA model for the spread of COVID-19 among heterogeneous populations. *Chaos, Solitons & Fractals*, Article 109925. May 25.

Davide, P., Andrea, P., Martina, O., Andrea, E., Davide, D., & Mario, A. (2020). The impact of the COVID-19 pandemic on patients with OCD: Effects of contamination symptoms and remission state before the quarantine in a preliminary naturalistic study. *Psychiatry Research*, Article 113213. Jun 9.

Di Lorenzo, G., Di Trolio, R., Kozlakidis, Z., Busto, G., Ingenito, C., Buonerba, L., et al. (2020). COVID 19 therapies and anti-cancer drugs: A systematic review of recent literature. *Critical Reviews in Oncology/Hematology*, Article 102991. May 21.

Dong, L., Hu, S., & Gao, J. (2020). Discovering drugs to treat coronavirus disease 2019 (COVID-19). *Drug Discoveries & Therapeutics, 14*(1), 58–60. Feb 29.

Egbert, A. R., Cankurtaran, S., & Karpiak, S. (2020). Brain abnormalities in COVID-19 acute/subacute phase: A rapid systematic review. *Brain, Behavior, and Immunity.* Jul 17.

Fan, D. P., Zhou, T., Ji, G. P., Zhou, Y., Chen, G., Fu, H., et al. (2020). Inf-Net: automatic COVID-19 lung infection segmentation from CT images. *IEEE Transactions on Medical Imaging.* May 22.

Feng, Y., Marchal, T., Sperry, T., & Yi, H. (2020). Influence of wind and relative humidity on the social distancing effectiveness to prevent COVID-19 airborne transmission: A numerical study. *Journal of Aerosol Science*, Article 105585. May 18.

Garg, L., Chukwu, E., Nasser, N., Chakraborty, C., & Garg, G. (2020). Anonymity preserving IoT-based COVID-19 and other infectious disease contact tracing model. *IEEE Access, 8*, 159402–159414. Aug 31.

Graves, L. M., & Karabayeva, A. (2020). Managing virtual workers–strategies for success. *IEEE Engineering Management Review.* Apr 27.

Guan, Y., Deng, H., & Zhou, X. (2020). *Understanding the impact of the COVID-19 pandemic on career development: Insights from cultural psychology.*

Haghani, M., Bliemer, M. C., Goerlandt, F., & Li, J. (2020). The scientific literature on Coronaviruses, COVID-19 and its associated safety-related research dimensions: A scientometric analysis and scoping review. *Safety Science*, Article 104806. May 7.

Huff, H. V., & Singh, A. (2020). Asymptomatic transmission during the COVID-19 pandemic and implications for public health strategies. *Clinical Infectious Diseases.* May 28.

Huynh, T. L. (2020). Does culture matter social distancing under the COVID-19 pandemic? *Safety Science*, Article 104872. Jun 10.

Jacofsky, D., Jacofsky, E. M., & Jacofsky, E. M. (2020). Understanding antibody testing for covid-19. *The Journal of Arthroplasty.* Apr 27.

Jia, J. S., Lu, X., Yuan, Y., Xu, G., Jia, J. S., & Christakis, N. A. (2020). Population flow drives spatio-temporal distribution of COVID-19 in China. *Nature*, 1–5. Apr 29.

Katal, S., Johnston, S., Johnston, J., & Gholamrezanezhad, A. (2020). Imaging findings of SARS-CoV-2 infection in pediatrics: A systematic Review of coronavirus disease 2019 (COVID-19) in 850 patients. *Academic Radiology.* Jul 30.

Kavsak, P. A., de Wit, K., & Worster, A. (2020). Emerging key laboratory tests for patients with COVID-19. *Clinical Biochemistry.* Apr 30.

Korth, J., Wilde, B., Dolff, S., Anastasiou, O. E., Krawczyk, A., Jahn, M., et al. (2020). SARS-CoV-2-specific antibody detection in healthcare workers in Germany with direct contact to COVID-19 patients. *Journal of Clinical Virology*, Article 104437. May 13.

Kulkarni, S., Down, B., & Jha, S. (2020). Point-of-care (POC) lung ultrasound in intensive care during the COVID-19 pandemic. *Clinical Radiology.* May 13.

Kumar, P., & Morawska, L. (2019). Could fighting airborne transmission be the next line of defence against COVID-19 spread? *City and Environment Interactions, 4,* Article 100033. Dec 1.

Li, Y., Liu, S., Zhang, S., Ju, Q., Zhang, S., Yang, Y., et al. (2020). Current treatment approaches for COVID-19 and the clinical value of transfusion-related technologies. *Transfusion and Apheresis Science*, Article 102839. Jun 3.

Maqbool, A., & Khan, N. Z. (2020). Analyzing barriers for implementation of public health and social measures to prevent the transmission of COVID-19 disease using DEMATEL method. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews.* Jun 14.

Meinzen-Dick, R. (2020). Collective action and "social distancing" in COVID-19 responses. *Agriculture and Human Values*, 1–2. Jun 3.

Mujawar, M. A., Gohel, H., Bhardwaj, S. K., Srinivasan, S., Hickman, N., & Kaushik, A. (2020). Aspects of nano-enabling biosensing systems for intelligent healthcare; towards COVID-19 management. *Materials Today Chemistry*, Article 100306. Jun 5.

Ng, M. Y., Lee, E. Y., Yang, J., Yang, F., Li, X., Wang, H., et al. (2020). Imaging profile of the COVID-19 infection: Radiologic findings and literature review. *Radiology: Cardiothoracic Imaging, 2*(1), Article e200034. Feb 13.

Oosterhoff, B., Palmer, C. A., Wilson, J., & Shook, N. (2020). Adolescents' motivations to engage in social distancing during the COVID-19 pandemic: Associations with mental and social health. *Journal of Adolescent Health.* May 8.

Ortiz-Prado, E., Simbaña-Rivera, K., Gómez-Barreno, L., Rubio-Neira, M., Guaman, L. P., Kyriakidis, N. C., et al. (2020). Clinical, molecular and epidemiological characterization of the SARS-CoV2 virus and the Coronavirus disease 2019 (COVID-19), a comprehensive literature review. *Diagnostic Microbiology and Infectious Disease*, Article 115094. May 30.

Ozturk, T., Talo, M., Yildirim, E. A., Baloglu, U. B., Yildirim, O., & Acharya, U. R. (2020). Automated detection of COVID-19 cases using deep neural networks with X-ray images. *Computers in Biology and Medicine*, Article 103792. Apr 28.

Pan, S. L., Cui, M., & Qian, J. (2020). Information resource orchestration during the COVID-19 pandemic: A study of community lockdowns in China. *International Journal of Information Management*, Article 102143. May 11.

Panwar, H., Gupta, P. K., Siddiqui, M. K., Morales-Menendez, R., & Singh, V. (2020). Application of deep learning for fast detection of COVID-19 in X-rays using nCOVnet. *Chaos, Solitons & Fractals*, Article 109944. May 28.

Parveen, R., Sehar, N., Bajpai, R., & Agarwal, N. B. (2020). Association of diabetes and hypertension with disease severity in covid-19 patients: A systematic literature review and exploratory meta-analysis. *Diabetes Research and Clinical Practice, 166.* Aug 1.

Peak, C. M., Kahn, R., Grad, Y. H., Childs, L. M., Li, R., Lipsitch, M., et al. (2020). Individual quarantine versus active monitoring of contacts for the mitigation of COVID-19: A modelling study. *The Lancet Infectious Diseases.* May 20.

Rahman, M. A., Zaman, N., Asyhari, A. T., Al-Turjman, F., Bhuiyan, M. Z., & Zolkipli, M. F. (2020). Data-driven dynamic clustering framework for mitigating the adverse economic impact of Covid-19 lockdown practices. *Sustainable Cities and Society, 62*, Article 102372. Nov 1.

rekha Hanumanthu, S. (2020). Role of intelligent computing in COVID-19 prognosis: A state-of-the-art review. *Chaos, Solitons & Fractals*, Article 109947. Jun 5.

Rodriguez-Morales, A. J., Cardona-Ospina, J. A., Gutiérrez-Ocampo, E., Villamizar-Peña, R., Holguin-Rivera, Y., Escalera-Antezana, J. P., et al. (2020). Clinical, laboratory and imaging features of COVID-19: A systematic review and meta-analysis. *Travel Medicine and Infectious Disease*, Article 101623. Mar 13.

Saghazadeh, A., & Rezaei, N. (2020). Towards treatment planning of COVID-19: Rationale and hypothesis for the use of multiple immunosuppressive agents: Anti-antibodies, immunoglobulins, and corticosteroids. *International Immunopharmacology*, Article 106560. May 8.

Sallard, E., Lescure, F. X., Yazdanpanah, Y., Mentre, F., Peiffer-Smadja, N., Florence, A. D., et al. (2020). Type 1 interferons as a potential treatment against COVID-19. *Antiviral Research*, Article 104791. Apr 7.

Schneider, S. L., & Council, M. L. (2020). Distance learning in the era of COVID-19. *Archives of Dermatological Research*, 1. May 8.

Sher, Y., Rabkin, B., Maldonado, J. R., & Mohabir, P. (2020). A case report of a COVID-19–associated hyperactive intensive care unit delirium with proposed pathophysiology and treatment. *Psychosomatics.* May 19.

Soraya, G. V., & Ulhaq, Z. S. (2020). Crucial laboratory parameters in COVID-19 diagnosis and prognosis: An updated meta-analysis. *Medicina Clinica.* Jun 5.

Suri, J. S., Puvvula, A., Biswas, M., Majhail, M., Saba, L., Faa, G., et al. (2020). COVID-19 pathways for brain and heart injury in comorbidity patients: A role of medical imaging and artificial intelligence-based COVID severity classification: A review. *Computers in Biology and Medicine*, Article 103960. Aug 14.

Tan, G., Lian, X., Zhu, Z., Wang, Z., Huang, F., Zhang, Y., et al. (2020). Use of lung ultrasound to differentiate COVID-19 pneumonia from community-acquired pneumonia. *Ultrasound in Medicine & Biology.* Jun 5.

Tan, W., Hao, F., McIntyre, R. S., Jiang, L., Jiang, X., Zhang, L., et al. (2020). Is returning to work during the COVID-19 pandemic stressful? A study on immediate mental health status and psychoneuroimmunity prevention measures of Chinese workforce. *Brain, Behavior, and Immunity.* Apr 23.

Thu, T. P., Ngoc, P. N., & Hai, N. M. (2020). Effect of the social distancing measures on the spread of COVID-19 in 10 highly infected countries. *The Science of the Total Environment*, Article 140430. Jun 22.

Touret, F., & de Lamballerie, X. (2020). Of chloroquine and COVID-19. *Antiviral Research*, Article 104762. Mar 5.

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management, 14*(3), 207–222. Sep.

Tuli, S., Tuli, S., Tuli, R., & Gill, S. S. (2020). Predicting the growth and trend of COVID-19 pandemic using machine learning and cloud computing. *Internet of Things*, Article 100222. May 12.

Udugama, B., Kadhiresan, P., Kozlowski, H. N., Malekjahani, A., Osborne, M., Li, V. Y., et al. (2020). Diagnosing COVID-19: The disease and tools for detection. *ACS Nano, 14*(4), 3822–3835. Mar 30.

Velraj, R., & Haghighat, F. (2020). The contribution of dry indoor built environment on the spread of Coronavirus: Data from various Indian states. *Sustainable Cities and Society, 62*, Article 102371. Nov 1.

Voisin, O., le Lorc'h, E., Mahé, A., Azria, P., Borie, M. F., Hubert, S., et al. (2020). Acute qt interval modifications during hydroxychloroquine-azithromycin treatment in the context of covid-19 infection. In *Mayo Clinic Proceedings*. May 20.

Wu, J. L., Tseng, W. P., Lin, C. H., Lee, T. F., Chung, M. Y., Huang, C. H., et al. (2020). Four point-of-care lateral flow immunoassays for diagnosis of COVID-19 and for assessing dynamics of antibody responses to SARS-CoV-2. *Journal of Infection*. Jun 15.

Xu, X., Han, M., Li, T., Sun, W., Wang, D., Fu, B., et al. (2020). Effective treatment of severe COVID-19 patients with tocilizumab. *Proceedings of the National Academy of Sciences, 117*(20), 10970–10975. May 19.

Yang, Z., Zeng, Z., Wang, K., Wong, S. S., Liang, W., Zanin, M., et al. (2020). Modified SEIR and AI prediction of the epidemics trend of COVID-19 in China under public health interventions. *Journal of Thoracic Disease, 12*(3), 165. Mar.

Young, S. D., & Schneider, J. (2020). Clinical care, research, and telehealth services in the era of social distancing to mitigate COVID-19. *AIDS and Behavior*, 1. May 21.