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# COVID-19 PANDEMIC: IMPORTANCE OF BEING ALERT TO ZOOSES

LA PANDEMIA DE COVID-19: IMPORTANCIA DE ESTAR ALERTA ANTE LAS ZONOSIS

Manuel E. Cortés<sup>1,a</sup>

## ABSTRACT

The pandemic of Coronavirus Disease - 2019 (COVID) has produced tens of millions of infections and millions of deaths worldwide, with the consequent collapse of health systems. SARS-CoV-2, the coronavirus causing COVID-19, is a pathogen with a zoonotic origin. The objective of this article is to highlight the importance of being alert to zoonoses, with special reference to COVID-19. First, the general chronology of the COVID-19 pandemic is described, then the characteristics of the coronaviruses are described in detail, especially regarding those of SARS-CoV-2. Subsequently, the One Health concept is highlighted as an appropriate approach to face this zoonosis and other related ones. Furthermore, the importance of unequivocally identifying the SARS-CoV-2 reservoir and intermediate animals as part of the knowledge necessary to develop treatments and a vaccine for COVID-19 and related diseases is highlighted. It is concluded that it is important that the One Health approach be known, communicated and integrated by all health centres and health professionals because, considering the severity of zoonoses such as COVID-19, we should not forget that human health is linked to animal health, and both with environmental health. Finally, it is recommended that health agencies maintain preventive measures and personal distancing to avoid more infections.

**Key words:** COVID-19; One Health; SARS-CoV-2; Zoonoses (source: MeSH NLM).

## RESUMEN

La pandemia de Enfermedad por Coronavirus – 2019 (COVID) ha producido millones de muertos y decenas de millones de contagiados en el mundo, con el consecuente colapso de los sistemas de salud. SARS-CoV-2, coronavirus causante de COVID-19, es un agente patógeno de origen zoonótico. El objetivo de este artículo es destacar la importancia de estar alerta ante las zoonosis, con especial referencia a COVID-19. Primero, se describe de forma general la cronología de la pandemia de COVID-19, luego se describen en detalle las características de los coronavirus, profundizando en aquellas propias de SARS-CoV-2. Posteriormente, se destaca el concepto de Salud Única como un enfoque apropiado para enfrentar esta zoonosis y otras relacionadas. Además, se destaca la importancia de identificar inequívocamente al reservorio y al intermediario de SARS-CoV-2 como parte del conocimiento necesario para desarrollar tratamientos y una vacuna para COVID-19 y enfermedades relacionadas. Se concluye que es importante que el enfoque de Salud Única sea conocido, difundido e integrado por todos los centros de salud y los profesionales sanitarios ya que, ante la gravedad de zoonosis como COVID-19, no debemos olvidar que la salud humana está vinculada con la salud animal, y estas dos, con la salud ambiental. Finalmente, se recomienda que los organismos de salud mantengan las medidas de prevención y distanciamiento personal para evitar más contagios.

**Palabras clave:** COVID-19; Salud Única; SARS-CoV-2; Zoonosis (fuente: DeCS BIREME).

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## INTRODUCTION

The city of Wuhan, located at the Chinese province of Hubei, experienced in December 2019 an epidemic outbreak that was initially characterized as atypical pneumonia<sup>(1,2)</sup>. This disease originated on Huanan Seafood Wholesale Market, a humid commercial establishment in which various live and dead animals are commercialized<sup>(1,2)</sup>. The pathogenic agent that caused the disease was identified as a coronavirus family of viruses, which was originally denominated as 2019-nCoV<sup>(3)</sup>, and finally receiving the name of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), while the disease which is produced by this virus is commonly known as Disease for 2019 Coronavirus (COVID-19), considered a viral zoonosis<sup>(4,5)</sup>. COVID-19 is characterized for fever, cough, dyspnea, myalgias and fatigue<sup>(6)</sup>. Some patients also present digestive<sup>(7)</sup>, neurologic<sup>(8)</sup> and cardiovascular<sup>(9)</sup> problems. Almost 20% of the patients present severe complications. The most frequent of those are the pneumonia and distress respiratory syndrome on adults<sup>(6)</sup>. 80% of the cases that present complications are adults over 60 years<sup>(6)</sup>.

On December 30, 2019, Dr. Li Wenliang (1986-2020) alerted a Wuhan group of colleagues about the COVID-19 outbreak, a disease that later cost him his life<sup>(10)</sup>. Chinese authorities notified the epidemic outbreak just on December 31, 2019 and Huanan Market was closed on January 1, 2020<sup>(1,2)</sup>. On January 11, 2020, the first death in China was produced and in mid January, massive migration to celebrate Chinese New Year (Lunar New Year)<sup>(11)</sup> accelerated the contagion. Likewise, some cases started to be presented in Thailand, Japan and South Korea. On January 30, 2020, the World Health Organization (WHO) declared a public health emergency of international interest<sup>(12)</sup>. Since that date, COVID-19 cases have been presented all around the world<sup>(13)</sup>, and the largest number of deaths has moved from China to Europe and, now, to the United States. All of the above led to the WHO declaring a pandemic on March 11, 2020<sup>(14)</sup>. To date (beginning of January 2021), the COVID-19 has produced about two million deaths and about ninety million infected. All of this has led the United Nations (UN) to declare that this disease constitutes the greatest test that humanity has faced since World War II<sup>(15)</sup>.

Since COVID-19 is a disease whose origin is related to animals, the aim of this article is to highlight the importance to be alert against these types of zoonoses, with special attention to COVID-19.

## CORONAVIRUSES CHARACTERISTICS

The coronaviruses (CoVs) are obligate intracellular parasites that take the control of cellular machinery of the host in order to make viral copies and then to spread<sup>(16)</sup>. The CoVs are pathogenic agents that have threatened human beings during thousands of years<sup>(17)</sup>. They are denominated this way because of the corona (crown) form that they possess when observed at electronic microphotography<sup>(18)</sup>. In the thirties, the first CoVs in animals were identified, and decades later other infection causes in humans were identified<sup>(17)</sup>. CoVs belong to the Nidovirales order, Coronaviridae family, Coronavirinae subfamily<sup>(19)</sup>. There exist four types of coronavirus, namely: Alfacoronavirus, Betacoronavirus, Gammacoronavirus y Deltacoronavirus<sup>(19,20)</sup>.

From a structural perspective, CoVs possess a diameter between 60 nm and 140 nm and possess projections similar to spicules on their surface<sup>(18)</sup>. CoVs also possess non segmented genomes that share a similar organization<sup>(17)</sup>, which consists of a single stranded positive sense RNA (+ssRNA) (~ 30 knt) with 5'-cap structure and 3'-poly-A tail<sup>(20)</sup>. About two-thirds of its genome contains two large overlapping open reading frames (ORF1a and ORF1b), which are translated into the replicase polyproteins pp1a and pp1ab<sup>(17)</sup>. Polyproteins are further processed in order to generate 16 non-structural proteins, which are designated nsp1 ~ 16. The remaining portion of the genome contains open reading frames for structural proteins, including spike glycoprotein (S), envelope protein (E), membrane protein (M) and nucleoprotein (N)<sup>(17)</sup>. Several lineage specific accessory proteins are also encoded according to the different existing lineages of CoVs<sup>(17)</sup>.

In the case of SARS-CoV-2, it was originally identified as a spherical virus with certain pleomorphic<sup>(3)</sup>. The virus particles possess very distinct spicules, of approximately 9 to 12 nm, granting to virions a solar crown appearance<sup>(3)</sup>, typical of the CoVs. The phylogenetic analysis determined that this pathogenic agent is part of the Betacoronavirus genre, Sarbecovirus (2B group)<sup>(3)</sup>. Research shows that SARS-CoV-2 RNA sequence consists of 29 870 nucleotides of longitude (about 9744 amino acids)<sup>(21)</sup>. Its genetic sequence is almost identical to that of SARS-CoV (which caused the Severe Acute Respiratory Syndrome epidemic in 2003), sharing 79.6% of the sequence identity with it<sup>(22)</sup>.

SARS-CoV-2 is able to infect pneumocytes type 2 and ciliated bronchial epithelial cells in human beings<sup>(4)</sup>,



which show the angiotensin-converting enzyme protein (ACE2). It is reported that SARS-CoV-2 enters to these respiratory system cells thanks to a receptor-binding domain that is located in the spike glycoprotein (S)<sup>(23)</sup>, a domain that is recognized and binds to the peptidase domain extracellular ACE2 mainly through polar residues<sup>(23)</sup>. It is known that ACE2 is expressed at digestive epithelium level<sup>(7)</sup> and brain tissues (being specifically detected on glial and neuronal cells)<sup>(8)</sup>. This is why these tissues constitute a potential objective for SARS-CoV-2.

## COVID-19 AS A ZOONOSIS

A zoonosis is an infectious disease in which causal pathogenic agents possess, in general, a wild animal reservoir<sup>(24)</sup>, and from this animal reservoir, which is generally asymptomatic, the pathogen can be directly transmitted to human beings or domestic animals, who in turn can transmit it to human beings<sup>(24)</sup>. It is demonstrated that the seven human CoVs have a zoonotic origin, and depending on the virus, exists different reservoirs and intermediaries<sup>(17)</sup>. Regarding the above, a great amount of research has previously warned of the big zoonotic potential and permanent epidemic risk that is constituted in CoVs that are present in some species of bats<sup>(25-27)</sup>.

SARS-CoV-2 is considered as zoonotic<sup>(4,13,28,29)</sup>. It is known that this coronavirus is 96% identical in complete genome level in comparison to a horseshoe bat coronavirus (*Rhinolophus affinis*), who lives in some regions of China and that has been proposed as its reservoir<sup>(22,30)</sup> (Figure 1). With respect to the intermediary host, there exists a lot of interest in identifying it<sup>(30)</sup>. It has been found that Malayan pangolins (*Manis javanica*) possess a coronavirus whose genome has between 85.5% to 92.4% of sequence similarity with SARS-CoV-2, which has led to propose that it may be the intermediary<sup>(31)</sup>.

Recent investigation proposes the possibility that ferrets and cats may get infected with SARS-CoV-2 and transmit it again to human beings<sup>(32,33)</sup>, continuing with a zoonotic cycle with the greatest difficulty to control the spread of COVID-19 in these animals<sup>(33)</sup>. The above mentioned must be taken into account, especially with respect to common pets as cats. However, more research is required in order to determine effectively this possibility of contagion.

### The importance of of Unique Health approach against zoonoses

Health should be seen as a holistic integrator concept.

The approach Unique Health (or One Health) arose some years ago as a holistic approximation to the Health concept, an approach in which some aspects which were originally separated are collaboratively associated, or even in different spheres; human health, animal health and environmental health<sup>(34)</sup>. The Unique Health approach, from its updated, integrative, multidisciplinary and multifactorial perspective, is very useful when it comes to comprehend both the transmission and prevention of zoonotic pathogenic agents, emerging or reemerging<sup>(34)</sup>, as SARS-CoV-2 and related coronaviruses. The Unique Health approach is capable of implementing in a better way, and with updated knowledge, the permanent prevention measures and oportune response that is required by localized epidemic outbreaks that may become into a pandemic<sup>(13)</sup>, as it has happened with COVID-19 and it may happen to other epidemics with a zoonotic origin in the future. It is necessary for the Unique Health approach to be known by physicians and other health professionals<sup>(29,35,36)</sup>, as veterinarians, biologists, biochemists, biotechnologists, pharmaceutical chemists, zootechnician engineers, food engineers, environmental professionals, psychologists as well as health educators, among many others<sup>(4)</sup>. In order to ensure an updated training about this topic between professionals that work in health, universities should integrate in their curricular innovations the concept Unique Health as soon as possible, in the contents that tribute to the graduation profile of those professions<sup>(35,37)</sup>.

## CONCLUSIONS AND FUTURE PROJECTIONS

Nowadays, various public and private organizations are participating in a real race in order to develop effective vaccines against SARS-CoV-2 as well as drugs which help on COVID-19 treatment<sup>(38)</sup>. It is important that the international biomedical community recognizes that COVID-19 is a zoonosis, and an unequivocal determination of which are the species that are its natural reservoir and its intermediary is extremely important, both to obtain future vaccine and to develop drugs to this disease. In that sense, the intermediary determination is useful in order to know in greater detail how the coronaviruses behave in the hosts and how do they transmit, since, in the future, we are not excent to produce a pandemic outbreak of zoonotic pathogenic agents with similar characteristics<sup>(26,30)</sup>.

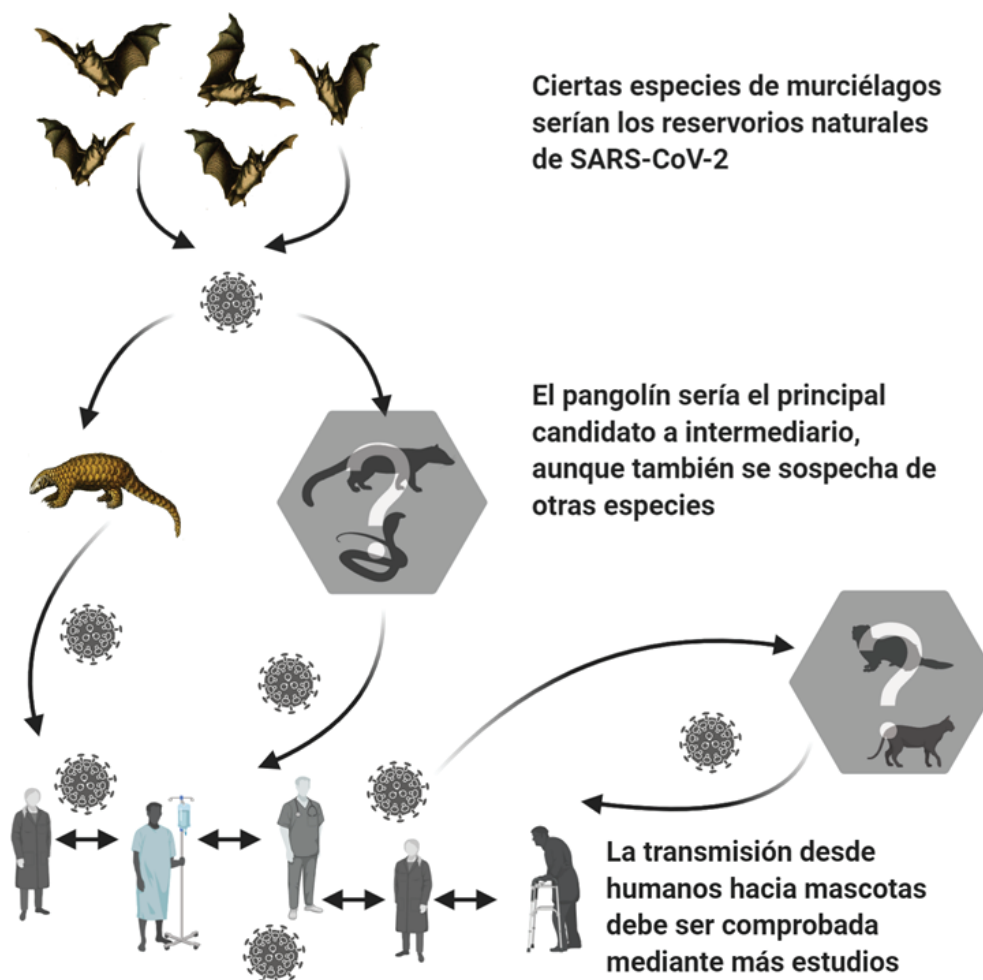
In consideration of all the above mentioned in this article it is concluded that is important for the Unique Health approach to be known, diffused and integrated for every health center and sanitary professionals, since given the seriousness of the zoonoses as COVID-19, we should not forget that human health is linked with animal health, and these two with environmental health..

Recently, certain risk groups have been immunized with vaccines; however, they will be available to the general population in several months. Before these projections, health organisms, both public

and private, as well as the educational institutions should put strict emphasis on the measures that prevent future contagion<sup>(5,13)</sup>. Meanwhile, in order to prevent the accelerated propagation of coronavirus, it is important to maintain effective hygienic and preventive personal distancing measures<sup>(38)</sup>.

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**Figure 1.** SARS-CoV-2 coronavirus is a zoonotic agent that has been transmitted from animals to humans. Figure created with computer program BioRender.com





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## BIBLIOGRAPHIC REFERENCES

- Zhou G, Chen S, Chen Z. Back to the spring of Wuhan: facts and hope of COVID-19 outbreak. *Front Med*. 2020: en prensa. DOI: <https://doi.org/10.1007/s11684-020-0758-9>
- Cohen J, Normile D. New SARS-like virus in China triggers alarm. *Science*. 2020; 367(6475): 234-5. DOI: <https://doi.org/10.1126/science.367.6475.234>
- Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, et al. A Novel Coronavirus from Patients with Pneumonia in China, 2019. *N Engl J Med*. 2020; 382(8): 727-33. DOI: <http://www.nejm.org/doi/10.1056/NEJMoa2001017>
- Bonilla-Aldana D, Villamil-Gómez W, Rabaan A, Rodríguez-Morales J. Una nueva zoonosis viral de preocupación global: COVID-19, enfermedad por coronavirus 2019. *Iatreia*. 2020;33(2): 107-10. Disponible en: <https://revistas.udea.edu.co/index.php/iatreia/article/view/341260>
- Rodríguez-Morales AJ, Sánchez-Duque JA, Hernández Botero S, Pérez-Díaz CE, Villamil-Gómez WE, Méndez CA, et al. Preparación y control de la enfermedad por coronavirus 2019 (COVID-19) en América Latina. *Acta Medica Peru*. 2020; 37(1): 3-7. DOI: <https://doi.org/10.35663/amp.2020.371.909>
- Trilla A. Un mundo, una salud: la epidemia por el nuevo coronavirus COVID-19. *Med Clin (Barc)*. 2020; 154(5): 175-7. DOI: <http://dx.doi.org/10.1016/j.medcli.2020.02.002>
- Cortés ME. Síntomas digestivos en la enfermedad por coronavirus 2019 (COVID-19). *Rev Gastroenterol Perú*. 2020; 40(1): 100-101. Disponible en: [http://www.scielo.org.pe/scielo.php?script=sci\\_arttext&pid=S1022-51292020000100100&lng=es](http://www.scielo.org.pe/scielo.php?script=sci_arttext&pid=S1022-51292020000100100&lng=es).
- Baig AM, Khaleeq A, Ali U, Syeda H. Evidence of the COVID-19 Virus Targeting the CNS: Tissue Distribution, Host-Virus Interaction, and Proposed Neurotropic Mechanisms. *ACS Chem Neurosci*. 2020; 11(7): 995-8. DOI: <https://doi.org/10.1021/acscchemneuro.0c00122>
- Triana JFF, Márquez DAS, Silva JSC, Castro CCA, Sandoval AFB. COVID-19 y enfermedad cardiovascular. *Rev Colomb Cardiol*. 2020; 228: 108653. DOI: <https://doi.org/10.1016/j.cbpc.2019.108653>
- Green A. Li Wenliang. *Lancet*. 2020;395 (10225): 682. DOI: [https://doi.org/10.1016/S0140-6736\(20\)30382-2](https://doi.org/10.1016/S0140-6736(20)30382-2)
- Parry J. Pneumonia in China: lack of information raises concerns among Hong Kong health workers. *BMJ*. 2020; 368(January): m56. DOI: <http://dx.doi.org/doi:10.1136/bmj.m56>
- Velavan TP, Meyer CG. The COVID-19 epidemic. *Trop Med Int Heal*. 2020; 25(3): 278-80. DOI: <https://doi.org/10.1111/tmi.13383>
- Cortés ME. Coronavirus como amenaza a la salud pública. *Rev Med Chil*. 2020; 148(1): 124-6. DOI: <http://dx.doi.org/10.4067/S0034-98872020000100124>
- WHO. WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020. WHO Speeches. 2020. Disponible en: <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---20-march-2020> (consultado el 28 de abril de 2020).
- BBC. Coronavirus: Greatest test since World War Two, says UN chief. *News*. 2020. Disponible en: <https://www.bbc.com/news/world-52114829> (consultado el 28 de abril de 2020).
- Rao K, Verma P, Kumar K, Verma MK, Siddiqui AH, Singh S, et al. Review on Newly Identified Corona Virus and its Genomics Organization. *SSR Inst Int J Life Sci*. 2020; 6(2): 2509-19. DOI: [https://iijls.com/currentissue/Review\\_Newly\\_Identify\\_Corona\\_Virus\\_Genomics\\_Organization.pdf](https://iijls.com/currentissue/Review_Newly_Identify_Corona_Virus_Genomics_Organization.pdf)
- Ye Z-W, Yuan S, Yuen K-S, Fung S-Y, Chan C-P, Jin D-Y. Zoonotic origins of human coronaviruses. *Int J Biol Sci*. 2020; 16(10): 1686-97. DOI: <https://dx.doi.org/10.7150%2Fijbs.45472>
- Singhal T. A Review of Coronavirus Disease-2019 (COVID-19). *Indian J Pediatr*. 2020; 87(4): 281-6. DOI: <https://doi.org/10.1007/s12098-020-03263-6>
- Zumla A, Chan JFW, Azhar EI, Hui DSC, Yuen K-Y. Coronaviruses — drug discovery and therapeutic options. *Nat Rev Drug Discov*. 2016; 15(5): 327-47. DOI: <https://doi.org/10.1038/nrd.2015.37>
- Chen Y, Liu Q, Guo D. Emerging coronaviruses: Genome structure, replication, and pathogenesis. *J Med Virol*. 2020; 92(4): 418-23. DOI: <https://doi.org/10.1002/jmv.25681>
- Wang C, Liu Z, Chen Z, Huang X, Xu M, He T, et al. The establishment of reference sequence for SARS-CoV-2 and variation analysis. *J Med Virol*. 2020; 92(6): 667-74. DOI: <https://doi.org/10.1002/jmv.25762>
- Zhou P, Yang X-L, Wang X-G, Hu B, Zhang L, Zhang W, et al. A pneumonia outbreak associated with a new coronavirus of probable bat origin. *Nature*. 2020; 579(7798): 270-3. DOI: <http://dx.doi.org/10.1038/s41586-020-1212-7>
- Yan R, Zhang Y, Li Y, Xia L, Guo Y, Zhou Q. Structural basis for the recognition of SARS-CoV-2 by full-length human ACE2. *Science*. 2020; 367(6485): 1444-8. DOI: <https://doi.org/10.1126/science.abb2762>
- Cabello C, Cabello F. Zoonosis con reservorios silvestres: Amenazas a la salud pública y a la economía. *Rev Med Chil*. 2008; 136(3): 385-93. DOI: <http://dx.doi.org/10.4067/S0034-98872008000300016>
- Menachery VD, Yount BL, Sims AC, Debbink K, Agnihothram SS, Gralinski LE, et al. SARS-like WIV1-CoV poised for human emergence. *Proc Natl Acad Sci*. 2016; 113(11): 3048-53. DOI: <https://doi.org/10.1073/pnas.1517719113>
- Menachery VD, Yount BL, Debbink K, Agnihothram S, Gralinski LE, Plante JA, et al. A SARS-like cluster of circulating bat coronaviruses shows potential for human emergence. *Nat Med*. 2015; 21(12): 1508-13. DOI: <https://doi.org/10.1038/nm.3985>
- Cheng VCC, Lau SKP, Woo PCY, Yuen KY. Severe Acute Respiratory Syndrome Coronavirus as an Agent of Emerging and Reemerging Infection. *Clin Microbiol Rev*. 2007; 20(4): 660-94. DOI: <https://dx.doi.org/10.1128%2FCMR.00023-07>
- Andersen KG, Rambaut A, Lipkin WI, Holmes EC, Garry RF. The proximal origin of SARS-CoV-2. *Nat Med*. 2020; 26(4): 450-2. DOI: <https://doi.org/10.1038/s41591-020-0820-9>
- Cortés ME. Enfermedad por coronavirus 2019 (COVID-19): Importancia

de la comunicación científica y de la enseñanza actualizada de las zoonosis. *Rev Peru Investig Salud*. 2020; 4(2): 87-8. Disponible en: <http://revistas.unheval.edu.pe/index.php/repis/article/view/697>

30. Zhang Y-Z, Holmes EC. A Genomic Perspective on the Origin and Emergence of SARS-CoV-2. *Cell* 2020; 181(2): 223-7. DOI: <https://doi.org/10.1016/j.cell.2020.03.035>
31. Lam TT-Y, Shum MH-H, Zhu H-C, Tong Y-G, Ni X-B, Liao Y, et al. Identifying SARS-CoV-2 related coronaviruses in Malayan pangolins. *Nature* 2020; DOI: <https://doi.org/10.1038/s41586-020-2169-0>
32. Shi J, Wen Z, Zhong G, Yang H, Wang C, Huang B, et al. Susceptibility of ferrets, cats, dogs, and other domesticated animals to SARS-coronavirus 2. *Science* 2020; eabb7015. DOI: <https://doi.org/10.1126/science.abb7015>
33. Arteaga-Livias FK, Rodríguez-Morales AJ. ¿SARS-CoV-2 de Humanos a Animales? ¿Nueva amenaza de zoonosis? *Rev Peru Investig Salud* 2020; 4(2): 55-6. Disponible en: <http://revistas.unheval.edu.pe/index.php/repis/article/view/714>
34. El Zowalaty ME, Järhult JD. From SARS to COVID-19: A previously unknown SARS-CoV-2 virus of pandemic potential infecting humans –Call for a One Health approach. *One Heal* 2020; 100124. DOI: <https://doi.org/10.1016/j.onehlt.2020.100124>
35. Cortés ME. Enfermedad por coronavirus 2019 (COVID-19): la importancia de estar alerta ante las zoonosis. *Iatreia* 2020; 33(2): In press. Disponible en: <https://revistas.udea.edu.co/index.php/iatreia/article/view/341482>
36. Lorusso A, Calistri P, Mercante MT, Monaco F, Portanti O, Marcacci M, et al. A "One-Health" approach for diagnosis and molecular characterization of SARS-CoV-2 in Italy. *One Heal* 2020; 100135. DOI: <https://dx.doi.org/10.1016%2Fj.onehlt.2020.100135>
37. Cortés ME. Enfermedad por coronavirus: la importancia de enseñar zoonosis bajo el enfoque de «Una sola salud». *Investig Educ Médica*. 2020; 9(35): 108-108. DOI: <https://doi.org/10.22201/facmed.20075057e.2020.35.20237>
38. Flórez G. LG. Pandemia COVID-19: ¿Qué más puedo hacer? *Rev Fac Med Humana* 2020; 20(2): 175-7. DOI: <https://doi.org/10.25176/RFMH.v20i2.2941>

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