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A Review on Coronavirus Disease (COVID-19) Epidemic Threat for Global Health in 2020

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Abstract The viral diseases are a malign condition in the world from 2001 to 2020. The human novel coronavirus disease (COVID-19) was an initial identification in Wuhan, China in December 2019. The major objective is to critically review the present situation of coronavirus in the world. Severe Acute Respiratory Syndrome coronavirus (SARS-CoV) in 2001, Middle East Respiratory Syndrome coronavirus (MERS-CoV) in 2012 and the COVID-19 in 2019 had serious effects in human life in China, Saudi Arabia, and China, respectively. The COVID-19 is a highly mutated virus for the human population in 2020. This review study reveals the host of the virus, history, characteristics, preventive measure, treatment, effects and the epidemic situation in the world.

Keywords: *COVID-19, history, epidemic, control, treatment*

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1. Introduction

Viral diseases are very common in any condition. In a cold situation, microorganisms spread many diseases. Coronaviruses are one of them. It is belonging to subgenus Sarbecovirus of the genus Betacoronavirus of the family coronaviridae and the order *Nidovirales* [1,2]. The virus is a gram-positive RNA genome ranging from 26 to 32 kb in length, crown-shape peplomers with 80-160 nM in size [1] and next-generation sequencing and phylogenetic examination of the genome exposed 2019-nCoV. This virus was very much identical (88%) to two bat-derived SARS-like coronaviruses and more distant from SARS-CoV (79%) and MERS-CoV (50%) [3,4] suggested that the 2019-nCoV might be able to bind to the angiotensin-converting enzyme 2 receptors in humans similar to SARS CoV. This virus is very closed that originated from the Rhinolophus bat which is > 96% homologous with the current SARS-CoV-2 virus. It is only 79% homologous with the original SARS CoV [5]. Coronaviruses are globally distributed and are found in humans, other mammals and birds. Last December 2019 cluster phenomena cases appeared in Wuhan, Hubei Province, China from China health authority [2]. Its shape was like a crown and crown mean corona which is a public health problem, has emerged in the Huanan Seafood Market, where livestock animals are also traded, in Wuhan State of Hubei Province in China and have been the focus of global attention due to a pneumonia epidemic of unknown cause [6]. It is consisting of genetic material surrounded by enveloping protein spike. This virus damages the respiratory system. The symptoms are fever, dry cough, pneumonia, fatigue, nasal congestion, sore throat, diarrhea and shortness of breathing and throat sore. The severe acute respiratory syndrome (SARS) (2003) was looked at in China and Middle East Respiratory Syndrome (MERS) (2012) in Saudi Arabia while Cov-2019 now appeared in China. Up to one-third of mild upper respiratory tract infections in adults are produced by human coronaviruses. The zoonotic SARS, beta-coronavirus (SARS-CoV) caused the SARS epidemic in 2003 when over 900 people died [7]. This virus is also spreading man to man and country to country. The Coronavirus effect is very severing which has globally affected 210 countries of the world and the total case number is about 2052148 while the died about 131356 and the death number is increasing day by day in developed countries (Table 4). Human coronaviruses are spread through direct contact with oozes and via aerosol droplets. Infected patients defecate viruses in faces and urine and under certain conditions, airborne transmission can occur from aerosolized respiratory secretions and fecal material [7]. On December 31, 2019, officially announced that the viral caused epidemic pneumonia in several attacks in humans [8,9]. The objective of this review article is to have an introductory estimation about the disease, the ways of prevention and treatment in this early stage of this outbreak.

2. Review Period

The review conducted when the SARS-CoV outbreak had been pandemic in the world in 2020. To be more specific this review study was carried out from 1st January to 15th April 2020.

3. Novel Coronavirus

The novel coronavirus is called SARS-CoV-2 which is a new strain that has not been identified in humans previously. The diseases caused by SARS-CoV-2 is known as COVID-19. Coronavirus belongs to a large family of viruses that circulate among animals and humans (Table 1). In humans, the virus can cause breathing diseases and pneumonia. The novel coronavirus first induced pneumonia (COVID-19) in Wuhan, China was identified in December 2019 and it has spread globally [10].

Table 1. List of discovered Novel Coronaviruses from 2001 to 2020

Initial Name	Official Name	Origin of discovery
2002-nCoV	SARS-CoV	Foshan, China
2005-nCoV	HCoV-HKU1	Hong Kong, China
2012-nCoV	MERS-CoV	Jeddah, Saudi Arabia
2019-nCoV	SARS-CoV-2	Wuhan, China

4. Host and Reservoir of Coronavirus

CoVs are naturally hiding in reservoir hosts like mammals, birds, camels, cattle, cats, bats, and other animals. Alpha and betacoronaviruses circulate in mammals, including bats. Gammacoronaviruses typically infect avian species and a few mammalian species, whereas deltacoronaviruses infect birds and mammals [11]. Animal CoVs are known to cause important diseases in animals and could be responsible for economic losses in domestic animals or birds [12,13]. This CoVs comprises avian infectious bronchitis virus (IBV), transmissible gastroenteritis virus (TGEV), porcine epidemic diarrhea virus (PEDV), and more recently, swine acute diarrhea syndrome- CoV (SADS- CoV). Although rare, animal CoVs can infect humans and could further feast through human- to- human transmission [14,15] (Table 2).

Table 2. Host and Reservoir of Coronaviruses

Virus	Reservoir	Final Host
SARS-CoV	Cattle, Birds, Bats, Rodents	Human
HCoV-HKU1	Mice	Human
MERS-CoV	Bats, Civets, Camels	Human
SARS-CoV-2	Wild animal, Bats	Human

5. History of the Novel Corona Virus Disease

Novel coronavirus was not a new disease of human but it has been reported science 2002. That time, the virus name was SARS-CoV. SARS coronavirus was identified in 2003. SARS-CoV seems to be an animal zoonotic virus first infected humans in the Guangdong province of China in 2002. Symptoms are influenza-like and include fever, myalgia, headache, malaise, diarrhoea, and shivering. The most frequently reported syndrome of SARS-CoV was fever. Sometimes coughing with shallow breathing. On the other hand, HCoV-HKU1 was first identified in January 2005, from a hospitalized old man with the severe respiratory syndrome in Hong Kong, China. Whereas Middle East Respiratory Syndrome coronavirus (MERS-CoV) [16]. The majority of patients were affected with fever, fever with cough, and shortness of breath, (98%, 83%, 72) %, respectively. Radiographic manifestations range from unilateral infiltrate, to increased Broncho vascular markings, and diffuse reticulonodular pattern (43, 17 and 4) %, respectively [17]. This MERS-Cov virus was initially identified in September 2012 from samples obtained from a Saudi Arabian patient who developed a severe acute respiratory infection and later had acute renal failure and he died [18]. The virus was subsequently reported as a cause of pneumonia in additional cases from Saudi Arabia, [18,22] Qatar, [23] Jordan, [24,25] United Kingdom, [26,27] Germany, [28]iFrance, [29] Tunisia, [30] United Arab Emirates, [31] and Italy, [4,30,32] observed that the novel coronaviruses, like influenza viruses, affected in various animal species in nature ways. The virus was alpha and beta can be affected in mammals and gamma and delta tend to infect birds, but some of them can also be transmitted to mammals [33] observed that COVID 19 is an ongoing public health emergency of international significance. The COVID 19 was mainly affected in poor prognostic factors include infiltration on chest imaging, lymphopenia, bacterial coinfection, smoking history, Chronic medical conditions like Hypertension and age >60 years. The late February 2020, in China, ten of thousands of cases and several thousand deaths have been stated and thousands of cases found in other countries [34].

6. Classification of Human Coronavirus

The coronavirus has four genera, Alpha, Beta, Gamma, and Delta under the subfamily *Coronavirinae* of the family *Coronaviridae*. All the coronaviruses are enveloped shaped, positive-sense, single-stranded RNA viruses that include both human and zoonotic species. Alphacoronaviruses are simply called Alpha-CoV. Under the subfamily, viruses have spherical virions with club-shaped surface projections and a core-shell. The word corona derived from Latin word which means a crown, which describes the appearance of the projections seen under electron microscopy that resemble a solar corona. On the other hand, Betacoronaviruses are simply called β-CoVs or Beta-CoVs which is under the subfamily *Orthocoronavirinae* in the family *Coronaviridae* and the order is *Nidovirales*. Whereas, Gammacoronavirus is known as Gamma-CoV which is under the subfamily of *Orthocoronavirinae* of the family *Coronaviridae*. The last one *Deltacoronavirus*es are simply known as Delta-CoV. Under the subfamily *Orthocoronavirinae* of the family *Coronaviridae*. All of the Alpha, Beta, Gamma, and Delta virus have zoonotic importance (Table 3).

Table 3. Important human coronaviruses

Genera	Strain	Discovery	Reservoir
Alpha-coronavirus	HCoV-229E	1966	Bats
	HCoV-NL63	2004	Palm Civets, Bats
Beta-coronavirus	HCoV-OC43	1967	Cattle
	HCoV-HKU1	2005	Mice
	SARS-CoV	2003	Palm Civets, Bats
	MERS-CoV	2012	Bats, Camels
	SARS-CoV-2	2019	Wild animal, Bats
Gamma-coronavirus	BW-CoV SW1	2008	Beluga whale
Delta-coronavirus	BuCoV HKU11	2008	Chinise bulbul

7. Syndromes of COVID-19

COVID-19 characteristically causes flu-like symptoms with a fever and cough. The main symptoms of coronavirus disease (COVID-19) are fever, tiredness, and dry cough. Some patients mainly the aged and others with other chronic symptoms can develop into pneumonia, with chest tightness, chest pain, and shortness of breath. Remarkably, the COVID-19 infection rarely seems to cause aches, runny nose, sore throat. Some people have experienced the loss of smell or taste. On the other hand, some people may have no symptoms at all. Aged people or who have existing chronic medical conditions, like heart disease, lung disease or diabetes may be at higher risk of serious infection.

8. Statistics of SARS-Cov-19

COVID-19 patients update on April 15, 2020 of some developed countries have been shown in Table 4.

Table 4. Patients update of twenty counties.

Country	Total Cases	Total Death	Total Recovered	Total Test
China	82341	3342	77816	N/A
USA	614606	26081	38820	3100387
Japan	8315	146	853	89551
Germany	132210	3495	72600	1317887
Russia	27878	226	1986	1517992
Indonesia	5433	479	446	36000
UK	93873	12107	N/A	382650
France	143303	15729	28805	333807
Australia	6494	65	3686	371377
Canada	27063	903	8235	450717
Italy	162488	21067	37130	1073689
Netherland	28887	3323	250	134972
Norway	6749	145	32	130216
S. Korea	10616	228	7616	534552
Spain	181206	18903	70853	600000
Iran	77901	4871	49933	299204
Denmark	6851	319	2515	77712
Turkey	65111	1403	4799	443626
Swiss	26736	1268	14700	199000
Singapore	3252	10	611	72680

9. Prevention and Control Strategies of Coronavirus

Prevention and control strategies approach needs at three stages: national level, patient level, and general population level. Numerous public health procedures may prevent the transmission of the COVID-19. These contain case isolation, identification, regular follow-up, use of disinfection, and use of personal protective equipment (PPE), maintain the social distances. The best prevention is to avoid being exposed to the virus as well as avoiding crowding place. Effective preventive and control measures that may reduce the risk of exposure is the use of sterile masks; covering coughs and sneezes with tissues with safely disposed of regular handwashing with soap, disinfection, and alcohol-containing hand sanitizer, maintaining social distance, quarantine, and abstaining from touching eyes, nose, and mouth with hands. At this moment there is no vaccine to prevent coronavirus illness 2019 (COVID-19). The best way to avoid illness is to prevent being bare to this virus. Follow CDC's references for using a facemask in CDC does not mention that people who are well wearing a treatment to defend themselves from respiratory diseases, including COVID-19, Facemasks should be used by people who show symptoms of COVID-19 to help avoid the spread of the disease to others. Guidelines from WHO that use of N95 or FFP2 facemask. The use of facemasks is also vital for health workers and people are taking care of someone in close settings (at home or in a health care facility) and wash your hands often with soap powder/soap and water for at least 20 seconds, especially after going to the bathroom, before eating, and after blowing your nose, coughing, or sneezing (Figure 1). If soap powder/soap and water are not readily available, use an alcohol-based hand sanitizer with at least 60% alcohol. Always wash hands with soap/soap powder and water if hands are visibly dirty [9].

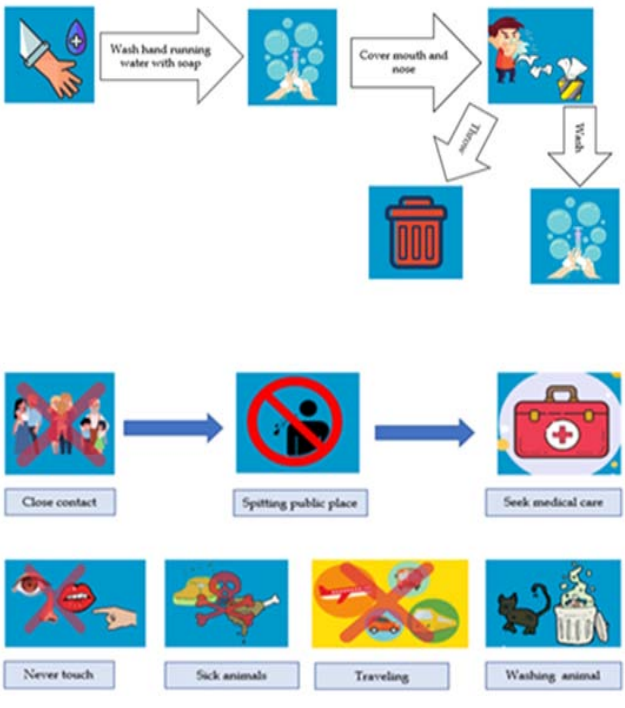

Figure 1. Preventive measure

10. Epidemic of the Novel Coronavirus

This virus epidemic started on 31 December 2019 in Wuhan City, Hubei Province of China and about 1,00,000 people have been infected worldwide [9] on March 8, 2020. A total of 210 countries has been affected. This virus outbreak was related to a huge seafood and animal market, and inquiries were ongoing to control the origins of the infection [35,36] observed that the (3.4, 35, and 62) % were died, recovered and still now infected. The top five places of death outside China were Italy (21067), Iran (4871), UK (12107), USA (26081) and France (15729) (Table 4). In 22nd January report describes the metrics of the epidemic and shows how the stock-flow perspective taken in environmental studies is useful to understand the epidemic evolution. From 12 and 22 January, 2020 reported found 425 confirmed cases of infection, whereas 73% of cases with illness onset between no exposure to either a wet market or another person with symptoms of a respiratory illness [37]. On 25 January 2020 reported that more than 75,000 infections may have occurred in Wuhan and increasing numbers of infections continue to be detected in other cities in mainland China and around the world [38]. Data come from the WHO reports, the [39] and the interactive web-dashboard as published in The Lancet infectious disease journal [40]. Initially, the research suggests that 2019-nCoV could not easily spread between humans [41] it is now very clear that infections have been spreading from person to person [37]. Infections with 2019-nCoV can spread from person to person, and in the earliest phase of the outbreak, the basic reproductive number was estimated to be around 2.2, assuming a mean serial interval of 7.5 days [37]. Average delays between infection and illness onset have been estimated at around 5-6 days, with an upper limit of around 11-14 days [38,41,42] and delays from illness onset to laboratory confirmation added a further 10 days on average [37]. The first large identifiable super spreading event during the present 2019-nCoV outbreak has taken place on the Diamond Princess cruise liner quarantined off the coast of Yokohama, Japan, with at least 130 passengers tested positive for 2019-nCoV as at 10 February 2020 [43]. Identifying which modes are important for 2019-nCoV transmission would inform the importance of personal protective measures such as face masks (and specifically which types) and hand hygiene.

11. Treatment of Human Corona Virus

Still, now no approved treatment or vaccine has been invented against COVID-19 contagion. Only supportive care and oxygen supplementation therapy are effective for the patient. Oxygen supplementation therapy can be done through non-invasive ventilation or via mechanical ventilation process. Some patients may also require vasopressor and antibiotics support to reduce secondary bacterial infections. On the other hand, some seriously ill patients need treatments against SARS-CoV-2, including ribavirin, interferon β-1a, the antiviral combination lopinavir or ritonavir, the antimalarial chloroquine or hydroxychloroquine, the antiviral nucleotide analog redeliver and the antiviral favipiravir. Whereas, hydroxychloroquine has been shown in vitro to alter the uptake of the virus in cells. There is no specific direct action recommended for COVID-19. People with COVID-19 should obtain supportive care to help sack symptoms. For severe cases, treatment should include support to care for major organ functions. People who think they may have been exposed to COVID-19 should contact their healthcare center where immediate provider treatment for COVID-19. (Source: WHO, 2020). From Table 5, the Proposed dose for COVID-19 in 500 mg (Chloroquine phosphate) BID 5 days and 150 mg (Oseltamivir) BID for 5 days was effective to control of this virus. (Source: Prepared by CDC MICC Team, Version 1 (28-02-2020). Combined nasopharyngeal/oropharyngeal swab: If positive repeal every 3 days till negative, if negative repeat the second test after 24 hours, if 2 consecutive negative isolation can be discontinued in the lower respiratory specimen is preferred when applicable and airborne and contact isolation is recommended for further information contact your infection control practitioner. Source: Prepared by CDC MICC Team, Version 1 (28-02-2020) (Table 5).

Table 5. Protocol for treatment of confirmed COVID-19 infection

Items	Route of administration	Proposed dose for COVID-19
Treatment 1		
Chloroquine phosphate	PO	500 mg BID 5 days
Oseltamivir	PO	150 mg BID for 5 days
Treatment 2		
Chloroquine phosphate	PO	500 mg BID 10 days plus
Darunavir or Cobicistar	PO	Darunavir 800 mg/Cobicistat 150 mg OD for 14 days
Atazanavir (Reyataz)	PO	Or 400 mg once daily with food for 14 days plus
Oseltamivir	PO	150 mg BID
Corticosteroids	IV	Methylprednisolone 40 mg 12 h for 5 days

Source: Prepared by CDC MICC Team, Version 1 (28-02-2020).

12. Conclusion

The spread of the pandemic will eventually stop, and the global system will find a balance, but most of the impairment will be permanent, particularly for the developing countries. The current disaster seriously hitting the economies on a local, regional and global scale. The COVID-19 epidemic is a striking image of the modern era. The present destabilize break the equilibrium of our planet's ecosystems. Nevertheless, epidemic has a chance to remedy this and build new foundations.

References

[1] Woo, P.C., Huang, Y. Lau, S.K., and Yuen, K.Y. 2010. Coronavirus genomics and bioinformatics analysis. *Viruses. 2,* 1804-1820.

[2] Zhu, N., Zhang, D., Wang, W., Li, X., Yang, B., and Song, J. 2020. A Novel Coronavirus from Patients with Pneumonia in China, 2019. New England Journal of Medicine.

[3] Lu, R., Zhao, X., Li, J., Niu, P., Yang, B., and Wu, H. 2020. Genomic characterization and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding. The Lancet [Internet]. 2020 Jan 30 [cited 2020 Feb 8];0(0). Available from: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30251-8/abstract

[4] Zhou, P., Yang, X-L., and Wang, X-G. 2020. Discovery of a novel coronavirus associated with the recent pneumonia outbreak in humans and its potential bat origin. *bioRxiv.* 2020.01.22.914952.

[5] Zhou, P., Yang, X-L., Wang, X-G., Hu, B., Zhang, L., and Zhang, W. 2020. A pneumonia outbreak associated with a new coronavirus of probable bat origin. *Nature*, 1-4.

[6] SDM, 2020. Seven days in medicine: 8-14 Jan 2020. *BMJ.* 368:m132.31948945.

[7] WHO (World Health Organization), final summary SARS, 15 August 2003. Summary table of SARS cases by country, 1 November 2002 - 7 August 2003. Geneva. Available from: http://www.who.int/csr/sars/country/country2003_08_15.pdf

[8] ICL (Imperial College London). 2020. Report 2: estimating the potential total number of novel coronavirus cases in Wuhan City, China. Jan 2020. Available from: https://www.imperial.ac.uk/mrc-globalinfectiousdisease-analysis/news-uhan-coronavirus.

[9] WHO (World Health Organization) on 12 February, 2020. 2019-nCoV Situation Report-22. https://www.who.int/docs/defaultsource/coronaviruse/situation-eports/.

[10] Zhang, J., Wang, S., and Xue, Y. 2019. Fecal specimen diagnosis 2019 Novel Coronavirus-Infected Pneumonia. *Journal of Medical Virology*, 0-2. https://doi.org/10.1002/jmv.25742.

[11] Woo, P.C.; Lau, S.K.; Lam, C.S.; Lau, C.C.; Tsang, A.K.; Lau, J.H.; Bai, R.; Teng, J.L.; Tsang, C.C. and Wang, M. 2012. Discovery of seven novel Mammalian and avian coronaviruses in the genus deltacoronavirus supports bat coronaviruses as the gene source of alphacoronavirus and betacoronavirus and avian coronaviruses as the gene source of gammacoronavirus and deltacoronavirus. *J. Virol.* 2012, *86*, 3995-4008. (In English).

[12] Lim, Yvonne Xinyi, Yan Ling Ng, James P Tam, and Ding Xiang Liu. 2016. "Human Coronaviruses: A Review of Virus – Host Interactions."

[13] Zhou, P.; Fan, H.; Lan, T.; Yang, X.L.; Shi, W.F.; Zhang, W.; Zhu, Y.; Zhang, Y.W.; Xie, Q.M.; Mani, S.; et al. Fatal swine acute diarrhea syndrome caused by an HKU2-related coronavirus of bat origin. *Nature* 2018, *556*, 255-258. (In English).

[14] Su, S.; Wong, G.; Shi, W.; Liu, J.; Lai, A.C.K.; Zhou, J.; Liu, W.; Bi, Y.; Gao, G.F. Epidemiology, Genetic Recombination, and Pathogenesis of Coronaviruses. *Trends Microbiol.* 2016, *24*, 490-502. (In English).

[15] Forni, D.; Cagliani, R.; Clerici, M.; Sironi, M. Molecular Evolution of Human Coronavirus Genomes. *Trends Microbiol.* 2017, *25*, 35-48. (In English).

[16] De Groot, R.J., Baker, S.C., Baric, R.S., Brown, C.S., Drosten, C., and Enjuanes, L. 2013. Middle East Respiratory Syndrome Coronavirus (MERS-CoV): Announcement of the Coronavirus Study Group. *J Virol.* 87: 7790-7792.

[17] Jaffar, A., Al-Tawfiq, M.D., FACP, Abdullah, Assiri, M.D., FACP, Ziad A., Memish, M.D., FACP. 2013. Middle East respiratory syndrome novel corona (MERS-CoV) infection Epidemiology and outcome update. *Saudi Med J.* Vol. 34 (10).

[18] Zaki, A.M., van Boheemen, S., Bestebroer, T.M., Osterhaus, A.D.M.E., and Fouchier, R.A.M. 2012. Isolation of a novel coronavirus from a man with pneumonia in Saudi Arabia. N Engl J Med. 367: 1814-1820.

[19] Assiri, A., Al-Tawfiq, J.A., Al-Rabeeah, A.A., Al-Rabiah, F.A., Al-Hajjar, S. and Al-Barrak, A. 2013. Epidemiological, demographic, and clinical characteristics of 47 cases of Middle East respiratory syndrome coronavirus disease from Saudi Arabia: a descriptive study. *Lancet Infect Dis.* 13: 752-761.

[20] Assiri, A., McGeer, A., Perl, T.M., Price, C.S., Al Rabeeah, A.A., and Cummings, D.A. 2013. Hospital outbreak of Middle East respiratory syndrome coronavirus. *N Engl J Med.* 369:407-416.

[21] Memish, Z.A., Zumla, A.I., Al-Hakeem, R.F., Al-Rabeeah, A.A. and Stephens, G.M. 2013. Family cluster of Middle East respiratory syndrome coronavirus infections. *N Engl J Med* 2013; 368:2487-2494.

[22] Al-Ahdal, M.N., Al-Qahtani, A.A., and Rubino, S. 2012. Coronavirus respiratory illness in Saudi Arabia. *J Infect DevCtries.* 6: 692-694.

[23] CDC, (Centers for Disease Control and Prevention). 2012. Severe respiratory illness associated with a novel coronavirus-Saudi Arabia and Qatar, 2012. *MMWR Morb Mortal Wkly Rep.* 61: 820.

[24] Hijawi, B., Abdallat, M., Sayaydeh, A., Alqasrawi, S., and Haddadin, A. 2013. Novel coronavirus infections in Jordan, April 2012: epidemiological findings from a retrospective investigation. *East Mediterr Health J.* 19 Suppl 1: S12-S8.

[25] ECDC, (European Centre for Disease Prevention and Control). 2013. Severe respiratory disease of unknown origin-Jordan-outbreak in ICU. Communicable Disease Threats Report. (Updated 2012 April-May 29; Cited 2013 May 22). Available from: http://www.ecdc.europa.eu/en/publications/Publications/CDTR%20online%20version%204%20May%202012.pdf

[26] HPA, (Health Protection Agency), UK Novel Coronavirus Investigation team. 2013. Evidence of person-to-person transmission within a family cluster of novel coronavirus infections, United Kingdom, February 2013. *Euro Surveill.* 18: 20427.

[27] Bermingham, A., Chand, M.A., Brown, C.S., Aarons, E., Tong, C. and Langrish, C. 2012. Severe respiratory illness caused by a novel coronavirus, in a patient transferred to the United Kingdom from the Middle East, September 2012. *Euro Surveill.* 17: 20290.

[28] Buchholz, U., Müller, M.A., Nitsche, A., Sanewski, A., Wevering, N. and Bauer-Balci, T. 2013. Contact investigation of a case of human novel coronavirus infection treated in a German hospital, October-November 2012. *Euro Surveill.* 18: 20406.

[29] Mailles, A., Blanckaert, K., Chaud, P., van der Werf, S., Lina, B. and Caro, V. 2013. First cases of Middle East Respiratory Syndrome Coronavirus (MERS-CoV) infections in France, investigations and implications for the prevention of human-to-human transmission, France, May 2013. *Euro Surveill.* 18. pii: 20502.

[30] WHO, (World Health Organization). Novel coronavirus infection. (Update 2013 May 22; Accessed 2013 August 5. Available from URL: http://www.who.int/csr/don/2013_05_22_ncov/en/.

[31] Drosten, C., Seilmaier, M., Corman, V.M., Hartmann, W., Scheible, G. and Sack, S. 2013. Clinical features and virological analysis of a case of Middle East respiratory syndrome coronavirus infection. *Lancet Infect Dis.* 13: 745-751.

[32] ISID (International Society for Infectious Diseases). 2013. MERS-COV- Eastern Mediterranean (16): Italy Ex Jordan, Contact Cases, WHO. ProMed mail. (Update 2008; Accessed 2013 August 5). Available from URL: http://www.promedmail.org/ promedprint.php?id=1750425.

[33] Khot, W.Y. and Nadkar, M.Y. 2020.The 2019 Novel Coronavirus Outbreak - A Global Threat, 68(March), pp. 67-71.

[34] Ashour, Hossam M., Walid F. Elkhatib, Masudur Rahman, and Hatem A. Elshabrawy. 2020. Insights into the Recent 2019 Novel Coronavirus (SARS - CoV - 2) in Light of Past Human Coronavirus Outbreaks. (Figure 1): 1-15.

[35] China CDC 2020. Tracking the Epidemic. Available form: http://weekly.chinacdc.cn/news/TrackingtheEpidemic.htm?from=timeline#Beijing%20Municipality%20Update.

[36] Dente, S.M.R. 2020. Corona virus (COVID-19) epidemic A stock-flow perspective. (February).

[37] Li, Q., Guan, X., Wu, P., Wang, X., Zhou, L., Tong, Y. 2020. Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus-Infected Pneumonia. N Engl J Med. NEJMoa2001316.

[38] Wu, J.T., Leung, K., Leung, G.M. 2020. Nowcasting and forecasting the potential domestic and international spread of the 2019-nCoV outbreak originating in Wuhan, China: a modelling study. Lancet. S0140-6736(20)30260-9.

[39] JHI (John Hopkins Institution). 2020. Coronavirus COVID-19 Global cases. Available from: https://gisanddata.maps.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd4029942346 7b48e9ecf6.

[40] Dong, E., Du, H. and Gardner L. 2020. An interactive web-based dashboard to track COVID-19 in real time. The Lancet infectious diseases.

[41] Wu, P., Hao, X., Lau, E.H.Y., Wong, J.Y., Leung, K.S.M., Wu, J.T. 2020. Real-time tentative assessment of the epidemiological characteristics of novel coronavirus infections in Wuhan, China, as at 22 January 2020.Euro Surveill. 25(3): 25.

[42] Backer, J.A., Klinkenberg, D., Wallinga, J. 2020. Incubation period of 2019 novel coronavirus (2019-nCoV) infections among travellers from Wuhan, China, 20-28 January 2020. Euro Surveill. 25(5): 2000062 10.2807/1560-7917.ES.2020.25.5.2000062.

[43] Swift, R. Sixty more people confirmed with coronavirus on cruise ship in Japan: media. Tokyo: Reuters. [Accessed 10 Feb 2020]. Available from: https://www.reuters.com/article/us-china-health-japan/sixty-more-people-confirmed-with-coronavirus-on-cruise-ship-in-japan-media-idUSKBN2040FG.