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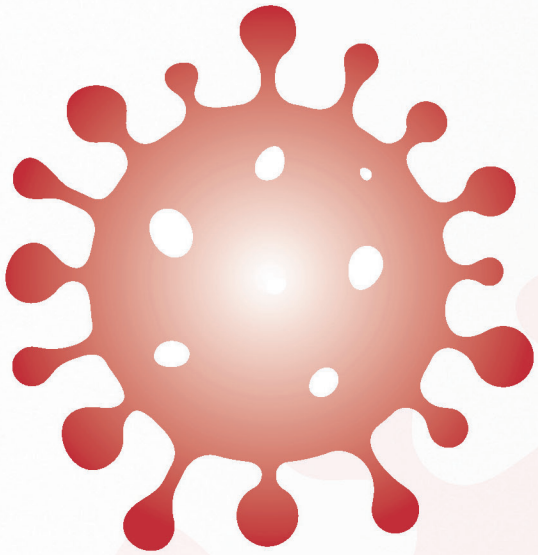

The Assessment Report on

COVID-19 GLOBAL OUTBREAK

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July 2020 - Ankara

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The Assessment Report

on

COVID-19 Global Outbreak

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July 2020, Turkey

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COVID-19 Global Outbreak

Terminology, Definitions, History and Current Situation in Turkey,
Pandemic Process Management,
Interaction Between Science Disciplines and Information Technologies,
Social and Economic Projection in Post-Pandemic,
COVID-19: Current Data Tracking Platforms,
COVID-19: Scientific Approaches.

July 2020, Ankara

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İbn-i Sina's (Avicenna / c. 980-1037) proposed solutions against person-to-person transmitted epidemics:

Do your provide hygiene with VINEGAR,

Make sure to wash your hands, dishes and clothing with vinegar.

Do not hang out together.

Do not form crowds of five or ten.

Keep away from marketplaces.

Avoid touching coin.

Do not pray by congregations in the places of worship.

Do not fear the pandemic, avoid the disease itself,

Do not leave your sick behind.

Stay home and be MERRY.

The disease flees from happiness and joy.

In his “El-Kanun Fi’t-Tıbb
(the Canon of Medicine)”
proposed remedies
for a number of diseases were identified
by Ibn Sina (c. 980-1037),
known in the East as the
“*Sage and Ruler of Physicians*”
and
“*Avicenna” in the Western world*.

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Preamble

"In today's world, where brutal competition and interest relations have top priority, every society prioritizes and promotes scientific, technological and commercial activities according to its strategy. On the other hand, we should produce alternative and exclusive solutions that offer better, more beautiful and efficient methods to humanity in scientific production. While doing this, we should build a culture of science, as in the past, that is based on fair sharing without exploiting anyone and that respects labor and people. Thanks to the opportunities provided in recent years, the scientific research infrastructure and project supports in our country offer our scientists a chance to compete with the world. Naturally, the scientific works do not produce short-term results. We must educate young scientists for the future while continuing scientific studies with patience and persistence.

In addition to artificial intelligence studies, the results of widespread communication opportunities of information technologies that eliminate the boundaries, unfortunately, have deepened the sociocultural problems of the human who opens the individual to the world but lonely in the swirl of technological developments. Besides increasing the welfare level of the countries, topics such as protection of basic human rights, equal opportunity in education, building healthy communication instead of social violence, free expression of thoughts, ensuring the safety of the individual, prevention of modern slavery, effective use of natural resources, healthy and balanced nutrition, conservation of biodiversity for the continuation of the ecological cycle in the universe, and fight against environmental pollution constitute the main agenda of the scientific world."

The above topics that we highlighted at the ceremony of 2019 TÜBA Awards, load us responsibilities in more production and human-centric works that feed from national and local values for a fully independent Turkey. Being aware of this responsibility, we have stated that we are cooperating to increase the scientific production and standards of our country.

Scientific responsibility and dignity impose us a humanitarian assignment to make efforts to produce solutions rather than just approaching these chronic problems of the age as an intellectual fantasy. The world had to wake up painfully from a sweet virtual dream with COVID-19 Pandemic. This awakening, which is the precursor of long-term interactions that societies will experience, has brought a series of measures and methods to our lives in the form of dramatic changes. Humans have met with an obligatory quarantine-based new way of life, where income and sharing imbalance between countries has lost their importance and that closes people to their homes with a limited social life. The subject of this process is a member of the virus family defined as COVID-19, which is a special creature whose origin has not yet been agreed upon, and which some people try to make sense of as Azrael and others as beloved Corona, and which shows a deadly interaction with the act of rapid transmission and spread. This pandemic and the struggle process that questions our past knowledge reinforces its strength with statistical data including the number of contaminants and deaths from different countries every day. This public health protection-based struggle process functions as a new router that questions different layers of life and changes from education to commerce, politics to philosophy, and laws to management mentality by subjecting the individual to sociological and psychological transformations in their old gains and habits.

The world of science strives to tackle the problems in a range of fields from biomedical to virology, infectious diseases to mental health, pedagogy to sociology, production to consumption habits, common value judgments to historical management habits, through inter-disciplinary and multidisciplinary methods. We witness the spread of a delayed effort to overcome this process by meeting with human values, being in solidarity and remembering and reminding the other creatures that we share the world with.

The cost of not taking the concerns of scientists and their warnings about society and administrations seriously has been heavy results. It has been seen through experience that the last regret is vain and brings heavy and misery consequences as a result of negligence. Thus, considering these experiences as solution-oriented, it may not be meaningful for today, but it contains important lessons and hopes for future generations.

TÜBA Assesment Report on COVID-19 Global Outbreak that prepared in the light of available data under the guidance of the above issues consists of scientific works about process management, analysis, and prediction of our country's scientists and scientific studies of other countries. Due to the ongoing feature of the COVID-19 process and the necessity to constantly update in the texts we receive from scientists; the efforts have been given place to include the most up-to-date data as much as possible in the report. TÜBA Working Groups on Cancer; Food and Nutrition and Sustainable Development, Finance and Environment also made important contributions to the preparation of the report. In this context, in the first part of the study, the history of pandemics and important definitions that should be known are mentioned. This section also includes the current situation about COVID-19 outbreak and Turkey's existing health infrastructure. In the second part, which contains the epidemic process management about COVID-19, the interaction in other science disciplines is given in detail. In the third part, a future projection of the economic and social effects of the epidemic with the similar cases in history has been put forward. In the fourth part, current data tracking platforms and useful internet resources are presented for the researchers' benefit. In the fifth part, besides COVID-19 reports of the World Science Academies, some COVID-19 research and projects conducted by TÜBA members are included. In the appendix, there are other internet resources and reports that are thought to be useful. This report is basically revised English version of the "COVID-19 Küresel Salgın Değerlendirme Raporu" which has been updated 6 times in Turkish as cited in the generic page.

Our scientists, who took part in the preparation of this report, contributed devotedly despite their intensive agenda and private affairs. I present my thanks to them. I would like to express our gratitude to all our public officials and scientists, especially our healthcare professionals, who take risks by working day and night for the welfare, safety, and health of the society.

Prof. Dr. Muzaffer ŞEKER
TÜBA President

Executive Summary

In late December 2019, a large number of patients with unknown causes of pneumonia were reported by press from a seafood market in Wuhan, Hubei province, China. This coronavirus was originally named the 2019 new coronavirus (2019-nCoV) by the World Health Organization (WHO) on January 12, 2020. The Coronavirus Working Group (CSG) of the WHO and International Committee proposed to call the new virus SARS-CoV-2 on February 11, 2020. As a result of the samples taken from the patient, the whole genome sequence of the SARS-CoV-2 was isolated on January 7, 2020, by Chinese scientists in a short time. WHO announced on February 11, 2020; that “COVID-19” will become the official name of the disease. Tedros Adhanom Ghebreyesus, director of the WHO, said the epidemic meant “ko”, “corona”, “vi” for “virus” and “d” for “disease” as first described on December 31, 2019. Such a name has been preferred to avoid stigmatizing a particular region, animal species or human.

The infection, which started to spread first in China and then in nearby countries, spread to most countries later on. The epidemic soon reached an international dimension, affecting the whole world. As a result, the WHO considered COVID-19 as an international public health problem and declared it as a pandemic on January 30, 2020. In humans, coronaviruses cause some cases of colds and respiratory infections that can be fatal, such as Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS), and Coronavirus disease 2019 (COVID-19). In recent years, new viral infections have been detected periodically in various countries. The first epidemic; was observed in 2002-2003 as a result of the crossing of a new coronavirus from bat origin to humans through palm civet cats in Guangdong Province, China. This virus, called SARS, affected a total of 8422 people in China and caused 916 deaths (11% mortality, however different rates are given in different literatures). The second epidemic event occurred approximately 10 years later. In 2012, the MERS coronavirus (MERS-CoV) emerged from bat origin through a dromedary camel in Saudi Arabia. It affected a total of 2494 people and caused 858 deaths (mortality rate of 34%). WHO has declared it as a pandemic after the outbreak and scientists are doing great efforts to identify the characterization of the new coronavirus and to develop antiviral therapies and vaccines. Clinical studies and vaccination studies are still ongoing fastly. Also, the pathogenesis of the virus is still not fully known, and new studies are needed in this regard. Currently, effective infection control intervention is the only way to prevent the spread of SARS-CoV-2. The most appropriate prophylactic regimen for patients under observation due to COVID-19 related disease is unknown. For this reason, treatment protocols should be planned by following the current guidelines.

This study consists of evaluating the opinions about the history of pandemics associated with COVID-19, related definitions and the projects being carried out with the compilation of available resources, the development stages of the pandemic and the projection of postpandemic interaction so far.

Part 1

Terminology, Definitions, History and Current Situation in Turkey

Background Information on Terminology
Microorganisms
Outbreak Identifiers
How Did First Infectious Diseases Break Out?
Significance of Zoonotic Root in Contagious Diseases
Causes of Novel Pandemic Outbreaks
Global Chaos, Past and Present of Pandemic
Role and Significance of World Health Organization (WHO) in Global Pandemics
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What is Basic Reproduction Number (R_0)
Herd Immunity
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Terminology, Definitions, History and Current Situation in Turkey

1.1. Background Information on Terminology

Rate of incidence and prevalence of infectious diseases are defined using a distinctive special terminology. With regard to public health, the World Health Organization is also tasked with definitions and taking measures against cases in light of common terminology.

Outbreak: The occurrence of cases in a certain area, in a certain community for a certain period of time in excess of normal expectancy. However, two or more cases of the epidemiologically related disease with potential threat or reoccurrence of a single case of a novel/previously eliminated or eradicated disease are also regarded as an outbreak. For certain diseases such as smallpox, poliomyelitis of wild poliovirus, even a single case is considered to be an outbreak.

Pandemic: Spread of a disease, infection or health-related issue within a number of countries or continents, or a wider area such as the whole world, thus contracting a significant portion of the population.

Epidemic: The occurrence of cases in a certain area, in a certain community for a certain period of time in excess of normal expectancy. A synonym for an outbreak.

Endemia: The repeated occurrence of an infectious agent or disease in a certain area or a certain community at a consistent rate. The occurrence of a disease at a familiar prevalence rate within a specific region or community usually indicates an endemia, as well.

Sporadic Case: Occurrence of cases irregularly, incidentally, occasionally, and generally rarely. The number of cases is low, and both time-wise and geographically distant from one another. Sporadic cases might indicate an outbreak of an endemic if conditions mature.

Infectivity: The ability of a pathogen to contract a healthy host and settle on tissues to reproduce. In measuring such a trait of the agent, the secondary attack rate is utilized.

Virulence: The ability of an infectious pathogen of causing disease with respect to its capability to invade tissues of a host and/or the severity of the disease it prompts.

Pathogenicity: Pathological reactions the pathogen is capable of causing in tissues of a host.

Pathogenesis: The ratio of individuals exhibiting disease symptoms with respect to the agent and those who contracted it.

Prevalence: The number of existing/novel cases of a disease at a certain point in time within a certain, predefined community.

Incidence: Indicates the probability of healthy individuals susceptible to contracting a certain disease within a given timeframe. The calculation is the number of new cases within a certain community in a certain period of time divided by the mid-year population or segment of society that is under risk.

Case Fatality Rate: Indicating the severity of the disease; demonstrates the rate of deaths among those contracted the disease or a certain incidence within a given time.

Mortality: The frequency of deaths within a certain society in a certain period of time.

Sensitivity: Indicates the capability of the diagnosis/measurement method in terms of detecting actual patients out of infected individuals. The proportion of individuals detected by means of new diagnostic tests as being sick to the total number of infected individuals as per the referential diagnostic tests demonstrates the sensibility, meaning sensitivity, of the new diagnostic tests.

Specificity/Selectivity: Indicates the capability of the new method of diagnosis/measurement in detecting accurately the (healthy) individuals out of intact ones. The proportion of those found to be healthy by means of new diagnostic tests to those known to be healthy as per the referential diagnostic tests demonstrates the specificity, meaning selectivity, of the new diagnostic tests.

Table-1: *Outbreak potential and impact capacity of certain diseases*

	Infectivity (Contagion Power)	Pathogenicity (Contraction speed)	Virulence (Severity and fatality)
High	Smallpox Measles Chicken pox Polio SARS, COVID-19	Smallpox Rabies Measles Chicken pox, Common cold MERS, SARS	Rabies Smallpox Tuberculosis Lepra MERS, SARS
Medium	Rubella Mumps, Common cold, Flu	Rubella Mumps Flu, COVID-19	Polio Measles, COVID-19
Low	Tuberculosis MERS	Polio Tuberculosis	Chicken pox Mumps, Flu
Very Low	Lepra Rabies	Lepra	Rubella Common cold

In contagious diseases, factors (infectivity, pathogenicity, virulence, etc.) based on infection agents determine the prevalence and severity of the disease. Adverse physical and socio-economical, environmental factors (water, waste, socioeconomic level, etc.) and malnutrition are also basic factors affecting the spread and severity of the disease.

1.2. Microorganisms

Microorganisms are the oldest species on the surface of the earth. They are common in nature. It is stated that there are 50 million bacteria cells in one gram of soil. Microorganisms are pathogens causing infectious diseases. Nonetheless, a great majority of microorganisms are not harmful to humans. There are around 1400 infectious agents capable of pathogenicity in humans. Less than 100 of those pathogens are anthropogenic, around 200 are of environmental-origin while the remaining majority are of zoological-roots. Zoonoses (diseases of animals communicable to humans and which exhibit similar clinical findings in both animals and humans) are transmitted from a wide variety of sources such as hoofs, carnivores, rodents, bats, farm animals, birds, and other vertebrates. Global warming and climate change further diversify such a variety of microorganisms.

Microorganisms are classified in various categories:

- Bacteria
- Chlamydia
- Rickettsia
- Fungi
- Protozoans (parasites)
- Viruses
- Virions, prions

Microorganisms are the cause of a number of diseases (e.g. Measles, rubella, chickenpox, Hepatitis type A-B-C, polio, flu, common cold, mumps, rabies, Ebola, Zika, Crimean-Congo Hemorrhagic Fever, etc.). While bacteria are not in need of living tissue to reproduce, viruses need living tissues for their reproduction. Viruses are the culprit of major infections and endemics. In cases of novel disease outbreaks, the implications of viruses are increasing with every passing year.

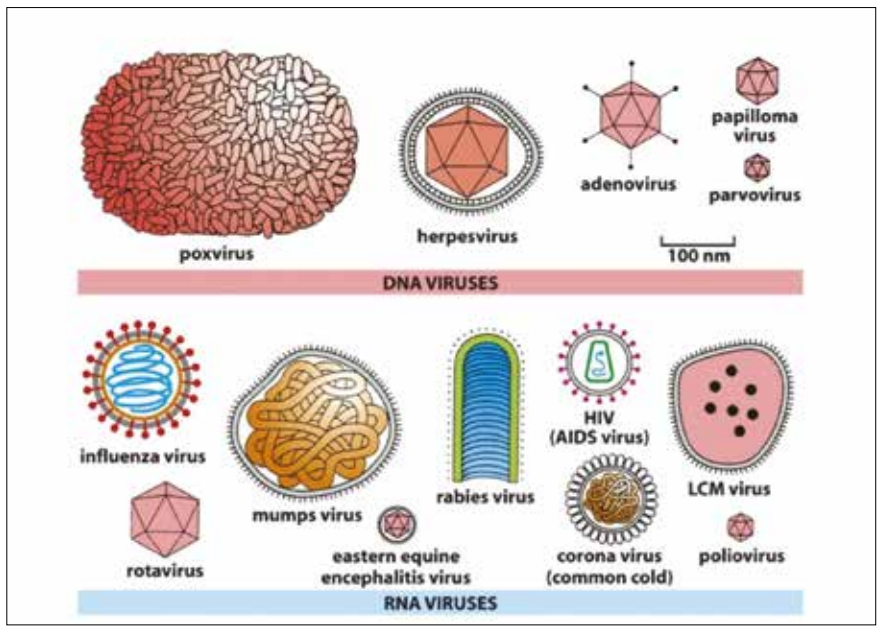


Figure-1: *RNA viruses*
Source: Molecular Biology of the Cell Fifth Edition Molecular Biology of the Cell Fifth Edition Chapter 24. https://slideplayer.com/slide/10294090/ [20.07.2020].

1.3. Outbreak Identifiers

Table-2: *Medical identifiers in an outbreak*

	Advantages	Disadvantages
High rate of infectivity (in-fection speed)		• Potential of a significant portion of society getting infected in a short time
Pathogenicity (with symptoms) at mid-level	• Symptomatic patients less • Not huge demand for treatment and care services	• Asymptomatic persons may be neglected. • Outbreak prevalence hikes
Virulence at upper-middle level	• Fatality not expected among asymptomatic, mild and middle level individuals.	• %5-6 fatality in cases requiring hospitalization • Greater fatality rate among elderly and patients with chronic diseases • Rapidly soaring need for sickbeds and IC units
Milder form in youth and children	• Lower impact on dynamic population	• Greater need arises for IC units due to greater impact on the elderly
Early detection of cases and contacts	• Early measures of isolation and quarantine • Social trust	
Abundance of diagnostic tests (including testing centers)	• Surplus of cases • Lower fatality rate • Early reach out to contacts • Early results	
Larger portion of elderly among population		• Hike in symptomatic cases • Hike in fatality&mortality rates • Increased demand for sickbeds and IC units
High number of sickbeds per person	• Standard hospital treatment and care • Reduction of panic • Increased observation of medical measures among public • Reduced fatality and mortality rates	
High number of IC units and ventilators per person	• Medical treatment for heavy cases • No need to be elective • Decline in fatality • Decline in mortality	
Sufficiency of Specialist Physicians	• Success at diagnosis, monitor and cure • Decline in fatality • Decline in mortality • Decline in healthcare related infections	

	Advantages	Disadvantages
Sufficiency of Physicians	• Success at diagnosis, monitor and cure • Specialists relieved with support • Inter-disciplinary cooperation • Decline in healthcare related infections • Decline in fatality • Decline in mortality	
Sufficiency of Nurses and Healthcare Personnel	• Decline in number of patients per healthcare personnel • Better treatment • Decline in healthcare related infections • Decline in fatality • Decline in mortality	• Kit production-supply problem • Discrepancy among centers • Hike in demand • Costs
Sufficiency of Protective Equipment	• Decline in healthcare related infections • Decline in anxiety among healthcare workers • Decline in number of cases	• Excess use and dissipation • Failure of logistics operations
Increase in hand-washing frequency and quality and in other hygienic behavior	• Decline in prevalence rate • Decline in fatality • Decline in mortality • Decline in other contagious disease frequencies	• Hike in psychological issues • Hike in water consumption
Planned and Efficient (within bearable limits) use of Healthcare Human Resources	• Decline in healthcare related infections • Decline in anxiety among healthcare workers • Decline in anxiety among families • Decline in fatality & in mortality	• Leave planning • Organizational planning • Identifying rear rank and reserve human resources and call for duty as needed
Corporate Communication and Coordination	• Hike in intervention speed • Engagement of supplementary factors • Taking outbreak under control in a shorter amount of time • Hike in confidence	

Table-3: *Administrative and Social identifiers in an outbreak*

	Avantajlar	Dezavantajlar
Strong and Effective Organization	• Well-defined authority, duty and responsibilities • Achievement of data flow • Situation awareness • A timely intervention capability • Sense of trust and ownership • Cooperation and inter-institutional coordination • Assertion of the scale of the issue at hand • Meeting the needs, supply of logistics operations	• Fatigue among critical figures and institutions • Difficulty in inter-institutional coordination • In case of absence of a crisis center-like authority being stuck in routine chaos.
Timely Activation of Social Measures	• Slowdown of Outbreak Speed • Extending Outbreak Over Time	• Emergence of panic • Economic losses, losses in produc-tion • Issue of meeting needs of those at home, hospitals or isolation areas • Issue of supporting daily wage earn-ers • Reconciliation of economic losses and disputes • Hike in number of psycho-logical is-sues • Vitamin D&C deficiency, and other nutrition disorders or obesity issues
Transparency and Scientific Approach	• Accurate interpretation and social trust	• Risk of panic for failure of ap-propriate explanations

1.4. How Did First Infectious Diseases Break Out?

Human is a species that began inhabiting the surface of the earth much later compared to microorganisms and animals, and its adaptation to the dynamic ecosystem is ongoing. With their capacity to alter the ecosystem altogether, humans occasionally interrupt this natural process. Throughout history, outbreaks stemming from a range of human infections have been taking place. A solid comprehension as to the emergence of these diseases would enable a better understanding of the impact of various factors thus facilitate taking necessary measures in the future. To this end, it is necessary to have a solid grasp of foregoing historic processes. Humankind is most advanced of all living creatures and the only one capable of achieving dominance over the environment and other species. While asserting such domination, interaction with the environment and other creatures occur, and though the interaction often works in favor of man, unfavorable consequences to the detriment of mankind may also emerge in the medium and long term. Infectious diseases are the most significant one of the adverse outcomes of the said interaction. Reviewing human history with regard to livelihood and sources of nutrition; a classic chronological classification in order of hunter-gatherer, agriculture, husbandry, civilizations periods, and contemporary modern society is adopted. Considering the issue in view of livelihood and nutritional classifications is a more useful method for assessment of the first human infections.

1.5. Significance of Zoonotic Root in Contagious Diseases

Human microorganism flora has reached its current state by developing-changing through quite a dynamic process. Whereas animals, having emerged in more ancient times than humans in terms of formation, their interaction with microorganisms that appeared long before them was as primeval, and their microorganism flora has been substantially stabilized. Meanwhile, certain microorganisms were of pathogenic properties to the detriment of animals and could lead to their death. Animal-to-animal interactions, beginning with relative species, attained microorganism adaptations over time, and as part of the process transmission of inter-animal infectious agents took place.

Following such periods of millions of years, the man also lapsed into this cycle. Adaptable infectious agents were communicated from animals, and to a lesser extent directly from the environment, to humans. The process was not an easy one. A symbiosis/common relationship, in such a manner to be mostly in favor of both species, was swift to emerge, yet such relation also harbored commensal-parasitic or pathogenic interplay at times. Still, infectious diseases did not gain wide currency until the period of animal domestication and husbandry, which is the main era of the broad and close relationship between humans and animal fauna.

More than %90 of human infectious diseases are of zoonotic origin, while the majority of those are no longer of their zoonotic character have thus become human-to-human diseases (e.g. measles, pertussis, diphtheria, influenza…).

Nearly all prime pathogens are of animal origin. However, the prevalence of these diseases took thousands of years to occur. We, human beings, jointly share 65 infection diseases with dogs, 46 with sheep and goats, 42 with swine, 35 with horses, and 26 with poultry.

Tablo-5: *Some infections from animal reservoir*

Disease	Base Reservoir/Vector	Intermediate Hosts and Res-er-voirs
Ebola	African Fruit Bats	Monkey, Swine
Marburg	African Fruit Bats	Monkey
Lassa	Rodents	
South America	Rodents	Bat, mosquito
Hanta	Rodents	Arthropods
Rift Valley	Sheep, Mosquito (Aedes and others)	
Yellow Fever	Monkey, Mosquito (Aedes, etc.)	
Dengue Fever	Mosquito (Aedes)	Monkey
CCHF (Crimean-Congo)	Tick (Hyalomma species)	Large and small mammals, ground-feeding birds
Omsk (OHF)	Gnawers/tick (Ixodes)	Small mammals

Disease	Base Reservoir/Vector	Intermediate Hosts and Res-er-voirs
Kyasanur Forest	Tick (Ixodes)	Small mammals
Alkhumra	Tick?	Sheep, goat, camel
Hendra (HeV)	Bats	Horses
Nipah	Bats	Swine
Measles	Human (previously cattle and dogs)	
Mumps	Human (previously bats and swine)	
Smallpox	Eradicated (previously cattle before human)	
Diphtheria	Human (previously cattle)	
Whoop cough	Human (previously animals and soil?)	
Tuberculosis	Human and animals (ruminants)	
Rubella	Human (previously animals)	
	İnsan (öncesinde hayvan)	
	İnsan (öncesinde hayvan)	
Typhoid	Human (previously animals)	
Syphilis	Human (previously animals)	
Tetanus	Human (previously animals)	
Flu	Human and animals (swine, avian)	
Common cold	Human (previously horse and bat)	
Lepra	Human (previously armadillo, buffalo)	
Malaria	Human (previously avian, monkey)	
Rotavirus	Human (previously birds and mammals: esp. cattle and swine)	
Plague	Human and animals (rodents)	Flea
Typhus	Human and animals (rodents)	Lice
Hepatitis B	Human	
HIV	Human (previously monkey)	
Dengue Fever	Human (previously monkey)	
Yellow Fever	Human (previously monkey)	
Cholera	Human (previously invertebrate aqu-at-ic)	
Chagas	Bat	

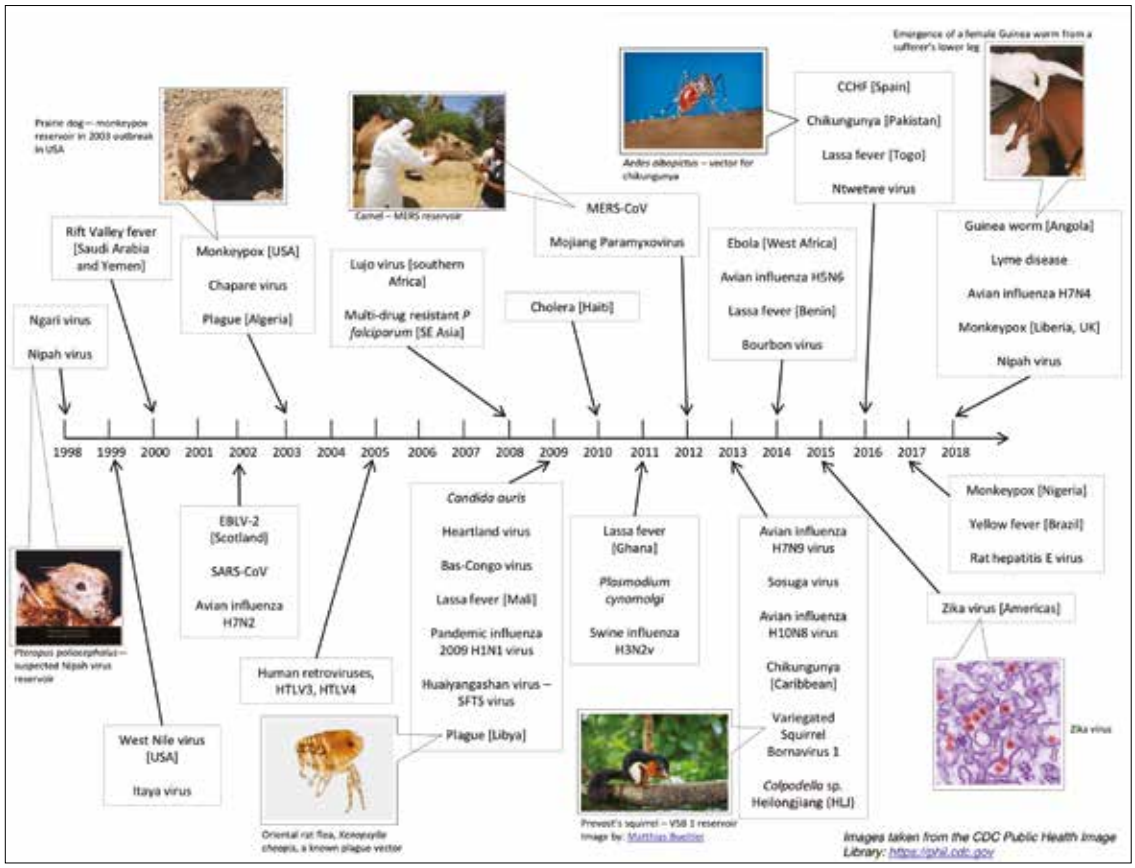


Figure - 2: *Chronological listing of novel and emergent infectious diseases from 1998 to date*
Source: GOV.UK https://app.box.com/s/3tdw3rj5tze7dbuhe8vcfyx78ngzwyx8 [20.07.2020].

87 (51 of which after 1980) novel microorganisms capable of causing infections in humans have been discovered in the last century. Of those microorganisms, the following is the distribution: 61 are Viruses; 11 Bacteria; 9 Fungus; 5 Parasites (3 are microparasites, 2 are intestinal parasites) and 1 Prion. 25 of the viruses are novel viral All hemorrhagic fever agents. These are suddenly developing feverish and hemorrhagic diseases following a course of severe complications or death. Generally, pathogens of these diseases are micro-sized, single-stranded, lipid-enveloped RNA viruses.

These are suddenly developing febrile and bleeding diseases with severe complications or deaths. The agents of these diseases are usually small, single-stranded, lipid enveloped RNA viruses.

In the case of novel outbreaks, along with the severity of viruses, host count and the multi-host property also rise. In recent years, it is also stated that infections communicable from wild animals such as bat or monkeys have escalated.

Untill the discovery of microorganisms in the industrial age, population growth, infrastructural defaults, poor sanitation, and hygiene conditions, soaring air pollution, and poor diet gave rise to infections with occupational and environmental. Exploration of microorganisms, vaccinations, the invention of antibiotics, hygiene, and sanitation measures have been countermeasures against the said poor conditions and such a category of diseases showed a tendency to rapidly decrease. As invasive medical practices and medical interventions boosted resistant microorganisms, so did healthcare-related infections began rapidly increasing. Moreover, predominantly viral outbreaks started more frequently (Figure 2).

1.6. Causes of Novel Pandemic Outbreaks

- Climate change-irregularities
  - Extreme heats and water retention
  - Rainfall regime (droughts, floods, inundations)
  - Mosquito and rodent excess
- Demographic and human behavior changes
  - Population growth
  - Rural-urban migration
  - Enlargement of cities and megacities
  - Sexual behavior changes
  - Drug addiction
  - Uprisings, migration
- Socio-economic factors:
  - Migration
  - Seasonal workers
- Ecological changes
  - Expansion or contraction of wildlife areas
  - Changes in human-animal relations
  - Hosts such as animal, avian or aquatic creatures
  - Interference with wildlife
  - Stray animals excess
  - Changes in soil qualities and land-use conventions
  - Biosystem effect
  - Dam projects and irrigated farming activities
  - Deforestation or forest surplus
  - Floods-droughts
  - Expansion of arthropod reservoirs or vector
- Lack of hygiene and sanitation
- Hospital treatment and resistance problem
  - Blood transfusion
  - Tissue-organ transplantation
  - Increased number of immunosuppressed individuals
  - Antibiotic resistance
- Global trade
  - Food and feed
  - Animals and birds
  - Inorganic carriers
- Global travel
- Wars
- Technological developments
  - Changes in food technology, drugs
  - Greater laboratory examination opportunities
  - Sensitivity toward disease warnings
  - Laboratory work, bioterrorism and biological weapon efforts
- Microbial adaptation and change

1.7. Global Chaos, Past and Present of Pandemic

Pandemic: A general term for diseases widespread and prevalent in an extended area in multiple countries or continents globally. According to the World Health Organization's (WHO) definition, in order for a disease to be regarded as pandemic three criteria are expected in general terms. These are; the occurrence of a novel virus or mutated agent, easily communicable to humans, and readily and continuously transmitted from person-to-person. Once distinctive criteria for pandemics exist, the WHO declares a Pandemic situation. Justification for the declaration is the occurrence of a disease agent posing a threat to all countries, in other words, the fact that somehow emerged novel virus is readily and rapidly transmitting from human-to-human.

The easy and rapid spread of the newly emerged virus from person-to-person is a significant criterion. The impact of a pandemic at the community level may vary depending on the infectivity and virulence of the virus, immunity level of members of society, interpersonal contact and inter-community transportation features, the existence of risk factors, state of healthcare services provided and the climate.

Considering Coronavirus spreading speed and its impacts on human health, a state of the pandemic have been declared in order to ensure the enhancement of protective measures at a general scale. By implementing protection and control measures against infection, it is accomplishable to alleviate the spread of infection within the community and thus reduce the number of individuals to be infected in early phases of the pandemic and decrease the cases to break out due to pandemic.

Protection and control measures during an outbreak may be implemented in three aspects. Measures of protection and control against the source, modes of transmission, and for benefit of healthy persons may be taken:

Measures that can be taken against the source: Detection of sources, reporting the disease, definitive diagnosis, treatment of patients, isolation, search for carriers, surveillance of suspects, health education, and large-scale destruction of animals in case of zoonoses.

Measures that can be taken against the modes of transmission: Improvement of setting conditions (disinfection), food and beverage inspection, health education, use of personal hygiene and protective equipment, improvement of housing conditions, impose restrictions on population movements.

Measures that can be taken for the benefit of healthy persons: Vaccination, seroprophylaxis, chemoprophylaxis, quarantine monitoring, and a healthy diet in face of threats that cause internationally devastating outbreaks, countries are under potential risk. Severe consequences could emerge as a result of panic stemming from the spread of pathogenic microorganisms, and from diseases and deaths they may cause as well as spread of consequent outbreaks.

On the other hand, the potential of genetic change of microorganisms might pave the way for the emergence of novel microbial agents. Such developments are particularly significant for healthcare workers since healthcare providers constitute the group of people, who would bear the heaviest burden and, in a position, to deal with issues caused by outbreaks and resulting situation. At this point, it becomes pertinent for a central management mechanism, which would steer collaboration with

stakeholders and exchange of views besides carrying on progress, to assume an active role, and lead the decision-making procedures so as to ensure smooth management and control of the situation.

Ease of transportation on such a scale, rapid globalization causes an outbreak anywhere in the world to pose a serious threat to all countries by spreading in an extremely expedited manner. In tandem with a pandemic, the intensity in the number of patients due to outbreak on top of existing chronic medical conditions adversely affects the healthcare system capable of both developing and developed countries.

1.8. Role and Significance of World Health Organization (WHO) in Global Pandemics

WHO is a specialist organization under the umbrella of the United Nations. The charter of this organization, which initial steps of the establishment were taken at the International Health Conference held in New York in 1946, was drafted and presented to member states for signing. On behalf of Turkey, Dr. İhsan Doğramacı appended the signature onto this draft undersigned by 61 countries. As stated in the Constitution, the main function of the organization is to achieve "the highest attainable standard of health for every human being" and to undertake management and coordination of international health work in order to achieve its objective. The official establishment of the organization was on 7 April 1948 and its headquarters is in Geneva. With "Law No. 5062 dated 9 June 1949" Turkey ratified the WHO Constitution and officially became a member.

There are 3 main organs, namely, the World Health Assembly (the Assembly), the Executive Board and the Secretariat. Member states participate at the annual World Health Assembly in May at the Palace of Nations at Ministers of Health level or represented by an authorized delegation. At the meetings, the Director-General and members of the Board are elected, working commissions formed, the budget approved, and decisions on the organizational policy taken. The Board assigned by the Assembly among 30 member state representatives convenes at least twice a year and makes an effort toward the realization of the decisions taken. The Secretariat, made of technical and administrative staff, operates the activities presided by the Director-General.

With its headquarters and 6 regional offices, the WHO assumes duty in case of all health-related issues around the world. The regions are America, Europe, Africa, East Mediterranean, South East Asia, and Western Pacific. Turkey is under the jurisdiction of the European Region.

In line with its constitutional bylaws, main functions of the organization are to assist governments, upon request, in strengthening health services, to collect data, to conduct epidemiological studies, to provide health services to minority and disadvantaged special groups such as refugee migrants or disaster victims, to stimulate work to control an epidemic, endemic and other diseases, to contribute to the elevation of health standards of all countries through conventions, agreements and regulations, and coordination of international cooperation with respect to health matters.
The moving budget of the WHO flows from the shares and voluntary contributions of UN member states corresponding with dues in proportion to their capacity. The WHO undertakes critical operations in terms of preventive health measures. For instance:

- To develop international standards with respect to the resolution of health-related issues among countries
- To collect, analyze and interpret common data on health
- To share practical experience on common health issues
- Joint struggle against strong sectors and commercial monopolies (tobacco control, pharmaceutical industry, etc.)

The most successful example of the WHO's efforts demonstrated itself in the eradication of smallpox. In times of outbreaks, it is particularly critical for countries to act together in line with international joint decisions. In the case of such diseases occurring at a global scale, common solutions and practices make up the most effective strategies in the struggle with outbreaks.

During the outbreak, Turkey and WHO perform a great scientific collaboration and regular policy consultancy. In addition to this collaboration, the help of Turkey includes valuable basic medical equipment support for medical staff and patients as an example of the solidarity between member countries. As a result of this performance, WHO decided to increase the volume of the relationship by a regional new office in Istanbul/Turkey (28 June). The agency's Istanbul office will serve as an operational unit of the WHO European Regional Office's "Health Emergencies and Infectious Diseases Division".

1.9. WHO Influenza Pandemic Preparedness Plan Scenario

The flow of events in a pandemic as per the "Checklist for Influenza Pandemic Preparedness Planning" published by the WHO is as follows:

- Reports on outbreak X in country X reach the Ministry of Health
- Cases identified in surrounding areas too
- A team is dispatched to the province
- Agent X found positive in specimens collected from patients
- They are characterized as agent X, never isolated from humans before
- Gene sequencing studies of agent X conducted
- The novel agent X makes headlines
- Outbreak begins to occur in neighboring countries
- Travel restrictions initiated
- Educational institutions are closed
- Supplies of antiviral drugs are limited
- A suitable vaccine is not yet available
- Panic starts
- Disease is isolated from airline passengers arriving from affected countries
- News breaks in from other continents
- Phones of health institutions ring constantly
- Vaccine, antiviral drugs cannot be obtained
- All health institutions are short-staffed due to illness
- ICUs are overwhelmed
- There are insufficient ventilators
- In about 8 weeks, the pandemic sweeps across the world
- Health and public service institutions are left desperate

1.9.1. Pandemics in History and Significant Outbreaks

- Plague (Black Death)
- HIV/AIDS
- Spanish Flu
- Asian Flu
- Cholera
- Typhus
- Smallpox

1.9.2. Outbreaks of Recent Past

- SARS 2003
- Influenza A H5N1 (bird flu) 2006
- Influenza A H1N1 (swine flu) 2009
- MERS 2012
- Influenza A H7N9 2013
- Ebola 2014
- Zika 2015

1.10. Historic Glance at Outbreaks - Specifically to Corona Viruses

Outbreaks are health events with global effects and that leads to management and life changes in world history. History witnessed these effects in their finest instances.

Outbreaks in history are considered to be grounds for several new developments in many areas from nutrition to architecture and even to the collapse of empires. For instance, though the exact figure is unknown, 75-125 million people in continental Europe, Eurasia, and North America died due to the Black Plague (Black Death) breaking out in Italy in the 1300s. With its consequences and results, this epidemic is considered to be the biggest epidemic in Europe. The epidemic, for its social, economic and political consequences, is thought to have been the primary factor in the collapse of feudalism in Europe

While unemployment prevailed before the Black Plague, in its aftermath worth of laborers increased hence their demands began to be taken into consideration. Women, on the other hand, began working in areas where they were previously not welcome. Similarly, as the land was not cultivated, they were deprived of their worth. Moreover, peasants became acquirers of their land. The absence of manpower assumed a groundbreaking state that could revolutionize mechanized agriculture. As a result of the recession of trade and voyages, explorers turned to seek new markets. In terms of medicine, developments about public health as a concept owing to the outbreaks gained impetus. The biggest implications of the outbreaks are shaped around the traumatic consequences faced by societies with no production despite having capital.

Spanish Flu of the previous century (1918-1920) infected about half a billion people and 17-50 million people died as a result of the pandemic. It is interesting to note that there is no mention of them in any of the prominent treaties of the time such as the Paris Peace Conference, although the death toll in these outbreaks was greater than the number of those who died in WWI. It was not mentioned in any of the important treaties such as the Paris Peace Conference. After all, COVID-19 is the first infectious disease outbreak in such scope and scale the world is facing since the Spanish Flu.

A group of researchers led by Dr. David Tyrrell in England in the 1965's carried out a series of studies on the common cold. Tyrrell's team focused on a virus seemingly novel in tissue culture and examined it under an electron microscope, noticed the similarity of this virus to ones isolated from chickens with bronchitis in the 1930s. With the discovery of this virus, Coronaviruses' property of transmission to humans was proven for the first time.

Figure-3: *The known Coronaviruses that affect humans*
Source: Alex Knapp, "The Secret History of the First Coronavirus," Forbes, E.T.: April 2020, https://www.forbes.com/sites/alexknapp/2020/04/11/the-secret-history-of-the-first-coronavirus-229e/#4fdbc4fe71d6 [20.07.2020].

Dr. Kenneth McIntosh of Harvard Medical School stated that “research on these viruses, known as Avian Bronchitis found in animals, is ongoing and that vaccines are also available”. In 1968, McIntosh’s team also discovered another common Coronavirus coded OC43, causing respiratory infections of today. Therefore, noting the similarity of their crown-like surface to the outer layer of the sun when viewed under an electron microscope, these viruses were called “Coronaviruses”.

On the other hand, Dr. McIntosh recalled that scientific circles did not focus on Corona-virus research until the appearance of SARS in 2003. The SARS-Coronavirus outbreak in China spread to 29 countries. Consequently, the transmission of the disease was confirmed and it went under record that it infected 8096 people and cost 774 lives. Noting that “Coronaviruses suddenly became the agenda again as SARS emerged, Coronavirus research became much more comprehensive and more technical following this outbreak” Dr. McIntosh said.

Two more Coronaviruses, namely the NL63 and HKU1, known for their cold symptoms, were discovered after the SARS outbreak. By 2012, nearly 50 years after its discovery, the entire genome of the virus coded 229E was finally sequenced. Also during these years, a series of case reports showing 229E could potentially cause severe respiratory problems in patients with weak immune symptoms were published. However, the effects of these viruses on healthy people are considered to be limited to those of the common cold only.

Although Coronaviruses have been comprehensively investigated since SARS, it is still not resolved why three Coronaviruses (namely the SARS-CoV-1, MERS-CoV and SARS-CoV-2, believed to be root cause of COVID-19 pandemic) tend to spread. It has been observed that the previously isolated Coronaviruses are impotent compared to the final three and that the latest Coronaviruses feature more severe symptoms and higher mortality rates.

Although it is widely held that the common origin of all these viruses is bats, the thesis that Coronaviruses infecting humans were transmitted through animals is valid for now. While the viruses are typically communicated from animals, they are thought to be able to find a mutual reproductive ecosystem in open-air food stalls and markets prior to moving to humans.
On the other hand, contrary phases of transmission were also observed. For example, the OC43 virus is predicted to have been transmitted to cattle from humans and have been circulating among humankind since the 18th century. It is known that while MERS-CoV is transmitted from camels to humans, other Coronaviruses including SARS-CoV-2 are communicated to humans through animals.

Finally, continuing his scientific research on the subject, Dr. McIntosh underlined that “Coronaviruses will continue to surprise researchers in many ways.” This is because, according to him, the molecular structure of coronaviruses is not fully characterized and they are able to mutate relatively easily at the genetic level.

Also stating that these viruses are able to reunite quite easily within the same cell and that such mutations can turn into both the SARS-CoV and the COVID-19, main agent of the current pandemic, Dr. McIntosh emphasized that “Coronaviruses have the largest RNA genome of any animal virus and hide many secrets”.

1.11. Millennium Viral Outbreaks: Corona Virus Family

Coronaviruses are RNA viruses that appear in humans and animals, and especially stand out with their quality of causing zoonotic diseases. In humans, they cause respiratory infections ranging from the common cold to pneumonia. The incubation period is around 3-5 days, and patients generally recover from the disease quickly. In a small number of cases, however, pneumonia and death may develop depending on whether the patients are in the risk group or not.

Nevertheless, the novel types of Coronaviruses, that began to be seen especially since the 2000s, started to manifest themselves with more severe flu-like respiratory tract infections rather than just cold. They cause symptoms such as high fever, cough, muscle pain, diarrhea, and hard breathing, especially by transmitting from animals to humans. The coronaviruses which cause infections are classified as alpha and beta coronaviruses.

Table-5: *Contagion in coronaviruses*

Beta Coronaviruses		
Contagion		
2003	2012	2019
SARS-CoV	**MERS-CoV**	**COVID-19**
• Risky animal contingence, • Close contact with the patient, • Common use of goods.	• Risky animal contingence, • Close contact with the patient, • Common use of goods.	• Risky animal contingence, • Close contact with the patient, • Common use of goods.
R_0: 3 (0,8) The power of transmission from person to person is ***Moderate***	R_0: <1 The power of transmission from person to person is ***Limited***	R_0: 2.0-2.5 The power of transmission from person to person is ***Moderate or High***

1.11.1. SARS-CoV

The Sars-Corona Virus (SARS-CoV) was first introduced as a virus seen in China. This virus, which causes severe acute respiratory failure, was seen for the first time in February 2003. This virus, which belongs to the Coronaviridae family and the genus Coronavirus, is an enveloped, linear, positively sensitive and single-stranded highly infectious RNA virus. They cause especially colds, pneumonia and various respiratory infections in humans. It has been determined by studies conducted to date that SARS-CoV can also have a serious mortality in people over 65 years of age. It is suggested that SARS-CoV, which generally causes disease in animals, is highly probable of bat origin and infect humans by chance. It is known that inter-individual transmission occurs as a result of contact with the respiratory tract, body fluids or feces. Especially the most important factors of health workers in forming the risk group; It is possible to count as patient care, living with the patient, patient secretions and direct contact of those working with body fluids. This virus, transmitted from animals to humans, causes symptoms such as high fever, cough, muscle pain, diarrhea and difficult breathing. Since this virus is capable of causing epidemic and pandemic outbreaks, preventive measures are of great importance in preventing outbreaks. While radiological findings were normal at the beginning of the disease, it was stated that there are consolidated sites due to focal interstitial infiltrates in the lung x-ray follow-up in advanced stages. This virus-induced infectious disease occurs asymptomatically in some individuals, may caused severe and fatal cases in individuals with compromised immune systems, children, the elderly, people with diabetes and people with complications such as hepatitis.

SARS-CoV must escape the host's cellular immunity in order to replicate its RNA. After viral replication occurs in host cells, cell damage is observed by viral-induced cytolysis or immunopathology.

Blood, nose / throat cultures, feces, and even urine or tissue samples are used for the microbiological diagnosis of SARS-COV. In addition, it is more important to investigate various viral proteins by replicating viruses in cell culture from these samples. Especially in routine and reference laboratories, PCR tests (RT-PCR) method with reverse transcriptases are used for diagnosis. In the PCR test, viruses specific ORF 1b or nucleoprotein gene were targeted. In addition, in diagnosis, while monoclonal antibodies or monospecific polyclonal antibodies against N protein can be demonstrated by antigen tests, polyclonal antibodies can be demonstrated by fluorescent dyes. Thus, as various serological and immunofluorescence tests are developed, the usage area is expected to become widespread. In the treatment of SARS-CoV, corticosteroids are quite effective. Ribavirin can also be used in treatment. This agent acts especially by stopping virus RNA replication. The lack of protective immunity against SARS-CoV makes it very difficult to fight this virus. After 2004, a new case report related to SARS is not available according to the sources we have. Quarantine measures are very important in preventing the disease caused by this virus. Laboratories working with this virus must comply with the standards set by WHO. All laboratories working with SARS-CoV must have a biosafety level of 3.

According to the precautionary rules set by WHO, hands should be regularly cleaned with disinfectant or alcohol-based solutions and water, surgical masks should be used, disposable

gloves should be used during contact with the patient, patients' belongings should not be used, patients should be isolated in independently ventilated rooms, medical personnel should wear protective clothing, necessary precautions should be taken during patient transportation, although the patient is completely recovered, the condition of symptoms should be monitored by following at least ten days.

According to the World Health Organization, the mortality rate from SARS was announced as 10.9% in a 9-month period between 2002-2003. The SARS outbreak that started in China and spread to 37 countries caused 8422 cases and 916 deaths in the world. It is often predicted that the SARS virus, known to be a reservoir of some animals, can return to humanity in different forms over and over again. In 2016, 319 people died from SARS in Ukraine.

SARS mortality rate according to WHO; If the age is ≤ 24, it is reported as below 1%, if it is between the ages 25- 44, it is 6%, if it is between 45 and 64, it is 15%, if it is 65 and above it is 50%. For comparison, the mortality rate from influenza is around 0.6% (especially in the elderly). However, in case of severe outbreaks of new strains, it can also reach high values such as 33%. It has also been reported that it can be transmitted by contact. The most important symptoms are; fever (above 38 ° C), myalgia, lethargy, cough, sore throat. Then shortness of breath may occur. Protection can be achieved by using alcohol-based cleaners with frequent washing of the hands. There were no case reports at the level of pandemics associated with SARS after 2004.

1.11.2. MERS-CoV

Another new Coronavirus infection is MERS-CoV (Middle East Respiratory Syndrome corona virus) infection. It started for the first time in 2012 in Saudi Arabia. Mers virus, a corona virus, appeared in Jordan in 2012, and it is an enveloped RNA virus that infects humans, bats and camels.

This different MERS-CoV epidemic, which was transmitted from camel to person and continued until June 2018, was detected in 2229 cases in 5 continents and 27 different countries. Thus, 791 of the cases were lost. While the mortality rate in SARSCoV was 10.9%, the rate in MERS-CoV reached 35%. In both SARS-CoV and MERS-CoV infections, the incubation period can be as short as 3-5 days, and this period can be extended up to 10-14 days. This means that the patient person can transmit the disease to others for up to 10-14 days before symptoms appear.

The disease is transmitted from person to person by close contact. By touching the mouth, nose, and eyes with hands that have come into contact with the virus-contaminated surface and objects; The virus is transmitted to humans by inhalation of droplets thrown into the air during sneezing, coughing and speaking. Health personnel constitute the most risky group due to the transmission route. The incubation period in MERS-CoV is 2-14 days. The most important symptoms are; fever, cough, shortness of breath, diarrhea, nausea and vomiting.

The disease may accompanied by serious complications, such as pneumonia and kidney failure. Approximately 30% of patients die and some of them recover asymptomatically. Protection can be achieved by using alcohol-based cleansers with frequent washing of hands, such as SARS.

1.11.3. SARS-CoV 2 (COVID-19)

This is an enveloped RNA virus, which is characterized by its transmission to humans as of 7 January 2020, and as the SARS-CoV and MERS-CoV are of the Coronaviruses family, which causes the severe respiratory syndrome.

On 31 December 2019, it was identified that a case reported in Wuhan city of 11 million in Hubei province in China was an infection of a novel Coronavirus never seen before. This virus, just as the SARS-CoV and MERS-CoV, is also thought to be a zoonotic infection, meaning transmission from animals to humans.

COVID-19 was first identified in humans at a seafood market in Wuhan, China in December 2019. Although scientists thought COVID-19 was communicated from bats, considering bats were not commercially available at the marketplace, it is suggested that some sort of intermediate reservoir must have acted as a carrier in the transmission of the virus to people. Today, as the disease rapidly spread from person-to-person and swarmed other Asian, European, and American continents outside China, the number of patients reached 6 million and death toll 400,000. The outbreak at the pandemic level is ongoing (as of June 2020).

According to researchers, the virus can survive for a maximum of 4-5 days on various surfaces such as aluminum, wood, paper, plastic, and glass. According to a study published in The Lancet journal in 2019, the most common symptoms of COVID-19 were identified as fever, cough, and shortness of breath. The sore throat was observed in 5% of cases and diarrhea, nausea, and vomiting in 1-2%. Pneumonia, severe acute respiratory failure, multiple organ failure, and death observed in patients with advanced courses.

It is concluded that the virus is transmitted from person-to-person with respiratory droplets generally generated with coughing. Touching your own face after contact with contaminated surfaces is also a model of contagion. Fecal-oral transmission may also be a means since virus particles are present in a patient's feces. While the incubation period is 2-4 days, disease symptoms seem to appear in 5 days.

1.12. Covid-19 Pandemic Outbreak and Global Timeline

The Covid-19 pandemic is the greatest outbreak after 100 years following the Spanish Flu of 1918-1919 (excluding a few small-scale pandemics).

Table-6: *Timeline in the World*

31 December 2019: China reports to the WHO on unusual cases of pneumonia occurring in the country. The cases were apparent in Wuhan city of an 11 million population in Hubei province.
01 January 2020: The first patients identified as workers at the Huanan Seafood Market, hence the place shutdown. The novel virus turns out not to be the SARS.
07 January 2020: The WHO announces a novel virus belonging to the Corona family is the cause of disease and the virus (nCoV) identified.
10 January 2020: First death due to nCoV reported from China.
12 January 2020: The first confirmed case has seen outside of China (Thailand and Japan). Both individuals found to have recently visited the city of Wuhan in China.
12 January 2020: The WHO dubs the virus the 2019-novel coronavirus (nCoV).
14 January 2020: The WHO announces Chinese officials unable to find evidence of the novel coronavirus transmitted person-to-person.
15 January 2020: China raises the CDC alarm to Level 1 (highest level).
16 January 2020: First confirmed case with Wuhan contact in Japan.
17 January 2020: Second death reported in Wuhan.
18 January 2020: Case reports outside of Hubei province in China
20 January 2020: The WHO publishes coronavirus reports. Accordingly, the virus transmits from person-to-person. nCoV found in healthcare workers.
23 January 2020: Effective quarantine initiated in Wuhan. The first death outside of Hubei province in China reported. The WHO announces no “international public health emergency” for lack of evidence the novel type of Coronavirus spreads to people outside of China.
27 January 2020: Coronavirus outbreak extends to France, first among European states. All three quarantined patients said to have returned from travel from China.
30 January 2020: The WHO declares Global Emergency.
31 January 2020: Cases reported from Russia, Spain, Sweden and UK
02 February 2020: First nCoV-related death outside of China reported in the Philippines
07 February 2020: The first person to announce the epidemic to the public, Li Wenliang dies of the epidemic
10 February 2020: China’s death toll increased to 908, exceeding that of the SARS outbreak in 2002-2003. The number of cases there reaches 40,171.

11 February 2020: The WHO dubs the disease COVID-19.
14 February 2020: The WHO dubs the virus SARS-CoV-2.
24 February 2020: Kuwait, Bahrain, Iraq, Afghanistan, and Oman report the first cases of coronavirus.
26 February 2020: Saudi Arabia prohibits Umrah visits. Global death toll 2,800, the number of cases exceeded 80 thousand. The virus in Norway, Romania, Georgia, Pakistan, Macedonia, and Brazil.
27 February 2020: First cases in Estonia, Denmark, Northern Ireland, and the Netherlands.
02 March 2020: Saudi Arabia, Jordan, and Tunisia to announce first coronavirus cases.
05 March 2020: The outbreak spread to 84 countries. The number of cases exceeds 95 thousand globally, death toll over 3 thousand and 30.
11 March 2020: The WHO declares the Pandemic. The first case reported from Turkey.
12 March 2020: Nationwide emergency declared in the US and halt EU flights.
17 March 2020: First death in Turkey, laboratory confirms. The EU locks borders to non-members.
18 March 2020: Europe with 3 thousand 421 death beats Asia, pandemic origin. EU Commission Head Ursula von der Leyen to confess EU too late in the struggle.
19 March 2020: The first day ever with no new cases in Wuhan city of Hubei province, China, pandemic epicenter.
23 March 2020: The WHO reports epidemic now speedier.
24 March 2020: Tokyo Olympic Games postponed for a year.
25 March 2020: Curfew in China's Hubei province lifted.
27 March 2020: China entry ban on foreigners.
03 April 2020: Swedish-based healthcare company Mölnlycke announces France to seize their millions of face masks and gloves imported for Italy and Spain from China.
06 April 2020: British PM Boris Johnson sick then in ICU.
10 April 2020: EU states agree on c. €540 bln. economic package against COVID-19 impacts.
02 May 2020: Number of labs. confirmed cases to reach 3.5 million in 212 countries, 250 thousand dead.
4 June 2020: Number of cases to reach 6,626,374, death toll 389,197, recovered patients 3,200,700 as at 19:30 worldwide.
27 July 2020: Coronavirus Cases: 16,446,932, Deaths: 652,852 (6%), Recovered: 10,068,202, Active Cases: 5,725,878, in Mild Condition: 5,659,481 (99%), Serious or Critical: 66,397 (1%), Closed Cases: 10,721,054, Discharged and Recovered; 10,068,202 (94%).

1.13. Chaos Prompted by Claims about COVID-19

Mutual accusations among countries following the pandemic and entailing developments lead to the spread of many baseless claims triggering social tension and panic. World opinion also witnessed scientists being accused of unwarranted and unauthorized publication of unethical work and information from countries or laboratories they worked for.

China has been subjected to the controversy on how long they withheld reporting and went overdue in isolating the first case, this and similar claims will probably perpetuate in the period ahead. It is claimed that COVID-19 is a virus of coronaviruses category that communicated to humans upon naturally mutating. Besides, opinions vary from COVID-19 being engineered in a laboratory yet causing an outbreak as it got out of control, or even that it was deliberately spread around the world by its creators. Some researches and articles are published claiming that the virus by which shoppers at Huanan Seafood Market in Wuhan city were infected originated from individuals who at bat soup or from a kind of snake.

Many unfounded, unproven, unscientific claims preoccupy the agenda of societies and the minds of individuals. It is also true that dissemination of social media posts claiming that suchlike scenarios were featured in a number of science-fiction and artistic works (movies, novels) in the past, or that such developments were predicted by popular culture works years ago, does nothing beyond contributing to escalating tensions and anxiety.

1.14. COVID-19 Diagnosis

In the diagnosis of the virus, various immunological tests and PCR: Polymerase Chain Reaction studies targeting specific genes are of great importance. The most ideal diagnostic method for COVID-19 is the Quantitative Real-Time Polymerase Chain Reaction (qRT-PCR) method with a nasopharyngeal swab. For this method to work, sensitive and specific results are acquired by using oligonucleotide probes marked with fluorescent dyes, which are unique detection systems. In tandem with the method, the diagnosis of the disease must assess symptoms, risk factors, and pneumonia findings and thorax CT scans altogether.

Since results take 4-6 hours (with latest kits dropped to 2-4 hours) and there is a need for experienced staff for PCR tests, though their sensitivity high, antibody tests (immunoassay) that generate fast results have been produced. Tests that can detect within 15 minutes the IgM and IgG antibodies spawned against the SARS-CoV-2 have been developed. However, there is a %13 chance of false-negative in detecting positive cases.

A rapid diagnostic kit for the detection of coronavirus has been developed in Turkey, as well. This kit is being routinely used in the National Virology Laboratory. Other diagnostic kits have also been developed as part of the process.

1.15. Outbreak Risk in a Changing Political and Economic Setting

As infectious diseases occasionally occur globally, risks related to the spread of the epidemic and infectious diseases remain on the agenda of world opinion. Last year, an Ebola epidemic centered in the Democratic Republic of Congo was one that received most media coverage due to its severity in areas it impacted besides its scope, the fact that it showed resistance to medical interventions, and the challenges faced in the combat with the epidemic.

Although it does not stand out as much as the Ebola, the reappearance of diseases such as the Middle East Respiratory Syndrome coronavirus (MERS-CoV) and Measles urges caution towards such diseases soon.

One of the major risks stemming from epidemics and infectious diseases is macro-depression; an economic recession, which results from loss of productivity caused by diseases and slowdown in trade or stalls in company activities in affected areas, comes into the picture. Although the WHO is generally very cautious about proposing regional closure practices such as closing borders and quarantines, countries are often reluctant to act on these proposals, instead of a unity of action, when such decisions are relayed to countries by the WHO. Especially, even in case of no global health emergency, supply chain-related issues occasionally become considerably evident in the health sector.

Over the past two years, medicine and device shortages probably affected markets of various sizes from Qatar to Egypt, from France to the USA and possibly the post-Brexit England. Unless various high-value trade regulations are reviewed, there may be more disruption in supply chains of medicine and devices.

Highest global pandemic risks of today possibly:

- Drug-resistant malaria,
- H5N6 flu, H10N8 flu,
- H5N1 flu, H7N9 flu,
- MDR/XDR tuberculosis,
- 2009 H1H1 flu,
- Antimicrobial-resistant threats, CRE, MRSA, C. Difficile, N. Gonorrhoeae,
- Ebola virus, and
- Adenovirus outbreaks.

Generally speaking, it is observed that some countries are not prepared for a serious health-related emergency at a global level. On the other hand, in such cases, companies can be expected to take part in the responsibility of protecting their personnel. Failure to do so may result in negative consequences. Likewise, failure to develop or offer treatments to address a health-related emergency poses a risk as far as healthcare companies are concerned.

Outbreak risk elevates mainly due to political and social factors, including the increasing rise of nationalist policies. Support and resources extended to international organizations providing outbreak planning and support are diminishing. Moreover, a more nationalist orientation enhances the risk of countries taking measures favoring local interests and possibly not serving global interests. Some such measures are as follows, inertness in allocating resources overseas for intervention in global health issues, unwillingness to cooperate in cross-border research initiatives such as sample sharing, and steps taken to restrict the movement of people and goods.

On the other hand, populism and anti-order ideals both promote a skeptical approach to vaccination and contribute to an alarming reduction of vaccination rates in local areas affected by preventable disease outbreaks. The main concern is uncontrollable new diseases that could affect millions of people or claim lives in all corners of the world. Countries' obligation in the case of pandemic is; to provide education, prevention, testing, and treatment opportunities, to develop effectively for the treatment of the disease and transfer of funds and organization of resources for clinical researches aimed at generating preventive vaccines.

1.16. Current COVID-19 Situation in Turkey

Turkey is among one of the countries that took measures against COVID-19 the earliest around the world. In this regard, in Turkey, measures:

- against the source (finding the source, reporting the disease, definitive diagnosis, treatment of patients, isolation, search for carriers, surveillance of suspects, health education)
- against modes of transmission (betterment of environmental conditions, an inspection of food and beverages, health education, use of personal hygiene and protective equipment, restricting population movements)
- for benefit of healthy individuals (quarantine, monitoring) have been and continue to be taken.

The index case in Turkey was identified on 11.03.2020, following which local measures have been taken gradually nationwide to prevent and slow down the spread of the virus in the community. Measures/precautions taken after the first coronavirus case in the world and upon detection of the first case in Turkey are shown chronologically in Table-8. Although these measures limit the normal flow of life in social stratum, they have been implemented without compromising economic and social rights.

Table-8: *Measures against Pandemic in Turkey in Chronological Order*

Chronological Illustration of Milestones and Regulations
31.12.2019: Index case in China
10.01.2020: Coronavirus Scientific Committee formed
11.01.2020: First death in China
14.01.2020: First Edition of 2019-nCoV Disease Handbook prepared
22.01.2020: Wuhan-Istanbul flights suspended by a Chinese airline company
04.02.2020: Thermal camera scans on arrivals primarily from outbreak countries initiated at airports
05.02.2020: All flights inbound from China suspended
23.02.2020: Turkey-Iran land border shutdown
29.02.2020: Precautionary suspension of all in-outbound flights from/to Turkey-Italy and South Korea and Iraq
11.03.2020: Index case reported
12.03.2020: Schools on recess, Public events restrictions
13.03.2020: Comprehensive restrictions on travel and transportation
15.03.2020: Temporary closure of public venues, Final group from Umrah arrives, monitored at college dormitories
16.03.2020: Friday and daily prayers in congregations on recess, Elective surgery and dental practices postponed
17.03.2020: Number of no-flight countries to 20
19.03.2020: Football, Basketball, Handball, Volleyball Leagues postponed, Number of centers administering Covid-19 tests to 18
21.03.2020: Curfew imposed on 65+ citizens, Number of centers administering Covid-19 tests to 73 (in 44 provinces), Number of no-flight countries to 68, Restaurants permitted take-away/delivery service only
22.03.2020: Flex schedule in public sectors
24.03.2020: Public transport capacity limited by %50, Social distance rule on passengers
27.03.2020: Sales of non-essentials in marketplaces banned 3-meter distance amid market stalls
28.03.2020: Inter-city bus/flights subject to prior permission, Overseas flights halt
31.03.2020: Number of centers administering Covid-19 tests to 75
01.04.2020: Addendum to marketplace regulations, All entry-exits inspected
04.04.2020: Curfew on 20 years old or younger, Entry-exit ban on 30 metropolitan cities, Face mask compulsory at work, shops and marketplaces
05.04.2020: Government supply free face mask to citizens aged 20-65
09.04.2020: Ministry of Environment and Urbanization decrees masks and gloves collected in separate waste collector, handed over to municipal teams after 72 hours
10.04.2020: Curfew declared on 11 to 12.04.2020
15.04.2020: Curfew declared on 18 to 19.04.2020
20.04.2020: Curfew declared on 23 to 26.04.2020
28.04.2020: Curfew declared on 01 to 03.05.2020
04.05.2020: Controlled lift on curfew on 65+ (on 11 May) aged 0-14 (on 13 May) and 15-20 (on 15 May) in varied time slots
06.05.2020: Minister of Health to announce Phase 1 in global fight against outbreak concluded
19.05.2020: 4-day long curfew on 23 to 26.05.2020
01.06.2020: Transition to normalization initiated in line with pre-announced calendar

1.17. Social and Common Measures in Fight Against COVID-19 Pandemic

Swift, effective, and frequently updated decisions were applied in the fight against pandemic under the leadership of the Presidency of the Republic of Turkey (RoT). Precautionary measures eliminating potentially risky settings, where citizens could gather in crowds and the risk of contagion would rise, were taken. Legislative framework was regulated for alternative methods of flexible shifts, alternating shifts, working from home in public and private sectors.

Following the decisions of the RoT Ministry of National Education and the Council of Higher Education (YÖK) on forced recess on education, legislative arrangements have been made to enable distance education and on the transition to the flexible academic calendar in consideration of the prediction of uncertainty and prolongation of the situation. In this regard, planned sports activities, all sorts of scientific operations, and art events were either postponed by suspension or canceled altogether.

1.18. Turkey's Implementation of Strategic Action Plan on Fight Against COVID-19

Special measures and practices standing out among those Turkey are taking in its combat with COVID-19 and that relatively positive contribution to the management of the process compared to other countries may be summarized under the following headings: the fact that pandemic influenza National Preparation Plan was updated in 2019 and task descriptions of the relevant institutions and organizations were planned accordingly, and realization of timely and effective measures in line with the plan as detailed in the above chronological table. The implementation of policies generated by shared wisdom through inter-institutional coordination and in international collaboration based on scientific facts by means of the Scientific Committee of the Ministry of Health. For instance, preserving the disciplined financial structure and prioritizing the production and continuity of economic activities, transparent and effective information sharing throughout the process, support based on efficient communication with all stakeholders, including non-governmental organizations, and the follow-up of cases with advanced digital applications have enhanced confidence in the fight against the global pandemic.

In line with recommendations of the Scientific Committee, pandemic protocols were established for diagnosis and treatment purposes in order to determine the definitively diagnosed cases by considering expert opinions, capable of offering scientific advice on the outbreak. Furthermore, a high number of tests were administered in order for disrupting the spree of spread, isolation, and treatment of infected patients.

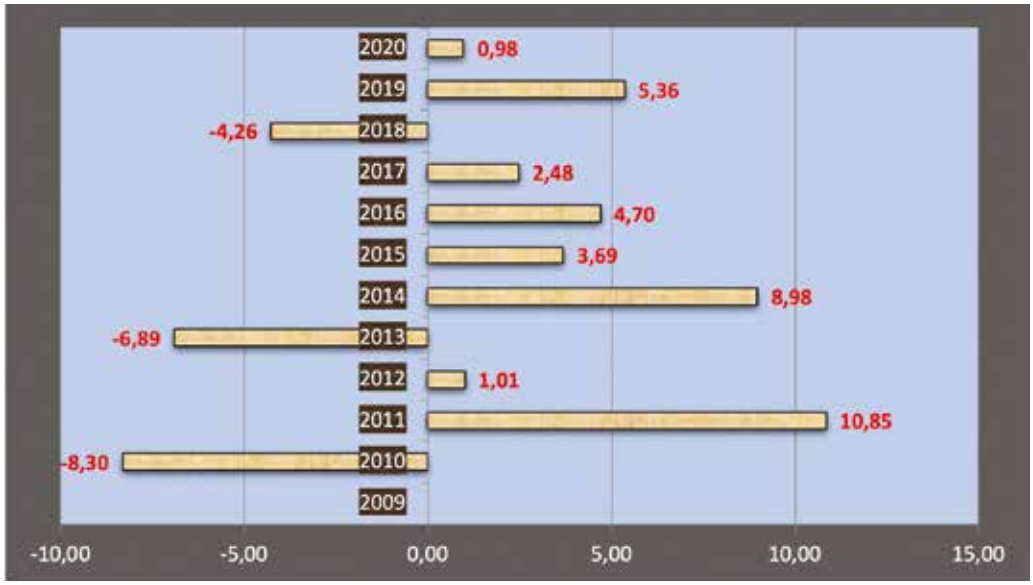
On the other hand, as necessitated by being a social state, compulsory quarantine was imposed on citizens, who were ambulated nationally and internationally as per precautionary measures, and special precautions and logistic support extended to those citizens hosted as guests for 14-days indispensably are highly appreciated.

Indicator	Total*	Last 7 Days**	Difference Between Previous Week	Change from Previous Week, (%)
Number of Tests	4.292.045	297.935	-47.080	-13,6
Number of New Cases	220.658	6.629	-553	-7,7
Number of Deaths	5.491	128	-10	-7,2
Number of New Hospitalizations	119.717	3.707	-1.965	-34,6
Number of New Intubated Patient	8.800	311	-36	-10,4
Number of New Hospital Discharges	118.087	3.682	-3.881	-51,3

** Total numbers including 19/07/2020, ** Numbers between 13/07/2020 – 19/07/2020*

Table-8: *Summary table of COVID-19 for Turkey*
Soruce: COVID-19 Situation Report Turkey, Ministry of Health, 30/06/2020 https://sbsgm.saglik.gov.tr/TR,66424/covid-19-situation-report-turkey.html [20.07.2020].

Graph-1: *Number of death in Turkey on 1 Jan. to 30 April (years 2009-2020)*



Graph-2: *Y-o-y change (%) on number of deaths from 1 Jan. to 30 Apr.*

In addition to these, the qualified infrastructure of existing public and private sector health systems and organization of health manpower to combat the global outbreak was motivated by societal sentiments, hence organized process management was efficiently carried out as planned, with all public officials, especially devoted healthcare workers, performing their duties without disrupting their responsibilities, of which they were aware. By deciding on flexible shifts in public institutions and organizations, public services were maintained without disruption. Other state institutions have also harmoniously fulfilled their economic, social, and financial duties, especially national and international security measures, for which they are responsible during this process.

Mr. President, at the level of Minister of Health and also through the COVID-19 Scientific Committee, executed a transparent and effective communication strategy at regular intervals and ensured that the public is regularly informed about the developments concerning the COVID-19 global outbreak.

The following flexible support and precaution packages were adopted, which would keep the economy and production vibrant without disturbing fiscal discipline, in the fight against the outbreak:

The 'Economic Stability Shield' support package worth TL 200 billion was implemented, a cash aid of TL 1,000 was provided to 4.4 million low-income families, the lowest pension was raised to TL 1,500 TL, irrespective of the sector "Minimum Wage Support" was extended to employers, besides, through "Short-Term Work Allowance" 3-month salary support was provided to citizens working in enterprises that reduced or stopped their activities. For workers on unpaid leave and those dismissed after 15 March 2020 but not entitled to unemployment benefits, a "Monthly Cash Support" of TL 1,170 was initiated, regulations were made on tax offsets for outbreak-stricken sectors for April, May, and June, employers were banned from layoffs for 3 months. The provision of convenient repayment rate loans for those in need by public banks was made available, and debtors were enabled to avail themselves of a delay of payment for their public bank credits due on 31 March 2020.

1.19. Significance of Domestic and National Production in Strategic Areas and Strategic Incentives

Turkey, through the priority list in strategic areas, currently develops new incentive models, in line with its objectives to boost current rates of production of own hospital equipment and use of artificial intelligence in medical instruments and devices as well as targets of reduction foreign dependency in manufacturing of medicine and vaccines. In the event of pandemics and the like, a call for project proposals was swiftly made by public institutions for the supply of technologies and equipment, and their production and development domestically, to be used in both disease prevention and treatment processes. In the scope of calls for proposals announced by nstitutions such as the Ministry of Industry and Technology, the Scientific and Technological Research Council of Turkey (TÜBİTAK) and SMEs Development Organization (KOSGEB), urgent measures and incentive packages have been put into practice for meeting the priority demands with respect to university-industry cooperation and other relevant stakeholder institutions of the public.

1.20. Social Solidarity Measures

During the COVID-19 pandemic struggle, special arrangements were made in order for Social Security Institution (SSI) to subsidize the expenses of all diagnosis and treatment services, including offered by both public institutions and the private sector. Tax reductions, offsets, and special incentive and support practices have been implemented in coordination with relevant ministries for business arms, which are in forced recess in terms of production and employment as well as those business lines that are in a position of compulsory or voluntary operations due to force majeure stemming from conditions of struggle against the pandemic. Support was received primarily from security forces besides local administrations and NGOs with intent to resolve the needs of the elderly and disabled people and individuals living alone, who restricted from going out as a result of decisions taken. Because of the long-term closing small shops (SMEs), the owner and employees have been supported by regular cash payment monthly and postponement of the debts including bank loans and taxes.

Table-9: *COVID-19 Indicators of Turkey*

COVID-19 INDICATORS of TURKEY

Total Test	598.933	18 April 2020	Total Number Today's Test	40.520
Total Number of Case	82.329		Total Number of Today's Case	3.783
Total Number of Deaths	1.890		Total Number of Today's Death	121
Total Number of Intensive Care Patients	1.894			
Total Number of Intubated Patients	1.054			1.822
Total Number of Recovered	10.453			

Table-9: *COVID-19 Indicators of Turkey*

COVID-19 INDICATORS of TURKEY

Total Test	673.980
Total Number of Case	90.980
Total Number of Deaths	2.140
Total Number of Intensive Care Patients	1.909
Total Number of Intubated Patients	1.033
Total Number of Recovered	13.430

20 April 2020

Total Number Today's Test	39.703
Total Number of Today's Case	4.674
Total Number of Today's Death	123
	1.454

COVID-19 INDICATORS of TURKEY

Total Test	889.742
Total Number of Case	110.130
Total Number of Deaths	2.805
Total Number of Intensive Care Patients	1,776
Total Number of Intubated Patients	883
Total Number of Recovered	29.140

26 April 2020

Total Number Today's Test	30.177
Total Number of Today's Case	2.357
Total Number of Today's Death	99
	3.558

COVID-19 INDICATORS of TURKEY

Total Test	1.135.367
Total Number of Case	126.045
Total Number of Deaths	3.397
Total Number of Intensive Care Patients	1.424
Total Number of Intubated Patients	766
Total Number of Recovered	63.151

3 May 2020

Total Number Today's Test	24.001
Total Number of Today's Case	1.670
Total Number of Today's Death	61
	4.892

Turkish Academy of Sciences, TÜBA, COVID-19 Global Outbreak Assessment Report, as of updates

Table-9: *COVID-19 Indicators of Turkey*

COVID-19 INDICATORS of TURKEY

Total Test	1.370.598	10 May 2020	Total Number Today's Test	36.187
Total Number of Case	138.657		Total Number of Today's Case	1.542
Total Number of Deaths	3.786		Total Number of Today's Death	47
Total Number of Intensive Care Patients	1.154			3.211
Total Number of Intubated Patients	598			
Total Number of Recovered	92.691			

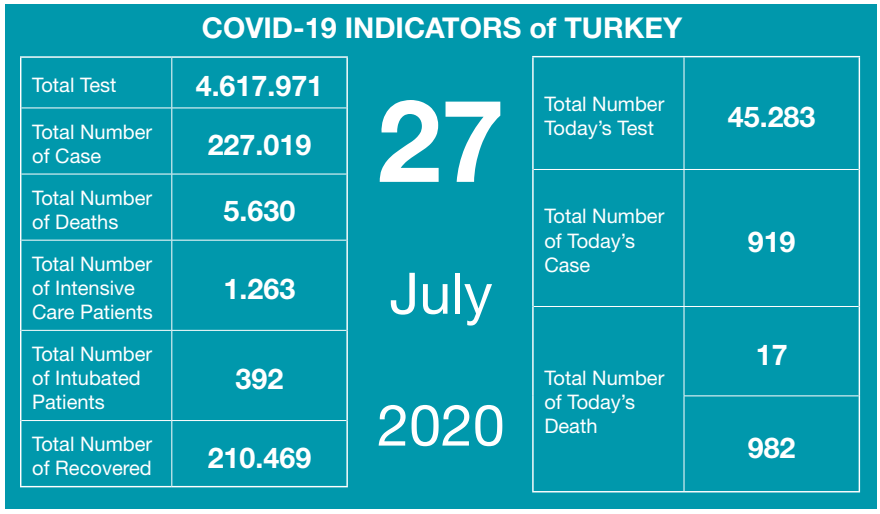
COVID-19 INDICATORS of TURKEY

Total Test	1.696.355	20 May 2020	Total Number Today's Test	20.838
Total Number of Case	152.587		Total Number of Today's Case	972
Total Number of Deaths	4.222		Total Number of Today's Death	23
Total Number of Intensive Care Patients	877			1.092
Total Number of Intubated Patients	445			
Total Number of Recovered	113.987			

COVID-19 INDICATORS of TURKEY

Total Test	2.209.583	5 June 2020	Total Number Today's Test	54.234
Total Number of Case	167.410		Total Number of Today's Case	988
Total Number of Deaths	4.630		Total Number of Today's Death	21
Total Number of Intensive Care Patients	602			926
Total Number of Intubated Patients	265			
Total Number of Recovered	131.778			

Turkish Academy of Sciences, TÜBA, COVID-19 Global Outbreak Assessment Report, as of updates



Moreover, in line with international solidarity strategy, Turkey also provided foreign aid (to Italy, Spain, UK, Iran, Bosnia and Herzegovina, Serbia, USA, China, Pakistan, Somalia, Sudan, Libya, Syria, and the Turkic Republics, etc.) out of its own production and stocks, as per its respective equipment requirements besides requests especially on basic insulation and protection equipment for health care workers. In the scope of the soft power concept, such instances of humanitarian relief in the international arena are also valuable for our nation in its political and economic relations.

1.21. Pandemic Hospitals in Turkey and Task Descriptions

The details of the decision concerning pandemic hospitals taken by the Ministry of Health General Directorate of Health Services (based on formal letter nr. 14500235-403.99 of the General Directorate):

The Coronavirus disease (COVID-19), a novel subtype originating from the People's Republic of China and reported by a number of countries, poses public health threats for the whole world and is closely monitored by our Ministry. In Turkey, necessary precautions are being taken by considering recommendations of the World Health Organization, as well. For the prevention of the spread of the disease in Turkey, the Scientific Committee regularly meets and makes assessments on the situation. Although measures have been taken in a range of areas, the need to take following measures has arisen in all healthcare service providers in order to minimize the density in both patients and their relatives and at healthcare institutions, as well as to alleviate the burden on our healthcare professionals:

1. Until a COVID-19 diagnosis is confirmed, it is obligatory to undertake admission and treatment procedures for all patients applying to the Ministry of Health hospitals, State and Foundation University hospitals, and private health institutions.
2. Hospitals with at least two of the specialists on Infectious Diseases and Clinical Microbiology, Chest Diseases, and Internal Medicine, and 3rd level adult intensive care beds available at their premises are treated as a Pandemic Hospital**. *During the course of the Pandemic, the need for Infectious Diseases and Clinical Microbiology, Internal Medicine or Chest Diseases Specialists may be met by assignment from another hospital. **Pandemic Hospital: is a hospital where the treatment of cases diagnosed with COVID-19 (test positive) has been undertaken.
3. A General Coordination Team of Pandemic should be formed at the hospital premises according to the Pandemic Action Plan prepared by the General Directorate of Public Health.

4. At Pandemic Hospitals, a clinic, and an intensive care unit dedicated to pandemic patients should be identified and reserved for such cases. In the event, that number of cases increases, the order in which other ICUs and clinics will be allocated should be predetermined. Beds in oncology-hematology and radiation oncology clinics, organ transplant clinics, and bone marrow transplant centers where there are patients whose treatment is already initiated and need to continue will continue to be used as intended as possible.
5. At Pandemic Hospitals, it should be predetermined in which clinic and ICUs patients other than those diagnosed with COVID-19 will be monitored.
6. In the event that Pandemic Hospitals are inadequate, hospitals with 2nd level adult ICUs should also be organized to serve as a pandemic hospital.
7. The route to clinical and ICU beds reserved for pandemic patients is predetermined and necessary measures are taken on this route.
8. The names and titles of the personnel to work at shifts in clinics and operating rooms and delivery wards at Pandemic Hospitals are to be predetermined.
9. At Pandemic Hospitals, 1 surgery room where COVID-19 infected cases can be operated and 1 delivery room where infected pregnant women can deliver in hospitals with gynecology and obstetrics clinics should be predetermined and reserved.
10. The chief physician/responsible manager of the Pandemic Hospital is fully authorized to use clinical beds, ICUs, operating rooms, and assign staff, without disrupting normal functioning.
11. Provincial Health Directors are fully authorized to change stations of personnel as needed in all health facilities throughout the province.
12. Provincial/district hospitals that are not a pandemic hospital, yet visited by patients diagnosed with COVID-19, should take the necessary measures and arrange transfer of these patients to the designated hospital in the referral algorithm. The transfers of patients are to be coordinated by the 112 Hot-line Command and Control Centers in or out of town.

It was required by the Ministry of Health to show due diligence in undertaking necessary work and procedures on the above-mentioned issues by the hospitals affiliated to the Ministry, State/ Foundation Universities, and all private health institutions.

Table-10: *Health Care Professionals Distribution in Turkey & OECD Comparison*

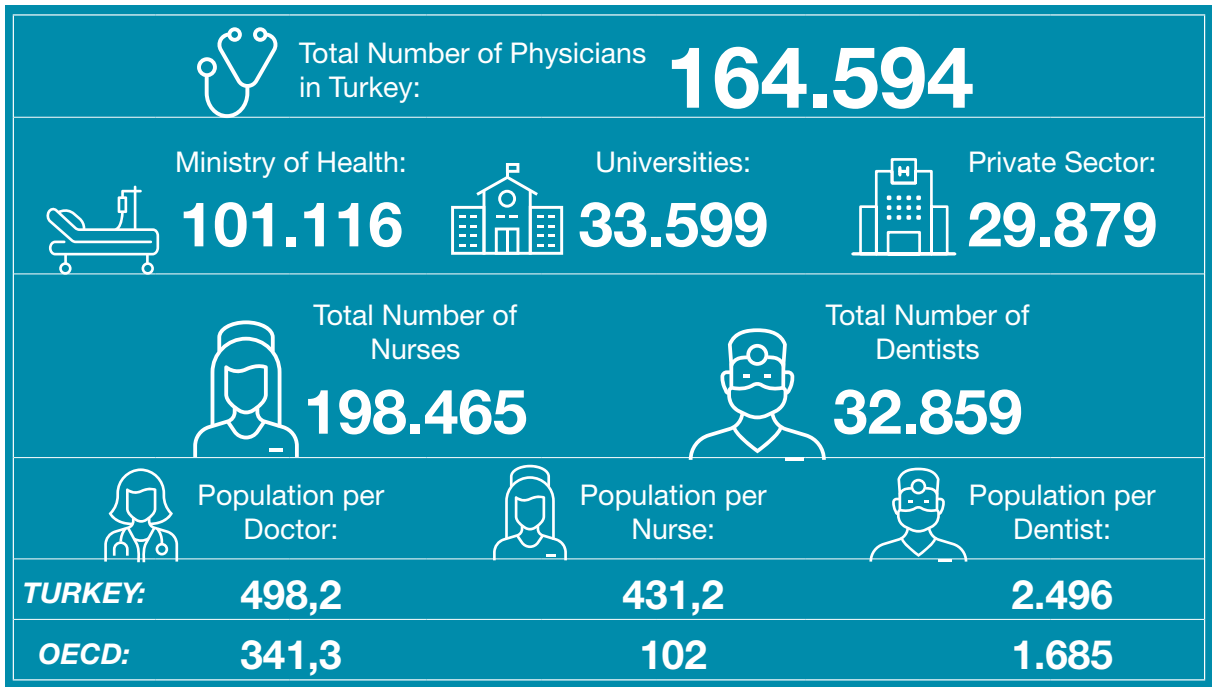


Table-11: *Bed Capacity at City Hospitals Currently Admitting Patients or are Under Construction*

No	Project	Bed Capacity	Targeted Completion Date
1	Adana City Hospital	1.550	IN SERVICE
2	Mersin City Hospital	1.294	IN SERVICE
3	Isparta City Hospital	755	IN SERVICE
4	Yozgat City Hospital	475	IN SERVICE
5	Kayseri City Hospital	1.607	IN SERVICE
6	Manisa City Hospital	558	IN SERVICE
7	Elazığ City Hospital	1.038	IN SERVICE
8	Ankara Bilkent City Hospital	3.711	IN SERVICE
9	Eskişehir City Hospital	1.081	IN SERVICE
10	Bursa City Hospital	1.355	IN SERVICE
11	İstanbul Başakşehir Çam ve Sakura City Hospital	2.682	IN SERVICE
12	Tekirdağ City Hospital	480	2020
13	Kütahya City Hospital	610	2020
14	Kocaeli City Hospital	1.210	2020
15	Konya Karatay City Hospital	1.250	2020
16	Ankara Etlik City Hospital	3.624	2021
17	Gaziantep City Hospital	1.875	2021
18	İzmir Bayraklı City Hospital	2.060	2021

In addition to the 13,424 bed capacity in current use, with the completion of city hospitals under construction an additional bed capacity 13,791 will be incorporated into the health system.

Table-12: *Comparison of COVID-19 fatality and mortality rates in Turkey with 6 developed countries elderly population and ICU capacities*

Country	65+ aged population (%)	ICU capacity (per 100k po-pulation)	COVID-19 fatalite (%)	COVID-19 mortalite (in million)
Turkey	9	49	2,7	44
USD	16	35	5,9	238
Germany	22	29	4,4	90
Italy	24	13	13,9	500
France	20	12	14,	402
Spain	20	10	10,1	562
UK	19	7	14,8	460

Data source: https://www.worldometers.info/coronavirus/ttcountries (7 May 2020) Census data: UNFPA, State of World Population 2019, other data from Eurostat statistics 2019, Statista, TÜİK (Turkish Statistics) and Ministry of Health SİNA System

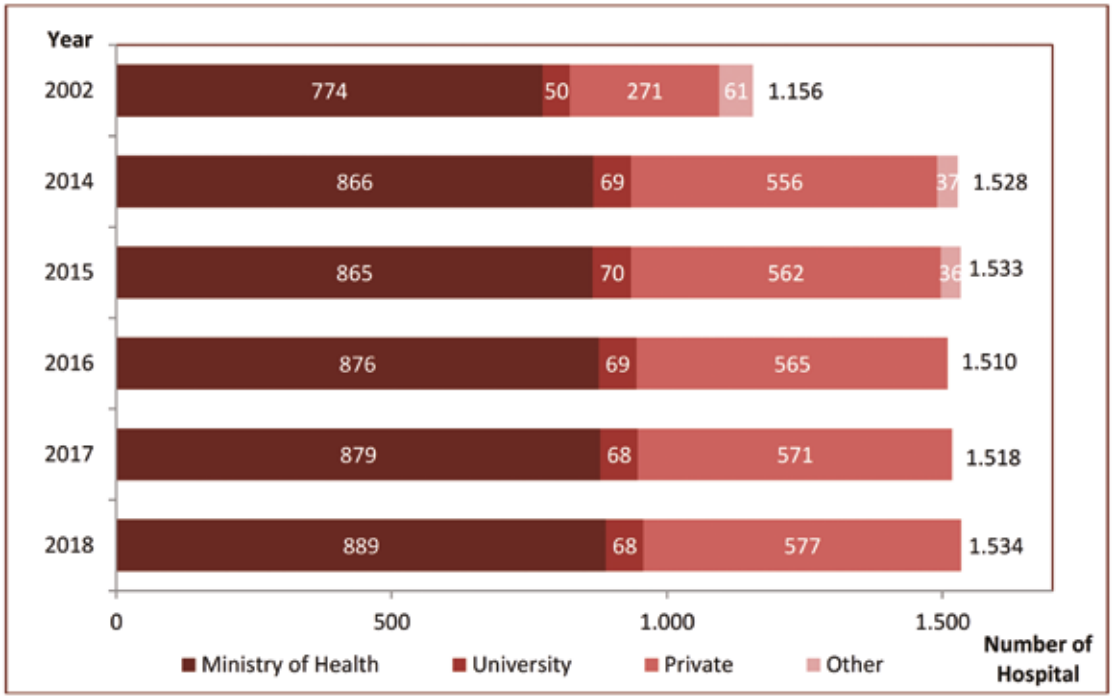


Figure-4: *Number of Hospitals by Years and Sectors*

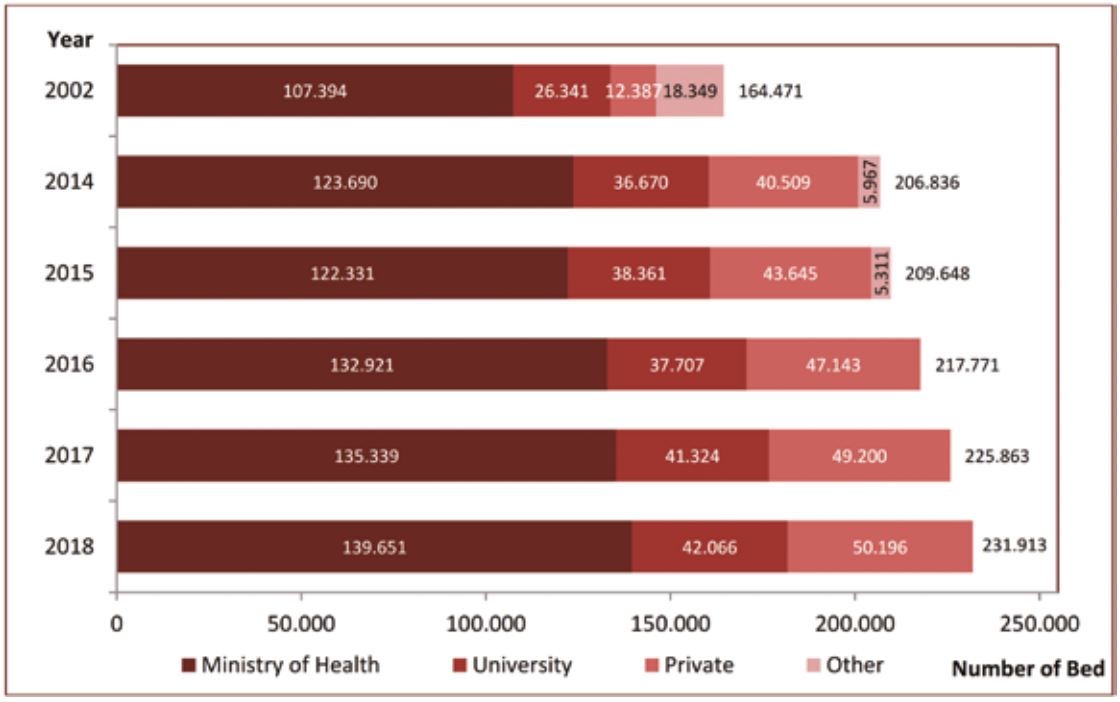


Figure-5: *Number of Hospital Beds by Years and Sectors*

Table-13: *Total registered bed capacity (incl. ICU)*

TOTAL REGISTERED BEDS (incl. ICU)	ICU BEDS	ICU BEDS ADULTS	ICU BEDS JUVENILE	ICU BEDS NEONATAL	QUALIFIED BEDS	QUALIFIED BEDS RATE
151.762	18.043	12.503	1.110	4.430	91.281	60,1

Source: Ministry of Health data (April/May 2020)

Table-14: *Number of Hospitals and Beds by Branches, 2018*

Branches	Hospital	Bed
General Hospital	1.423	212.883
Obstetric and Child Hospital	25	4.826
Ophthalmology Hospital	25	316
Physical Treatment and Rehabilitation Center	19	2.904
Chest Diseases Hospital	12	3.569
Psychiatry Hospital	11	3.887
Child Diseases Hospital	4	1339
Cardiovascular Diseases Hospital	4	599
Bone Diseases Hospital	3	436
Occupational Diseases Hospital	2	246
Oncology Hospital	2	712
Orthopedics and Traumatology Hospital	1	33
Leprosy Hospital	1	34
Hospital for Children with Leukemia	1	75
Spastic Children's Hospital and Rehab Center	1	54
Total	1.534	231.913

Source: General Directorate of Health Services

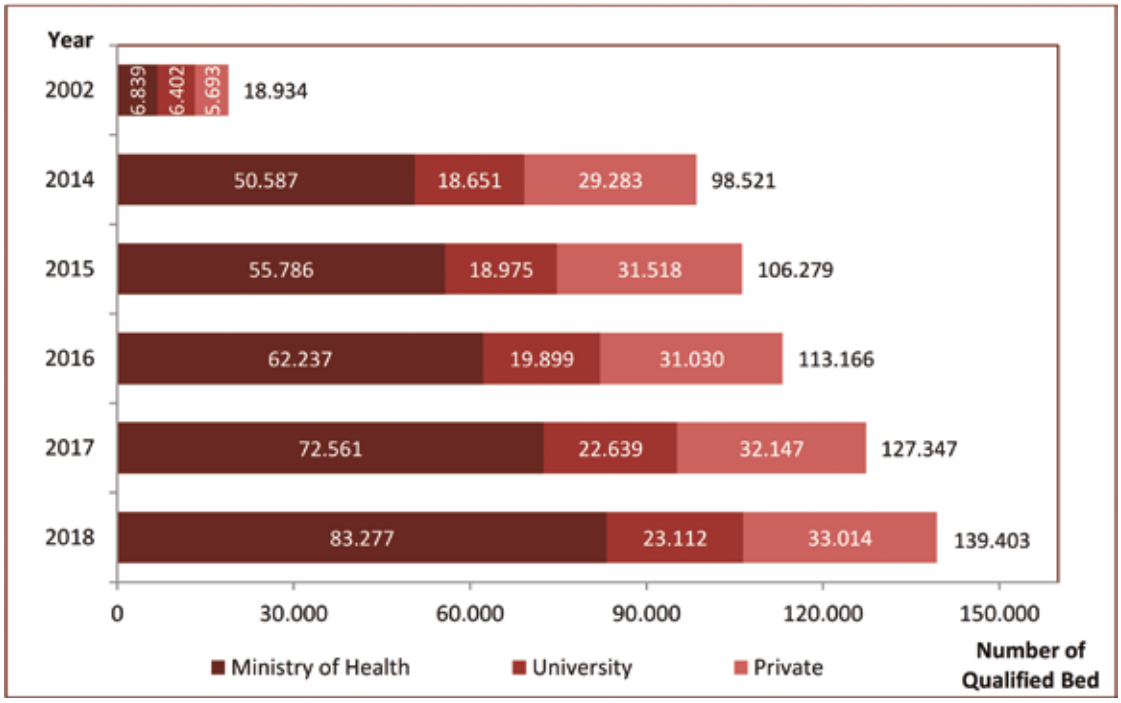


Figure-6: *Number of Qualified Beds by Years and Sectors*
Source: General Directorate of Health Services

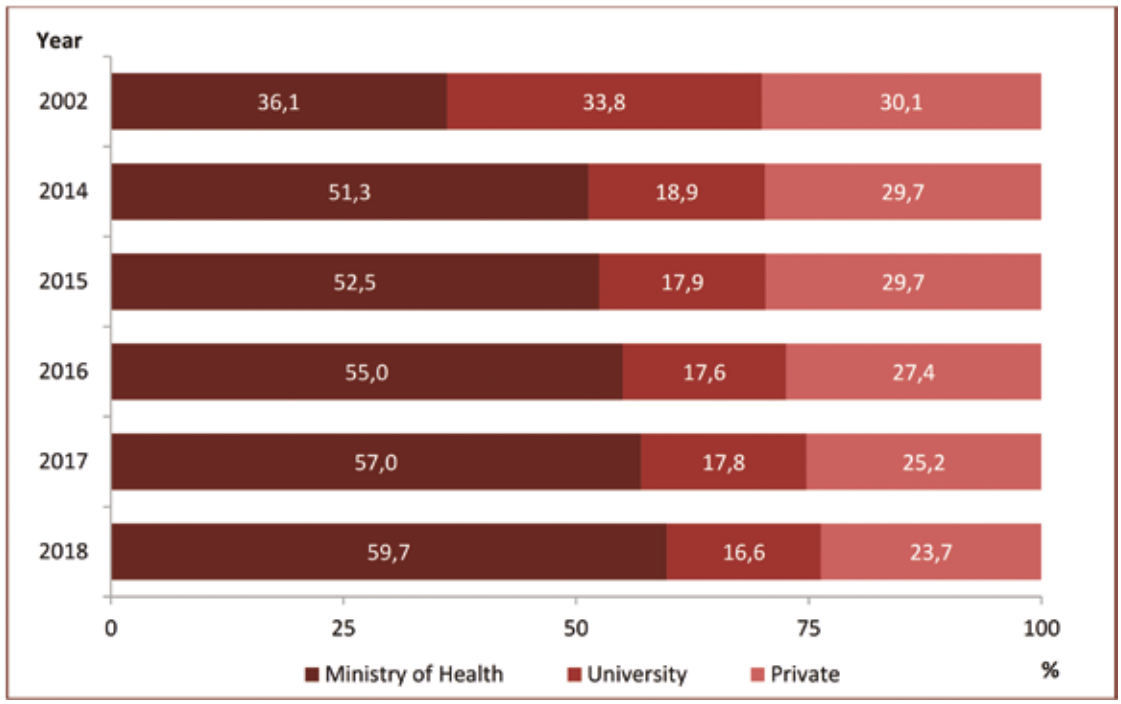


Figure-7: *Distribution of Qualified Beds by Years and Sectors (%)*
Source: General Directorate of Health Services

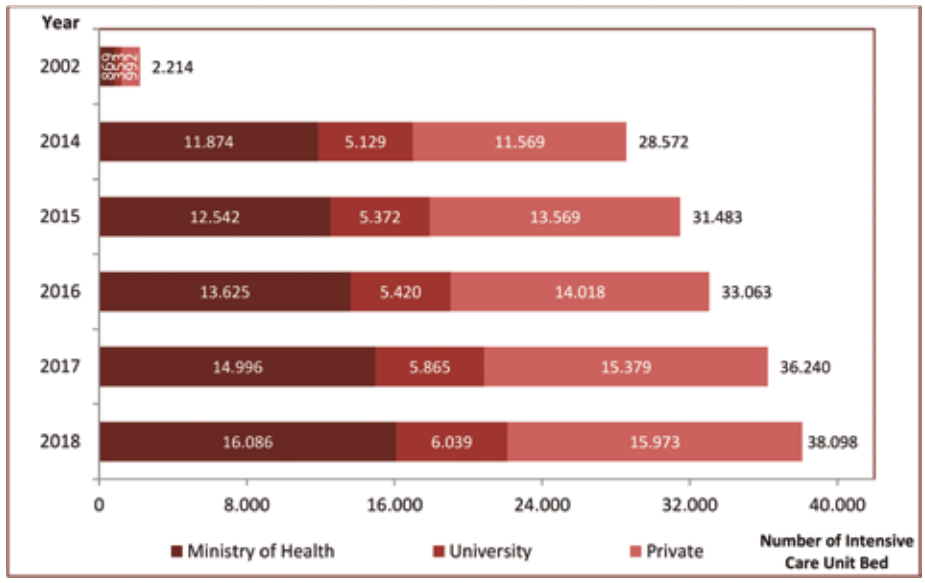


Figure-8: *Total Number of Intensive Care Unit Beds by Years and Sectors*
Source: General Directorate of Health Services

Table-15: *Sectoral Breakdown of ICU Beds in Turkey's Supply of Healthcare Services*

Healtcare Service Provider	Adults	Juvenile	Neonatal	Total
Ministry of Health	12.986	1033	4-166	18.185
University Hospital	4.240	594	1.474	6.308
Private	8.933	165	7.025	16.123
TOTAL	25178	1-792	12.665	40.616

Data source: Ministry of Health Stats, 27 April 2020 (Sina System).

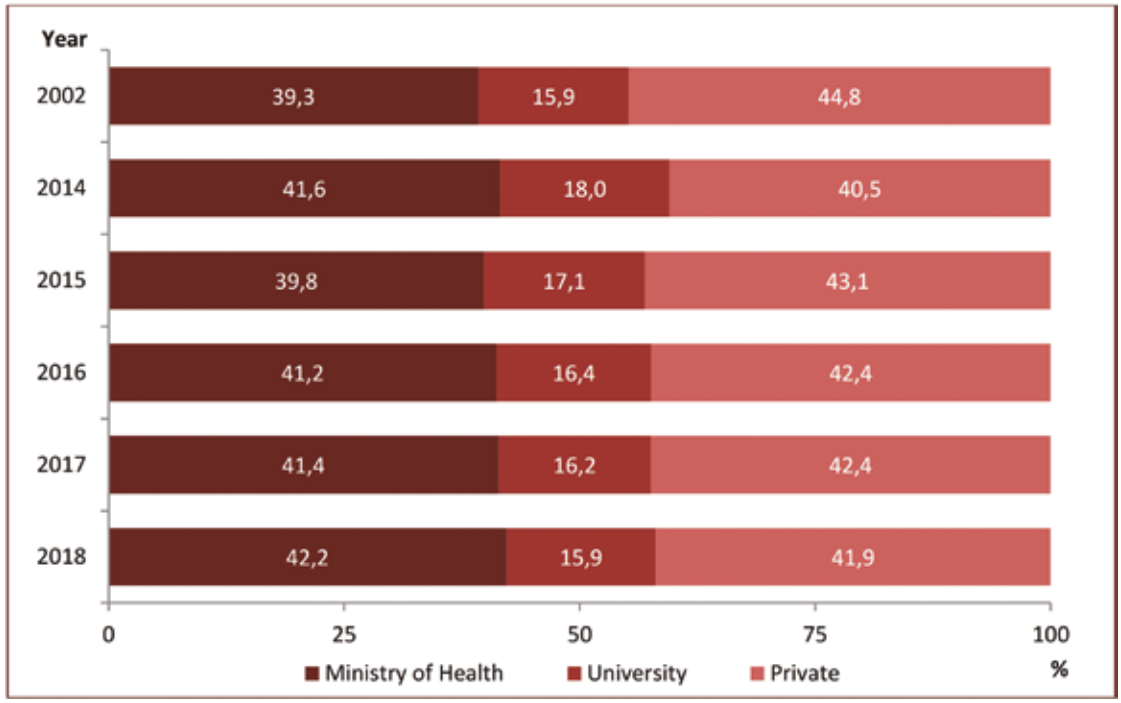
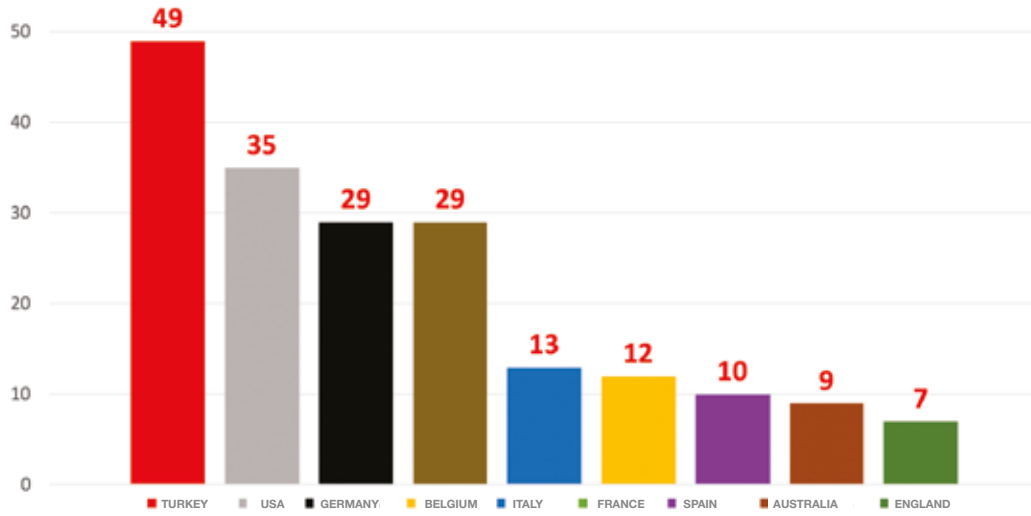


Figure-9: *Distribution of Intensive Care Unit Beds by Years and Sectors (%)*
Source: General Directorate of Health Services



Graph-3: *Countries Breakdown of ICU Beds (April 2020, per 100k population)*
Source: Eurostat, Statista, T.C. Ministry of Health (SİNA, 27 Nisan 2020)

Table-16: *Imaging Devices*

USG		Doopler USG {device capable of both doopler and regular USG scans)		ECHO		Computed Tomography (CT)		Magnetic Resonance {MR}	
Fixed Assets	Service Procurement	Fixed Assets	Service Procurement	Fixed Assets	Service Procurement	Fixed Assets	Service Procurement	Fixed Assets	Service Procurement
1.037	15	2.071	165	1.354	49	356	244	51	293

Data source: Ministry of Health Stats, 27 April 2020 (Sina System)

Table-17: *Number of Health Care Professionals by Years, All Sectors*

	2002	2014	2015	2016	2017	2018
Specialist Physicians	45.457	75.251	77.622	78.620	80.951	82.894
General Practitioners	30.900	39.045	41.794	43.058	44.649	44.053
Medical Residents	15.592	21.320	21.843	23.149	24.397	26.181
Total Physicians	**91.949**	**135.616**	**141.259**	**144.827**	**149.997**	**153.128**
Total Dentists	16.371	22.996	24.834	26.674	27.889	30.615
Pharmacists	22.289	27.199	27.530	27.864	28.512	32.032
Nurses	72.393	142.432	152.803	152.952	166.142	190.499
Midwives	41.479	52.838	53.086	52.456	53.741	56.351
Other Health Personnel	50.106	138.878	145.943	144.609	155.417	177.409
Other Personnel and Procurement of Services	83.964	303.110	311.337	321.952	339.241	376.367
Total Personnel	378.551	823.069	856.792	871.334	920.939	1.016.401

Source: General Directorate of Health Services Note: 1.932 physicians in the subspecialty program are inclued to the number of "Medical Resident". 2.056 dental residents are included to the number of "Total Dentist". 1.727 pharmacists including graduated intern pharmacist and second pharmacists were added to the number of "Pharmacists".

Table-18: *Distribution of Health Care Professionals by Sectors and Titles, 2018*

	Ministry of Health	University	Private	Total
Specialist Physicians	43.347	14.438	25.109	82.894
General Practitioners	39.442	291	4.320	44.053
Medical Residents	8.770	17.411	-	26.181
Total Physicians	**91.559**	**32.140**	**29.429**	**153.128**
Specialist Dentists	902	1.959	2.029	4.890
Dentists	9.844	277	13.548	23.669
Dental Residents	68	1.988	-	2.056
Total Dentists	**10.814**	**4.224**	**15.577**	**30.615**
Pharmacists	3.064	691	28.277	32.032
Nurses	126.891	29.263	34.345	190.499
Midwives	52.495	789	3.067	56.351
Other Health Personnel	121.206	16.493	39.710	177.409
Other Personnel and Procurement of Services	236.155	48.377	91.835	376.367
Total Personnel	642.184	131.977	242.240	1.016.401

Source: General Directorate of Health Services

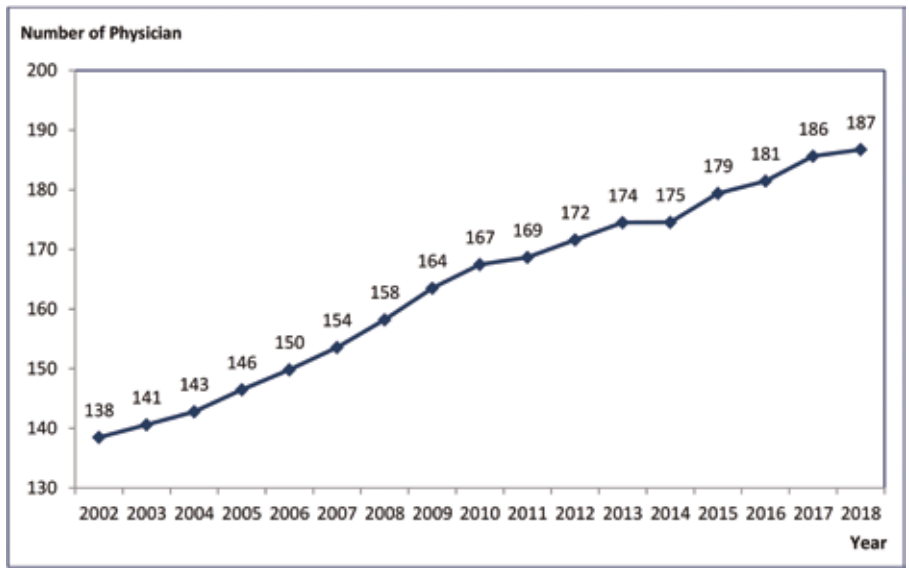


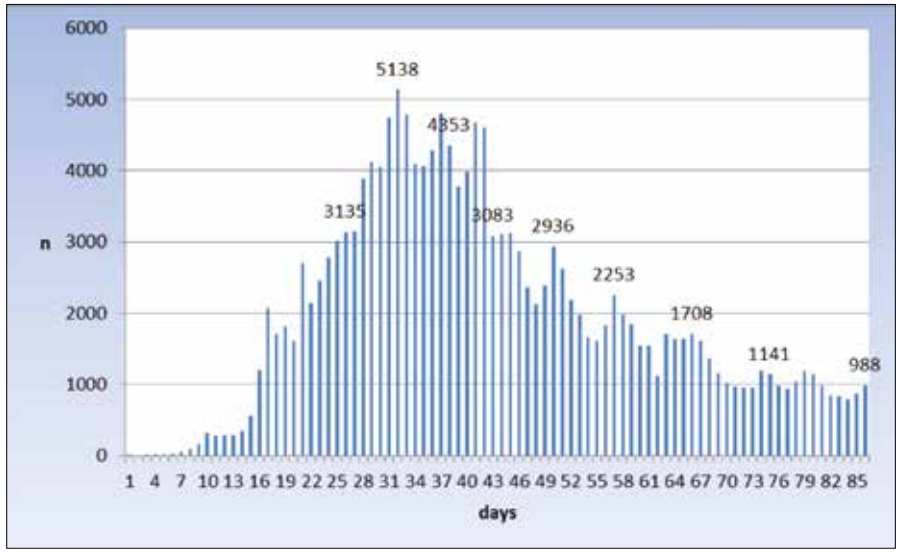
Figure-10: *Number of Total Physicians per 100.000 Population by Years, All Sectors*

1.22. Epidemiological Assessment of Data on Turkey

Measures have been taken gradually in the fight against the Covid-19 outbreak since the index case from 11 March 2020 till 4 June 2020. The precautions taken may be principally listed as isolating the sick, quarantine of suspects, restriction of physical activities of healthy people, promotion of the use of personal protective equipment, and disinfectants. This report presents an epidemiological assessment of Covid-19 in Turkey between 11 March and 4 June 2020.

1.22.1. Number of New Cases

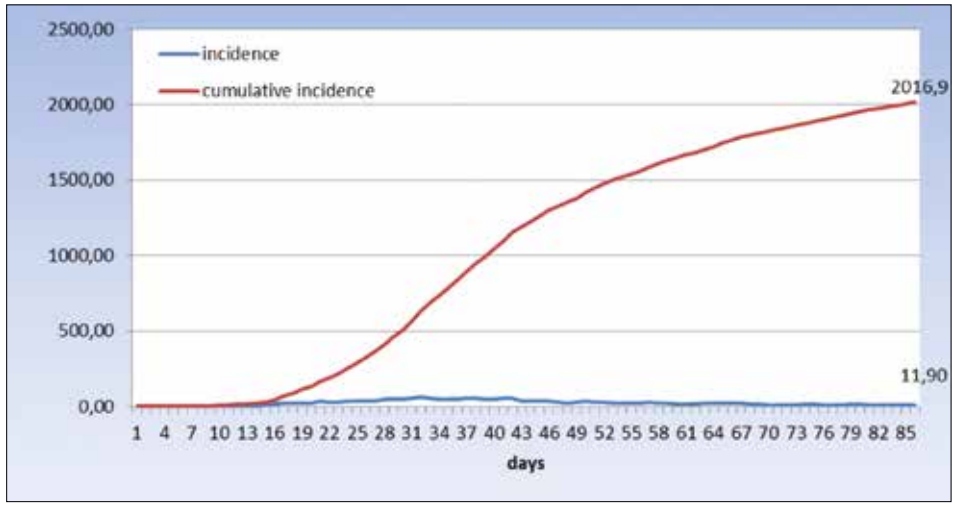
Numbers of new cases of Covid-19 in Turkey since the index case until 4 June 2020 are shown in Graph-4.



Graph-4: *Turkey daily new cases of COVID-19*

1.22.2. Incidence and Cumulative Incidence Rates

The incidence and cumulative incidence rates of Covid-19 cases in Turkey since the index case until 4 June 2020 are shown in Graph-5.



Graph-5: *Turkey Covid-19 incidence and cumulative incidence rates (in millions)*

1.22.3. Outbreak Growth Rate

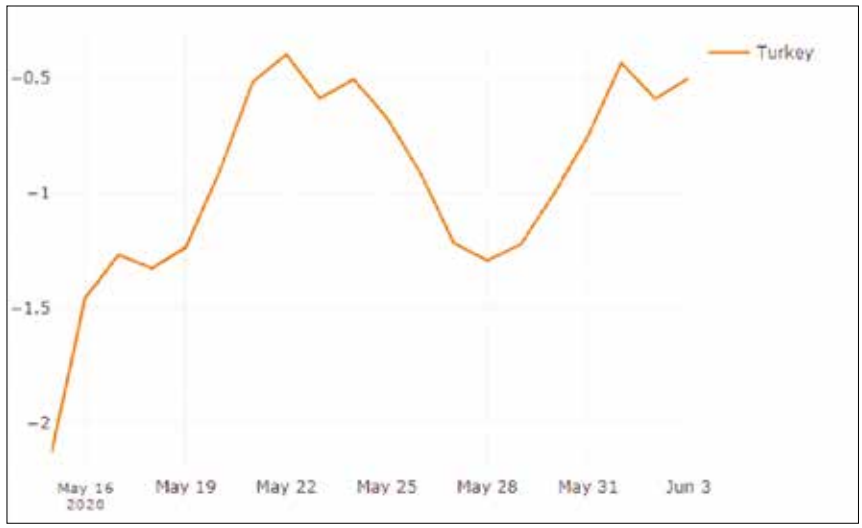
Growth rate: This rate shows the growth rate in the number of active cases. Positive values are unfavorable while negative values are favorable. A steady decline in growth rate over time and maintaining in the negative region indicates controlled progress. The growth rate is calculated by the below formula.

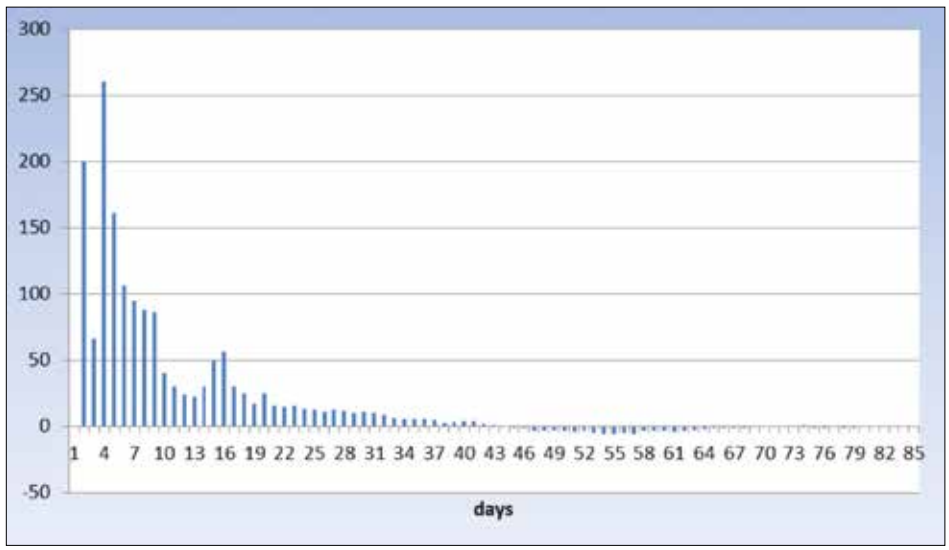
$Gt=(A_{t}.A_{t}-1)/A_{t}-1$

A (Active cases)= cumulative cases – total death – cumulative treated cases
t: day

Turkey growth rate details are shown in Graph-6.

As of 23.04.2020, the growth rate in Turkey appears to be in a negative region. As of 4 June 2020, the growth rate is found to be 0.1





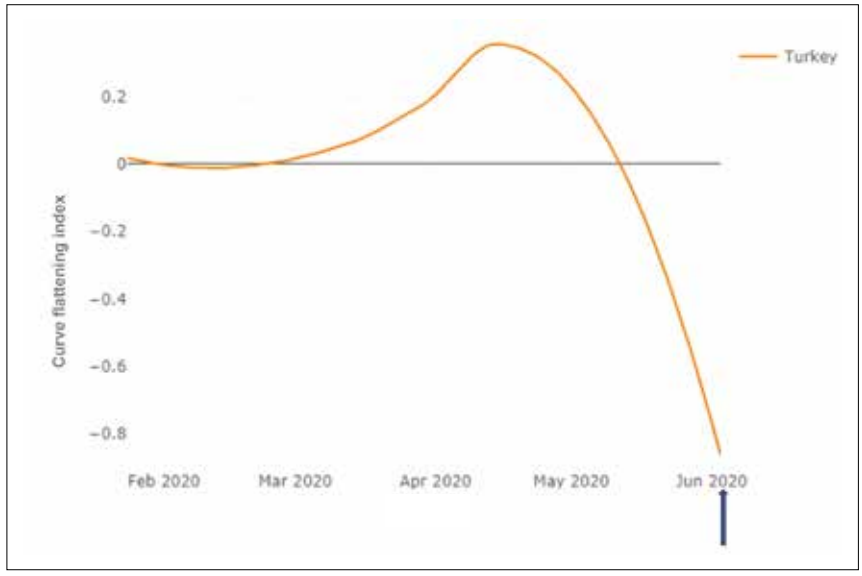
Graph-6: *Turkey growth rate*
(Source: *https://covid19forecast.science.unimelb.edu.au/)*

1.22.4. Curve Flattening Index

Curve flattening index: This is a measure of how well a country straightens the pandemic curve at any given time. It is an index that shows how the growth rate changes over time. The fact that the curve is in the positive region means the growth rates decreased in the said period. This index Ct is calculated by the below formula. This index covers the entire timeframe of the pandemic. For this index, positive values are considered to be good and negative values bad. For Turkey's curve flattening index, please see Graph-7

$$C_t = \frac{(\ln A_t - \ln A_{t-1}) - (\ln A_{t-1} - \ln A_{t-2})}{\sqrt{(\ln A_{t-1} - \ln A_{t-2})^2}}$$

Currently, as of early June, the curve flattening index is in the negative direction.



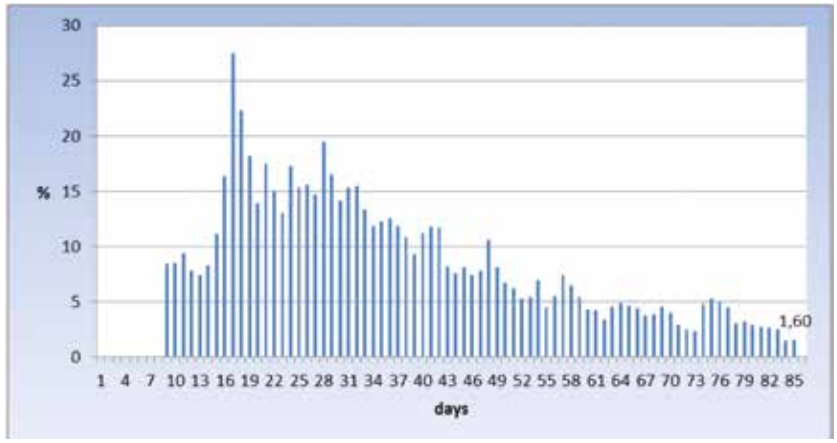
Graph-7: *Currently, as of early June, the curve flattening index is in the negative direction.*

1.22.5. Positivity Percentage as per Daily Number of Tests

Please see Graph-8 for positivity percentage as per the daily total number of tests between index case until 4 June 2020.

1.22.6. Cumulative and Daily Fatality Rates

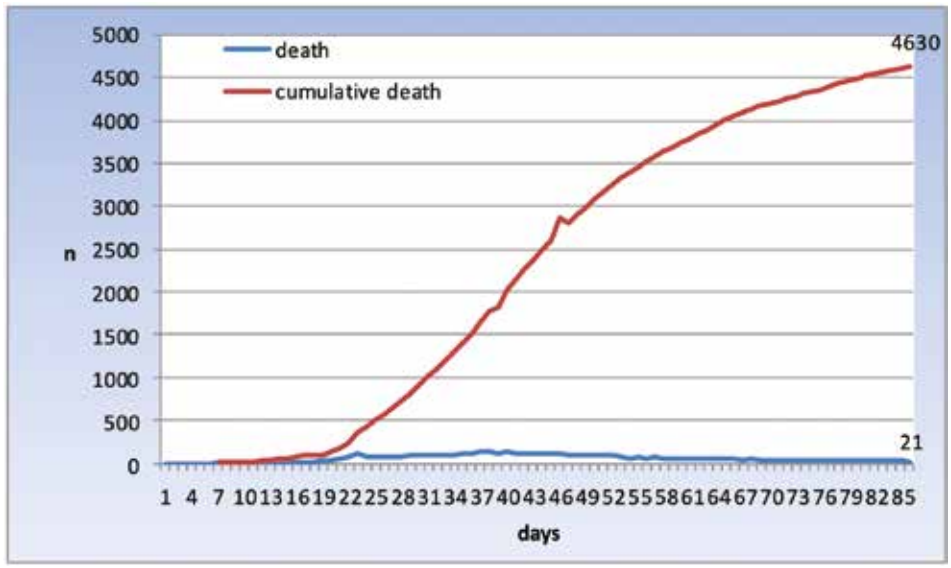
For cumulative and daily fatality rates of Covid-19 for Turkey, please see Graph-9.



Graph-8: *Positivity percentage per daily number of tests*

1.22.7. Case Fatality

Various formulas are used to evaluate death rates. The most commonly used formula to evaluate fatality in case fatality. Case fatality is calculated as follows:



Graph-9: *Cumulative and daily death rates*

CFR, case fatality rate = current total deaths / current confirmed cases

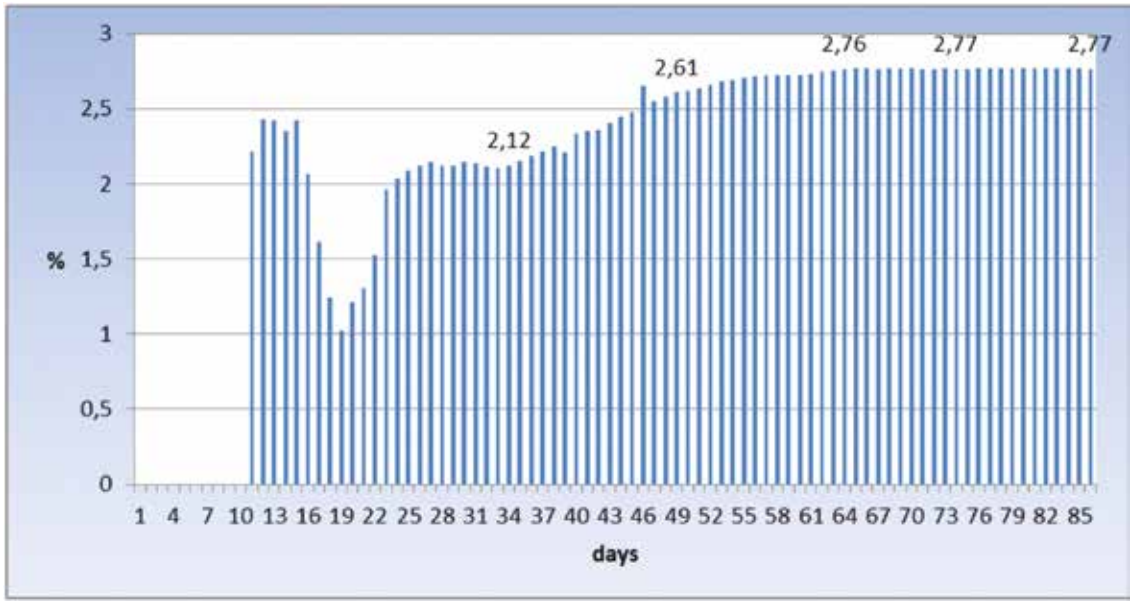
What is criticized about this formula is that such calculation would be meaningful only if the outbreak ceased finally, however since it is the ongoing use of this formula is considered defective. Diagnosis of a viral infection is conducted days or weeks prior to actual recovery or death, therefore the number of deaths should be checked against a number of cases, an alternative formula accounts for such delay then predicts case fatality. (Source: 2019-Novel Coronavirus (2019-nCoV): estimating the case fatality rate – a word of caution DOI: https://doi.org/10.4414/smw.2020.20203)

The alternative formula – since the outbreak is ongoing – is as follows:

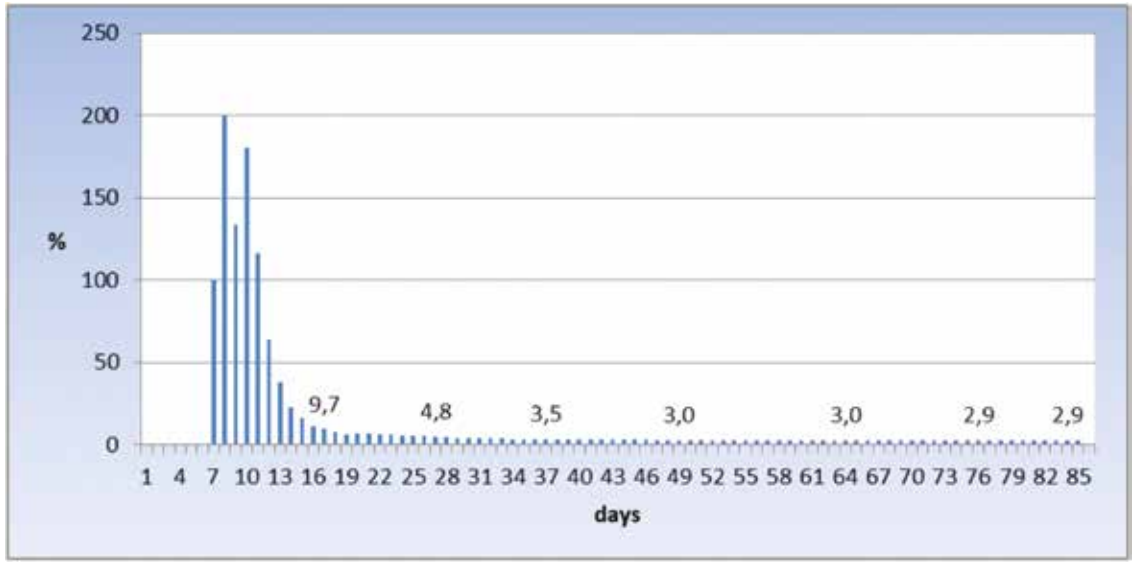
CFR= number of deaths on day X / X – T number of cases on day
T= duration of time from case confirmation till death, cannot be 0

Case fatality rates for Turkey are shown in Graphs-10 and 11 respectively by means of both methods.

According to the first equation, CFR is found to be around %2.77 with a mild increase within days, whereas the second (corrected formula) indicates %2.90



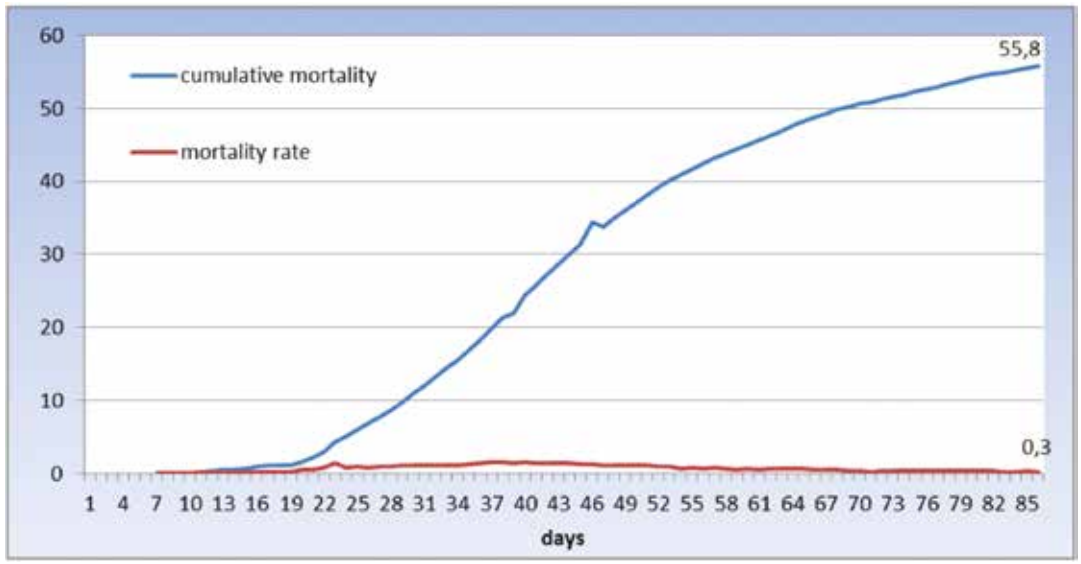
Graph-10: *Turkey case fatality rate % (total deaths/total cases)*



Graph-11: *Turkey case fatality rate % number of deaths on day X / X – T number of cases on day*

1.22.8. Mortality and Cumulative Mortality Rates

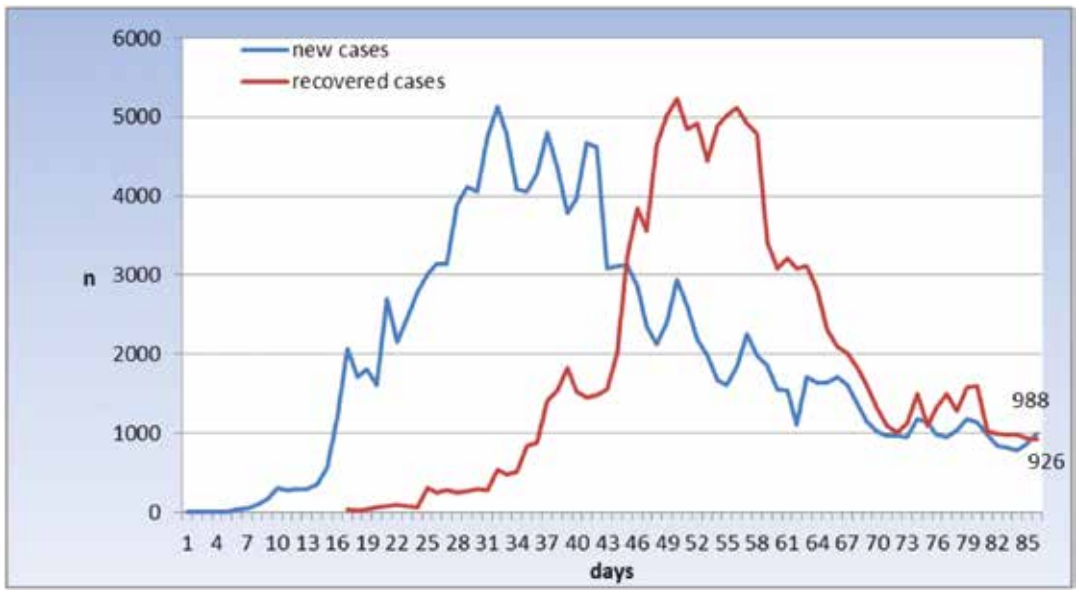
For mortality and cumulative mortality rates of Covid-19 for Turkey, please see Graph 12
For Turkey, current mortality rate of Covid-19 is 0.3 per million and cumulative mortality rate is 55.8 per million.



Graph-12: *Turkey mortality and cumulative mortality rates*

1.22.9. Number of Daily New Cases and Recovered Cases

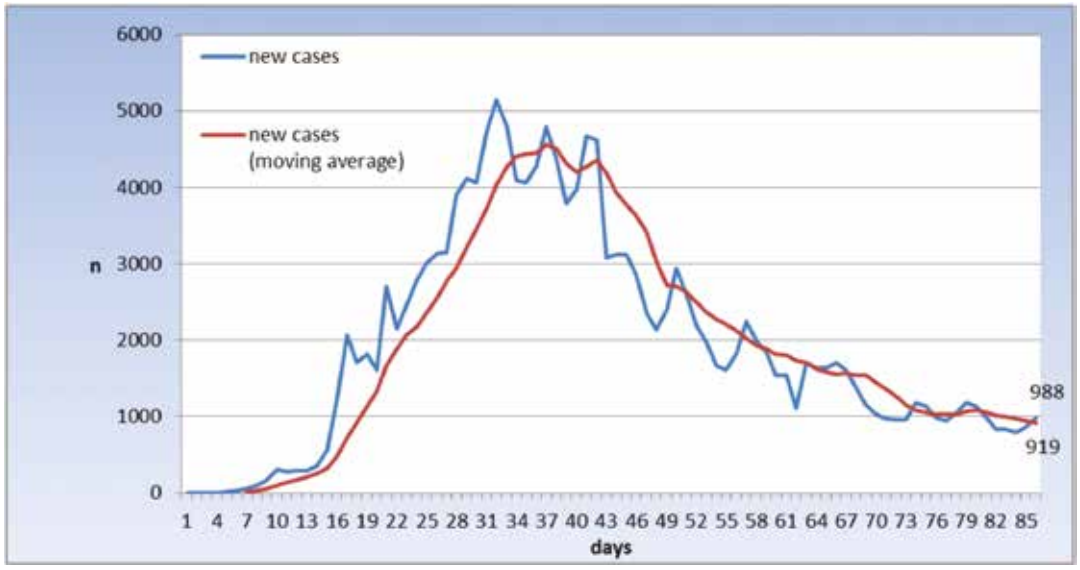
The number of recovered cases is found to be greater than the number of new cases w.e.f. 25 April 2020 which trend continues till 4 June 2020 as of which the number of new cases is higher by 62 individuals than that of recovered cases.



Graph-13: *Number of daily new cases and recovered cases*

1.22.10. Number of Daily New Cases and Moving Average of New Cases

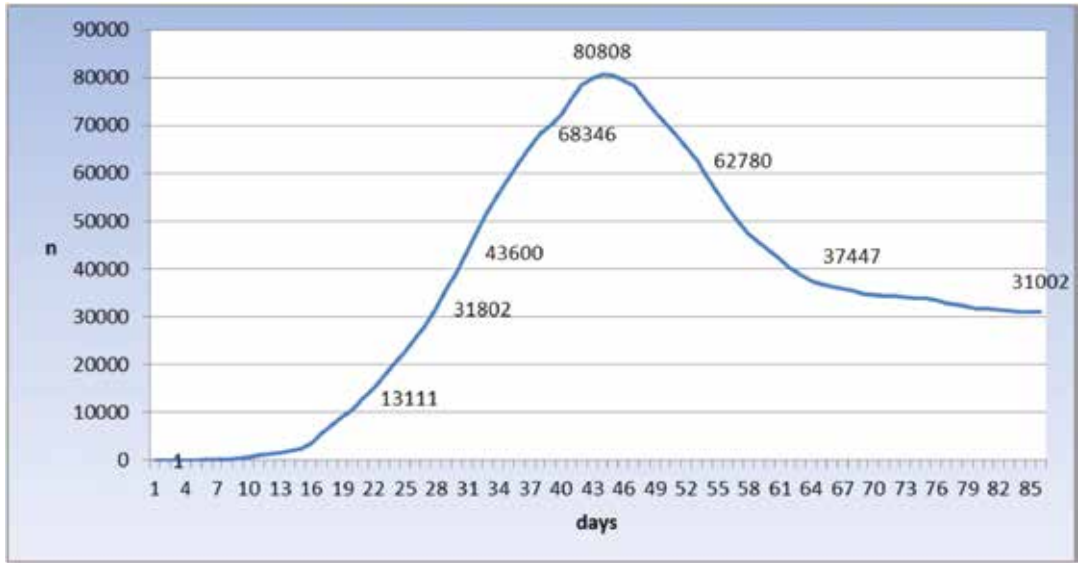
In moving average calculation, means of the last 7 days are accounted for.



Graph-14: *Number of Daily New Cases and Moving Average of New Cases*

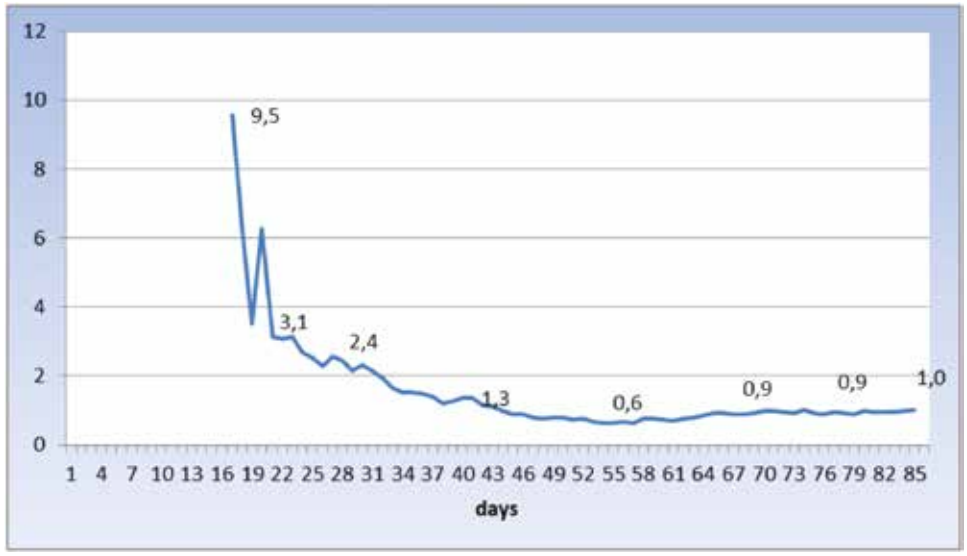
1.22.11. Total Number of Active Cases

It appears that active cases tend to drop.



Graph-15: *Total Number of Active Cases*

1.22.12. Covid-19 Estimated R_0 Value for Turkey

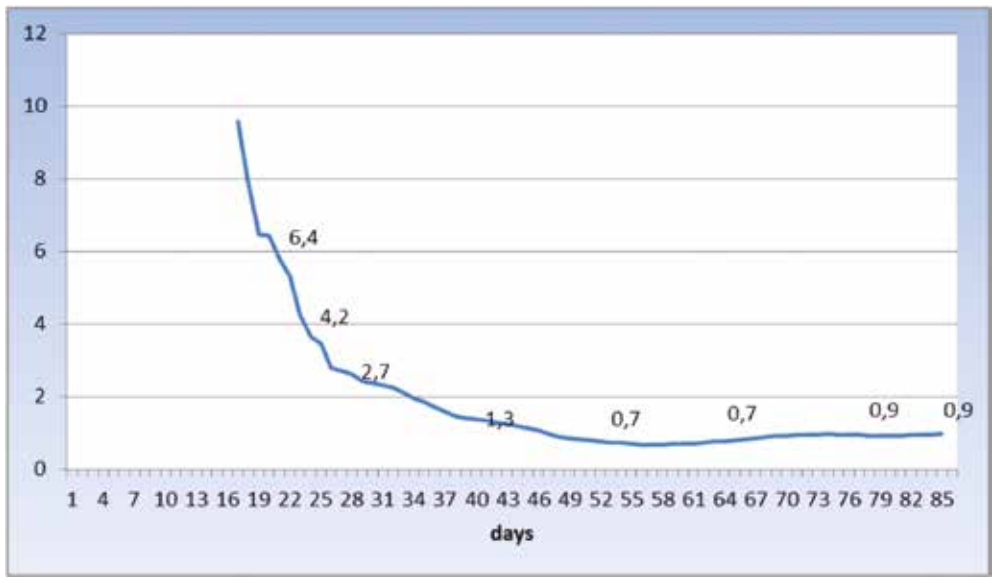


Graph-16: *Estimated R_0 values (R_0=erTc) for Turkey w.e.f. day 18.*

Tc=7.5 presumed.

The estimated R_0 value for Turkey Covid-19 appears to have dropped below 1 w.e.f. 24 June 2020. On 4 June 2020, the R_0 value is found to be 1. The median of estimated R_0 values of the outbreak calculated until 4 June 2020 is 1.11.

1.22.13. Covid-19 Estimated R_0 Value for Turkey (Moving Average)



Graph 16: *Estimated R_0 values for Turkey after day 18 (7 day moving average)*

On day 47, the R_0 appears to have dropped below 1.

The (7 day moving average) median of estimated R_0 values of the outbreak calculated until 4 June 2020 is 1.29.

1.23. What is Basic Reproduction Number (R_0)

Pronounced “R zero”, the R_0 (Basic reproduction number; Basic reproductive ratio, Basic reproductive rate, R zero or R naught) is a mathematical term indicating how contagious an infectious disease is. In consideration of infectious disease, R0 represents the average number of secondary cases infected by a single case (stemming from that patient) within a wholly susceptive community. It is especially true for a community where there is no previous infection (susceptible) or one that is unvaccinated. The R0 value may be an ordinary number e.g. 2 or a numeric range e.g. 1.5-6.2. For instance, if the R0 value of a disease is 2, it is estimated that a sick person would transmit the infection to an average of 2 other people. Such contagion would prevail unless a vaccine is available or the herd is not immune i.e. susceptible. The R0 value of a disease is only valid for as long as every member of any population is totally susceptible to the disease, which means nobody has been vaccinated, caught the disease and that it is uneasy to contain the disease. The coincidence of all conditions at once is a rare occasion thanks to advancements in medicine. Many diseases that were fatal in the past are currently controllable or curable.

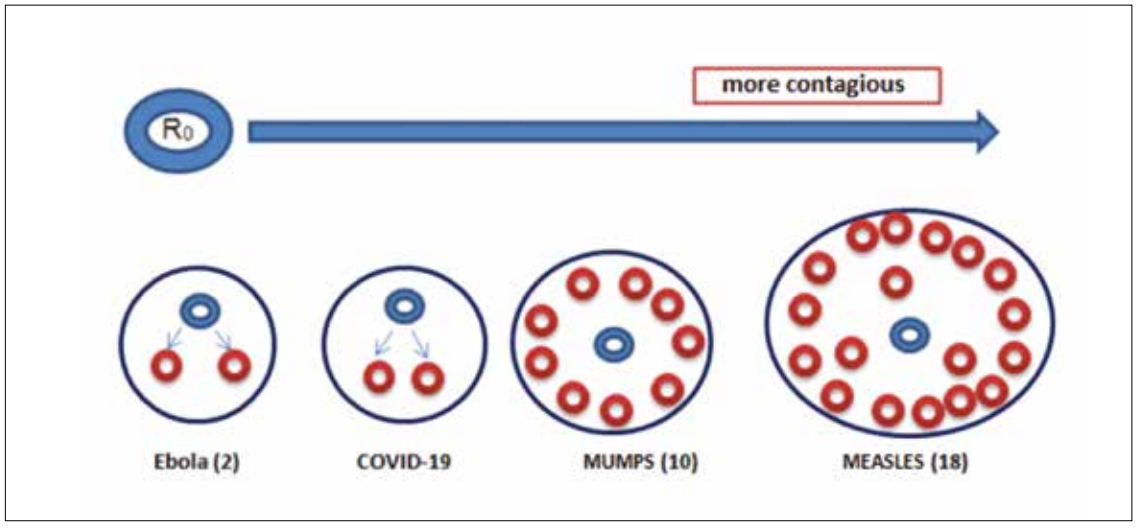


Figure-11: *R_0 values of various infection pathogens*

In the calculation of estimated R_0 values, three epidemiological variables, namely the infection agent, host, and environmental factors are significant. Following factors are considered in the calculation of R_0 of a disease;

1. Infectious period: Some diseases may remain infectious for a longer period of time than others. For example, adults with flu are infectious for up to 5-7 days. Children and people with weak immune systems may become infectious for more than 7 days. The longer the transmission period of a disease, the more likely a person with the disease is to transmit it to other people. A longer contagion period will result in a higher R_0 value.
2. Contact rate: If a person with an infectious disease comes into contact with many people, who are not infected or vaccinated, the disease is transmitted faster. If this person remains at home, hospitalized, or quarantined while being infectious, the disease will be transmitted more slowly. Higher contact rate will result in a higher R_0 value.

3. Mode of transmission, contact density and contact time: The fastest and easiest-transmitted diseases are airborne (by way of droplets) ones like the COVID-19. There is no need for physical contact to be infected by a person with such a disease.

In contrast, diseases transmitted through bodily fluids such as Ebola or HIV are more difficult to transmit or communicate. The reason why is that you should contact infected blood, saliva, or other body fluids. Airborne diseases have a higher R_0 than those transmitted by direct contact. Extension of contact time or frequent contact also facilitates the transmission of airborne diseases.

The R0 may vary depending on many factors such as the epidemiological features (transmission mode, incubation period, infectious period, immune rate of society); the biological features of an infectious agent (infectivity, virulence, pathogenicity); the socio-demographic features (characteristics of setting amid patients and healthy people, risk density and duration of contact). Many factors may affect R_0. R_0 is actually predicted for a fully susceptible (disease-free or vaccinated) society. If a certain proportion of immune individuals are present within a community, R_0 may be estimated by more complicated calculations.

1.23.1. What does R_0 Value Mean?

There are potentially three possibilities for transmission or remission of a disease:
1. If R_0 is less than 1, each current infection prompts less than 1 new case. In such a case, the disease declines and ceases to exist eventually.
2. If R_0 equals 1, each current infection prompts another new case. The disease remains active and stable, yet does not prompt an outbreak.
3. If R_0 is greater than 1, each current infection prompts more than 1 new case. The disease spreads among people and may cause an outbreak.

The R0 value indicates how many people a disease spread from a sick person. There is also no relationship between the R_0 value and the severity of disease and spread rate within the community alone. For example, presuming the R_0 of two infectious agents to be 3, if an agent's incubation period or latent infection time is long, then its potential to cause an outbreak is lower (e.g. Tuberculosis). Also, advances in medicine might affect the spread and consequences. For instance, the Spanish flu epidemic, which killed 50 million people worldwide, took place in the year 1918. The R_0 value of the 1918 pandemic is estimated to have been between 1.4 and 2.8. However, in the outbreak of the H1N1 virus in 2009, the R_0 value is said to have been between 1.4 and 1.6. The availability of vaccines and antiviral drugs is thought to change the dimensions of an outbreak.

1.23.2. Estimated R_0 Values for Covid-19

In a research involving 12 studies conducted in China and overseas between 1 January 2020 and 7 February 2020 (in the early period of the outbreak), it was intended to predict the basic reproduction number for Covid-19. The average R_0 value for Covid-19 was found to be 3.28 with a median value of 2.79 (min-max: 1.4-6.4).

In another study, concerning an increase in the R0 reporting rate, the Covid-19 R_0 is estimated to vary between 2.24 (95% CI: 1.96-2.55) and 5.71 (95% CI: 4.24-7.54). All R0 estimates show that the R0 of Covid-19 is significantly greater than 1. The WHO estimates Covid-19 R_0 values as 1.4-2.5.

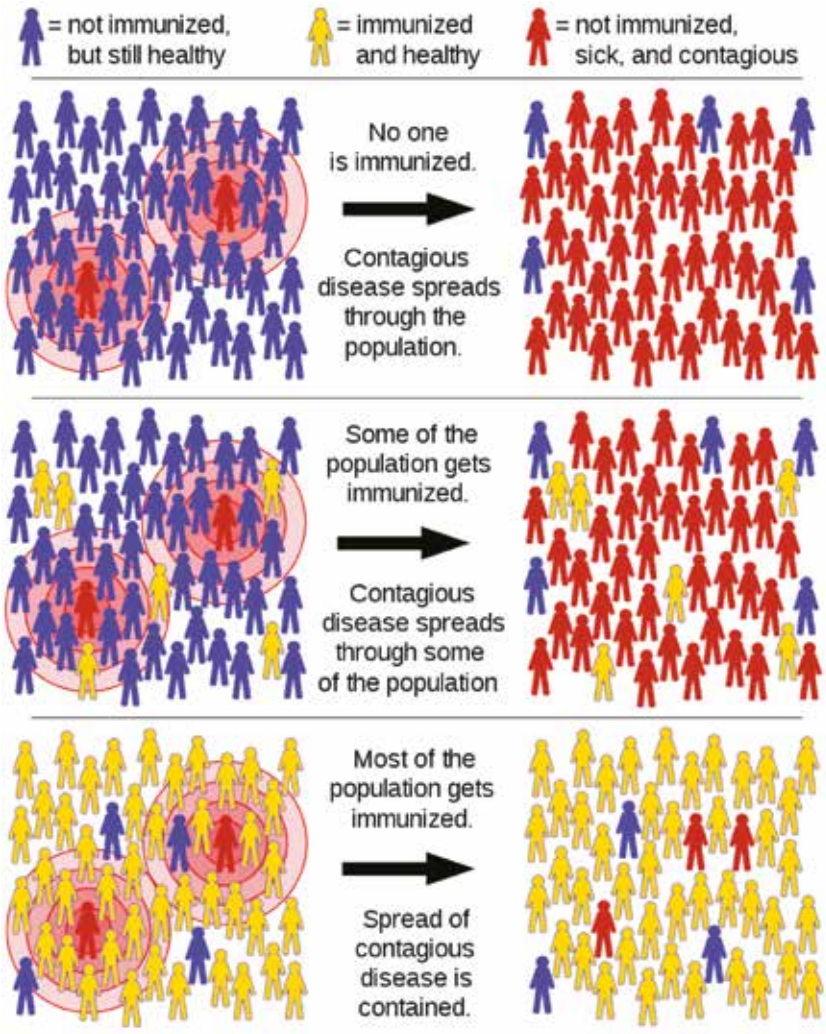
In another study, in the early stage of the outbreak, the R_0 value for COVID-19 was found to be 2.28 by using the Maximum Likelihood method of R_0, and the %95 confidence interval median value of R_0 was calculated as 2.28 (2.06-2.52). Meanwhile, in a study on the data of 11 European countries, the R_0 of COVID-19 was estimated at 3.87 (95% CI: 3.01-4.66). In the study, it is emphasized that non-drug interventions (social distance, mask, quarantine, etc.) in various European countries resulted in a significant decrease in R_0. In general, it is appropriate to say that the R0 value of the SARS CoV-2 virus, which causes the current COVID-19 outbreak, is approximately around 2.6. Therefore, it is safe to say that COVID-19 disease has a rapid spreading potential. Presuming the R0 value to be 2.6, it is estimated that one COVID-19 patient will infect 2.6 people after 1 transmission cycle (2-14 days, an average of 5 days), and infect up to 368 people in 7 transmission cycles (average of 35 days).

1.24. Herd Immunity

Herd immunity (herd effect, community immunity, population immunity, social immunity) is a form of indirect protection from infectious diseases that occurs when a large percentage of a society becomes immune to infection by vaccination or previous recoveries from infections. Thus, indirect protection is provided for non-immune individuals. The term “herd immunity” is widely used, but it has several meanings. Some researchers use herd immunity to define the immunity rate among individuals in a community. Another group uses it as the threshold rate of immune individuals, which should lead to a decrease in the incidence of infection. Still, others prefer to a model of immunity that must protect society from the invasion of a new infection. What the term implies is that the risk of infection among susceptible individuals in a society is reduced by the presence of immune individuals. Sometimes herd immunity is also called “indirect protection”. The concept of society “herd immunity” emerged about a century ago, but it was not widely used until the last decades. What prompted popular usage of this term have been discussions of eradication of diseases and cost-benefit analysis of vaccination programs with the increasing use of vaccines.

The social immune threshold can be considered the lowest vaccination rate required to stop the spread of an infectious disease that can be protected by vaccination in the community. The primary way to increase immunity levels in a community is vaccination. When the number of immune individuals in a community increases, the disease transmission/spreading rates drop, when it reaches a certain critical level the infection speed of the disease stops.

The fact that some individuals in the community are vaccinated and are protecting those who are not vaccinated is the result of herd immunity. In the media during the pandemic, herd immunity is used instead of the term social immunity. This naming is a false and inappropriate definition. The concepts of “social immunity or mass immunity” should be used in Turkish, (rather than the herd, which means of cattle).



Graph-18: *Spread of an infection in a community according to herd immunity status*

1. Box 1: indicates an outbreak in which a few people in a community are infected (shown in red) and the rest are healthy but not immune (shown in blue). The disease spreads in the community.
2. Box 2: a community where society has a small number of immunity (shown in yellow) is attained. Those not vaccinated get infected while vaccinated individuals don't.
3. Box 3: a large portion of the population is vaccinated, an immune against disease. In this illustration, the spread of disease within the community is prevented considerably including among those not immunized.

In the first two illustrations, while healthy unvaccinated individuals get infected, in the final illustration only 1/4 healthy unvaccinated individuals get infected.

If vaccination goes beyond the herd immunity threshold:

If the proportion of immune individuals in a society exceeds the critical threshold, the spread of the infectious disease in this community stops. The ultimate goal of social immunity is the elimination or eradication of the disease, depending on the nature of infectious disease.

Table-19: *Estimated R0 Values and Herd Immunity Threshold Value (for known infections)*

Disease	Mode of Transmission	R_o	Herd Immunity Threshold Value
Measles	Airborne	12-18	%92-95
Whoop cough	Airborne droplets	12-17	%92-95
Mumps	Airborne droplets	4-7	% 75-86
SARS	Airborne droplets	2-5	%50-80
COVID-19	Airborne droplets	1.4-3.9	%29-74
Influenza	Airborne droplets	1.5-1.8	%33-44

1.25. Serologic Diagnosis-Seroprevalence

1.25.1. Diagnosis of an Infectious Disease

The clinical presentation of an infectious disease project the interaction between the host and the microorganism. This interaction is affected by the host's immune status and the virulence factors of the agent. Findings on the disease vary depending on the setting and severity of the infection. Different pieces of information are required for the diagnosis of the disease, including history, physical examination, radiological findings, and laboratory data. The definitive diagnosis of an infectious disease can be made upon various microbiological assessments. These are:

a. **Direct assessments and techniques:** Microorganisms can be identified by direct examination of samples by microscopy. Specific microbial antigens can be detected by immunofluorescence, immuno-peroxidase staining, and other immunoassays. Genetic analyzes can identify genus-specific DNA or RNA sequences.
b. **Culture**: Isolation of infectious agents often requires a special setting. The non-inhibitory medium allows many microorganisms to reproduce. Selective venues contain inhibitors that only allow the growth of certain types of microorganisms.
c. **Microbial Identification:** Colony and cellular morphology features of the agent may allow preliminary identification. The growth characteristics of microorganisms, the use of carbohydrates, and other substrates under various conditions, enzymatic activity can give an idea for diagnosis.
d. **Serological diagnosis:** The high/rising titer of agent-specific IgG antibodies or the presence of specific IgM antibodies may facilitate diagnosis or confirm it.
e. **Antimicrobial Susceptibility:** Diagnosis can be made in vitro by determining whether microorganisms, especially bacteria, are sensitive to antimicrobial agents.

1.25.2. Serologic Diagnosis (Serodiagnosis)

Infection disease can be diagnosed by antibody response to microorganisms. The presence of antibodies against a pathogen in a person's blood indicates exposure to this pathogen. Serological tests usually measure one of two types of antibodies; immunoglobulin M (IgM) and immunoglobulin G (IgG). The presence of high-titer agent-specific IgM in a single serum sample is diagnostic for acute infection. The absence of either the IgM or IgG indicates that the person did not meet the suspected factor at all or that the test was performed at a very early phase in the disease. If the only IgG has been detected, the patient did encounter that microorganism, but there may be no infection in this acute period. In this case, to diagnose acute infection, it is necessary to represent the increase in the specific IgG titer in the second serum sample. IgM is produced in high quantities shortly after a person is exposed to the pathogen, and then its production drops rapidly. IgG is produced at the first exposure, but not as fast as IgM. At subsequent exposures, the antibodies produced are primarily IgG and remain in circulation for a long time.

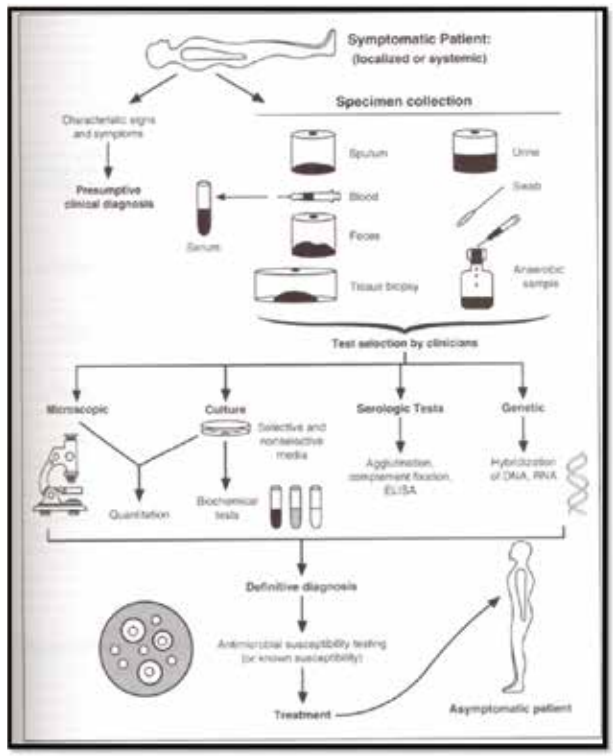


Figure-12: *Laboratory procedures to confirm clinical diagnosis of an infectious disease*

The serological diagnostic approach is especially useful in cases where the suspected microbial agent cannot be isolated in culture or can be but with great difficulty. The disadvantage of serology as a diagnostic tool is that there is often a delay between the onset of infection and the formation of antibodies against microorganisms. Although IgM antibodies occur relatively rapidly, it is often necessary to represent an increased IgG antibody titer against the suspected pathogen in acute and recovery phase (convalescent) serum samples. In some cases, the presence of a high antibody filter may seem diagnostic initially but may reflect a high titer infection or be a completely different cause of the existing infection. Another limitation on the use of serology as a diagnostic tool is the possibility that an antibody response does not develop in patients with suppressed immune systems.

1.25.3. Seroprevalence

Seroprevalence is the number of serology samples for a particular disease in a community that is positive for this disease. The presence of the disease in the person is confirmed by the presence of antibodies formed against this disease in the serum. Seroprevalence is usually presented as a percentage of the total samples tested or a rate per 100,000 people tested. Since identifying the emergence of the disease as positive is usually based on the presence of antibodies for this disease, this number does not matter if the specificity of the antibody is low. Serological tests help investigate an ongoing outbreak and provide a retrospective evaluation of the attack rate and the severity of the outbreak. In addition, it provides information for the examination of the pandemic. The immunity rate in the community, the speed of virus spread can provide an assessment of the impact of measures. In cases where the nucleic acid amplification tests are negative and have a strong epidemiological relationship with COVID-19 infection, the study of validated serological tests in serum samples taken in the acute and convalescent-phase may support the diagnosis. Cross-reaction with other coronaviruses may be a problem, but commercial and non-commercial serological tests are currently being developed. Antibody tests are necessary for determining the global load of the disease, determining the role of asymptomatic cases, the increase in rates of infection, and calculation of overall fatality. The findings of seroprevalence studies conducted in EU countries and the USA are as follows; antibody positivity at 1% in a study on blood donors in Scotland, antibody positivity at 1.9% in the study on blood donors in Denmark, antibody positivity at 3% in the study on blood donors in France, antibody positivity at 3.2% in the study on blood donors in the Netherlands.

1.25.4. COVID-19 Antibody Tests

For COVID-19, virus-specific antibodies can be monitored from the serum/plasma sample. IgM antibody begins to become positive on day 3-4 of the symptoms or day 7-10 of infection and IgG antibody on day 11-14 of the infection. Seroconversion has been shown to occur in 50% of patients on day 7 and on day 14 in all patients.

1.26. Sensitivity and Selectivity of Rapid Diagnostic Tests

A rapid diagnostic test is a quick and easy medical diagnostic test. The European Union defines rapid diagnostic testing as qualitative or semi-quantitative in vitro diagnostic medical devices, which include non-automated procedures and is designed to generate a quick result, used alone or in small series. Rapid diagnostic tests are suitable for pre-screening, emergency medical screening, and use in medical facilities with limited resources. Also, it can be used as point-of-care testing in primary care. Bedside testing is defined as a medical diagnostic test used at or near the treatment point. Results typically appear within 20-120 minutes.

The names of companies and generic products rapid antibody tests for COVID-19 are; Euroimmun, SureScreen Diagnostics, Accu-Tell, BioMedomics. The sensitivity and specificity values of these rapid diagnostic tests are shown in Table-21.

Table-20: *COVID-19 antibody tests sensitivity and specificity results*

Kit	Sensitivity %	Specificity %
Sure Screen Rapid Diagnosis Test (10 Min.)	IgM: 91.8 IgG: 100	IgM: 99.2 IgG: 99.5
Accutell Rapid Diagnosis Test (10 Min.)	IgM: 86.8 IgG: 97.4	IgM: 98.6 IgG: 99.3
BioMedomics Rapid Diagnosis Test (10 Min.)	88.66	90.6
Euroiummun Eliza (120 min.)	Days 10-20 IgG: 75 >days 21 IgG: 93.8	IgG: 99.6

Part 2

Pandemic Process Management Interplay of Scientific Disciplines, Information Tecnologies

Appropriate Information Management in Pandemics

Reliable Information in Pandemic Management

COVID-19 Pandemic and Its Psychological Implications

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Relation of Nutrition and Strong Immune System in COVID-19 Struggle

Pandemic Process Managemen, The interplay of Scientific Disciplines, and Information Technologies

2.1. Appropriate Information Management in Pandemics

The importance of accessing up-to-date and reliable information has demonstrated itself throughout the pandemic situation at hand. Especially, disinformation caused by false news brought into circulation via social media and the internet is one of the most damaging aspects of the process of combating COVID-19.

In this process, it is necessary and essential to inform the citizens with reliable data and to share information obtained from the automated data of the health system for transparent, fast, and reliable information by official institutions and organizations. Thus, it will be easier for the individual to be furnished with knowledge and equipment about true information and realistic measures and incentives instead of social panic and insecurity. In this section, information sources and current reports are presented for researchers and those who wish to follow.

In the pandemic process, manipulative and disinformative information sharing by unauthorized persons through social media proved that it is very important for the organizations in charge to share the right information with the public. In this process, many data sharing sites began broadcast alongside national and international organizations. Especially in order to be able to conduct interdisciplinary studies, it has become imperative to follow current data flows.

2.2. Reliable Information in Pandemic Management

One of the most important stages in the fight and control of infectious diseases that have developed into an epidemic scale is true data evaluations and their reporting. Analysis, interpretation of data with correct methods, disclosure to relevant units, and by authorized offices is one of the areas requiring preparedness in the fight against outbreaks. There are various ways of reporting (such as numbers, tables, graphs, figures, projections, and comments).

Lessons learned from such sources after each outbreak that morphed into a pandemic and left its mark in world history have been a useful guide in subsequent outbreaks and struggles. Perhaps the most important key phrase in this field, in which epidemiology and statistics science contributes greatly, is perhaps “collecting true data and analyzing correct records with the right methods”. Therefore, countries attach great importance to studies that will increase the strength and quality of the surveillance systems, as in every other field. And even worldwide, efforts are made to create a platform where the same language is spoken, using common coding systems to enable cross-country comparisons. In the common struggle that concerns the whole world like a pandemic situation, it is possible to carry out simultaneous case follow-ups, outbreak progress, and projections within such common ground.

The pandemic steps are characterized by the simultaneous and multi-sectoral transactions executed collaboratively in a coordinated manner. Reports and evaluations prepared during or at the end of an outbreak must be made available to the public through mass media, meetings, and presentations to health authorities and even to the whole world by declarations. Scientific congresses or articles can also be shared with the world for the presentation of final reports.

In situations such as a pandemic, health communication is carried out in such a manner as to informing about the current situation, requesting support when necessary, announcing new developments, informing the public sectors, and opinion.

Stakeholders to receive these transfers may be their own members of intervention groups (internal stakeholders), other official institutions, academic persons and institutions, non-governmental organizations and professional organizations, individuals in the general public, and even the whole world.

Therefore, the ways of presentation and sorts of information may differ according to the target. Delivering the messages to reach masses in the correct language is also of great importance as well as the preparation and presentation of information notes or scientific reports prepared for special groups in the first place. By providing the right messages and information, public inclusion and contribution can be ensured, and the possibility of acceptance for even the most difficult practices in the fight increases. On the other hand, it may be possible that false messages or comments prompt chaos or irreparable damage. Today, it is possible to reach a large number of people instantly with social media, a very powerful and effective way, and mass media tools. In the Corona outbreak, as in the case of Italy, this issue is thought to be one of the reasons for the distressed outlook which came after the spread of the disease to entire Italy, which could have been possible to take under control by public announcements disclosing areas with intensified cases through various means, and encouraging prompt internal movements of migration to sterile areas hence keeping the situation occurring within a limited area. While some countries, including Turkey, learned lessons from the experience and opted for withholding regional information when making announcements about the cases until at least local measures were taken.

Because depending on the character of the diseases causing a pandemic or extraordinary situations, accurate data analysis and presentation methods are scientific studies that must be meticulously addressed; we cannot stress enough the first thing to be done is “to work with the experts of the relevant subject and other scientists who can contribute in a multidisciplinary manner”.

While the quality of the messages to be delivered can be translated into formats that will reach target audiences with presentations and comments of experts, they can be prepared with scientific, ethical messages that are not unrealistic. The salient point here is to prepare the messages and information to be given in a clear language by modifying them according to the target group presented.

As we experience the Corona outbreak, the database of committee members consisting of scientists competent in their fields and the Ministry of Health, which conducts the outbreak management, utilizes the surveillance data system available in Turkey. Analysis and interpretation of existing data are also based on universal epidemiological criteria calculation methods and computer-aided scientific software. Being able to interpret and discuss these graphics requires as much expertise to prepare them. Unfortunately, guests and commentators, especially those featured in broadcasts followed by the public through media, make erroneous comments and mislead the audience even when they lack expertise, or make erroneous assessments on tables and graphics they present. These interpretations can be misunderstood, cause the public to feel despair and to have a negative sense of confidence in the fight against the epidemic through their opposition to public practices.

It is difficult and not right to make an assessment especially for countries that speak the same language but do not use the same criteria in case of definitions particularly when making cross-country comparisons and comments on the analysis and their results. In other words, it would be wrong to compare apples and oranges.

Proposals to amend defective aspects of the issue:

Common use of a surveillance system making use of the same language and jargon, “case definitions” with same criteria and not allow criteria to be stretched depending on situation and agenda,

Ensure assessments and interpretations of cases, tables, graphs carried out, and announced by expert scientists (public health specialists, epidemiologists, bio-statistics experts, etc.) in their fields,

Prevention of illustration and presentation of case data in a manner as to distort facts,

For authorities in charge of case management to be open to comments and contributions from and open to the scientists from related fields (public health specialists, epidemiologists, bio-statistics experts, etc.) with permission and authority in a manner as to allow transparent assessment,

Limitation of media appearance of figures to reach out to masses who do not contribute to appropriate informing of the public in line with “ban on media appearance”, a practice may be as valuable as curfews itself,

Commentators to explain the situation in a language comprehensible by the public and to avoid and prevent interpretations that may trigger misconceptions or panic and chaos,

Prevention of data sharing by unauthorized and unassigned individuals to act in areas and premises in a manner as to exceed their authority.

2.3. COVID-19 Pandemic and Its Psychological Implications

The COVID-19 outbreak can be defined as a threat that the 21st-century generation has not experienced before and has a global impact that affects our lives in all aspects. It is necessary to make assessments in a number of dimensions such as public health, economy, sociology, psychology, concerning the possible effects of an outbreak which is affecting our health and social lives so deeply. In this regard, although it is still not possible to conduct experimental psychological studies on COVID-19, in the report titled COVID-19 Outbreak and Post-Psychological and Sociological Evaluations prepared by the Police Academy on the psychological dimensions of the subject, contributes to the management of the global pandemic process and subsequent developments. a theoretical perspective is provided. In the report, the COVID-19 outbreak was analyzed at three levels: psychological effects, social relationships, uncertainty, and vital vulnerability. In addition, long-term socio-psychological consequences of the COVID-19 global outbreak in people and social relationships are expected. Socio-psychological interaction may include the duration of the global pandemic, mortality rates

associated with it, how political authorities manage this outbreak, and its prevalence, whether it will continue with different waves, etc. are emphasized.

Consequently, the ability of the society to act together and to show common solidarity in the fight against the outbreak, which will continue for a longer period of time with security, health, economic, social, psychological and political effects, has been described as the most effective factor in overcoming foreseen and unforeseen problems. As underlined before, the most important condition to get rid of social, psychological, political, and economic losses with the least damage is the national and international community's common efforts to solve this problem through common sense and solidarity. Therefore, the importance of international cooperation, solidarity, common sense, and universal values, which are free from commercial and political concerns, are more vital than ever before.

2.4. Interaction of Pandemics with Scientific Disciplines

The concept of "One World One Health" has come to the fore as a result of the initiatives in the USA and the EU, due to the global effects of new zoonotic diseases that have emerged in recent years on human, animal and environmental health, and international trade and economy.

One World One Health approach, has gained importance as cooperation activities of different disciplines working locally, nationally and globally on the optimal health of people, animals, and the environment, consequently, the only health concept was adopted between the American Veterinary Medical Association and the American Medical Association in 2007 and later also adopted by the European Federation of Veterinary Medicine.

The FAO/WHO Joint Committee on Zoonotic Diseases reported that in 1967 there were more than 150 bacterial, viral, parasitic and fungal originated zoonotic diseases in the world, and this number exceeded 200 in the year 2000. The need for humans and veterinarians to combine efforts in effective fight with diseases is obvious when considering that approximately 60% of infectious diseases seen in humans are zoonotic and 75% of them are novel or regained zoonotic diseases, more than 90% of foodborne diseases are caused by animal foods. Diseases such as West Nile virus, Ebola hemorrhagic fever, SARS, BSE, Monkey Blossom, CCHF Disease, High Pathogenicity Avian Influenza are known to cause social fear, global trade disruption, and great economic losses.

2.5. Vaccines

The vaccination aims to develop secondary (developed by vaccination) immunity rapidly, after the encounter with the targeted microorganism, to reduce the occurrence/severity of the clinical disease. This is due to the emergence of memory T and B cells after vaccination and the formation of the neutralizing antibody. When asked what a vaccine is, the following 3 items are explanatory:

Live or inactive microorganisms (virus, bacteria, parasite),
Their components (protein),
Their metabolic offsets (toxin).

2.5.1. Conventional Vaccines

Live Vaccines (active vaccines, attenuated vaccines): They are prepared by eliminating or weakening the disease-causing power of microorganisms naturally (natural passages) or artificially (tissue culture or experimental animals). It reproduces, spreads, and stimulates the immune system (lymphoid and myeloid cells) in the body it has been injected.

2.5.2. Inactive Vaccines

They are prepared by bringing the agent completely inactive by chemical or physical means. It does not reproduce in the organism in which it is injected, it stimulates the immune system (lymphoid and myeloid cells).

2.5.3. Biotechnological Vaccines

Synthetic Peptide Vaccines: prepared based on determining the protein structures of the immunogenic components of the infection agent in in-vitro conditions and using the peptides as vaccines. While it is an advantage that they do not form infections, can be administered in large quantities and are easy to maintain, the fact that the antigenic determinant to be synthesized must be well determined and multiple components must be vaccinated are disadvantages.

2.5.4. Vaccines Produced by Genetic Engineering

Mutant, recombinant mutant microorganisms and their products and antigenic units obtained by some manipulations in the genomes of microorganisms are used as vaccines.

2.6. Standardization of Vaccines

The production of vaccines should be within the terms of GMP (Good Manufacturing Practices). GMP is a quality assurance that ensures that medicinal products are produced and controlled in accordance with their intended use and in a consistent manner as required by product specifications. GMP defines quality criteria for both production and quality control, ensures that processes required for production and testing are clearly defined, verified, reviewed, documented and that personnel, facilities, and materials are suitable for production.

In the production of viral vaccines, specially equipped laboratories with a bio-safety level of 3 or 4 according to the risk level of the virus and the GMP conditions described above should be met. If a known and standardized and an identified virus is to be studied, the main seed strain of this virus will be produced and the main seed strain and working seed strain studies can be started in the laboratory where the production will be determined (identification, sterility, purity, potency, immunity, etc.) and production of the vaccine can be initiated. However, if the strain has not been previously used in the production of vaccines, first of all, the antigenic properties of the strain are to be carried out. If live vaccines will be produced, many studies such as attenuation studies can be used and the strain can be used as the main vaccine strain by making it the standard vaccine strain.

Then, in each mass production segment of the vaccine, bulk production of the vaccine is initiated by making standard controls on the main seed strain and working seed strain, including nutrients to be used in production, cell cultures. Various tests (purity, sterility, potency, etc.) are carried out to ensure the final product by taking various samples at critical control points (may be different for each vaccine) until the final production of the vaccine.

After the final product, tests (purity, sterility, potency, stability, immunity, etc.) are carried out by taking sufficient samples in accordance with the standards. Prior to actual sales, final product tests are to be repeated at a setting determined by the national authority, if vaccine passes these tests as well, then sales are allowed. After-sales, in line with rules of Pharmacovigilance (scientific studies on the detection, evaluation, identification, and prevention of side effects and other possible problems related to medicinal products), the use of the vaccine in the field is also monitored.

2.7. Etiopathology of COVID-19 and Points to Take into Account in Current Treatment

2.7.1. COVID-19 and SARS-CoV-2 Syndrome

SARS-CoV-2, which is the cause of COVID-19 disease, is an enveloped RNA virus from the coronavirus family and can cause disease courses ranging from simple colds to severe acute respiratory failure in humans. Although it has been nearly 5 months since 2019, when the first case was reported in China (as of June 2020), there is no specific treatment and preventive vaccine with proven efficacy and safety for the treatment of the disease. In many countries and our country, scientists carry out many drug studies to be used in the treatment of the disease, and different treatment protocols are carried out with the permission of local and international authorities for emergency therapy within the framework of mandatory clinical situations. Their positive results are expected in the near future.

COVID-19 refers to infection with severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). The disease, which was first detected in 2019, has rapidly transformed from a regional epidemic to a global pandemic. Treatment protocols have to be created very quickly to cope with this seriously fatal disease. Treatment protocols that are internationally accepted in the treatment of COVID-19 have been developed based on the treatment of different viral infections such as malaria, Ebola, and cholera. In this rapidly spreading disease, the need for emergency treatment methods stalled the opportunity to carry out controlled clinical studies required to determine the effectiveness of treatment methods. Therefore, the effectiveness of currently approved and potential treatment needs to be determined in preclinical and controlled clinical trials. This requirement has also been welcome by the scientific circles, and many controlled clinical studies are underway to explore different treatment approaches.

2.7.2. Recent Therapeutic Approaches for Treatment of COVID-19 and the Necessary Precautions

COVID-19 is caused by a novel, enveloped single-stranded RNA virus, Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2). It was first recognized in December 2019 in China. After causing a regional epidemics, COVID-19 rapidly expanded to a global pandemic with significant mortality. In order to fight with this rapidly emerging threat, treatment protocols were created in a very short time. Worldwide recognized protocols to treat COVID-19 are based on previous experiences with other viral infections such as malaria, ebola, and cholera. Although protocols were based on positive results obtained by various groups, these data could not be generated from direct conventional well designed clinical trials because of the urgent need for treatment. Hence, a better understanding of the pathogenesis of COVID-19 infection as well as preclinical testing of approved and candidate treatment modalities are required. These requirements are actually well appreciated by the scientific community and many controlled trials are registered for various drugs recruiting patients.

2.7.3. Immunopathology of COVID-19

Studies suggest that the pathogenesis of SARS-CoV is mediated by disproportional immune responses and the ability of the virus to circumvent innate immunity (m2). For example, critical patients with respiratory problems often demonstrate lower levels of lymphocytes, extremely high inflammatory parameters, including C reactive protein (CRP) and pro-inflammatory cytokines (IL-6, TNFα, IL-8, IL-1, etc.). Lymphocytopenia is one of the most prominent features of COVID-19, and also a diagnostic criterion. The majority of infiltrated immune cells in lung lesions are found to be monocytes and macrophages, whereas lymphocytes infiltration is minimal. Multiple studies confirmed the elevation of IL-6, one of the most inflammatory cytokines, in critically ill patients with COVID-19. Furthermore, an increased level of IL-6 is associated with fetal outcome. The increased inflammatory response in these patients is likely to induce vasculitis and hypercoagulability leading to multiple organ damage. Cytokine storm, which can be fatal if not controlled properly, is a condition characterized by the excessive and uncontrolled release of pro-inflammatory cytokines. Accumulating evidence revealed that the majority of severe COVID-19 patients have cytokine storms. All these immunological findings in critically ill patients demonstrate that immunomodulatory drugs might be beneficial and even lifesaving.

2.7.4. Immune Modulatory Drugs

These drugs include non-steroidal anti-inflammatory drugs, glucocorticoids, chloroquine, hydroxychloroquine, immunosuppressants, inflammatory cytokine antagonists (such as IL-6R monoclonal antibodies, TNF inhibitors, IL-1 antagonists, Janus kinase inhibitors). Several of these drugs were already used with mixed results. Given the clear immunological findings in these patients, these mixed results were likely to arise from insufficient experimental design such that timing, duration, and the dose of the treatments were not tailored properly. Immunomodulatory agents should be used to reduce systemic inflammation before it becomes overwhelming and results in multi-organ dysfunction. In this phase, the use of corticosteroids may be justified in concert with the use of cytokine inhibitors such as inhibitors of IL-6 inhibitor and IL-1. Intravenous immunoglobulin may also inhibit the inflammatory response in these patients. Recently it was shown that indomethacin, a non-

steroidal anti-inflammatory drug, exhibits potent antiviral activity against canine coronavirus as well as human SARS-CoV suggesting that indomethacin might be a good alternative to inhibit excessive inflammation in these patients. Overall, the prognosis and recovery from this critical stage of illness are poor, and the immunomodulatory approach may save the patient's life.

2.7.5. Drugs Used in Cancer Therapy

Many drugs used in malignancies, depending on the dose, have anti-inflammatory/immune-modulatory or cytotoxic effects. Interestingly some of these drugs also inhibit viruses. For example, 6-mercaptopurine and 6-thioguanine were found to be specific inhibitors for the SARS coronavirus. Mycophenolate mofetil is a drug used widely for the prophylaxis of acute rejection in renal transplantation and also in cancer treatment. Mycophenolate mofetil suppresses the immune response and has antiviral activity in very low concentrations. Tacrolimus, also known as FK506, is an immunosuppressive drug that inhibits viral replication of SARS-CoV, HCoV-NL63, and HCoV-229E at non-toxic, low-micro molar concentrations. Hence all these immune-modulatory drugs in lower doses alone or in-combination might be effective in critically ill patients with cytokine storm.

2.7.6. Cell-Based Therapies

As part of anti-inflammatory approaches, cell-based therapies, primarily involving mesenchymal stem (stromal) cells have been conducted. Some of these studies also utilize mesenchymal stem cell-derived conditioned media or extracellular vesicles. Mesenchymal stem cells, when they are lodged in the lungs, release soluble mediators including anti-inflammatory cytokines, antimicrobial peptides, angiogenic growth factors, and extracellular vesicles. Although mesenchymal stem cells may prevent excessive inflammation, they may also lose viability and immune-regulatory activities once they are exposed to viruses. This condition might be prevented by using extracellular vesicles. Hence, further pre-clinical studies must be done to evaluate the effectiveness of mesenchymal stem cells determining the dosing strategies as well as the appropriate source for these cells.

2.7.7. Critical Requirements in Determining the Effectiveness of the Treatment Modalities

We need to be cautious about the possible toxicity of the drug candidates as well as the drugs that are approved right now. Drugs that seem to be efficacious may later prove to be more harmful. Many medicines have been withdrawn because of adverse reactions after showing clinical promise. Chloroquine and hydroxychloroquine are front-line medications for the treatment and prophylaxis of malaria and are also used to treat autoimmune diseases, and these drugs possess a broad spectrum of antiviral effects on viruses including human immunodeficiency virus (HIV) and SARS-CoV-1. Hence hydroxychloroquine is widely used for COVID-19 and considered safe. No drug is guaranteed to be safe, and hydroxychloroquine has rare but potentially fatal harms, especially when prescribed with azithromycin which is found in the treatment protocol of critically ill COVID-19 patients. Furthermore, the beneficial effects of chloroquine in patients with COVID-19 need to be tested through appropriately conducted clinical trials. This is also valid for all the mentioned candidate drugs for critically ill COVID-19 patients.

In conclusion, in a short time with the hard work of many scientists/doctors, a great deal of knowledge has been obtained opening a new venue for finding safe and effective therapy for COVID-19 patients. COVID-19 caused the loss of many patients, pain of the loss of loved ones, distress, anxiety, economic and psychological crisis, but it also leads to a tremendous number of people with different backgrounds to come together to solve all these problems. This union of people creates great confidence and gives hope for a better planet for the humankind.

2.8. Highlights of Fight Against Pandemics

Physicians, especially family physicians and emergency room specialists, first encounter epidemics. Therefore, the role of the physician is very important in the early detection of outbreaks. During an outbreak, physicians will face large patient mass, vaccination, and antibiotic prophylaxis. Meanwhile, they will both inform the public and work in hospitals and communities to control the outbreak. Therefore, physicians should be involved in the preparation and development of medical preparedness and response plans with local and national authorities.

The most important point in dealing with outbreaks in the presence of strong health infrastructure. Investing in community health services will facilitate regular monitoring and recognition of rare or unusual disease outbreaks. To establish a response to epidemic threats, to recognize and investigate them, basic public health services (disease surveillance, supporting laboratory services) need to be performed. With a more effective global surveillance program, the early diagnosis of infectious diseases and diseases that reemerge will be easier. It is extremely important for clinicians to be alert about extraordinary infection cases and clusters, to receive support from infectious diseases specialists in diagnosis, and to report the cases to public health professionals.

Physicians see only one or a few cases, and sometimes they may not notice an outbreak that has initiated. Therefore, the collaboration of primary healthcare physicians with public health officials is important. While healthcare providers are trying to deal with an epidemic, they need cooperation from emergency management units, lawmakers, healthcare institutions, and many community service agencies. For these different groups to work together effectively, advanced planning should be carried out. In addition to surveillance programs, health officials, public healthcare providers, and primary healthcare staff need to be informed and trained about the agents that can be used. Besides, it is necessary to strengthen laboratory capacity for rapid diagnosis of the outbreak as well as to provide medicines, vaccines, medical services, and hospital services for control of the outbreak.

Genetic modification of microorganisms can cause microorganisms to be created, either intentionally or unintentionally, that are more virulent, more resistant to antibiotics, or more persistent in the environment. In addition, these microorganisms can alter their immunogenetic properties, leading to the disruption of natural or acquired immunity.

Advances in genetic engineering and gene therapy can cause the immune system response of the target population to change. This change may be to disrupt the function of normal host genes of these individuals or to increase or decrease the susceptibility to pathogens. It seems essential to be careful about these issues and to take the necessary measures at the very beginning of the process.

Today, the pandemic vaccine is administered to high-risk people such as carers, relatives of immunodeficient individuals, healthcare professionals, and oncology patients. Health professionals may be the most important source of infection in the transmission of seasonal and pandemic influenza to patients. Healthcare professionals may be asymptomatic during the incubation period and may spread the infection, especially in close contact. Various randomized clinical trials conducted in long-term health institutions have shown that vaccination of healthcare workers is associated with a reduction in the rate of disease and the number of deaths in patients with acute respiratory diseases during the winter months. It is an ethical imperative for health workers to be vaccinated against HINI, especially for those working with immunodeficient patients. It is also recommended so that the necessary care services are not interrupted during the vaccine epidemic. Incentive activities should be carried out by health institutions to increase the pandemic vaccine application among their employees.

Rapid advances in microbiology, molecular biology and genetic engineering, and digital information technology have created outstanding opportunities in the field of biomedical research, and make a great promise in improving human health and improving quality of life. Better and faster diagnostic tools, new vaccines, and drugs will be developed in the near future. At the same time, there is concern that abuse of research will result in the construction of new and dangerous biological weapons and the spread of new infectious agents. These studies seem difficult to distinguish from biomedical research. Everyone involved in biomedical research is obliged to comply with moral and ethical rules to take into account the possibility of abuse of their findings and to take the necessary safeguards.

No vaccine has yet been found for the treatment of the disease. Scientists project that the vaccine will be produced and made available to people in 2021. Chloroquine, used in the treatment of Malaria, has been found to be effective according to studies in China. In addition, Azithromycin has been identified as a potential treatment in combination with Hydroxychloroquine in a study. It is predicted that blood and blood products collected from individuals who have survived COVID-19 can be used in the treatment of the disease.

Since a vaccine developed against coronavirus disease is not currently available, the measures taken are mostly for resource control and transmission. Filiation is important in this regard. In other words, scanning the contact chain related to infectious disease and/or finding the source of the disease and taking the measures before they spread play an important role in the fight against the disease. It is also important to collect and analyze data regularly and routinely, such as in case of surveillance practice.

2.9. What is Surveillance?

For prevention and control of infectious diseases; surveillance is the process of collecting data regularly, routinely, analyzing, interpreting, and distributing the data to the relevant units. The method of surveillance in which the data sent for a specified period is analyzed, interpreted, and feedbacked within the system determined by the persons executing diagnosis without data being actively collected by the person or units responsible for reporting, is called Passive Surveillance.

The method of surveillance, in which data is collected, analyzed, interpreted, and feedbacked by authorized units without waiting for the person or units responsible for reporting in the surveillance system by themselves, is called Active Surveillance. Active surveillance is used when the current situation and time are critical.

Syndromic approach The syndromic approach is the method of surveillance, where health-related data consisting of diagnosis or symptoms that are not specific to a particular disease are collected, analyzed, interpreted, and feedbacked. Objectives; Based on the main symptoms (and epidemiological clues, if known), a flowchart that the physician can first consider which factors and which samples to send for which diagnostic tests and when. The WHO recommends this approach to countries where sources are limited. In an exemplary society selected to detect cases early, access information about disease trends, and collect quality and accurate data, the surveillance method in which data is collected, data analyzed, interpreted, and feedback is called Sentinel Surveillance.

In the scope of surveillance efforts, actions as per the table below are carried out after a diagnosis of a disease is established in health institutions in relation to communicable diseases. In addition, part or all of the activities may be carried out, depending on the nature of the situation or event, in case of diseases that are not in the scope of mandatory notification class but unusual or unexpected and a threat to public health.

Table-21: *Activities to be conducted by health instructions in scope of surveillance*

CASE REPORT	**NOTICE**	Notifying via phone healthcare units about the case without delay for written report concerning a suspected, possible or definitively diagnosed special case
	REPORT	Reporting within 24 hours concerning suspected, possible or definitive case by means of forms and systems designated by healthcare authorities
AFTER CASE REPORT	**FIELD ANALYSIS / FILIATION**	Field investigation / fillation is the study of determining the source and the effect after the reporting the case and / or tak-ing protection and control measures including the contacts
	CASE STUDY	In cases where there is no clustering or epidemic feature, after the diagnosis is made in the health institution, sending the information included in the disease-specific case study form and sending other studies to confirm the diagnosis
	OUTBREAK STUDY	In cases where there is no clustering or epidemic feature, after the diagnosis is made in the health institution, sending the information included in the disease-specific case study form and sending other studies to confirm the diagnosis.

Source: *Ministry of Health Guide Book on Struggle against Contagious Diseases Bulasici-Hastaliklar-ile-Mucadele-Rehberi-Genelgesi-2017-11 .pdf*

2.10. What is Filiation-Contract Tracing?

Filiation means all work to identify the source of the agent and its contacts and to take protection and control measures, including treatment and isolation. In the case of infectious disease, contact follow-up is the infection screening of anyone who has had contact with the disease. In the case of infectious disease, it is very important to conduct a filiation work. The aim is to detect the agent and the source in the early period and prevent the spread of the disease.

In public health, contact tracing is the process of identifying people who may have contracted an infected person and then gathering more information about them. With contact tracking it is aimed at:

- By tracing contacts of the infected,
- By administering tests on infection,
- By treating patients and tracing their contacts,
- Reduction of infections within the community.

Diseases in which contact monitoring is common to include vaccine-preventable infections such as tuberculosis, measles, sexually transmitted infections (including HIV), blood-borne infections, some serious bacterial infections, and new infections (COVID-19). The benefits of contact monitoring are:

To stop ongoing contagion and reduce the prevalence of infection,
To warn contacts against infection risk and offer preventive counseling or prophylactic care,
To provide diagnosis, counseling, and treatment, as needed, for the infected,
If the infection is curable, to help prevent re-infection of already infected patients,
To collect data on the epidemiology of a disease in a given community.

There are 3 steps to be followed in contact tracing:

1- Contact identification

When a case is confirmed to be infected, the individuals the person is in contact are to be identified:

The person's activities and people in their environment since the commencement of the disease
Interview the person about his/her social roles to identify contacts
Contact may be anyone who has been in touch with the infected (family, coworkers, social circles, healthcare providers, etc.)

2- Contact list: All persons who are thought to be in contact with the infected person should be listed as the contact. Each person listed should be identified and should be contacted. To these people:
explain what contact means
what they should be self-monitoring (fever, cough, muscle pain, etc.)
underline importance of early treatment in case symptoms develop
information on disease prevention should be offered.
In some cases, quarantine or isolation at home or in the hospital is required for high-risk contacts.

3- Contact follow-up: All contacts should be followed up regularly to monitor symptoms and test for signs of infection.

4- Contact types: Types of contact in terms of public health management vary with infectious disease due to different modes of transmission. For sexually transmitted infections, sexual contacts of the index case (the first case) and babies born from the index case are important. For blood-borne infections, blood transfusion recipients, people sharing a needle (substance addicts), and people who may have been exposed to the blood of the index case are important.

For lung tuberculosis, people who live in the same house or spend a significant amount of time in the same room as the index case are important. It is critically dangerous for COVID-19 to remain at a distance of less than 1 meter without any protection measures (mask, etc.).
Contact tracking is a critical tool for investigating new diseases or unusual outbreaks, as well as being widely used for disease control. For example, as in COVID-19, contact monitoring is used to determine whether newly detected possible/definitive cases are linked to known cases and to determine the presence of secondary transmission in a particular community. In chaotic processes like a pandemic, it is very difficult to follow up with the contact. For this reason, guidelines should be prepared for contact follow-up in the pandemic and solid strategies should be developed.

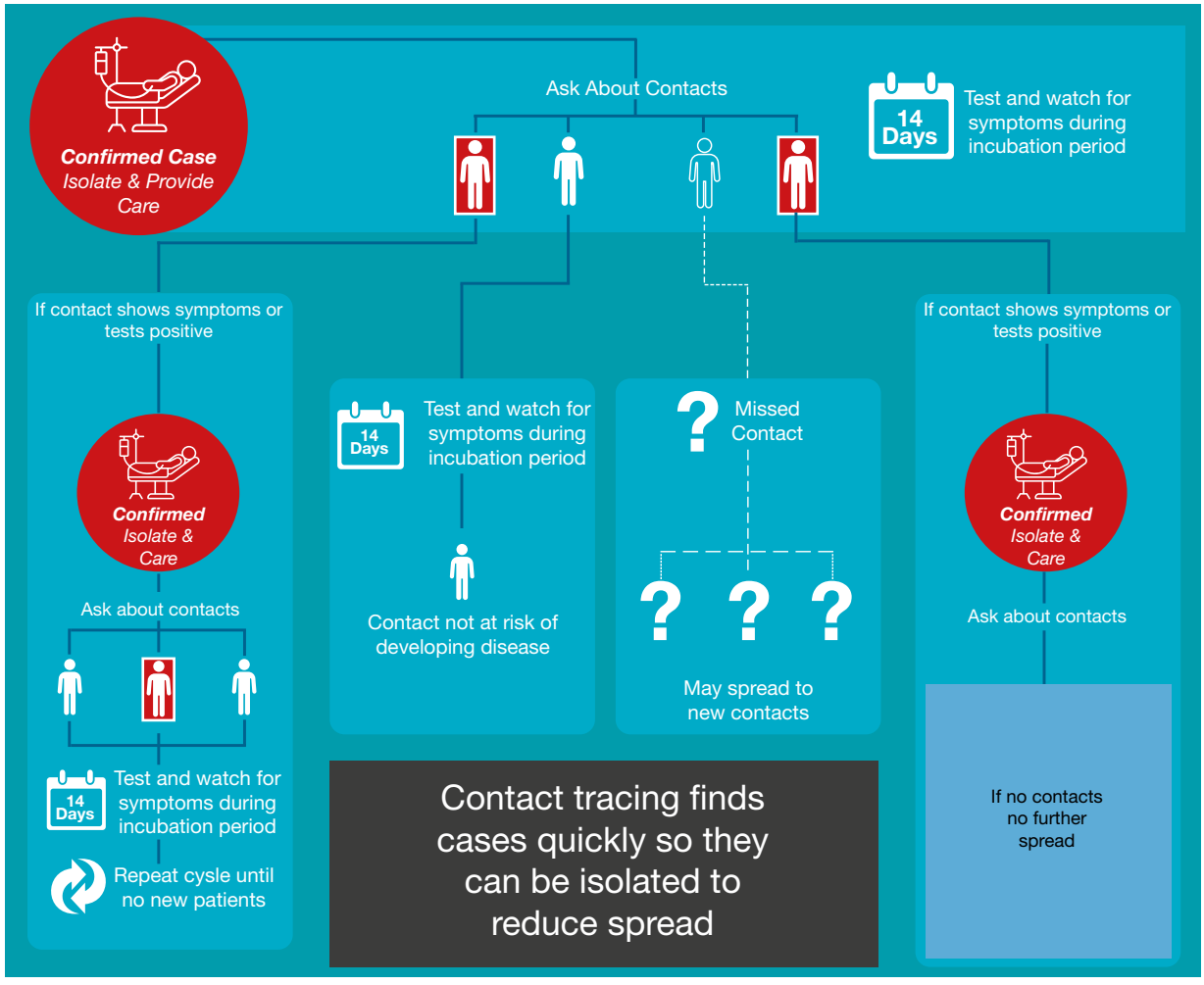


Figure-14: *Aschematics illustration of filiation*

2.10.1. Privacy and Risk of Stigmatization

Some healthcare providers have expressed concerns in their contact tracking that individuals may give up seeking medical treatment due to loss of privacy and subsequent stigma, discrimination, or fear of abuse. Public health officials say that contact monitoring goals need to maintain trust in the vulnerable population and balance with sensitivity to individual situations.

2.11. How and When Does a Pandemic End?

No matter how properly planned the strategy in combating global outbreaks is possible, the problems that may arise in practice and individual errors can negatively affect the fight against global outbreaks. Therefore, for the global pandemic to end, everyone from authorities to citizens should demonstrate due seriousness and care in the fight against the disease.

Medically speaking, 3 different paths are available for a pandemic to end:

- A significant portion of society to encounter the disease and generate antibodies,
- Vaccine or preventive drugs to reduce the portion of society susceptible to the disease,
- Slowdown of the agent's infectivity and pathogenicity.

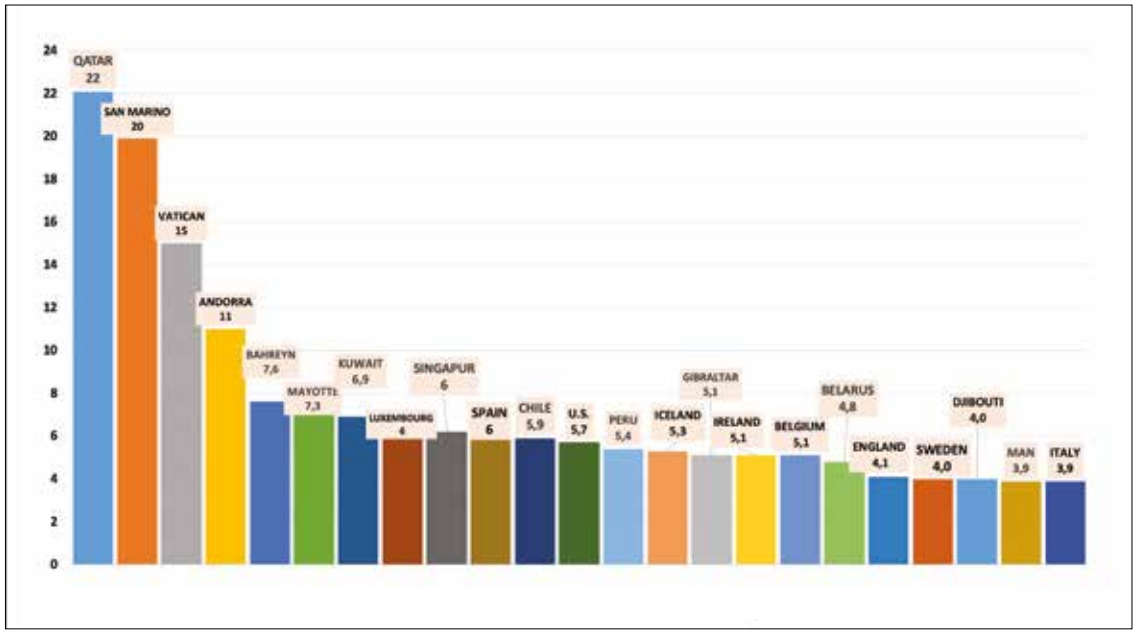
There is no sign of a third option for COVID-19. Vaccine and prophylactic drug-Ig, the second option, are not yet available, but some trials are underway. There is only 1 way left. But in that method, the mortality rate is very high. It should not be ignored that:

- Fatality is %5 (for all cases) in the lab. confirmed cases,
- The rate possibly to hike with the death of some of the follow-up patients,
- Lab tests preferred in case of rather medium/heavy courses.

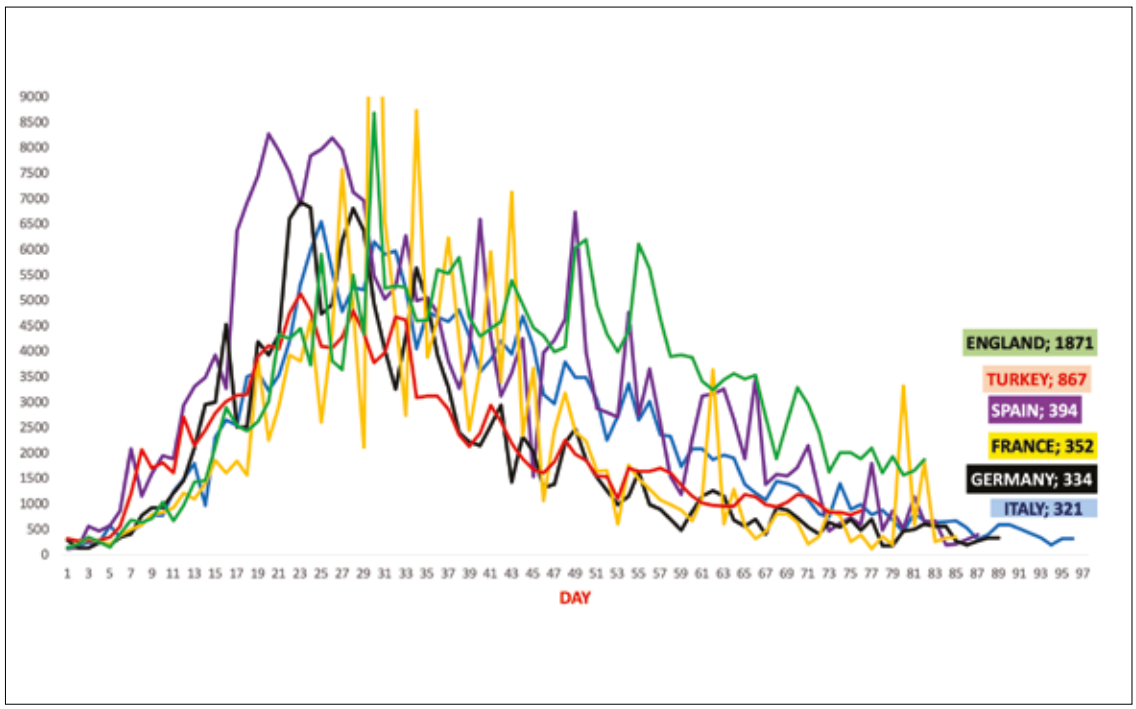
Even though it is too early to discuss when the global epidemic will end, the social pressure may turn into a process that will put the administrators in the fight against the epidemic in a difficult situation. Although it is not correct to evaluate the developments in different countries in the same pot in this regard, the geographical and demographic characteristics of each country and the current health system and the method of combating epidemic involve differences. This will naturally affect this calendar. The evaluations below are based on statistical data, ignoring these interactions.

Table-22: *COVID-19 confirmed cases and mortality rates (7 June 2020)*

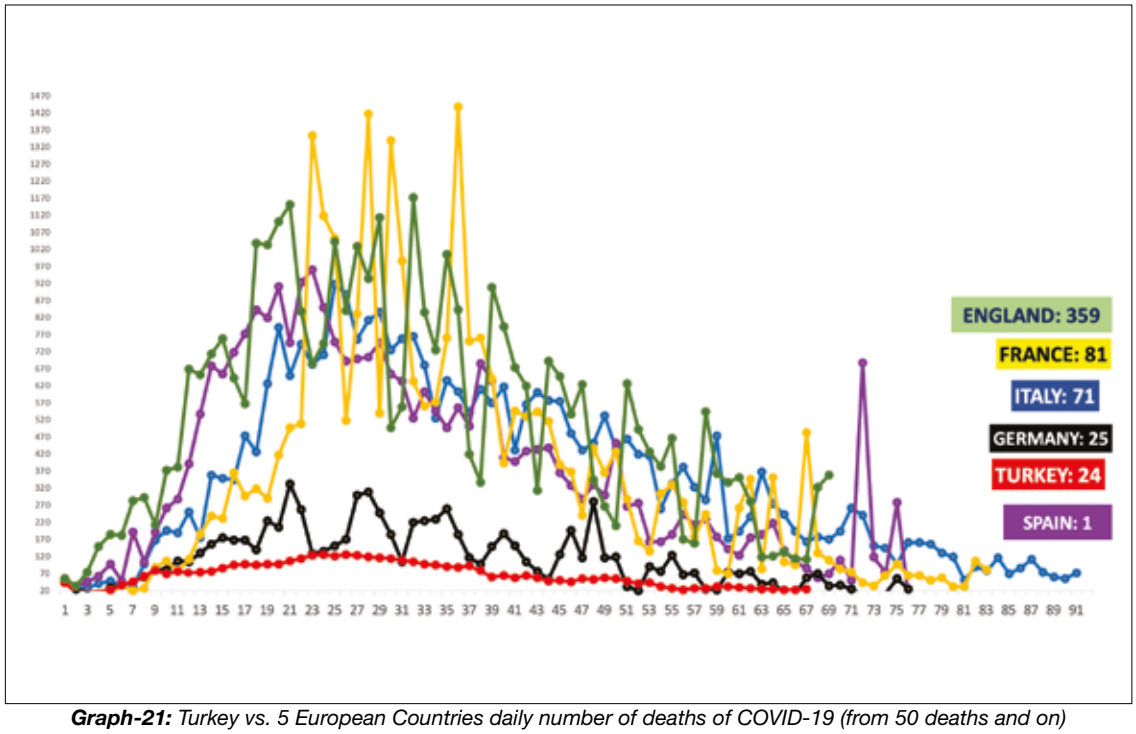
Country/Region	Total cases	New cases	Total death	New death
The World	6.799.713	136.409	397.388	4.586
Africa	131.324	4.763	3.148	86
America	3.234.875	79.505	179.394	3.227
Eastern Mediter-ranean	623.684	18.658	14.326	302
Europe	2.268.311	18.312	183.732	604
South-east Asia	350.542	13.965	9.672	356
Western Pacific	190.236	1.206	7.013	11
USA	1.886.794	28.922	109.038	1.127
Brasil	645.771	30.830	35.026	1.005
Russia	467.673	8.984	5.859	134
United Kingdom	284.872	1.557	40.465	204
India	246.628	9.971	6.929	287
Spain	241.310	332	27.135	1
İtaly	234.801	270	33.846	72
Peru	187.400	4.202	5.162	131
Germany	183.979	301	8.668	22
Iranian	169.425	2.269	8.209	75
Turkey	169.218	878	4.669	21
France	150.022	527	29.084	31
Chile	127.745	5.246	1.541	93
Mexican	110.026	4.346	13.170	625
Pakistan	98.943	4.960	2.002	67
Saudi Arabia	98.869	3.121	676	34
Canada	94.335	265	7.703	51
China	84.629	9	4.645	0
Train	67.195	1.700	51	2
Bangladesh	63.026	2.635	846	35
Belgium	59.072	165	9.580	14
Netherlands	47.335	183	6.011	6
Belarus	46.868	0	259	0
South Africa	45.973	2.539	952	44



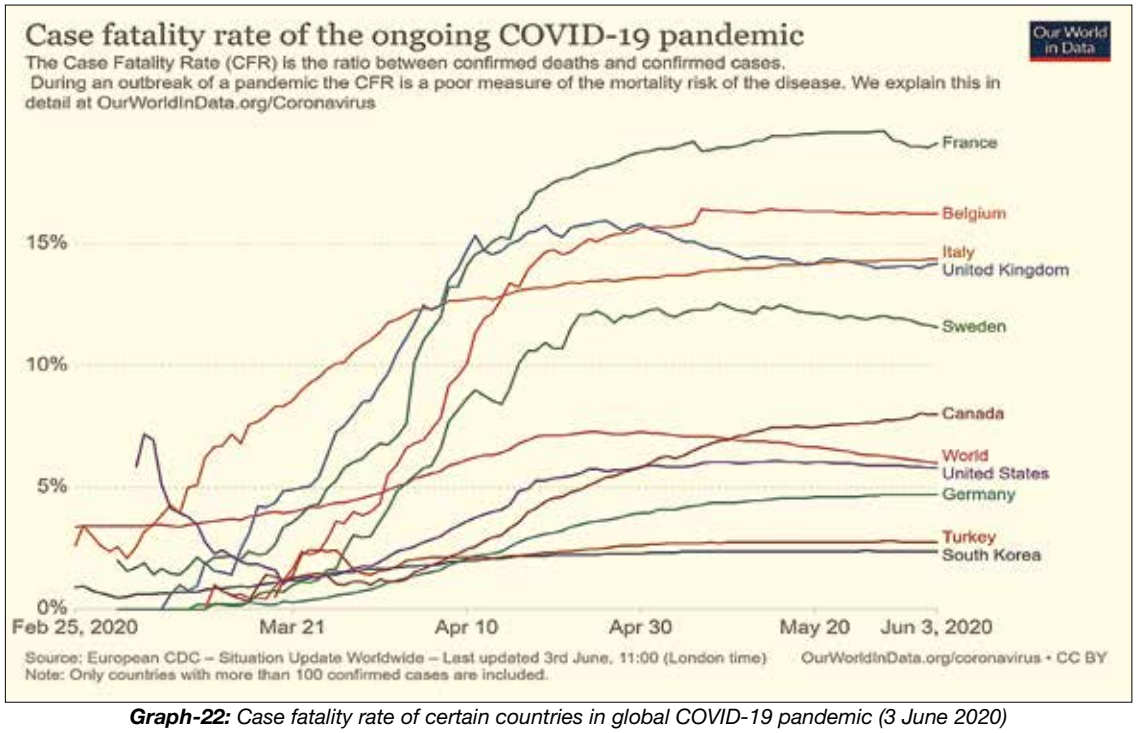
Graph-19: *Comparison of highest number of cases per country population (per mille). Data source: https://www.worldometers.info/coronavirus/#countries (3 June 2020).*



Graph-20: *Turkey vs. 5 European Countries COVID-19 daily flow of cases and final state comparison as of 3 June 2020 (Starting point from 317 for Turkey, Germany 283, Italy 147, Spain 124, UK 130 and France 138). Data source: https://www.worldometers.info/coronavirus/#countries*



Graph-21: *Turkey vs. 5 European Countries daily number of deaths of COVID-19 (from 50 deaths and on)*
Data source: https://www.worldometers.info/coronavirus/#countries (3 June 2020).



Graph-22: *Case fatality rate of certain countries in global COVID-19 pandemic (3 June 2020)*
Data source: European CDC.

2.12. Inter-country Rating Restrictions in Global Combat with Pandemics

Since comparative analysis on countries regarding their fight against the global epidemic bears some scientific limitations, proper analysis of this period can only be carried out with an objective assessment after the post-pandemic struggle process is completed all together. Some of these restrictions making comparisons difficult are; reasons such as effects of differences in the number of test runs, test repeats, test attributes, test reliability in the data methodology, data reliability, and difficulties in standardized data supply. In addition, the varying demographic parameters of countries, population density, elderly population rate, testing capacity, and a naturally higher number of cases in countries with higher reliable data sharing quality should not be ignored in special cases specific to this disease in question. High mortality rates are closely related to the high population of the elderly and the intensive care capacity, and the impact of other factors is very limited for countries with high levels of welfare. For developing countries, criteria such as qualified health system infrastructure and qualified health manpower (qualified patient bed, number of doctors, nurses and diagnosis, therapeutic medicine, access to preventive medicine, and medical equipment) are also important parameters. The cross-country comparative evaluation data in this report should be interpreted taking these constraints into account.

2.13. Current Treatment Protocols in COVID-19

The main symptoms of C0VID-19 are fever, cough, and shortness of breath, maybe accompanied by symptoms such as sore throat, weakness, malaise, joint-muscle aches as seen in other viral infections. It is known that early commencement of treatment in viral infections plays an important role in the success of treatment.

Therefore, if the patient has symptoms and known contact history during the epidemic period, it is recommended to start hydroxychloroquine according to the clinical state, laboratory, and radiological findings of the patient without pending PCR results. Considering the clinical outlook of patients, this practice was removed from the protocol as of 14.04.2020, as stated in Table 24 and Table 25.

In COVID-19 disease, treatment planning should be made according to the severity/stress of the disease, and if there is a progression in symptoms and signs in the follow-up, treatment changes should be made. Accordingly, the patients to be treated can be grouped as mild/outpatient follow-up patients, moderate-heavy/hospitalized patients, and very severe patients whose clinic worsens. In the treatment of each patient, the decision must be made according to the patient's specific condition, and accompanying comorbid diseases must be taken into consideration.

Patients with mild symptoms, under 50 years of age, without pneumonia and concomitant hypertension, cardiovascular diseases, chronic respiratory disease, diabetes, cancer, immune suppression, and outpatient treatment who cannot be diagnosed/influenza are recommended treatment according to the below tables, and new updates carried out within the framework of assessment results created by the Scientific Board based on feedback and demands from the clinic (for details please see Ministry of Health Guide Book on Struggle with Contagious Diseases https://sbu.saglik.gov.tr/Ekutuphane/kitaplar/t4.pdf).

Table-23: *Mild, potential/confirmed COVID-19 case outpatient*

Drug	Mode of Administration / Dose	Duration / Day
Hidroksiklorokin 200 mg tb	Oral, 2x400 mg charge (As of 14.04.2020 loading dose in such cases cancelled) 2x200 mg	5
Oseltamivir 75 mg tb	Oral, 2x1	5

It is recommended to add Azithromycin to the treatment of patients, who need to be hospitalized, but who are in the middle clinic state, whose pneumonia is not heavy, and there are no accompanying comorbid diseases.

Table-24: *Secondary, potential/confirmed COVID-19 case admitted in clinic*

Drug	Mode of Administration / Dose	Duration / Day
Hidroksiklorokin 200 mg tb	Oral, 2x400 mg charge (As of 14.04.2020 loading dose in such cases cancelled)	5
Oseltamivir 75 mg tb	Oral, 2x1	5
Azitromisin tb	Oral, 1x500 mg on day 1, 1x250 mg for 4 days	5

It is recommended to use Favipiravir, which is an effective antiviral in the treatment of patients with severe pneumonia, concomitant co-morbid diseases, and severe clinic state, and adding favipiravir to the treatment of patients with worsening clinic state and developing pneumonia. Oseltamivir is discontinued in cases where favipiravir is started.

Table-25: *Heavy, potential/confirmed COVID-19 case admitted in clinic*

Drug	Mode of Administration / Dose	Duration / Day
Hidroksiklorokin 200 mg tb	Oral, 2x400 mg charge, 2x200 mg	5
Favipravir 200 mg tb	Oral, 2x1600 mg charge, 2x600 mg main-tenance	5
Oseltamivir 75 mg tb	Oral, 2x1	5
Azitromisin tb	Oral, 1x500 mg on day 1, 1x250 mg for 4 days	5

Studies in the literature suggest that it is appropriate to add drugs such as quinolone to the atypical agents together with beta-lactam antibiotics to those who are considered to have infection/pneumonia, according to clinical, laboratory, and radiological findings, among those, who have started receiving COVID-19 treatment.

If an infection other than viral infection is not considered/can be excluded, the use of antibiotics may not be preferred depending on the patient's clinic. The treatment protocols described above are updated with the recommendations of the Scientific Committee and these updates

are shared with health institutions. In addition, treatment should be organized in different doses and combinations with specialist physicians as per individual patient.

It is important to treat/continue the underlying diseases of the patients, provide oxygen with a mask, and provide fluid support. Inhaler drugs that should be administered with nebulis should be administered with a metered-dose inhaler due to the risk of transmission. In non-invasive mechanical ventilation (NIMV) applications, helmet masks should be preferred for mask contamination reduction. Hypertension and diabetes mellitus are the most common comorbid diseases and these patients should be monitored closely since the presence of advanced age and comorbid disease is a risk factor for the development of a rather severe disease.

Azithromycin and hydroxychloroquine can prolong the Q-T interval and cause ventricular tachycardia. Azithromycin should not be used in patients with another underlying disease that prolongs QT. The patient should be monitored closely by ECG daily scans, azithromycin should be discontinued first in those with undesirable effects, the dose of hydroxychloroquine should be reduced first if the problem persists, and discontinued if prevails.

It is recommended to evaluate the option of follow-up without treatment if the symptoms/clinic is mild, if comorbid conditions are not accompanied in pregnant women with a definitive diagnosis of COVID-19, to use treatment Lopinavir 200 mg/ritonavir 50 mg tab 2x2 10/14 days and to add hydroxychloroquine for 5 days depending on the situation. Favipiravir should not be used in nursing mothers and pregnant women.

2.14. Use of Nonsteroid Anti-inflammatory Medication and Acetaminophen

There is concern about the use of nonsteroidal anti-inflammatory drugs (NSAIDs). This concern has emerged when several young patients reported using NSAIDs and their condition deteriorated in the early stages of the disease. However, currently, there is insufficient data to support NSAID use or to ban it altogether. For suspicious cases, acetaminophen should be preferred as an analgesic and antipyretic. However, if NSAIDs such as rheumatic diseases and cancer are required, it is stated that the lowest effective dose can be used if there are no contraindicated conditions such as gastrointestinal bleeding and kidney damage. In guidebooks, it is recommended that patients not interrupt their routine treatments unless their physicians specify otherwise. To make a definitive judgment on this dilemma, it is considered that clinical studies are needed in the coming days for the use of nonsteroidal anti-inflammatory drugs and acetaminophen in COVID-19 patients.

If all contraindicated conditions such as active bleeding and severe thrombocytopenia are present in all COVID-19 patients treated for the prevention of venous thromboembolism, prophylaxis by using low molecular weight heparin is recommended.

In the treatment of patients with worsening clinic state and moved to ICU, depending on their clinical state, an additional dose of steroids 1-2 mg/kg/day for 5-7/days, high dose of vitamin C, 25 g/day and for those with cytokine storm IL-6 inhibitor tocilizumab may be considered. Immune plasma therapy and stem cell therapy have started to be used as promising treatments in patients whose general condition has worsened and do not respond to treatment.

2.15. Algorithm Updates in Treatment in Turkey and Process Management

In the first COVID-19 cases encountered, the pandemic and treatment protocol experiences of China, having been previously struggling with the pandemic, were taken into consideration in Turkey, as well. However, after the first 1-2 weeks, our own treatment algorithm was developed based on our own clinical observations and experiences. Within the framework of the recommendations of the Ministry of Health Scientific Committee, update suggestions were made in the algorithm. In Turkey, a distinct and effective treatment protocol, which is different from other practices in the world, has been formed.

The capacity of our intensive care units equipped with the past professional experiences, organizational capabilities, as well as our widespread hospital infrastructure, which have been developed in light of the objective recommendations of the Scientific Committee based on scientific data created under the leadership of the Ministry of Health, has created a great advantage in the fight against the disease.

- Hidroksiklorokin treatment commenced at a very early stage in the disease, which required adequate medicine stocks. The Ministry was swift in taking necessary actions to this end,
- Favipravir treatment commenced during the replication phase of the virus, meaning before it gained severity and ICU need emerged. However, early practices in many other countries involved such treatment during the ICU phase not prior, which is believed to be not very efficient,
- Early intubation (invasive ventilation) was abandoned in intensive care patients. Because it was observed that this did not change the course of the disease much. Instead, the technique of non-invasive ventilation - a continuous positive compressed airway called CPAP - was adopted. Thus, lung damage, which is the risk of creating invasive ventilation, was also prevented,
- It was also observed that the disease was not a typical ARDS outlook as described, additional problems such as coagulopathy (coagulation disorder) occurred and patients were lost. Accordingly, anticoagulant drugs were added to the algorithm,
- The fact that our IT capacity, which is more effective than PCR for the diagnosis of COVID-19, is available in our hospitals in terms of quantity and quality increased our ability for rapid diagnosis.

2.16. Plasma Treatment in COVID-19

Caused by a new viral pathogen, SARS-CoV-2 (Acute Respiratory Syndrome coronavirus-19), or COVID-19 for short, has evolved into a 21st-century pandemic affecting billions of people. Since it is a newly encountered virus, no vaccine, monoclonal antibody or a drug directly affecting have been developed yet.

Especially when new mutations are also taken into consideration, vaccine and antibody development studies are question marks as to whether they can be used in this pandemic and the possibility of not being able to conclude these studies into the treatment process is also a consideration. Noting that the virus is new and RNA-based, drug studies that directly target the virus are promising but have not been developed yet.

Therefore, it is one of the fastest treatment options that can be administered directly and can target SARS-CoV-2, and the easiest to monitor the use of serum or plasma in people who survive this disease, which is considered to contain antibodies against this virus, both for preventive and therapeutic purposes. This use, unlike vaccination, ranks in passive antibody treatment class and contains both benefits and risks.

2.17. Passive Antibody Therapy (PAT)

Transfer of antibodies from individuals, whose immune system is activated against the pathogen, to individuals sensitive to the pathogen for treatment or prophylaxis aims is defined as Passive Antibody Therapy. This form of treatment differs from the vaccine.

Because it involves the delivery of viruses that have lost their pathogenicity or the ability to cause disease in vaccination, to healthy individuals and introduce these individuals the ability to make the immune system susceptible to the pathogenic virus causing the disease, that is, to gain the ability to produce antibodies by itself. This process involves:

(i) A vaccine being available,
(ii) The vaccine recipient not to have encountered the disease, yet
(iii) Phases where the immune system of the individual becomes susceptible to the pathogenic agent in question and to produce antibodies by itself.

In contrast, PAT involves the transport of antibodies that the individual's immune system will produce against the pathogen by the end of the disease from individuals who have already survived this disease. This method was used before the development of antimicrobial drugs and lately in the treatment of SARS-Cov-1.

In this regard, when considered historically, the PAT started and developed in the 1890s with the idea of Behring and Kitasato that specific antibodies might be protective against bacterial toxins.

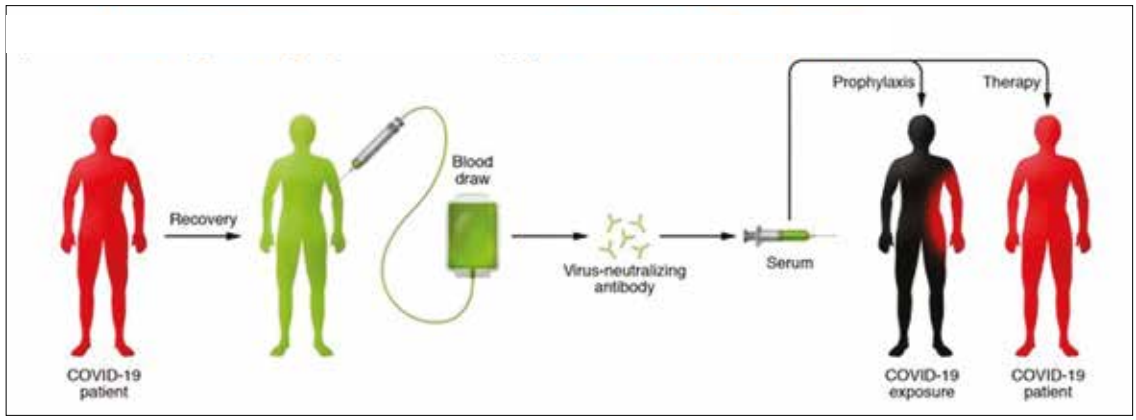


Figure-15 : *PAT Treatment Scheme for COVID-19*

The specific antibody treatment against the disease was carried out by the transfer of sera from animals vaccinated against targeted pathogens or from people who survived the disease. The use of serum of animal origin brought with the risk of causing hypersensitivity from antigen-antibody complex diseases in recipient humans since it contains species-specific proteins.

PAT became a more usable, non-toxic treatment option with the development of antibody purification methods in the 1930s. This method's importance receded with the advent of the development of antimicrobial drugs. After the 1940s, this treatment method continues to be used only in the treatment of poison, toxin, and some specific viral infections.

After the 2000s, PAT started to regain popularity with a wide range of use as biotechnological drugs in the treatment of non-infection diseases like cancer and has gained an increasingly important rank in health expenditures.

2.17.1. Points to be Considered and Necessary Precautions in Passive Antibody Therapy

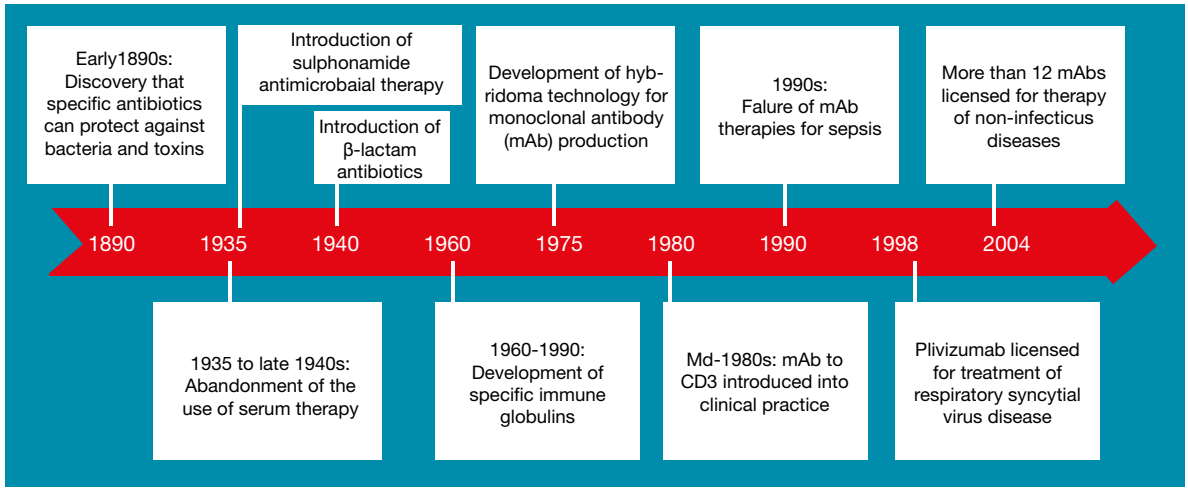


Figure-16: *Advancements in Serum treatment*

1. Training offered to healthcare workers against potential risks and operations
2. Selection criteria of healthy individuals who can donate plasma having survived the disease without PAT treatment, and crosschecked for other diseases
3. Sufficient blood bank or aphaeresis facilities
4. Virology analysis laboratories that have serological tests available for both SARS-Cov-2 and neutralization antibody detection and titer.
5. Minimizing the risks of other diseases that can be transmitted from the donor
6. Clear and detailed preparation of PAT protocols and related documentation
7. Detailed documentation of additional treatment protocols
8. Documentation of medication of the patient's other diseases, if any
9. Inspection and reporting on ethical rules and data by health committees
10. Possibly knowing the neutralizing antibody titer in the serum to be transported and mixing with other sera to reach an effective dose when necessary
11. It should be taken into consideration that it will be dosed considering whether it will be given for prophylactic or treatment and that less doses can be used in prophylactic

12. Updates offered to physicians and staff constantly with newly available situation
13. Increase awareness on severity of the illness within society thus tackle unreluctance for quarantine and make use of early treatment opportunities
14. Awareness that PAT treatment is temporary and that even recovered this time next infection protection is not guaranteed
15. Recording the effectiveness of antibodies on disease according to donors and storing samples for effective antibody selection in the future. Within the framework of this genetic engineering, it will give an idea about which antibody should be produced when there is no disease and it is absolutely useful in vaccine studies.

2.18. Relation of Nutrition and Strong Immune System in COVID-19 Struggle

For the treatment of COVID-19, a viral disease, vaccination research continues on one hand, while widespread and effective treatment methods are sought on the other. It is very important to have a strong immune system in order to prevent viral diseases or to survive the disease course in the lightest way.

In this section, first of all, nutrients required to have a strong immune system will be focused on, and then the effects of some frequently consumed food and plant species on the immune system.

Part 3

Social and Economic Projections in Post-Pandemic Period

Worst Outbreaks in History and Economic Consequences in Light of Coronavirus

Long-term Effects of Corona Virus Pandemic in Business

Impacts of Corona Outbreak on Energy Markets and Turkey

COVID-19 Interaction with Tourism as a Fragile Industry

Who Is to Bear Cost of Global Outbreak on National Economies?

Social and Economic Projections in Post-Pandemic Period

3.1. Worst Outbreaks in History and Economic Consequences in Light of Coronavirus

With the emergence of cities and urbanization and development, outbreaks and illnesses have also led to significant deaths on human populations, especially in areas where the population is dense. In fact, such outbreaks, along with human deaths, are able to trigger significant change, transformation, and developments in the economic and social context, as well. The number of people who died from the Coronavirus (COVID-19) outbreak we are witnessing nowadays is increasing in all countries of the world. Nevertheless, although some changes in economic and social life have emerged in a short time, we can say that we are on the eve of a significant structural change and transformation in the economic and social fields, primarily in monetary and financial markets, trade, education, and service sectors. This study focuses on the economic and social changes and transformations stemming from the major outbreaks of the last two millennia of human history in light of past experiences in this field. Moreover, it makes suggestions in the context of cause and effect relation regarding the process humanity is facing.

3.1.1. Outbreaks in History

The relationship between outbreaks and people and civilizations goes back to ancient times. Significant population losses happened due to epidemic diseases from Babylonians, Hittites, and ancient Greek site states to the Great Roman Empire, China, and Japan to Europe and America, entailing significant economic and social consequences. In parallel with the plague outbreak that emerged during the Roman era (161-166) and death of nearly five million people, fights for the throne started in the Empire leading it to its dissolution resulted in the Roman kings, who had waged a total war against Christianity, reconciling with this religion thus its penetration throughout the state.

During the reign of the Byzantine Emperor Justinian (527-565), the plague in Constantinople (Istanbul) at that time caused the death of about ten thousand people, yet it affected wide geography from North Africa to Iran and China, especially the ports in the Eastern Mediterranean (Levant) and caused the death of 25-50 million people in a period when the world population was around 200 million. It can be said that this plague played a role in the expansion of the Islamic civilization and rapid development of conquests, which emerged in the 7th century, especially due to the influence of the Byzantine and Sassanid Empires.

Plague, lepra, dysentery, syphilis, and malaria were among the most common diseases amid European Christian armies during the Crusades against Muslims for a period of 200 years from the late 11th to the late 13th century.

Some of these illnesses were carried from Europe to the Islamic geography by the Crusaders by way of the Church's wars to reclaim Jerusalem from Muslims. Due to these epidemics, the number of soldiers, who could return from Christian armies who set out 9 times from Europe to take Jerusalem for 200 years, was merely as high as hundreds of thousands. Then again, they infected upon return their countrymen with the diseases and microbes that they carried and significant population losses perpetuated.

In Europe, epidemics made a critical impact on the fall of feudal order and transition to modern capitalism. The plague, which originated in China in 1331, reached Italy from the Crimean port of Feodosia in the middle of the century and spread in Southern Europe such as Pisa, Florence, Venice, and Genoese, caused the death of 5 million people in China in the 14th century while it killed 100-200 million people in Europe.

In the same period, the city population increased in southern Europe and around Italy with the effect of trade, but the infrastructure of the city for sewage and water use was far from meeting the needs. The plague microbe, which the Mongols brought from Asia to Crimea/Kefe (Feodosia) in 1346, spread to the city by catapults as part of a war strategy by the Tatars who besieged the city, and it was communicated to Europe onboard ships carrying Genoese seafarers and merchants, who were in charge of the city where they lived in large groups, as they attempted to flee from the outbreak. The plague microbe, spread through mice and fleas on ships, affected a population living in a wide area from Moscow to Greenland and was one of the most important factors in the collapse of the millennial long feudal order in Europe.

3.1.2. Impacts of Outbreaks on Economic and Social Transformation

With the plague epidemic spreading across Europe, the declining population in the countryside caused shock declines in agricultural production, resulting in major famines and hunger problems from the second half of the 14th century. While agricultural production was decreasing in Europe, there was a significant increase in livestock herds wandering in pastures and animal husbandry developed. The decrease in population increased wages of workers, as a result of the comprehension of time as a concept, time and productivity came to the fore as the most important facts. Workers began to earn the same wage by working two days instead of five. In countries such as the Netherlands and the UK, which stand out in agricultural and industrial productivity, workers gained the power to determine their working days and hours. This resulted in drafting labor from overseas, especially the establishment of a new production system based on slave labor and wage-labor system.

Wealthy people started to build houses/villas in rural areas to flee from the plague widespread in the cities. The rich mounted their horses and got away from the cities and tried to hold onto dear life in these country houses. There was a significant increase in trade and adventure travel to long distances to escape from the plague. This led to the process of Europeans sailing across transoceanic regions and countries, hence the construction of larger ships that could sail in ocean waters. While the Mediterranean and its surroundings were the European economic center until the 15th century, the new center gradually started to become the Atlantic basin.

The effects of the Plague epidemic were not limited to the economy, but also had significant effects on the mentality and beliefs of European individuals and nations. The monopoly of Latin was shattered, local languages such as English and French began to emerge and to be widely used in education as well as intellectual activities. Loss in religious values and their questioning prompted suspicion toward the Christian belief system. The influence and power of the Church and the clergy were shaken. The way to reform the process in religion was paved with the popularity of Protestantism, which encourages every individual to speak directly to God by reading the Bible, led by Martin Luther and Calvin. As the venue of freedom of access to information and freedom of individuals widened from a scholastic religious understanding,

the value judgments on the world and nature changed. Nature was now an entity that had to be tamed and controlled by man.

3.1.3. Designing the Modern World Through Outbreaks

In modern times, Europeans dominated with microbes rather than the weapons they carried and used, and back home they had to fight these microorganisms. The UK-based London Plague broke out in 1665 and spread to other cities in the country within two years, killing 100,000 people. The plague, which started in France in the 1720s in Marseille, became widespread especially in the cities of the south, and caused the death of over 100,000 people.

Outbreaks occurred elsewhere in the world, and claimed massive population losses, although not with as significant consequences in modern times as in the Western world since the medieval plague. It was another epidemic that ended the Middle Ages of China and collapsed the Ming dynasty. Half of the country's population died as a result of the outbreak known as the Chinese Plague. Due to the famine and grasshopper invasions that emerged after the epidemic, people in China turned to cannibalism on bodies of victims.

As a result of this epidemic, the Ming Dynasty that ruled China for more than three centuries (1368-1644) collapsed and the Manchu Qing dynasty formed in its place. 200 thousand people died in the Plague (1770-1772) that emerged in the Ekaterina II Russia. Public uprisings arose against tight quarantine measures, the Kremlin Palace, Tsarina's headquarters, was occupied by people. During the same period, 250,000 people died from the epidemic that reached and spread to Iran. With the spread of the outbreak to the east in India, the number of dead exceeded 2 million. 15 million people died as a result of the cholera epidemic, which emerged in India's Ganga Delta in 1817, spread to China, Thailand, Japan, and the Philippines through traders and sailors. The cholera epidemic, which emerged in India in the 1830s, spread to Russia, Finland, Poland, Hungary, and Germany through trade, and then reached Europe from America to cause the death of hundreds of thousands of people. In the middle of the century, another outbreak occurred again in India, affecting many countries in both the east and the west.

Throughout the 19th century, outbreaks continued in major countries of the world. The army of Napoleon, which penetrated Russia with 500 thousand people in 1812, vanished to 30 thousand due to famine and epidemic, and the typhus epidemic was regarded as the most important cause for its defeat. The military defeat of Napoleon in Russia due to the typhus epidemic led to the convention of the Vienna Congress in 1815 under the leadership of Britain, Austria, Prussia, and Russia and the construction of a new European order. Another one of the armies infected by the epidemia carried by the Russians is the Ottoman army. Due to the typhus outbreak that emerged during the 1854-1856 Ottoman-Russian Crimean war, 24,500 Ottomans and 374,000 Russian soldiers died.

During the First World War, many soldiers and armies on the fronts were affected by epidemics. The number of those who died from typhus during this war period is nothing less than 3 million. Much more human losses than those who died in the war occurred due to outbreaks, in the hinterland and aftermath of the war. 500 million people were affected by the disease known as the Spanish flu that emerged in America in 1918 and caused a rapid wrapping of the First World

War, as the number of those who died exceeded 50 million. This epidemic, which emerged in the USA and was first moved to European countries by American soldiers, visited almost all continents, especially the colonial states of the Western countries, and eventually caused the establishment of the World Health Organization in 1919. After this great epidemic in the twentieth century, 2 million people died from the Asian flu that emerged in the middle of the century (1957-58), and about 1 million people died from the Hong Kong flu (1968-1969).

Although suffering from relatively fewer casualties, the Ottomans, like other countries and geographies, were affected by the outbreaks. Microorganisms (virus-microbe), which have become more active with sedentism of human life, evolved into an epidemic in certain periods of history, causing large population losses and consequently caused important economic and social changes. It is understood that some civilization territories throughout history reveal their lethal powers with their own hands, which will destroy both themselves and the rest of the world, with or without intention. Diseases occurring as a result of contact with animals in certain periods of history, in certain periods, appeared in relation to the rampant and impermanence of the so-called human being and seem to be an orientation to self-destruction.

Unlike the slower and more prolonged spread of outbreaks that traveled around countries and regions mainly by trade and seaway in previous ages, the Coronavirus (Covid-19) microbe, which emerged in China in the first months of 2020, reached almost all the countries in the world in a relatively short (two months) amount of time. Viruses can be transmitted at the same speed of the age of globalization, gratification, and speed. Certain outbreaks in history have caused major transformations and significant structural, economic, social, and political changes. Everyone is entangled in the language that in the aftermath of coronavirus we are facing nothing will ever be the same as before. It is understood that important changes in the economic area await us. Plague and variola microbes were among the most determining factors in the emergence of the mercantilist (trade capitalism) period and the emergence of modern European-based nation-states in years 1450-1750. On the basis of the liberal view during the 1750-1930 period, microbes also had an important effect on shaping and development of industrial capitalism within the framework of the market mechanism. Keynesian economics, which highlighted the increasing importance of the state in the period of 1930-1980, continued to be the neo-classical economic insight from the 1980s until 2020 as the dominant general paradigm forecasting the state would withdraw from the market and the private sector would be more effective. What is clear is that with Coronavirus, the weight of the state in the economy will gradually increase, and national approaches that become more introverted instead of globalization will come to the fore.

3.1.4. The Need for a New Economic Mentality

The transportation, tourism and service sectors are among sectors that will be primarily affected by the situation. Agriculture and food security will become more and more important. Stronger infrastructures and more qualified intellectuals will be needed in the field of health. Along with some other sectors, the most important structural change in the education and research sector will increase the importance of distance education through electronic systems, and home-based computerized workstations instead of physical face to face education and research will come to take precedence. It can be said that we are on the eve of a significant change in money and credit markets. It seems that money invented in Anatolia by the Lydians and the banking and

financial system that modern Europeans have institutionalized and developed since the 16th century will be replaced by a considerably digital system, if not completely.

Along with this process, another phenomenon is that a need for new economic growth and development paradigm has emerged. Because, a dominant economic paradigm created by modernity is based on the scarcity of resources on earth, whereas the insatiability of human needs.

However, people's needs may be limited but their desires and wishes unlimited. Bearing this perception in mind, modern people thought that they achieved greater gratification and happiness as they consumed more. More consumption means more production, thus excessive use of resources, and damage, and abuse of environment and nature.

Soil, water, and air are contaminated. Lands and seas are filled with garbage and industrial waste. Every day, the count is adding up to millions of people that die of terrorism and starvation on earth. This trend is far from ensuring people's well-being. It even deteriorates people's current situation. Hence there is a need for a more sharing, encompassing, solidarity-oriented, and more balanced "sustainable development" model.

3.2. Long-term Effects of Corona Virus Pandemic in Business

Here we go again. The world will not be the same. We claim that the global order, our daily life, everything will change significantly. Didn't we hear the same arguments after the financial crisis from the 11 September 2008? Continuity and change have always been part of our lives. But, it is as if the change in world history has been more and more constant lately. We are listening to futurologists more than ever. The books of futurologists, such as Yuval Harari, who bases his fundamental concepts in history, remain among the best-selling books. His statements are watched by millions of viewers. It is certain that nothing endures but change, yet recently everyone has been sensing this change in their daily lives, perhaps by staying at home. More importantly, although each change harbors uncertainties, the recent Coronavirus outbreak presents us with many more unknowns of obscurities. The Coronavirus outbreak is an unknown wrapped in a mystery for the world economy like the 2008 global crisis. These are the sorts of crises that most people cannot anticipate and unable to consider in their financial projections. But, the coronavirus outbreak calls for greater uncertainties and unknowns than the 2008 global financial crisis did. Since the 2008 crisis was basically a financial crisis, the world economy was able to recover rapidly, when confidence was established in financial markets. In the case of Coronavirus crisis, loss of confidence is not only experienced in financial markets. Trust issues dominate every aspect of our lives. States do not trust one another. They close their airports to passengers from other countries or quarantine and monitor them for a long time. Global solidarity and trust are replaced by reactive attitude countries are taking in trying to solve their problems alone. While governments do not allow mask exports, they find the solution in reflex acts that go back to confiscating masks produced by the private sector. Perhaps this problem of trust challenging the manufacturers is causing them to produce less where they are capable of doing more, but nobody bothers analyzing the issue at this time.

3.2.1. China as the Epicenter of Pandemic Outbreak

The country that will be most affected by the trust issue seems to be China in the medium and long term. Obviously, Chinese production occupies a considerable portion of the supply chain of many countries. When the Corona crisis first broke out, many manufacturers and consumer companies experienced the Corona crisis as a supply chain crisis due to the products they bought directly or indirectly from China, and over time, they started thinking about the need to diversify their resource supplies. However, the crisis that sparked in a supply chain aspect, with the spread of the Coronavirus all over the world, evolved into a global demand crisis. While some consumers do not want to consume Chinese products at all, large store chains are trying to remove all their products from Chinese origin gradually, even if not initially.

The negative Chinese perception that the Trump government has pumped in recent years is now at a level that will further affect the perception of Chinese products in America. We read signals that China will be held responsible for the process even after the Corona crisis is over. A person from Texas can take the liberty to file a case against the Chinese government for allegedly withholding Coronavirus outbreak, thus deliberately causing it to spread to the world. Even if the Corona crisis ceases to maintain its impacts after a certain period of time, it seems that the search for a scapegoat and for claims and rights will not be in favor of China at all.

As such, it is of course very important to make plans to predict the direction of the world economy, to read the relevant ideas, to follow and participate in conferences. But considering practical solutions and making medium-term plans will be especially more beneficial for Turkish companies. Of course, this global crisis will demonstrate negative effects in detriment to Turkish companies in the first place. It would be unwise to expect Turkey would not be adversely affected by the situation in a world economy where shrinkage projections are being made. But, in the mid-term, the challenges may be turned into opportunities. First of all, the crisis reminded the importance of having local industrialists at hand. Nowadays, many domestic companies have been mobilized to produce respirators. In a way, we see that economies that rely solely on the services sector in the international business distribution experience much deeper problems in the process. With its industrial capacity, Turkey has been a distinguished epitome in this regard.

3.2.2. Impacts of Pandemic on Turkish Economy

The share of services allocated in national income undoubtedly increased in Turkey, as the prosperity of the country's economy has risen. Still, Turkey continues to be a strong manufacturing base. As a result of abnormalities in supply and demand balance against China, as we predict which countries' production could be shifted to among the G20 countries, the first country to come to mind is Turkey. With flexible production capacity and proximity to major markets, Turkey is in a position closer than ever to becoming a production base for the neighboring countries. Cheap labor and high human capital make Turkey one of the most convenient options for production on a smaller scale.

Smaller scale, but higher quality and reliable production and distribution channels will be more prominent in this period rather than China's large scale production. Ask yourself how many other countries come to your mind other than Turkey holding a comparative advantage in this respect? Turkey's goods occupy a favorable position before the global consumers. The whole world is

aware of the quality of goods produced in Turkey. It will be a very important achievement for our exporters to add the American market on top of the European and African markets in this period.

We should not expect our companies to inherently benefit from this process where trade diversion from China and the Far East is evident. A number of firms in Turkey are already indebted in the past decade of the 2010s and still have difficulty achieving long-term financing. If we open up to new markets and leave our production and export in its course, we may not be able to benefit from the window of opportunities ajar by this crisis. Venues to financially support the government and private sector spending seem to be limited in Turkey, a developing country, as well. For this reason, it is useful to employ special solutions. When it comes to a private-sector solutions, it doesn't necessarily mean to say increase production on our own and carry out exports. We should also consider during this period increasing international cooperation in production and trade as one of our special solutions among our options.

3.2.3. Pandemic and Opportunities

We are now making plans about the course of the world economy in Turkey, what our advantages and our disadvantages may be, we should also take note that many companies all over the world are probably doing the same, if not with better planning. They are also trying to analyze the advantages and disadvantages of production in Turkey. For this reason, rather than just making plans for how we increase our exports in this period, we should consider the question of whether we can incorporate strategic partners within our firms in an environment of capital shortage.

For example, Chinese companies as a result of trade wars facing challenges to engage in some markets, particularly in America as a result of the situation, may consider shifting part of their production to a country like Turkey and act as a manufacturer from Turkey rather than appearing as a Chinese company after the Corona crisis. We know that Chinese firms bought a large number of companies manufacturing in Northern Italy after the 2008 global crisis. Even bringing workers from China is now among the reasons for the rapid spread of the virus in Italy. In this new era, Turkey can be an important production base not only for Chinese companies but also for many international companies that outsource production in China. It is beneficial to approach trade and production with a win-win strategy. It should not be ignored that China prioritizing its economic interests instead of a win-win approach is among the reasons for China's deteriorating perception. It does not seem easy for China to change this attitude soon. However, firms in Turkey are more flexible towards such an approach. Wouldn't it be better to get a bigger share of a big cake than a small cake all by ourselves?

Turkey, though in need of capital, with its flexible and strong production and manpower, comes to the fore as a strong partner able to enlarge this pie. This has been partly done by our companies so far.

Currently, many companies in Anatolia are producing jointly with their partners in Europe and exporting to Europe or third countries. Therefore, we should ask ourselves more often the question as to how to enhance our global production and sales networks through international partnerships besides how we can increase our domestic production and export. We are entering a period, in which we should consider not only exporting to third countries but also investing in other countries with our strong financially international partners, considering that as a global trend local production and product diversification will increase in near future.

Figure-17: *Potentially Winning and Losing Sectors of the Global Outbreak*
Source: Decode Economic & Financial Consulting (https://dcodeefc.com/infographics)

3.3. Impacts of Corona Outbreak on Energy Markets and Turkey

According to 2018 data, the average daily oil production in the world is around 95 million barrels. The average amount of oil produced daily has increased gradually since 2010 as the effects of the crisis disappeared after the 2008 crisis. The amount of oil consumed daily is around 100 million barrels. Oil consumption data also followed an increasing trend each year, with the crisis years excluded. When the amounts of oil produced and consumed are figured together, it is obvious that some of the consumption is met from stocks. Economic activity and oil prices play an important role in global oil consumption. Oil production, on the other hand, is highly affected by political factors as well as global demand conditions. Undoubtedly, one of the most critical factors affecting oil production and consumption decisions is oil prices. Oil prices have been following a quite fluctuating course lately. That is to say, crude oil, which was 28 dollars in 2000, rose to 97 dollars in 2008, and after the subsequent global crisis, it decreased as far back to 60 dollars in 2009. Crude oil prices, which regained momentum later, reached $110 USD in 2013 and dropped back to $20 USD in 2016. At the end of 2019, crude oil barrel prices rose up to around 60 dollars.

While the price ranged at these levels until the Coronavirus crisis, the effects of the virus first saw below $50 USD, and then the $20 USD level due to the narrowing in demand thus competition among oil producers in tandem with the virus crisis.

In the post-coronavirus period, global economic activity that was gradually adversely affected by these developments reduced the demand for oil. In this period, the daily total oil consumption decreased by 73 percent, while the increase in stocks and the increase in production caused the prices to fall to $20 USD level.

3.3.1. Global Energy Markets Interplay

Most of the approximately 95 million barrels of oil produced in the world are produced by the USA, Russia and OPEC countries. Namely, about 16% of oil production is carried out by the USA, 12% by Russia, and about 30-35% by OPEC countries. When the production details of OPEC countries are reviewed, it is necessary to note that Saudi Arabia is the main producer with its 13 percent share in world production. Therefore, we can note that the daily oil production of Russia and Saudi Arabia is close to each other. According to available data, we can note that the USA leads the world in daily production. However, it is also worth noting that the said production of the USA stems from shale gas production. Production from shale gas is relatively costly. In other words, Russia's and Saudi Arabia's move to accelerate oil prices upwards by production restriction, thus increasing the prices above production costs in the USA urges the USA to bump its production rate. Therefore, as the USA raises its production, the market penetration potential of Russia emerges. Russia, which did not want to lose its market share, was reluctant to renew the production cut agreement, which ended on April 1. Therefore, in this period, as a result of the increasing economic effects of the coronavirus pandemic, oil prices have dropped to the level of 20 dollars with the falling oil demand. Thus, oil prices fell to their lowest levels in the last 18 years.

Falling oil prices put oil-producing countries in a very difficult situation. Considering the burden of economic packages announced by states due to the Coronavirus pandemic, a decrease in oil prices will considerably affect the countries, which generate high revenues from oil sales, in this process. It is quite obvious that firms in the US, which is the leading country among oil producers, are unable to produce due to falling oil prices since oil production from shale gas is a costlier process and the financial conditions of these companies will gradually deteriorate and eventually trigger bankruptcies in the sector.

Besides initial data on economic activity in the USA hinting signals of a deep economic contraction due to the pandemic, the bankruptcy of these shale gas oil-producing firms taking shrinkage one step further seems inevitable.

Although the economies of Russia and Saudi Arabia seem to tolerate this drop-in oil prices for some time, countries such as Iraq, Nigeria, Algeria, Iran, and Libya, whose economy is highly dependent on oil revenues, are unlikely to keep their economic activities vibrant given these prices in the long term. Therefore, the Coronavirus pandemic may result in the economic collapse of many countries, especially those dependent on oil revenues.

3.3.2. OPEC Meetings and Pricing Policy Strategies

However, However, it should be noted that the scenario has not worsened at least for these countries. On 9 April 2020, a meeting was held between OPEC, Russia, and other oil-producing countries (OPEC+) via teleconference, and a series of decisions were taken on how oil prices will be affected by supply-oriented factors in the coming periods. The first decision agreed at the meeting was to reduce daily oil production by 10 million barrels between 1 May and 30 June 2020. In this regard, Saudi Arabia's daily average oil production will decrease to 3.3 million barrels, while Russia will decrease to an average of 2 million barrels per day. The second item

agreed is the cut of 8 million barrels per day in oil production between 1 July and 31 December 2020. Afterward, it was agreed that the daily production cut would be 6 million barrels in the 16-month long period between 1 January 2021 and 30 April 2022. OPEC+ members agreed to reunite on 10 June 2020 in order to reassess the conditions that will develop following their agreements. On the other hand, negotiations for compliance with the current agreement will be reviewed at the meeting to be held in December 2021.

It is clear that production cuts will push oil prices back up, irrespective of demand conditions. Yet, it should be noted that demand for oil will also be negatively affected by global economic activity, falling demand, and production conditions, which are severely injured by the increasing intensity of coronavirus pandemic. Therefore, besides supply conditions, the course of oil demand will be very important in terms of the course of oil prices in the coming period.

3.3.3. Impact of Petroleum Prices during Pandemic on Turkish Economy

The decline occurring in oil prices could have quite a significant impact on Turkey's economy. As already known, Turkey is a highly foreign dependent country when it comes to oil. Therefore, changes in oil prices have effects on many factors in the economy, from production to inflation. Falling oil prices in terms of Turkey's economy is undoubtedly desirable, especially in terms of deficit reduction. As oil prices fall, production costs will decrease, production and output will increase. On the other hand, decreasing production costs and decreasing import prices will bring down inflation. Especially when the domestic demand conditions, which are gradually falling under the pandemic conditions, are figured together, the effect of the decrease in oil prices on inflation will be even deeper.

Naturally, while falling inflation eases the hand of the central bank in terms of reaching its inflation target, it will also lead to the expansionary steps to be taken to swiftly get rid of the negative conditions of the economy. At the same time, the oil price decrease will be very significant in terms of decreasing the costs of companies that are already in a major bottleneck. Therefore, it is clear that oil prices are an important parameter for oil producers as well as countries that are highly dependent on oil.

3.4. COVID-19 Interaction with Tourism as a Fragile Industry

In Turkey, tourism, one of the sectors that have high growth targets in 2020, is one of the most deeply affected sectors during the outbreak as in the world. The COVID-19 outbreak greatly affected the service sector, where people have close physical relations with each other. Especially the tourism sector is one of the primary sectors, on which the outbreak directly impacts with measures such as social distance, quarantine, and curfew.

Although measures taken in scope of current situation have affected the economic and commercial life by slowing down between 50% and 80%, it can be said that this rate is close to 100% in tourism sector. All serious measures have been taken for the recovery of tourism in Turkey including instructions, regulations, and applications related to sector considering all aspects of tourism and outbreak from individual to companies. But the full recovery takes time and depends on the psychological and sociological effects in the world. Layoffs and

periodic closures are the most important indicator of contraction in the sector. It is clear that the contraction in the tourism sector, which contributes positively to foreign currency inflow in addition to employment it provides, will also negatively affect the macroeconomic balances.

3.4.1. Future of Tourism in Post-pandemic Period

In addition to the measures taken, consumer behavior is another issue affecting the tourism industry. The contraction, especially in the economic sense, inclined consumers to waiver tourism spending, which is a relatively luxury expenditure, easier than and before other needs. The risk of pandemic impacts prevailing beyond the summer season and people's psychological desire to avoid crowded environments predicts that the recovery in the tourism sector will take a long time.

Turkey is one of the actors in the tourism sector with significant potential in the world. Considering the current international tourism-related data for the year 2018/2019, Turkey, as one of the most attractive destinations with alternatives and diversity in tourism, enjoys a share of 3.7% in the world tourism market and market share of %7.1 in European tourism. With these shares, Turkey is the 6th most visited country in the world. It is also featured to be the 7th most popular tourist venue in the world. In 2018, in terms of the number of tourists by country, it ranks 4th in Europe, and 6th in tourism income, and 6th in the number of tourists and 15th in tourism income in the world. In 2019, it is the 6th among the most visited destinations with 51.7 million tourists and 13th in tourism revenues (UNWTO, 2019 & 2020). In order to achieve the 11th Development Plan Goals, it is aimed to detect high added value special tourism categories such as health, gastronomy, golf, etc. and diversity of alternatives such as sports branches, cruise, wedding, belief, congress and shopping and to increase the number of visitors (11. Development Plan Goals, pp. 101-102). For this purpose, the incentive is given to conduct new projects in the scope of "Destination Management", which is an integrated approach to amend infrastructure deficiencies in tourism-related areas, diversify the market, supporting subprojects on diversification of alternative tourism types and increasing the duration of accommodation.
The table details tourism movements for 2017, 2018, and 2019. As per the table, though close, the targeted number of projected tourists and per capita spending was not accomplished. The latest political developments, global crisis, and exchange rate fluctuations are thought to be effective in detriment to numerical targets.

Table-25: *Foreign tourist flow in past 3 years in Turkey*

	Incoming tourists	Income ($ Billions)	Per capita expenditure
2017	(Million)	($ Billions)	by visitor ($)
2018	46.112	26.283	647
2019	51.747	34.520	666

Source: Tourism Statistics by the General Directorate for Investments and Enterprises of the Ministry of Culture and Tourism of the Republic of Turkey

In the post-global pandemic period, financial special incentives and protections are needed to address negative effects by taking into account the logistical subsector relations as well as past investments and employment capacity in the sector, which is a fragile one.

Although there are supports and incentives to the tourism sector, it is difficult to fully compensate for the loss. The sector expects a long-term recovery period. As a service sector that should not be ignored in this regard, it is a fact that tourism affects a wide range of sector-based interactions, from transportation to agriculture, from animal husbandry to logistics support in different fields. Although health-related concerns are currently occupying the agenda, it can be projected that the activities people are going to engage in order to relieve the stress stemming from long-term quarantine and social distance measures in the post-pandemic period will contribute to the revival of the sector. In this regard, the sports industry and entertainment industry, which is affected by the global epidemic, similar to tourism, can develop alternative stakeholder strategies to overcome this outbreak with the least damage. More efficient advances can be achieved with special strategies in scientific and commercial congress tourism, health tourism, cultural tourism, and faith tourism.

Especially in tourism types such as wellness, medical tourism, thermal tourism, disabled, and elderly care tourism under the umbrella of health tourism; positive outcomes of success rates achieved in the past years are expected to reemerge. Successful process management and health investments and service delivery and new legislative arrangements in this area will have a positive impact on sector-based development, which the Ministry of Health and the health sector have drawn in the global pandemic situation. The advantage of the Turkish health system has been approved by authorities during the outbreak considering the well-educated and trained health care professionals and updated management style and well-equipped hospital capacity and also geographical locations and international affairs. These capacity and capability are giving a good opportunity for the development of medical tourism income.

3.5. Who Is to Bear Cost of Global Outbreak on National Economies?

In order to reduce the impact and damage of the global epidemic, in which all layers of the society are affected, priorities and measures proposed by trade bodies in consideration of their own sake feature unrealistic goals that are likely to affect other societal stratum and not very likely with limited economic resources.

In this regard, it is necessary for the government to adopt special policies in light of objective data in preserving and supporting the safety, protection, and survival of primarily individuals and families, and low-income artisans and SMEs, as well as strategic industrial areas, which are of special importance to Turkey. It is deduced from the practices of the Presidency that this strategy is being followed in its undertakings through relevant Ministries on this issue. (others incl. Turkish Travel Agencies Assoc. TURSAB, Exporters Council TİM, Union of Chambers and Commodity Exchanges TOBB, Independent Industrialists & Businessmen Assoc. MÜSİAD, Industrialists & Businessmen Assoc. TÜSİAD, Economic Enterprise, and Business Ethics Assoc. IGIAD, and reports by Trade Unions and Bodies).

This period makes it compulsory for people to prioritize themselves and society at the same time. The complaints that some banks are reluctant or opportunistic have been voiced by the public, especially considering the fact that debt translation and interest-free or low-interest long-term lending is important for businesses that have been in a difficult situation due to force majeure. In this regard, the Banking Regulation and Supervision Agency, BDDK, should take measures to minimize transaction differences between state banks and private sector banks. The issue that should not be forgotten is that it is necessary to approach the situation at hand with awareness that responsibility and burden should not be attributed to state institutions only and should be shared by other stakeholders considering every segment and group in society are being impacted under these difficult conditions. It should not be forgotten that the cost of damage due to unfavorable or collapsed economic conditions will, as it is true for the whole world after the global pandemic, be inflicted upon all stratum of society. Therefore, it is necessary to minimize in this period disadvantages stemming from income distribution imbalances, which may cause unfair competition.

When consequences of historical pandemic processes are analyzed carefully, it is pointed out that socio-cultural change and transformation occur very rapidly in many areas from post-pandemic processes to the economy, production techniques, employment policies, consumption habits, administrative differences, and social-political movements. It should not be surprising to experience similar changes and interactions after the COVID-19 global pandemic situation.

Countries attempting to accuse other countries or seek a scapegoat without evidence in the struggle against the COVID-19 global pandemic may be defined as their strategic perception operations to entertain the agendas of their domestic politics. This situation can also be considered as attempts of the politicians in the long term to justify the heavy bills of their country's economies and cover for their failures.

It is unthinkable that the recovery process of the damage caused by such long-term economic activities, the transportation and consumption habits of the society, and social isolation processes in fragile economies will take place in the short term. Inevitably, the cost of this situation to individual and social financial budgets will cause economic shrinkage all over the world.

To reduce the damage of the post-pandemic process, which will have a mandatory reflection from the weakest sector-based rings to the strong industrial organizations, from family budgets to state financial balance sheets, tight fiscal measures and serious fiscal discipline policies will be reflected in the current and investment budgets of public institutions and natural spending habits of citizens. The mandatory administrative cost of this global outbreak must be consolidated and compensated by all countries and layers of society in a balanced and unbalanced manner.

This will create a new process that will cause societies to sacrifice from the level of well-being they are accustomed to. Those who will survive this process with the least amount of damage will be the institutions and organizations that can survive on their equity, with no difficulty in accessing external financing aid and countries with low natural dependency and self-sufficient countries with local production.

Unless necessary precautions are taken, the rapid increase in unemployment rates pose a potential risk to evolve into social vulnerabilities, and political turmoil, and regional instability, as the contraction or depression in economic activities is reflected in employment policies all over the world.

As a result, the structural transformation and changes in consumer behavior caused by the COVID-19 outbreak will cause temporary effects in some sectors, while causing a total change in others. While the losing sectors of the process are tourism and transportation sectors where social interaction is physically high, information technology-based sectors have strengthened their positions.

This pandemic process will inevitably affect future generations, from finance to the environment, from housing to education, from health to safety, from political life to belief systems, as a result of questioning people's consumption priorities and views of the world. From now on, it has become imperative, not an option, for countries to plan and build their future economic development strategies considering all this transformation.

Part 4

Covid-19
Current Data Tracking Platforms

International Platforms
National Platforms

Covid-19 Current Data Tracking Platforms

International Platforms

National Platforms

Covid-19 Current Data Tracking Platforms; International Platforms and National Platforms

4. Covid-19 Current Data Tracking Platforms

Data sharing platforms that provide information and updates on the global scale will be discussed in this section. With the help of these platforms, through open-source sharing the data on the Covid-19 has been made available for access by national administrators, scientists, healthcare professionals, and individuals from all segments of the society.

The COVID-19 disease is an infectious disease caused by a newly discovered coronavirus. Most people infected with the Covid-19 virus will experience mild to moderate respiratory syndrome and will recover without special treatment. Developing serious consequences (death) is a greater risk for the elderly, those with underlying medical conditions such as cardiovascular diseases, diabetes, chronic respiratory issues, and cancer.

The best way to prevent and slow down infection is to be well-informed on the Covid-19 virus, the disease caused by it, and how it spreads. Using technology and making information more accessible is essential to winning this war. With this section, it is aimed to advise how to access which information on Covid-19 related data platforms in the world and Turkey.

The content of this guideline is comprised of two sections, namely the international and national platforms.

4.1. International Platforms

- World Health Organization
- USA Centers for Disease Control and Prevention
- US Food and Drug Administration
- European Centre for Disease Prevention and Control-ECDC
- Coronavirus Covid-19 Global Cases by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)
- Covid-19 Live Tracker
- Coronavirus Pandemic: Real Time Counter, World Map, News
- CoronaTracker
- Worldometers Covid-19
- HEALTHLYNKED Covid-19 Tracker

4.2. National Platforms

- Republic of Turkey, Ministry of Health
- Covid-19 Turkey Web Portal
- Novel Coronavirus (Covid-19) Newsletter by HASUDER
- Turkish Medical Association
- Covid-19 HUB

4.1.1. World Health Organization (WHO)

The WHO, as the international health steering and coordination authority within the United Nations system, operates under the UN's principles of honesty, professionalism, and respect for diversity. The WHO workforce values, which also reflect the WHO Constitution, represent human rights, universality and equality principles and the ethical standards of the organization.

These values of the World Health Organization are inspired by the mission of all people to reach the highest attainable level of health, promote health, keep the world safe, and serve special groups. It is an organization dedicated to realizing these values.

4.1.2. U.S. CDC - Centers for Disease Control and Prevention

It is a unit of the US Department of Health and Human Services, HHS, which works to ensure the public health and public safety. The US Centers for Disease Control and Protection, based in Georgia, supports health advancement and development, in particular, by providing information and collaborates with other government health departments and bodies. Information and data provided by the CDC on Covid-19 can be accessed at https://www.cdc.gov/coronavirus/2019-nCoV/index.html

4.1.3. FDA - U.S. Food and Drug Administration

The FDA, affiliated to the HHS (the US equivalent of Ministry of Health), is the office responsible for food, dietary supplements, medicine, biological medical products, blood products, medical devices, radiation-emitting instruments, veterinary instruments and cosmetics. FDA stands for the U.S. Food and Drug Administration. Information and data provided by the FDA on Covid-19 can be accessed at https://www.fda.gov/home

4.1.4. ECDC - European Centre for Disease Prevention and Control

Founded in 2005 and based in the Swedish capital of Stockholm, the ECDC is an independent EU body that aims to strengthen Europe's defense against infectious diseases. The webpage of the European Disease Prevention and Control Center is available at https://www.ecdc.europa.eu/en

4.1.5. Coronavirus Covid-19 Global Cases by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)

This platform was developed by the Johns Hopkins University (JHU) Center for Systems Science and Engineering (CSSE) in response to an ongoing public health emergency. It was developed as an interactive web-based dashboard to visualize and monitor reported cases in real-time. The dashboard, which was first shared publicly on January 22, shows the location, deaths, and treatment status of Covid-19 cases confirmed for all affected countries. It was developed to provide researchers, public health authorities, and the general public with a user-friendly tool to monitor the outbreak as it unfolds. The dashboard features numbers at the provincial level in China, the city level in the USA, Australia, and Canada, and nationwide in other countries. Information and data provided by the JHU-CSSE on Covid-19 can be accessed at https://www.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6

4.1.6. Covid-19 Live Tracker

The information featured in the map prepared by the Bing team is obtained from such sources as the World Health Organization (WHO), U.S. Centers for Disease Control and Prevention (CDC), the European Center for Disease Prevention and Control (ECDC) and Wikipedia. The map is broadcast in Turkish. Information and data provided by the Covid-19 Live Tracker on Covid-19 can be accessed at https://www.bing.com/covid

4.1.7. Coronavirus Pandemic: Real-Time Counter, World Map, News

Coronavirus Pandemic: Real-Time Counter, World Map, News is basically a live broadcast shared on YouTube. It does not have a map-based system. A live broadcast, which shares in detail how many cases are in which country, also shares the number of deaths and survivors of the Coronavirus.

4.1.8. CoronaTracker

CORONATRACKER.com is a community-based project supported all over the world by more than 460 volunteers ranging from data scientists, medical experts, UI/UX designers, full-field developers to the general public. In addition to collecting data for further analysis, it serves as a public portal to keep up with the latest news on Covid-19. Sources are sorted out by volunteers to ensure news is reliable and to the benefit of the public. Data sources are WHO, CDC, ECDC, NHC of the PRC, JHU CSSE, DXY, QQ, and various international media. Inspired by the Coronavirus Outbreak Map of John Hopkins University, which is highly informative. Information and data provided by the CoronaTracker on Covid-19 can be accessed at https://www.coronatracker.com/

4.1.9. Worldometers Covid-19

Information and data provided by the Worldometers Covid-19, which shares details such as total number of cases, the daily number of new cases, total deaths, daily deaths, total recovery, number of active cases and number of cases at risk of death concerning Covid-19 can be accessed at https://www.worldometers.info/coronavirus

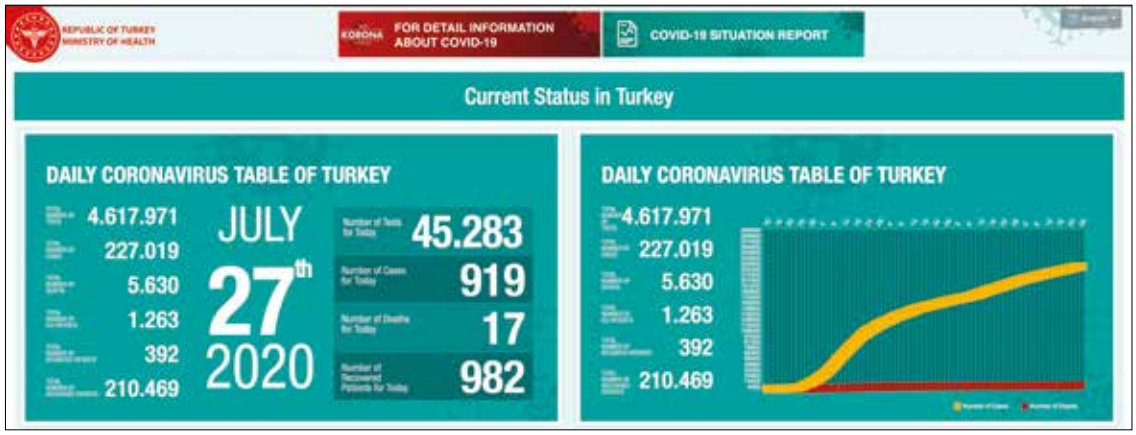
4.1.10. Healthlynked Covid-19 Tracker

HEALTHLYNKED Covid-19 Tracker, a mobile application, is available for free on both Android and iOS platforms. However, the Android version of the application is not yet actively available for Turkey. https://apps.apple.com/tr/app/healthlynked-covid-19-tracker/id1500575377

4.2. National Platforms

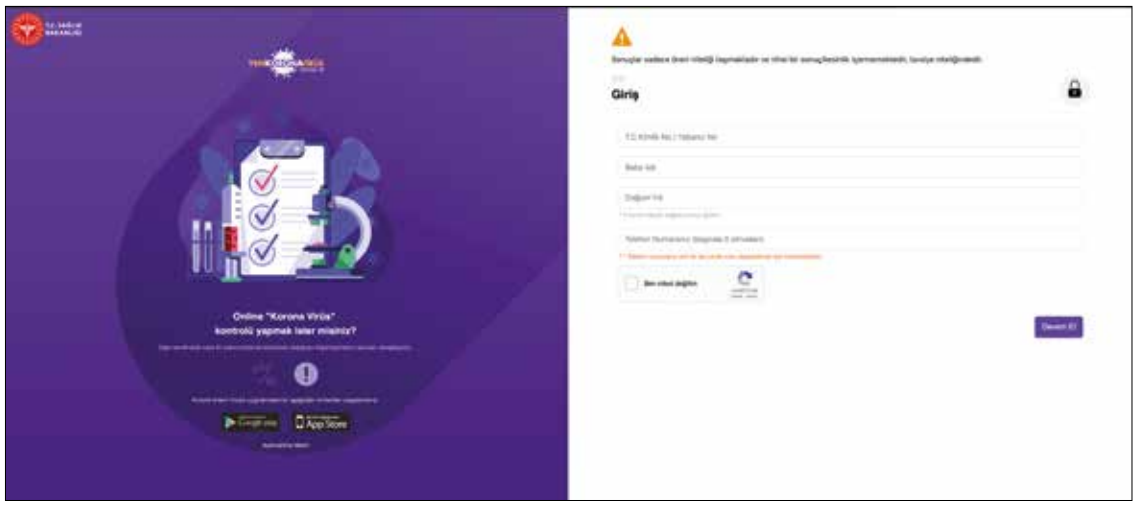
4.2.1. Republic of Turkey, RoT, Ministry of Health

Republic of Turkey Ministry of Health can be accessed at https://www.saglik.gov.tr Information on the total number of tests, the total number of cases, the total number of deaths, the total number of intensive care patients, the total number of intubated patients, the total number of recovered patients and daily tests, number of cases is available at (https://covid19.saglik.gov.tr/) current situation page.



4.2.1.1. R_oT Ministry of Health Novel Corona Virus Measure App

The novel Corona Virus Measure (ÖNLEM) app, a mobile application, is available for free on both Android and IOS platforms. With this application, one may find out their risk of encountering the coronavirus.

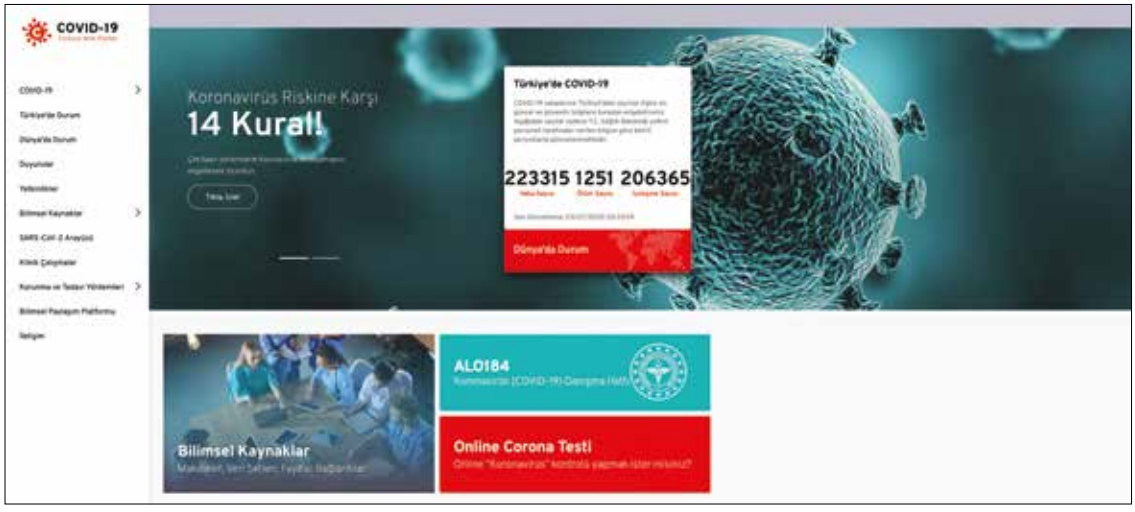


4.2.1.2. Ministry of Health "Life-at-Home" (Hayat Eve Sığar) App

Hayat Eve Sığar (Life-at-Home) App is a mobile application developed by the Ministry of Health to inform our citizens about the Novel Covid-19, to minimize the risks associated with the outbreak and prevent it from spreading.

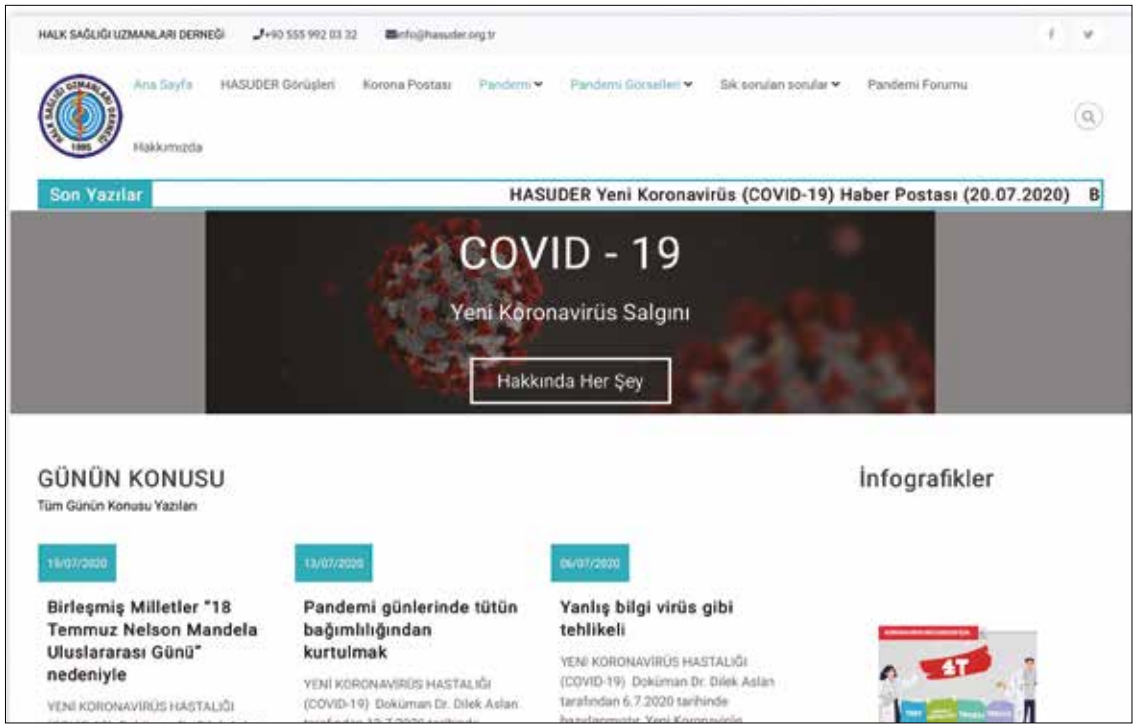
4.2.2. Covid-19 Turkey Web Portal

In the race against time, collaborative efforts among researchers have been maximized, and a need has arisen to take on approaches that combine multiple disciplines and prioritize shared wisdom in order to discover urgently effective solutions against the common threat. This portal, created with the idea that every challenge can also be an opportunity, has been launched in a virtual environment to bring together the Covid-19 research ecosystem, to share useful information, and is in a manner open to development. This portal is available at https://covid19.tubitak.gov.tr/anasayfa



4.2.3. Novel Coronavirus (Covid-19) Newsletter by HASUDER

HASUDER Novel Coronavirus (Covid-19) Task Force is an advisory board to the Association of Public Health Specialists (HASUDER) Executive Board, which enables the academia and field staff to jointly deliver scientific work concerning the Covid-19, declared by the WHO a pandemic by March 2020, in order to closely monitor work conducted in the world and Turkey by means of proactive activities, contributing to existing studies on scientific ground, provide suggestions on the health of the individual and/or public from a public health perspective. Details on the framework and main duties of the task force and the portal itself can be accessed at https://korona.hasuder.org.tr



4.2.4. Turkish Medical Association

News, opinions, and other documents related to the novel Coronavirus can be accessed on this page. The homepage of the site features numerical data from around the globe and Turkey, the following content is on TMA's suggestions to health and non-health workers concerning Covid-19. The webpage of the Turkish Medical Association is available at https://www.ttb.org.tr/

4.2.5. Covid-19 HUB

The Hub is designed as a scientific center in the scope of the TABİP Academic and Scientific Cooperation Project, which is carried out by the Yunus Emre Institute under the auspices of the Presidency of the Republic of Turkey. It was established to provide an opportunity to follow the latest scientific studies and technological developments on Coronavirus from reliable sources. "Covid-19 HUB" offers everyone hundreds of free articles and analysis under dozens of categories. The webpage of the Covid-19 HUB platform is available at https://covid19.tabipacademy.com/

Part 5

Covid-19
Calls of World Science Academies

Some COVID-19 Studies and Research Projects Conducted by TÜBA Members

COVID-19 Activities of World Science Academies

News from TÜBA Newsletter, February 2020

Some COVID-19 Studies and Research Projects Conducted by TÜBA Members

Covid-19 Calls of World Science Academies Some COVID-19 Studies and Research Projects Conducted by TÜBA Members

5.1. COVID-19 Activities of World Science Academies

S20
SAUDI ARABIA 2020
SCIENCE

Science 20 Statement to G20 Leaders on the COVID-19 Pandemic
24 March 2020

On behalf of the Science Twenty (S20) G20 Saudi Arabia engagement group representing the G20 Academies of Sciences, we welcome the Saudi G20 Presidency's call for an extraordinary virtual G20 Leaders' Summit this week to advance a coordinated response to the COVID-19 pandemic and its human and economic implications.

The coronavirus pandemic is still unraveling, but its global impact is already staggering. Any hope of a better outcome for this and other similar threats in the future requires evidence-based policies, global collaboration and coordinated actions, and investments in goal-oriented basic and applied research. The unprecedented impact of COVID-19 compels a framework for action that positions science at the core of decision-making.

We, the Science 20, call on the G20 Leaders to fasten policy development and decision making on scientific evidence. Scientific research continues to improve our understanding of the fundamental nature of communicable diseases, as well as its broader connections to risk factors associated with environment, human-animal interactions and socioeconomic considerations. Scientific knowledge is essential for developing strategies for prevention, control and intervention. Epidemiological modeling that assimilates the best science available can guide robust and effective policies to slow and arrest the spread of COVID-19 and to better communicate risk and uncertainty to the public.

The COVID-19 pandemic is also a stark reminder that we are an interconnected world. Our linked existence is the platform for viral spread, yet it is also a major instrument for fighting back. Scientific research is a collaborative enterprise, and it is through cooperation and sharing of accumulated knowledge and best practices that we can impede the unfolding impact of the COVID-19 pandemic and improve future preparedness and response. Sharing real-time information and knowledge will lead to improved strategies and actions for preventing, responding and controlling outbreaks and pandemics. Global cooperation is a must.

Beyond the present crisis, however, lies similar emergent threats to our future health and socioeconomic wellbeing. Whereas our understanding of viral pandemics continues to improve, COVID-19 sadly reminds us that we are far from equipped to prevent and respond to the next outbreaks. We need to build up and fill the gaps in our body of knowledge, and that can best be accomplished through global investment on goal-oriented basic and applied research on viral transmission, prevention and cure. Finally, the knowledge attained through these investments as well as the tools developed to fight back must also be promptly disseminated to benefit medical practitioners and frontline decision-makers.

Science must guide our collective response to COVID-19 and future global health threats. Through your leadership, we as global citizens first and scientists second have the opportunity to alleviate and gradually work together to prevent future outbreaks.

Anas Alfaris, PhD
Chair, S20 Saudi Arabia 2020

s20saudiarabia.org.sa

The Science 20 (S20) consists of the national science academies of the G20 countries.
S-20: https://s20saudiarabia.org.sa/en/Pages/default.aspx

CALL FOR GLOBAL SOLIDARITY ON COVID-19 PANDEMIC from the InterAcademy Partnership (IAP)

The COVID-19 pandemic presents critical global challenges, affecting individuals, families, communities, health services and economies. These are extraordinary times and there is much to be done to collect, validate and use evidence: both to improve preparedness and responsiveness now and to improve our governance systems for the future. Research has already achieved a great deal: in identifying the virus, beginning to understand its epidemiology, characterising its clinical course, and providing the information to accelerate the development of new interventions - diagnostics, therapeutics and vaccines - although this will still take time. How should we make better and faster use of research and its outputs for our collective benefit, that is, the global public good?[1] This Global Call from IAP emphasises the vital importance of doing more now to act collectively: effort on the global scale is essential to mitigate the spread of coronavirus in all territories.

The current global COVID-19 tragedy underscores the critical need for international collaboration across the scientific community and beyond, including open communication, shared resources and coordinated actions. We have seen the value of international scientific and other collaboration in past serious infectious disease outbreaks, for example, in tackling HIV[2], SARS[3], Ebola and avian influenza[4]. Sustained strategies to tackle other major infectious disease threats, such as drug-resistant tuberculosis[5] and antimicrobial resistance[6] have also depended, and do still depend, on worldwide collaboration and concerted action. We must apply the lessons of what worked or didn't work in response to other threats, as well as learn from ongoing experience as this global pandemic unfolds so as to enable the best data-driven policies and programmes and to reaffirm collective endeavour now.[7]

Facts matter and leadership matters! Strong leadership supported by the best available medical and scientific information is vital. We must have coordinated national responses and international solidarity in sharing information and resources in responding to COVID-19, unhampered by antagonism between countries relating to perceived origins of the virus, by conspiracy theories and by stigmatising of minority groups. It is essential to avoid fragmentation in knowledge generation and disconnects in what should be a global COVID-19 strategy. If individual governments announce public health actions at variance with WHO advice, they should substantiate such initiatives by making available the advice on which their policies are based[8].

Deficits in international collaboration will be particularly deleterious for those who are most vulnerable, including countries with weaker health systems. Some low- and middle-income countries have yet to report many COVID-19 cases[9] but this will change and will have major consequences for those countries, their neighbours and for us all. Although WHO has a strategy for convening expertise and sharing information on global research and innovation on COVID-19[10] there is much to be done to ensure that this information does not lag behind rapid developments in the spread and impact of COVID-19, and that collective effort includes all relevant actions, engages with all relevant science, and shares all relevant outputs. WHO must also play a more powerful role in mandating and ensuring equitable access to the diagnostics, therapies and vaccines that will emerge. The scientific community can cooperate with WHO to achieve these objectives. IAP and its academies recognise the importance of supporting each country in communication with WHO in an open and responsible manner to support public health security worldwide.

Much about COVID-19 is uncertain but, to reduce uncertainty while building critical mass for sustained action, IAP urges:

1. **All countries to renew their commitment to collaboration based on whole-of-government and whole-of-society approaches**. Leaders in public health and governments must work together to fight the outbreak and there must be global-scale planning. IAP calls for renewed partnership efforts in research and innovation on COVID-19 between scientific institutions and others. The world must share expertise and resources: to improve understanding of the threat in its biological, clinical and societal dimensions; to identify and fill knowledge gaps; to develop new diagnostic tools; to identify and develop new or repurposed therapies; to accelerate progress in vaccine innovation and provision, and to monitor and evaluate the impacts of interventions. Identifying ways to expedite manufacturing, regulatory and supply-chain activities applies not just to novel interventions but also to the provision of personal protective equipment and other standard public health procedures. And it is vital to assess and manage the implications of COVID-19 and choices made on the provision of other healthcare and on other sectors essential for health, such as agriculture[11]. The urgency of

the objectives demands unrelenting focus and unprecedented commitment to collaboration across all scientific disciplines and between the public and private sectors. There is no place now for promoting narrow commercial or national competitiveness and self-interest at the expense of others. Pathogens respect neither territorial nor ideological boundaries.

2. **Coordination in the communication of validated information worldwide, by inter-governmental organisations and others[12] is essential to enable strengthening of public health preparedness, informed by the best scientific evidence.** Research outputs must also be deployed to increase the reliability and relevance of modelling the health and socioeconomic impacts and to avert unintended consequences, for example to supply chains. Better provision of science-based, robust advice is also essential to counter unproven assertions, prejudice and deliberate misinformation that otherwise acts to disrupt and destabilise civil solidarity and equity. The scientific community can and should show solidarity with others in promoting responsible, transparent and timely communication of credible evidence[13]. In addition, there are important social and behavioural questions to be addressed by research: for example, how to tackle anxiety, rumour and discrimination; how to involve communities in adhering to public health measures; and how to work with the media on communication[14]. Thinking further ahead, society must also be ready to pursue the options for decarbonising the economy when economic growth returns.

3. **IAP recommends particular efforts to work with and support countries with weaker public health frameworks and health care systems, perhaps especially in Africa, Latin America and the Caribbean, and Southeast Asia where coronavirus infections are expected to increase soon.** IAP is committed to acting through its global network of more than 140 academies of science, engineering and medicine, together with the Global Young Academy and national young academies, to enable scientists in developing countries to draw on international scientific evidence to advise their own policy makers and citizens and to contribute to efforts worldwide in developing new interventions. The power of this global scientific resource, across all disciplines, is augmented by IAP implementing lessons for catalysing the sharing of good practice and building capacity, learned in previous inter-regional activities. IAP stands ready to work with WHO and other global and regional agencies to ensure that the best available scientific information is used to best effect, and this includes capitalising on advances at the frontiers of science and technology in the control of the virus, for example artificial intelligence and robotics. One initiative that IAP is proceeding in collaboration with others in the scientific and medical communities is the provision of web-based resources of curated, validated information contributed by academy members.

We conclude by reiterating that these are extraordinary times that demand global solidarity with coordinated effort informed by the best scientific evidence. IAP will do all it can to promote the sharing of expertise and good practice, and to catalyse action.

Signed by the members of the Steering Committee of the InterAcademy Partnership, March 2020

Volker ter Meulen,
IAP President

Depei Liu,
IAP President
and co-chair, IAP-Health

Margaret Hamburg,
co-chair, IAP-Health

Krishan Lal,
co-chair, IAP-Science

Cherry Murray,
co-chair, IAP-Science

Richard Catlow,
co-chair, IAP-Policy

Masresha Fetene,
co-chair, IAP-Policy

This IAP Communiqué can be downloaded at https://tinyurl.com/IAP-COVID-19.
For more information about IAP see www.interacademies.org and follow @IAPartnership on Twitter.

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Notes

1. Pontifical Academy of Sciences "Responding to the pandemic, lessons for future actions and changing priorities" http://www.pas.va/content/accademia/en/events/2020/coronavirus.html.
2. WHO "Global health sector strategy on HIV 2016-2021. Towards ending AIDS", 2016
3. For example, Mackenzie et al. "The WHO response to SARS and preparations for the future" in Institute of Medicine "Learning from SARS: preparing for the next disease outbreak: workshop summary", 2004.
4. For example, Fidler "Global outbreak of avian influenza A (H5N1) and international law" American Society of International Law, 2004; Shu et al. "A ten-year China-US laboratory collaboration: improving response to influenza threats in China and the world, 2004-2014" BMC Public Health 2019 19 (Suppl 3), 520.
5. For example, Global drug-resistant TB initiative, www.stoptb.org/Wg/Mdrtb/default.asp; Balfour "Global collaboration formed to develop novel treatment regimens for TB" European Pharmaceutical Review 28 February 2020.
6. For example, WHO "Global action plan on antimicrobial resistance" www.who.int/antimicrobial-resistance/global-action-plan/en; CDC "Combat antimicrobial resistance globally" www.cdc.gov./drugresistance/intl-activities.html; Goff et al. "A global call from five countries to collaborate in antibiotic stewardship: united we succeed, divided we might fail" Lancet Infectious Diseases 2017 17, PE56-E63;
7. WHO Global Preparedness Monitoring Board, www.who.int/gpmb; Academy of Medical Sciences UK, Medical Research Council and IAP "Interdisciplinary research in epidemic preparedness. Workshop report", 2019.
8. Editorial "Coronavirus: three things all governments and their science advisors must do now" Nature 2020, 579, 319-320.
9. WHO dashboard, https://experience.arcgis.com/experience/685d0ace521648f8a5beeeee1b9125cd.
10. See in particular (i) "Report of the WHO-China joint mission on coronavirus disease 2019 (COVID-19), 16-24 February 2020 and (ii) www.who.int/blueprint/priority-diseases/key-action/novel-coronavirus/en.
11. "CGIAR's response to COVID-19", www.cgiar.org/news-events/all-news/our-response-to-covid-19.
12. For example, World Health Summit COVID-19 Platform, www.worldhealthsummit.org/covid-19.html.
13. Calisher et al. "Statement in support of the scientists, public health professionals and medical professionals of China combatting COVID-19" Lancet 2020 395, e42.
14. Ghebreyesus and Swaminathan "Scientists are sprinting to outpace the novel coronavirus" Lancet 2020 395, 762-764.

About the InterAcademy Partnership (IAP)

Under the umbrella of the InterAcademy Partnership (IAP), more than 140 national, regional and global member academies work together to support the vital role of science in seeking evidence-based solutions to the world's most challenging problems. In particular, IAP harnesses the expertise of the world's scientific, medical and engineering leaders to advance sound policies, improve public health, promote excellence in science education, and achieve other critical development goals.

IAP's four regional networks - AASSA, EASAC, IANAS, and NASAC - are responsible for managing and implementing many IAP-funded projects and help make IAP's work relevant around the world.

3

The InterAcademy Partnership (IAP) was formally launched in South Africa in March 2016. Under the new InterAcademy Partnership, more than 140 national and regional member academies work together to support the special role of science. IAP: http://www.interacademies.org/

Statement on COVID-19 of The World Academy of Sciences (TWAS)

International collaboration in combating the pandemic is key, says the TWAS Council, and mitigating the disease's impacts depends on joint efforts inclusive of developing countries.

TWAS endorses the global call from UNESCO and from its close partner organization, the InterAcademy Partnership (IAP), recognizing the essential need for the global research community to act collectively and for open science to control the spread of the virus. TWAS also emphasizes that efforts to use scientific research to contain the virus must be inclusive of countries in the developing world, with an eye toward strengthening capacity for scientific research in the least-developed countries.

The rapid spread of the novel coronavirus and its resulting condition, COVID-19, has caught much of the world off-guard. The tragedy has yet to fully play out, but it is already clear that the crisis is thoroughly global in nature and that science is on the front lines in the fight against the virus. This includes medical professionals attempting to heal the sick at risk to their own health, public health officials tracking the virus and vigilantly urging such measures as social distancing to mitigate its spread, and researchers now engaged in the development of diagnostics, treatments and vaccines.

All of these will be especially important in the developing world, where resources are scarce, scientific infrastructure remains underdeveloped, and health care services are under-resourced. Science is needed in these countries, where many millions are vulnerable to the virus. Africa alone has an estimated 25.7 million citizens living with HIV as of 2018, who as immunocompromised persons could be highly threatened by the virus. Tuberculosis patients, of which there are millions in both Africa and South Asia, are also a high-risk population.

In fact, there are numerous issues common to the developing world that could worsen the impact of the virus. How can people without access to clean water be expected to wash their hands? How can people living in overcrowded, urban living situations expect to effectively practice social distancing? How will preventative measures impact developing nations that are most vulnerable to the effects of climate change or the economic consequences of a quarantine? These alarming and major challenges confront us today, and they will remain when the pandemic has ended unless the global community takes action.

So TWAS, as a leading organization for the development of science capacity in the developing world, not only endorses IAP's statement but holds that developing countries and especially the Least Developed Countries must receive strong support from the global health and scientific communities. We call for international collaboration, especially South-South collaboration between developing countries, both during the COVID-19 pandemic and in its aftermath, to provide developing nations with expertise and scientific knowledge to respond to this crisis and guard against similar future events.

TWAS was founded in 1983 by a distinguished group of scientists from the developing world.

TWAS is a global science academy based in Trieste, Italy. https://twas.org/

How Can European Academies Support Fight Against COVID-19

In times of crisis and uncertainty good science is more important than ever. COVID-19 outbreak is a worldwide challenge and international efforts and swift exchange of reliable information are needed to tackle it. Our member academies can play a key role in finding solutions to the problems created by the coronavirus pandemic by providing their expertise in medical and epidemiological sciences but also on social and economic effects of the epidemic.

In order to facilitate exchange of information on existing initiatives related to the coronavirus we have compiled a series of key resources. The list is not exhaustive, and we will expand it as new information comes to light.

ALLEA ACADEMIES' ACTIVITIES

- Royal Society Open Science's call for reviewers.
- Leopoldina's statements on Coronavirus: first, second (in DE), third (in DE).
- Swiss Academy of Medical Sciences' Guidelines "Triage of patients for intensive-care treatment under resource scarcity".
- Lithuanian Academy of Sciences' Commission on evaluation of the COVID-19 infection. More in LT.
- Swiss Academies of Arts and Sciences' resources for parents in DE and FR.
- Bilim Akademisi- Turkey's science website on COVID-19 with reliable resources for the general public.
- Czech Academy of Sciences' science advice on COVID-19 webpage.
- Polish Academy of Sciences against COVID-19.
- Royal Netherlands Academy of Arts & Sciences's symposium on 'the new Coronavirus' – video footage.
- Academy of Sciences of Albania's webpage on Coronavirus (in AL) and two statements (in EN): statement 1, statement 2.
- Accademia Nazionale dei Lincei's COVID-19 Call for support to European Academies., COVID-19 executive report and a report on animal tests.
- National Academy of Sciences of Ukraine's information on its working group on COVID-19 spread, the development of Ukrainian test for diagnostics and COVID-19 – related projects (in UK).

TOP RESOURCES AND INFORMATION

- World Health Organisation: Live database of ongoing research.
- European Commission: Roundup of ongoing European research into fighting pandemics.
- SAPEA: Compilation of resources.
- AAAS and Science: Compilation of resources.
- Global Young Academy: A global message from young scientists on COVID-19.
- The InterAcademy Partnership's call for global solidarity on COVID-19 pandemic.
- European Commission's letter calling to make coronavirus publications and the data supporting them immediately accessible via public repositories.
- International Network for Government Science Advice's call to contribute to a knowledge base on science/policy actions on COVID-19 outbreak.
- International Academies Partnerhsip: Compilation of resources.
- PEriTiA: Compilation of resources on trust and expertise in times of COVID-19.
- National Academies of Sciences, Engineering and Medicine: information on social distancing, spreading COVID-19 by conversation and crisis standards of care.
- Acatech's report on "Keeping the economy running, meeting basic necessities, maintaining innovation".
- Science|Business live blog on R&D response to COVID-19 pandemic.

RESEARCH FUNDING OPPORTUNITIES

- European Union: funding opportunities.
- Agence Nationale de la Recherche: Flash call COVID-19.
- Spanish Ministry of Science and Innovation: funding opportunities.
- Science Foundation Ireland, Enterprise Ireland, IDA Ireland: COVID-19 Rapid Response.
- Science|Business database on coronavirus funding opportunities

ALLEA is the European Federation of Academies of Sciences and Humanities, representing more than 50 academies from over 40 EU and non-EU countries. Letter to ISC Members From Daya Reddy Regarding The COVID-19 Pandemic, https://allea.org/

International Science Council

Dear colleagues,

I write at a time when our world is engulfed in a crisis of almost unimaginable proportions. The stark reality of what might have felt like a surreal situation has well and truly hit home, bringing normal social and economic activity and lifestyles to a halt, as our leaders put in place measures to stem the spread of the COVID-19 virus, and to minimize the casualties that are a tragic reality.
If ever it was vital to listen to the scientists, it is now. The World Health Organization leads the way in the fight, rightly, while growing numbers of scientists and scientific organizations work frantically to develop a vaccine. At the same time epidemiologists and other modellers, a central component of the task teams assembled by governments, provide advice on the concrete, often unpalatable measures that policymakers have to implement.

Maximal levels of cooperation are essential to a successful outcome. Beyond working together, it ought to be abundantly clear that our success depends crucially on the ability of experts from a vast range of disciplines to engage in truly transdisciplinary approaches in combating the threat of the COVID-19 virus: straddling geographical boundaries, the public and private sectors; and planning, researching, implementing strategies that draw not only on the biomedical sciences, but from the vast range of knowledge and expertise in the natural and social sciences, and engineering. The impact on social behaviour and responses poses new and fundamental questions that must be addressed.

The Governing Board met some weeks ago to ask: what should the ISC, as a global scientific organization, be doing about this health, economic and social crisis? In what ways can the ISC add most value to the work of those at the frontlines? In responding to this question, we returned to our vision of science as a global public good – where scientific knowledge, data and expertise are universally accessible and the benefits universally shared. First, in this context, we affirm our strong support for the World Health Organization, and our readiness to respond to any of its needs that we might be able to address. We urge acknowledgement of its leadership role at the global level.

A further response by the ISC has been to establish an online COVID-19 Global Science Portal (www.council.science/covid19) hosted on the ISC website. The portal shares scientific commentary and analysis and provides access to information on various initiatives, highlighting the scale and scope of response, and encouraging ISC members and partners to collaborate and share best practices during this global emergency. The Portal carries with it the powerful message of the importance of collaboration across organizations, disciplines, and geographical and cultural boundaries. I ask that members continue to populate this portal with their initiatives, think-pieces and debates using the online form.

As a global community we are rightly consumed with addressing the immediate challenges presented by the pandemic. But the ISC is in a position to go further than this. We have no idea of the kind of world to which we will return, once this threat is overcome. Much will have changed, some of it irreversibly. We will have learned a great deal about how better to approach major challenges, how to work together. The ISC is well placed to contribute to the set of challenges that go beyond the immediate. In this regard the ISC COVID team is engaging actively and in partnership with others.

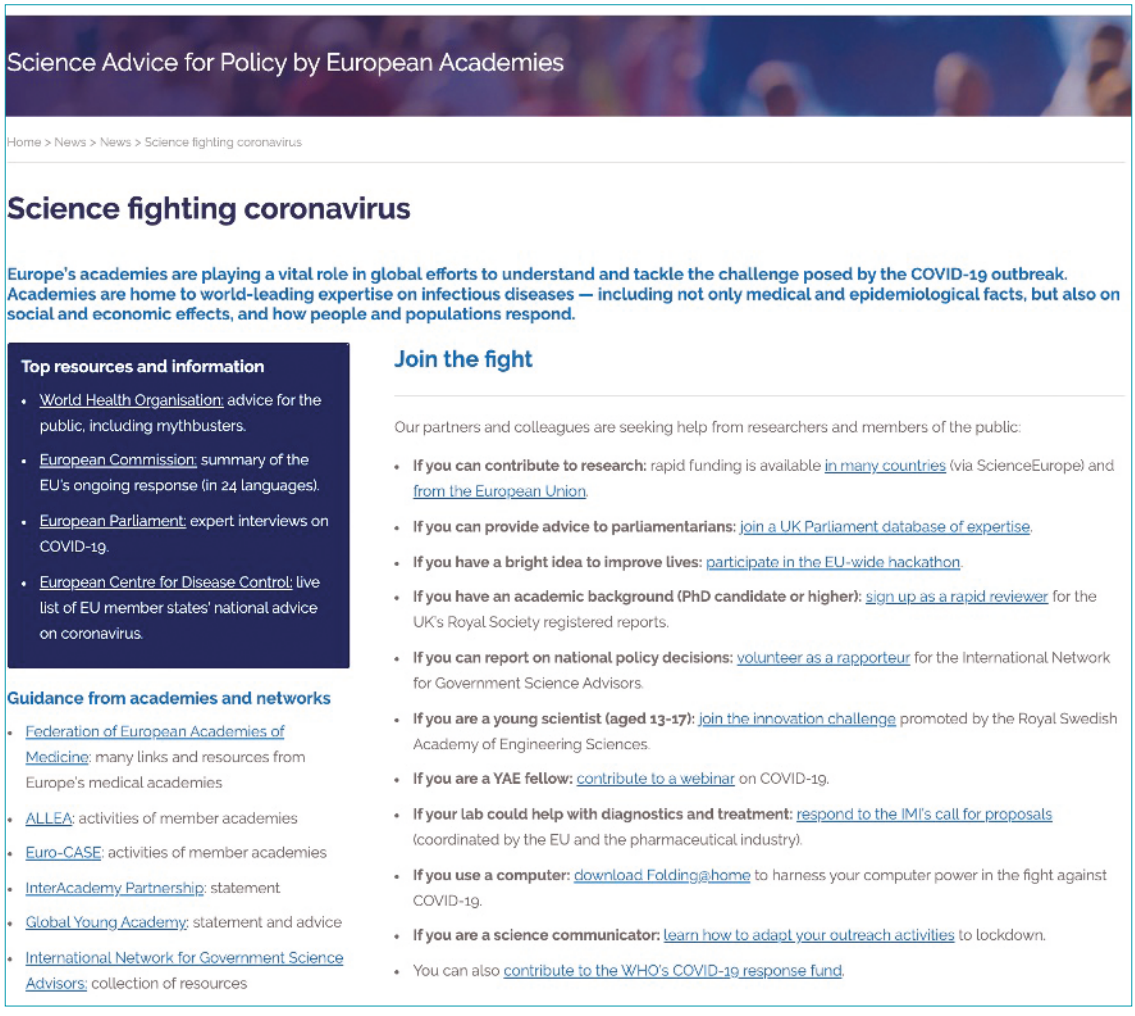
We will ensure that our members and partners are kept abreast of these initiatives as they take shape. Likewise, we look to you, our members, to work with the ISC in (re) shaping the scientific agenda.

I have no doubt that through our collective efforts, as well as the many expressions and actions of solidarity, mutual support, and of caring, within and beyond the scientific community, we will emerge better able to address the many global challenges that will continue to shape our world, and our work as scientists.

I wish you well during these difficult times.

Daya Reddy,
President, International Science Council

Science Advice for Policy by European Academies



Science Advice for Policy by European Academies

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Science fighting coronavirus

Europe's academies are playing a vital role in global efforts to understand and tackle the challenge posed by the COVID-19 outbreak. Academies are home to world-leading expertise on infectious diseases — including not only medical and epidemiological facts, but also on social and economic effects, and how people and populations respond.

Top resources and information

- World Health Organisation: advice for the public, including mythbusters.
- European Commission: summary of the EU's ongoing response (in 24 languages).
- European Parliament: expert interviews on COVID-19.
- European Centre for Disease Control: live list of EU member states' national advice on coronavirus.

Guidance from academies and networks

- Federation of European Academies of Medicine: many links and resources from Europe's medical academies
- ALLEA: activities of member academies
- Euro-CASE: activities of member academies
- InterAcademy Partnership: statement
- Global Young Academy: statement and advice
- International Network for Government Science Advisors: collection of resources

Join the fight

Our partners and colleagues are seeking help from researchers and members of the public:

- **If you can contribute to research:** rapid funding is available in many countries (via ScienceEurope) and from the European Union.
- **If you can provide advice to parliamentarians:** join a UK Parliament database of expertise.
- **If you have a bright idea to improve lives:** participate in the EU-wide hackathon.
- **If you have an academic background (PhD candidate or higher):** sign up as a rapid reviewer for the UK's Royal Society registered reports.
- **If you can report on national policy decisions:** volunteer as a rapporteur for the International Network for Government Science Advisors.
- **If you are a young scientist (aged 13-17):** join the innovation challenge promoted by the Royal Swedish Academy of Engineering Sciences.
- **If you are a YAE fellow:** contribute to a webinar on COVID-19.
- **If your lab could help with diagnostics and treatment:** respond to the IMI's call for proposals (coordinated by the EU and the pharmaceutical industry).
- **If you use a computer:** download Folding@home to harness your computer power in the fight against COVID-19.
- **If you are a science communicator:** learn how to adapt your outreach activities to lockdown.
- You can also contribute to the WHO's COVID-19 response fund.

SAPEA brings together outstanding expertise
in engineering, humanities, medicine, natural and social sciences
from over 100 academies, young academies and learned societies across Europe.
https://www.sapea.info/

The Global Young Academy

Beyond Boundaries: a Global Message from Young Scientists On COVID-19

The Corona Virus Disease 2019 (COVID-19) pandemic has disrupted the world and it will not be the last pandemic to wreak havoc on humanity. Global health and the economy are at serious risk if proper mitigation measures are not taken in each country. To mitigate transmission of the virus, we need rapid, synchronised international action. Governments must consider the best science available to make informed decisions, the public must act as responsibly, and young researchers must recognise that they can be a crucial part of the solution. This Global Young Academy (GYA) Statement delivers specific recommendations for governments, the public, and young researchers.

Governments should:
Promote a shift from global health security to global health solidarity. Although we need to temporarily close borders to contain the spread of COVID-19, in the long term we need to change the current framing of health security. Instead of believing that we can protect borders from the incursion of disease, we should build global partnerships that benefit our collective health.

Exchange information quickly and openly, promote information exchange networks between national science advice mechanisms and implement open science policies. More efficient and free exchange of information will let us gain invaluable time in responding to crises, saving many lives.

Recognise the importance of multiple disciplines for decision-making. Given the evolving nature of the science underpinning pandemics, the science advisory mechanisms supporting policymaking must be composed of diverse perspectives so that a full assessment of the intended and unintended consequences of policy actions can be quickly and thoroughly made. Take into account the long-term impact of the pandemic on health and society as well as the importance of prevention. Young researchers, accessed through the National Young Academies and the GYA, can provide important contributions to both immediate and long-term responses.

The public should:

Take precautions to avoid the spread of COVID-19, and play our part in controlling the pandemic by following guidelines, sensibly using and distributing resources, and supporting vulnerable members of society. Avoid spreading misinformation. Encourage responsible use of social media. Learn to distinguish fear-based from fact-based information to avoid rumors or “fake news”, and highlight when we are uncertain about the veracity of the information (or we should simply not share anything that cannot be verified). Seek expert opinion and guidance about our local situation, and ensure that the information we accept about the situation around the world is from a reliable source.

Young researchers should

Act responsibly in our use of global platforms to share and exchange information and experiences, and present the credentials for statements we make. Contribute by translating science communication to local languages and “lay person” terminology, and adapting the message to local contexts. Play an active role in interpreting complex scientific information to the general public in non-technical language. Help to bridge the gap between science and policy. Take the initiative to approach the government if we have relevant knowledge, whether this is directly regarding the pandemic or in fields relating to human reactions and behaviour. Play an active role in promoting good practices and advising the people around them. Establish strong connections across various stakeholders, such as the government, civil society and the wider public regarding the role of science in improving our global health.

Together, we can develop stronger science-informed networks for information exchange that will combat the effects of this pandemic and provide long-term collaborative benefits.

The Global Young Academy gives a voice to young scientists around the world.
As of 2014, the GYA has reached its full capacity with 200 members
https://globalyoungacademy.net/

5.2. News from TÜBA Newsletter, February 2020

Turkey Issues Coronavirus Advisory for Public

The coronavirus, officially known as COVID-19, originated in Wuhan, China last December and has spread to the whole world. Turkey confirmed its first case of the novel coronavirus 11.03.2020, 3 months after the spread all over the world, with the health minister urging citizens to avoid international travel unless necessary. "Overseas contact will continue to be a risk." Koca noted, and adding the "importance of applying measures strictly".

The World Health Organization declared the outbreak a pandemic. On March 29, 2020, out of 634.835 confirmed cases, the death toll now exceeds 30.000, while more than 150.000 patients have recovered, according to WHO and Worldometer.

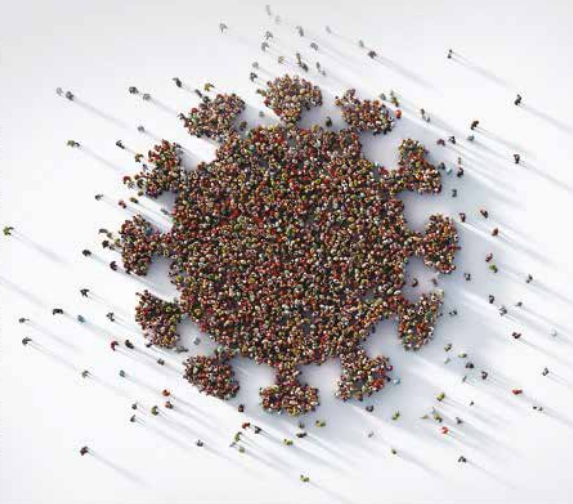
Turkey steps up quarantine measures. Turkey closed its borders and halted most international flights but struggles to keep ahead of the coronavirus outbreak that threatens the world. Authorities repeatedly warn the public to not travel abroad and if they do so, to impose self-isolation for 14 days. Turkey has rolled out a series of new steps against the coronavirus, from new flight suspensions to closure of schools and a ban for spectators in sports events. The government made it mandatory to wear gloves and masks for people working in businesses involving frequent money transactions and cargo deliveries.

Health Minister Dr. Fahrettin Koca pointed out that one of the main factors of getting out of control in cases of the outbreak is panic. "Panic is emotional and not reasonable. We must be discreet. This situation will not go on like this, we will return to our normal lives." Minister added. "The common sense of our people is as important as the organizational power of our state. In most of the world, the picture is an outbreak table. We are lucky compared to the general picture. Our health infrastructure is fast and widespread. We have to be sure that we will overcome this problem with strict measures. He also announced that the number of laboratories which make coronavirus test will be increased. In addition184 Corona Lines has started to serve as "ALO 184 Corona Hotline". Dr. Koca added: "Turkey aims to test about 15,000 suspected cases of the coronavirus per day and the basic kits and tools, which are necessary are being provided for free during quarantines.

www.tuba.gov.tr www.facebook.com/tubagovtr twitter.com/tubagovtr instagram.com/tubagovtr youtube.com/tubagovtr

Press Release of TÜBA on the Latest Coronavirus (COVID-19) Pandemic

TÜBA Academy Council made a statement regarding the new Coronavirus - COVID-19. The statement states that TÜBA supports the efforts of institutions that work to prevent the spread of the epidemic in Turkey. TÜBA also once again stressed the measures to be taken. Drawing attention to the preventive role of individuals' efforts in spreading the epidemic as well as institutions, TÜBA recommended that people should follow the announcements of official institutions without panic. Stating that disinformation and false news, especially on social media, should not be respected, TÜBA underlined that the measures taken should be implemented in a strict and controlled manner. Moreover, TÜBA has decided to postpone its national and international programs and scientific activities to future dates due to the pandemic, except for mandatory meetings.



www.tuba.gov.tr www.facebook.com/tubagovtr twitter.com/tubagovtr instagram.com/tubagovtr youtube.com/tubagovtr

5.3. Some COVID-19 Studies and Research Projects Conducted by TÜBA Members

5.3.1. Natural Compounds in the Treatment of COVID-19 Disease

Prof. Dr. Ömer Küçük-TÜBA Honour Member

Emory University, Atlanta, Georgia, U.S.A.Coronavirus disease (COVID-19) started in late 2019 in Wuhan, China and has rapidly spread to the rest of the world becoming a major pandemic causing high morbidity and mortality. The disease is caused by Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-Cov2) which is likely to be of zoonotic origin. Person-to-person transmission of COVID-19 infection occurs through droplets carrying the virus attaching to respiratory mucosa. While most patients are relatively asymptomatic and recover rapidly, susceptible patients appear to have a very stormy course characterized by severe inflammation (cytokine storm) and lack of NK cells and T cells. Therefore, it is possible that certain anti-inflammatory agents in the diet may prevent the most severe manifestations of the disease allowing more patients recover and survive the disease. Soy isoflavones have anti-inflammatory and immunopotentiating effects and may provide support needed by vulnerable patients allowing them to weather the storm.

Soy isoflavone genistein has well-established anti-viral effects against HBV, HIV and Ebola virus. In addition, genistein improves the immune system and prevents inflammation and oxidative stress. It also has ACE-2 inhibitory activity and may inhibit the binding of SARS-Cov2 to respiratory epithelium. Recent reports show that patients with COVID-19 disease who have the worst outcome have overwhelming inflammation and oxidative stress. Genistein may reduce inflammation in the tissues affected by the virus and therefore help the patient survive the cytokine storm. In addition, genistein could reduce the viral counts directly, and inhibit ACE2 binding of coronavirus, and improve immune function which is impaired in patients dying from COVID-19.

Patients who succumb to COVID-19 have low NK cells and T cells, which could be prevented by genistein or other natural compounds. We have data showing that leech saliva extract has anti-inflammatory effects and improves the NK cell and T cell counts. Therefore, leech saliva extract and other natural compounds may also benefit patients with COVID-19.

Pre-clinical studies and clinical trials should be conducted with genistein and leech saliva extract to investigate their potential benefits. Currently we are planning some of these research studies.

5.3.2. Convalescent Plasma (CP) Therapy

Prof. Dr. Fikrettin ŞAHİN-TÜBA Academy Council Member, Yeditepe University- Istanbul

Convalescent plasma (CP) therapy, a conventional adaptive immunotherapy, has been used in the prevention and treatment of infectious diseases for more than a century. In the past 20 years, CP treatment has been used successfully with satisfactory efficacy and safety in the treatment of SARS, MERS and 2009 HI N1 outbreak. In a meta-analysis of 32 studies on SARS coronavirus infection and severe influenza, a statistically significant reduction in the collected mortality rates following CP treatment, with or without placebo. In 2014, it was recommended to use healing plasma as an empirical treatment during Ebola virus outbreaks, and in 2015, a protocol for the treatment of coronavirus of Middle East respiratory syndrome was established with healing plasma. With other viral infections such as SARS-CoV, H5N1, this approach has been reported to be effective in transfusion of healing plasma in bird flu and H1N1 influenza. Virological and clinical features are similar between SARS, Middle East Respiratory Syndrome (MERS) and COVID-19. Therefore, it is predicted that the use of healing plasma transfusion may be a promising treatment option in patients infected with SARS-CoV-2. Therefore, in cases where high neutralizing antibody titer is detected in patients recovering from COVID-19, these patients are considered to be used as a valuable donor CP source. Many hospitals, Turkish Red Crescent and University hospitals (such as Yeditepe, Acıbadem, Medipol Universities etc) led by the Ministry of Health in Turkey started to be used for the collection of healing plasma and treatment of high-risk COVID-19 patients.

Similarly, it has been observed that cellular therapies give successful results in the treatment of many diseases that have no cure available. Treatment of severe acute respiratory infection, known as the most dangerous phase of the new type of coronavirus (COVID-19) disease, is known to be a very important factor in reducing mortality rate. Recently, clinical studies have been initiated for use in the treatment of many diseases of MSCs due to their immunomodulatory and regenerative properties. After intravenous transplantation of MSCs, a significant cell population accumulates in the lung, as well as maintaining the immunomodulatory effect, can protect alveolar epithelial cells, restore pulmonary microenvironment, prevent pulmonary fibrosis and treat lung dysfunction. Especially cytokine storm is a common pathology in new coronavirus disease (COVID-19). The prevention and reversal of cytokine storm is thought to be crucial for the treatment of patients with severe COVID-19 pneumonia. For this reason, as in the world, many scientists collaborated from different Universities in Turkey and started some pilot MSCs applications for the treatment of intensive care COVID-19 patients in the high risk groups. Therefore, studies for development of an inactive vaccine and/or biotechnological vaccines against COVID-19 have been carried out by scientists at Yeditepe University and Acıbadem University in Turkey. In addition, is is known that some scientists at Yeditepe University have been working to have made significant progress in developing a novel broad spectrum antiviral agent that effective against different viruses including various types within the Covid family.

5.3.3. Projet on the Covid Human Genetic Effort

Prof. Dr. Tayfun ÖZÇELİK-TÜBA Principal Member

Bilkent University, Faculty of Science, Department Molecular Biology and Genetics, Ankara
The COVID Human Genetic Effort is an international consortium aiming to discover:

Monogenic inborn errors of immunity (IEI), rare or common, underlying severe forms of COVID-19 in previously healthy individuals

Monogenic variations, rare or common, which make certain individuals resistant to the infection by the SARS-CoV2 itself, despite repeated exposure.

With these two projects, Covid Human Genetic Effort aims to discover truly causative monogenic variations, rare or common, and decipher in depth the molecular, cellular, and immunological mechanisms by which they actually cause resistance to viral infection or predisposition to severe disease.

We are a group of friends and colleagues in the field of IEI, many of whom have successfully worked together on other challenges for years. We enthusiastically welcome the addition of new talents and look forward to making new friends in these dire times, for the benefit of humanity.

For many years, up to 25 years for some, members of the Covid Human Genetic Effort have studied the human genetic basis of life-threatening diseases striking previously healthy human beings in the course of primary infection by a variety of viruses, bacteria, fungi, or parasites. In particular, we and others have identified monogenic inborn errors of immunity (IEI) that selectively underlie life-threatening or lethal viral diseases in previously healthy children or adults, including various severe diseases caused by Epstein-Barr virus, herpes simplex virus encephalitis, varicella zoster virus encephalitis, fulminant hepatitis due to hepatitis A virus, lethal primary infection by cytomegalovirus, severe pneumonitis due to influenza virus or rhinovirus, beta-pap- illomavirus-driven skin cancer, human herpes virus 8-driven Kaposi sarcoma, and others (see references below).

In December 2019, a pneumonia due to a novel coronavirus (designated SARS-CoV-2) emerged in China, and quickly spread world-wide with an increasing number of cases and deaths. In populations naive to this new virus, there has been stunning inter-individual variability among infected individuals, ranging from asymptomatic infection to lethal coronavirus infectious disease-19 (COVID-19). Although this is not proven yet, there might be individuals completely resistant to the infection itself, as seen with other viruses. Two overlapping groups of infected individuals are at high risk of severe pneumonitis, and more rarely encephalitis: elderly individuals (>70 years) and patients with a pre-existing condition (including but not limited to cardiovascular and pulmonary diseases, diabetes and obesity, liver or kidney dysfunctions, and overt immunodeficiency). Only a small proportion of otherwise healthy, relatively young people therefore fail to control SARS-CoV-2 infection and require hospitalization in a pediatric or adult intensive care unit (ICU) In this context, we hypothesize that life-threatening COVID-19 in previously healthy individuals younger than 50 years, and perhaps even in older individuals without any overt co-morbidities, can be caused by monogenic IEI, which may or may not display complete clinical penetrance.

5.3.4. Covid Human Genetic Effort Aim

In collaboration with many colleagues around the world, our first project will tackle three specific aims:

- Recruit otherwise healthy young patients with severe COVID-19 (and their family members, and seropositive individuals who had remained asymptomatic, when available, as controls).
- Search for candidate disease-causing variants by whole-exome sequencing/whole-genome sequencing of patients and controls (including asymptomatic infected subjects).
- Perform functional studies to characterize the products of the candidate variants biochemically, and to analyze the corresponding patients' cells immunologically.

This project should reveal the critical circuits involved in the pathogenesis of severe COVID-19, which may also be disrupted by other mechanisms in patients older and/or with co-morbidities, thereby paving the way for the development of novel preventive and therapeutic strategies.

In our second project, we will search for, enroll, and study individuals who have not been infected by SARS-CoV2 despite repeated exposure (e.g. in the household of a patient with severe pneumonitis), as attested by the lack of both disease and specific antibody titers against the virus.

If such individuals are found, we will test the hypothesis that some of them carry monogenic variations that make them naturally resistant to the entry of the virus, as previously shown for DARC and Plasmodium vivax, CCR5 and HIV, and FUT2 and norovirus.

5.3.5. The Potential Macroeconomic Impacts of COVID-19 Outbreak Through Domestic Trade Network in Turkey

Prof. Dr. Halit YANIKKAYA-TÜBA Associate Member, Gebze Technical University, Kocaeli

While epidemic diseases sometimes appear in a certain geographical area with limited effects, and yet pandemics such as the COVID-19 outbreak affect most of the world. This pandemic, along with transport restrictions and social distance rules, has led to disruptions in the trade of countries which are linked by supply chains. Unfortunately, for especially the developed countries it is anticipated that it is going to be much destructive than the recent 2008 global crisis. Moreover, the deeper integration of domestic geographical units and sectors within a country also causes domestic trade to be affected by these shocks. Thus, the COVID-19 outbreak not only affects trade among countries but also trade within the country.

International trade networks address the structure and evolution of trade relations between countries in the context of the network approach. Similarly, we evaluate the domestic trade flows within Turkey as a province and sector-based domestic trade network. This pandemic affects the domestic trade network due to the domestic transportation restrictions between the provinces and regions. The demand and supply shocks caused by the pandemic also influence the sectors at different levels and affect the form and volume of domestic trade as well as the nature of the trade network. As a result, the outbreak affects not only the domestic trade network but also employment wages, and production measures.

In this study, using the Entrepreneur Information System data set of the Turkish Ministry of Industry and Technology, the possible effects of the shock caused by the COVID-19 on the domestic trade network is going to be examined. This dataset is a firm-level dataset available for 4-digit NACE codes and contains 250 million of observations for sectoral and provincial data on trade, employment, value added, sales, wages and financial data for the 2006-2018 period. This very rich dataset allows the comprehensive analysis of macroeconomic impact of the COVID-19 outbreak on employment and value added through the domestic trade network. Using the data for available years and the trade network measures, we are going to estimate the effects of domestic trade on several macroeconomic measures such as employment and value added with dynamic panel estimation methods. With the parameters obtained from the above estimations, we then forecast how provinces and sectors is going to be affected from the shock for the year 2020 and later depending on the levels of interdependence of the provinces and the locations of the provinces in the trade network.

5.3.6. Development of Prototype Lateral Flow Immunoassay for Diagnosis and Follow-Up of COVID-19

Prof. Dr. Hakan PARLAKPINAR-TÜBA Associate Member, İnönü University Faculty of Medicine, Department of Pharmacology, Malatya.

This study is supported by Inonu University Scientific Research Projects Coordination Unit as a priority area project (project number: 2188).

Real Time Polymerase Chain Reaction (RT-PCR) studies targeting various immunological tests and specific genes are very important in the diagnosis of COVID-19. However, although the specificity of the PCR method is high, it has some disadvantages. Such as, this method needs preliminary preparation phase, the result of test takes approximately 2-4 hours, requires certified laboratories and expensive equipment, needs experienced personnel, distinguishes only positive or negative according to the presence of active infection, some of the infected people show at least 1 false negative, do not give information about the past infection and insufficient sample taken from the nasopharynx. However, an accurate and rapid test method is needed to quickly identify multiple infected patients, asymptomatic carriers to prevent virus transmission and identify those who have had the disease and immunized ensure timely treatment of patients. In this project, we aim to develop rapid lateral flow immunoassay in human fingertip blood that can detect IgM (active infection) and IgG (immunized) antibodies against the virus SARS-CoV-2 within 10-15 minutes simultaneously. This kit, which is planned to be developed locally as a prototype, can be used in hospitals, clinics and test laboratories, as well as in businesses, schools, airports, ports, train stations, etc. can be used effectively in places. Thus, the IgG-IgM combined antibody test kit will enable large-scale screening of asymptomatic carriers, which constitute the vast majority of cases, to enable diagnosis and monitoring of infection.

5.3.7. Development of Isotope Dilution Based Analytical Method for High Accurate, Sensitive and Fast Determination of Chloroquine and Hydroxychloroquine Chemicals Used in SARS-CoV-2 (COVID-19) Treatment in Blood, Urine and Saliva Samples

Prof. Dr. Sezgin BAKIRDERE-TÜBA Associate Member, Yıldız Teknik University-İstanbul

In this project, it is aimed to develop high accurate and sensitive isotope dilution based analytical method for the determination of chloroquine and hydroxychloroquine at trace levels in blood, urine, and saliva samples. Isotope-enriched analogues of analytes will be synthesized and used in the determination of analytes using the isotope dilution method. Quadrupole isotope dilution (ID4) method will be tried to obtain high accuracy and precision for the determination of target analytes. The developed method will be applied to spiked blood, urine and saliva samples in order to control the accuracy and applicability of the method.

5.3.8. Exploring Conformational Transition of 2019 Novel Coronavirus Spike Glycoprotein Between Its Closed and Open States Using Molecular Dynamics Simulations

Assoc. Prof. Dr. Mert GÜR-TÜBA Young Academy Member, Istanbul Technical University-Istanbul

Since its first recorded appearance in December 2019, a novel coronavirus (SARS-CoV-2) causing the disease COVID-19 has resulted in more than 2,000,000 infections and 128,000 deaths. Currently there is no proven treatment for COVID-19 and there is an urgent need for the development of vaccines and therapeutics. Coronavirus spike glycoproteins play a critical role in coronavirus entry into the host cells, as they provide host cell recognition and membrane fusion between virus and host. Thus, they emerged as popular and promising drug target. Crystal structures of spike protein in its open and closed states was resolved very recently in March 2020. These structures comprise 77% of the sequence and thus provide almost the complete spike structure. Based on down and up positions of receptor binding domain (RBD), spike protein can be in a receptor inaccessible closed or receptor accessible open states, respectively. Starting from open and closed state crystal structures, and also 16 intermediate conformations, an extensive set of all-atom molecular dynamics (MD) simulations in the presence of explicit water and ions were performed. Simulations show that in its down position, RBD has significantly lower mobility compared to its up position; probably caused by the 6 interdomain salt bridges of RBD in down position compared to 3 in up position. Free energy landscapes based on MD simulations revealed multiple substates between closed and open states. Minimum energy pathway between down and up positions comprised a gradual salt bridge switching mechanism. Furthermore, although significantly lower than open state, ACE2 binding surface of RBD contained a partial solvent accessibility in its closed state. Thus, our study predicts that, based on the solvent accessibility of the ACE2 binding surface, it would be theoretically possible to develop a small molecule drug that could bind the closed form of the spike protein. Not only would such a molecule not be limited to binding only the active open state of the spike protein, it would also prevent the protein to transform into an active form; hence preventing the virus to bind and infect human cells. Furthermore, our study provides unique insight into the structure and dynamics of the ACE2 binding surface of the spike protein, which in turn provides critical insight into the development of coronavirus drugs.

5.3.9. Development and Clinical Validation of Diagnostic Kit for COVID-19 and Other Viral Infections

Assistant Prof. Mehmet Cengiz ONBAŞLI-TÜBA Young Academy Member Koç University – Istanbul

(İhsan Solaroğlu, Önder Ergönül, Füsun Can, M. Cengiz Onbaşlı, Müslüm İlgi, Hakan Ürey, Arzu Baygül, Aykut Coşkun, Mehmet Cengiz Onbaşlı)

In this study, an innovative new diagnostic kit with high sensitivity is developed. PCR test kits used in the diagnosis of COVID-19 have high costs and can sometimes give false negative or positive results. In this project, a new diagnostic kit and measurement device based on SERS technique with high speed, sensitivity and selectivity is developed and COVID-19 presence in patients' nasal fluid will be tested in the laboratory and in clinical trials. High sensitivity, fast response will be achieved and COVID-19-specific diagnosis will be provided. Large-scale test kit fabrication processes will be established for low cost and domestic production. Diagnosis with higher sensitivity and selectivity equivalent or higher than the currently used standard PCR diagnostic techniques would be achieved. This diagnostic kit could also be applied to other viral outbreaks in the future and in the case of biological warfare. The processes will be ready for high-volume production (80 million diagnostic kits within 3 months). These point-of-care test kits could be used in the field without the need for a lab. The project is expected to be completed before the second expected epidemic in autumn. The project has been funded by the Ministry of Health, TÜSEB for 6 months and support has been received from Bank of America.

5.3.10. Diagnostic Software Based on Artificial Intelligence Based Lung Tomography

Assistant Prof. Mehmet Cengiz Onbaşlı-TÜBA Young Academy Member Koç University - İstanbul

In this study, 92% test accuracy has been achieved in diagnosis. After the completion of the research, the artificial intelligence model is expected to diagnose viral lung infections with over 95% test accuracy.

5.3.11. Development of Web-Based Model and Database for Estimation of Propagation and Impact Levels of New Generation Coronavirus COVID-19

Assoc. Prof. Mehmet Lütfi YOLA-TÜBA Young Academy Member, İskenderun Technical University-iskenderun

SARS-CoV-2 (COVID-19), which caused the disease that can be fatal to humans and animals, which first appeared in Wuhan-China, has become the most important member of the SARS and MERS family in recent days. The virus spread to almost all of the world today and showed a significant increase in a short time in Turkey. According to the latest reports of the ministry of health, the total number of cases has exceeded 140000 and the number of deaths has reached 4000. Although the number of patient recovery has increased in current data and has reached 98000, nearly 40000 active cases remain. The lack of definitive treatment for COVID-19 at the current stage has made protective measures against COVID-19 important. At this point estimation model can be found in the design of future predictions, justification or of the measures taken in the normalization process in Turkey are thought to create vision issues such as increasing. For this reason, the discovery of changes in COVID-19 spread in Turkey and a model providing predictions are aimed to develop. Three different mathematical and statistical methods are used to strengthen the predictions and reduce the error rate. Methods were compared to Average Absolute Percentage Error (AAPE) as a measure of predictive accuracy.

Between 11 March 2020 and 12 May 2020, the data including the total change of case, death and recovery information over time was divided into the first fifty days of training and the rest as a test set. The prediction models completed with the training set made predictions since 30 April 2020 ana as shown in Table 26, error values were calculated by comparing the forecast results with the test set.

Table-26 : *Prophet, ARIMA and Decision Tree methods' error bar in case, death ve recovery values*

Data	Method	AAPE
Case	Prophet	4.63
	ARIMA	8.05
	Decision Tree	45.69
Death	Prophet	3.15
	ARIMA	7.41
	Decision Tree	49.82
Recovery	Prophet	1.59
	ARIMA	21.18
	Decision Tree	73.22

As can be seen in Table in the COVID-19 data, while the Decision Tree model, whose working principle is based on deductive understanding, is the model with the highest prediction error, ARIMA, which makes better predictions in total case and death values, has not been able to maintain its stability in recovery values. As a result, Facebook Prophet method, which can well analyze the complexity of applications, has been determined as the method to be used in future forecasts because it can make stronger predictions.

In the second stage of the study, all the data were re-analyzed by Facebook Prophet method, and points of change in case, death and recovery data were determined as in Figure 18. The model was retrained considering the points of change and 15-day forecasts were made as shown in Figure 19.

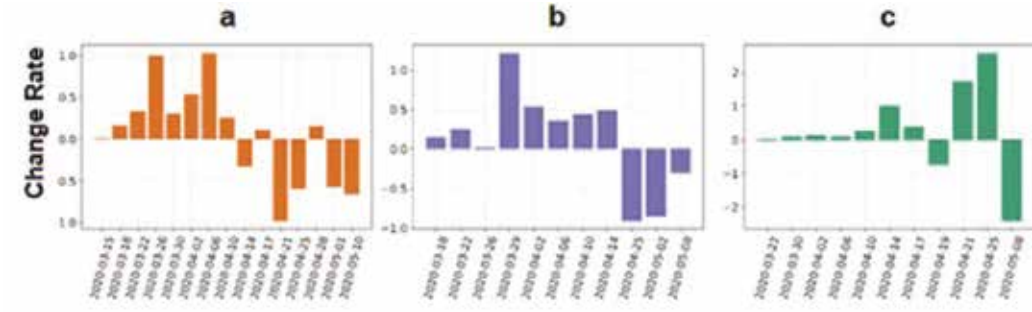


Figure-18: Critical dates that show an increase or decrease in the change of data over time, a) Points of change in total case values, b) change points in total death values, c) points of change in total recovery values

Case, death and recovery values are thought to be critical in COVID-19 combat. For example, the rate of change on April 25,2020 has become a breaking point where deaths have decreased in Figure 18/b. Likewise, it is possible that changes in the number of cases can be a guide in planning the measures.

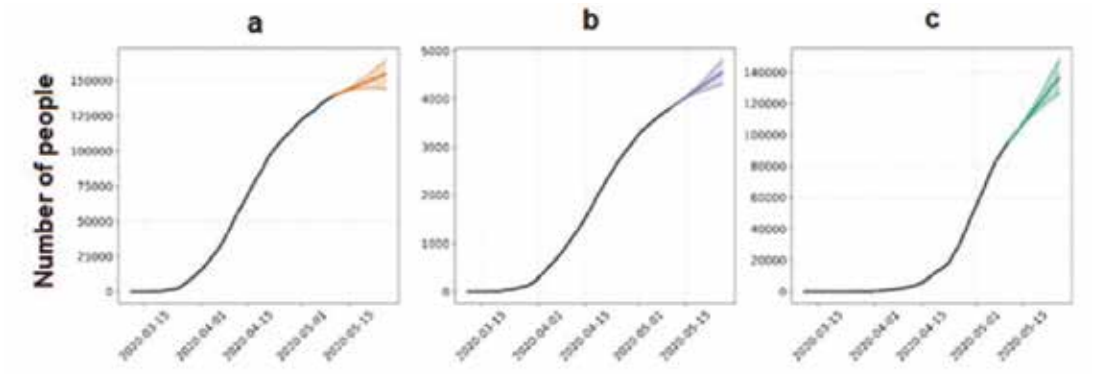


Figure-19: 15-day time series prediction a) total number of cases, b) total death, c) total recovery

Considering the results of the prediction model, If a major change in the pandemic process can not occur in Turkey, it predicts that the number of cases can reach 157000, the deaths to 4500 and the number of recovered patients can reach 136000 within 15 days. Under these conditions, it is considered that the number of active cases will be almost halved. Fiowever, the decrease in the number of cases in Figure 18/a decreases day by day and the recovery curve has been losing slope in recent days. Necessary measures should be taken to maintain the decline in the total number of infected people.

5.3.12. Investigation of Existing Pharmaceutical Ingredients Against COVID-19 as In Silico, In Vitro and In Vivo

Assoc. Prof. Açelya Yılmazer Aktuna-TÜBA Young Academy Member, Ankara University – Ankara

Project Number: TÜBİTAK 1004- 18AG020 (Dr. Altay ÜNAL/Executive Researcher)

The aim of the proposed study is to investigate the efficacy of FDA approved or preclinical drugs against COVID-19 by in silico, in vitro and in vivo approaches. Repurposing of drug molecules is a strategy for identifying new uses for approved or investigational drugs that are outside the scope of the original medical indication. This strategy offers various advantages over developing a new drug for an indication. First, and perhaps most importantly, safety of the drug has already established in preclinical models and in humans. Second, the time frame for drug development can be reduced, because most of the preclinical testing, safety assessment and, in most cases, formulation has already been developed. Third, less investment is needed compared to the process of developing an entirely new drug. Regulatory and phase III costs may remain nearly the same for a repurposed drug as for a new drug. However, the savings in preclinical, phase I and II trials will still be significant. Taken together, these advantages have the potential to result in a less risky and more rapid return on investment in the development of repurposed drugs. Molecular docking, molecular dynamics, and computational chemistry with large drug databases are the main in silico analyses that will be performed in this study. They will allow us to select “possible candidates” among thousands of pharmaceutical active substances. During the proposed study, the follow-up of the literature will be done very carefully and priority will be given to drug active substances that have clinically successful against COVID-19.

5.3.13. Development of a New Hand and Skin Antiseptic Formulation

Assoc. Prof. Dr. Nurettin MENGEŞ-TÜBA Young Academy Member
Van Yüzüncü Yıl University-Van Project Number; 33SAA- Republic of Turkey Ministry of Industry and Technology

The project includes obtaining a new disinfectant formulation that does not contain alcohol. This formulation will be prepared with the national facilities of our country and its preparation on a small scale. In the project, our national and natural resources are used as the primary active agent of the disinfectant, and we aim to add some additives based on the literature information to increase the antibacterial effect. Plant extracts will also be used to provide the moisturizing feature and odor in the formulation. Due to the similar chemical properties with alcohol or different influence on microorganisms or proteins, we have assumed that our formulation will show the same results. In the preliminary trials, it was concluded that a solution to a certain amount of active substance in pure water is effective on several different bacteria. Within the scope of the project, it is explored that which solution range the most appropriate effect will be, and which extracts will increase the impact and other moisturizing and odor properties. One of the originalities of the project is that it will not contain alcohol. In this way, concerns about skin irritation or alcohol ingredient are thought to be eliminated. It is seen that disinfectants are mostly produced from ethyl alcohol or isopropyl alcohol. Thanks to this formulation, we aim to develop a suitable and new formulation by removing to use alcohol.

If the formulation is determined, it is thought that the commercialization of the products evaluated as OTC (on the counter) in pharmacies with antibacterial and antifungal properties by using different additives with the same formulation will also be assessed.

In this way, we estimate that active substance in the disinfectant will act as a substrate by damaging the protein structures in both bacteria and viruses.

5.3.14. Ongoing Studies for Development of Blocking-Drug Candidates and Diagnostic Kits for Sars-CoV2.

Assoc. Prof. Urartu Özgür Şafak ŞEKER-TÜBA Young Academy Member Bilkent University-Ankara

Multiple approaches are applied within the scope of COVID19 studies going on under the direction of Assoc. Prof. Urartu Şeker. In this context, it is aimed to produce different biotechnology-based drugs for COVID-19 that will prevent the spread of infection and block Sars-CoV2 virus after the viral infection has developed. In the first of these approaches, it is aimed to produce griffithsin (GRFT) protein, which has been being used by our research group to block viral glycoproteins, and to reproduce it through genetic engineering / protein engineering approaches. Studies on the design and production of this GRFT protein have been succesfully completed. Our research group aims to use this protein not only outside the cell, but also inside the cell, blocking the infectivity of viral particles. This work is financially supported under the TÜBİTAK-COVID-19 consortium. In the second study that is conducted in parallel with this research, it is aimed to develop another method that will prevent the virus from entering the cell by binding to Sars-COv2 antigens. Within this framework, it is aimed to scan and select different antiviral peptide molecules and short protein chains by using nanobody and phage display libraries that are currently available in our laboratory.

It is very crucial to identify the presence of viral particles in the process of Sars-CoV2 treatment and its screening. However, rapid development of alternative techniques to currently used techniques is also essential. In this sense, as a group making use of synthetic biology tools, we are working on patenting the progress we achieved in our work related with fast diagnostic sensors which are using RNA switches (toehold switch).

In a recently supported project under the call of TÜBİTAK 1507 Covid, we have started developing ELISA kits for use in serological screening tests. In this context, within the scope of our project conducted with Intergen, our project partner, our work on recombinant production of the necessary viral antigens for the development of ELISA kits continues. As a result of this study, which we expect to be completed in a short period of time, an ELISA based serological diagnostics kit, that is developed solely with national facilities is going to be introduced.

Part 6

References and Selected Readings

Printed Bibliography

Online Soruces

Appendix

References and Selected Readings

6.1. Printed Bibliography

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6.3. Appendix

6.3.1. Prominent Reference Resources and News on COVID-19

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