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# Measures to Contribute to the Prevention and Control of Covid-19 in the Milk Production Chain

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## Abstract

Food production is a currently priority for all governments, when facing the global threats on the production systems caused by the pandemic COVID-19. The dairy chain, of vital importance for feeding vulnerable groups such as children and the elderly, can be significantly affected if health requirements in all their links are not met and if the "One Health" approach is not applied. Based on scientific studies, this article summarizes the main hygiene requirements on the presence, transmission and persistence of SARS-CoV-2 virus, in the animal, milk, processes, surfaces, and environments. In particular, it highlights the role of humans and their knowledge in minimizing the potential risk of transmission of COVID-19 and its consequences for the quality, safety, availability, and access to these foods.

**Keywords:** Milk; dairy products; SARS-CoV-2; COVID-19

## Introduction

COVID-19, a disease caused by the SARS-CoV-2 virus, currently affects 216 countries, areas or territories, with more than 31 million people infected and a growing number of deaths [1]. Its impact is not only sanitary, but also economic and reaches all sectors, including the food production chain [2]. In this context, international agencies warn about food shortages and predict hunger due to the disruption of production systems, recommending several measures to mitigate this situation [3]. This problem also affects the dairy production.

So far no SARS-CoV-2 infection has been reported in milk producing animals, although "in silico" researches have proven that the virus can potentially affect several mammal species, as in the case of bovine [4]. Long-term endemic prevalence of the virus increases the likelihood of infection of productive animals and pets through contact with infected people. In fact, SARS-CoV-2 infection of three mink farms in the Netherlands from affected handlers has also led to the first report of diseases transmitted from animals to humans in that scenario, as high homology was demonstrated in virus sequences isolated from minks and humans [5].

On the other hand, there should be a concern about the possible contamination of milk, utensils and containers used in the dairy industry through the aerosols expelled by people infected with SARS-CoV-2 [6], given the proven viability of the virus on stainless steel and plastic surfaces between 48 and 72 hours, at 21-23°C and 40 % relative humidity, respectively [7]. In addition, the virus is excreted in the faeces of affected people [8], which guarantees the presence of the virus in wastewater from areas affected by COVID-19 [9] and the consequent potential risk of the use of untreated water in the dairy industry. Traditionally, raw milk and products made with unpasteurized milk, such as cheese, along with undercooked eggs and meat, are recognized as the greatest risk to the health of consumers, due to their possible contamination with pathogens causing the so-called foodborne diseases [6].

Milk and dairy products are a major food because of the multiple benefits of their components, such as proteins,

carbohydrates and fats [6]. A preliminary study found the in vitro inhibition of SARS- CoV-2 replication by the bovine lactoferrin enzyme in the VeroE6 and A549 cell lines [10]. Although it has not been demonstrated that milk has specific immunological benefits to avoid COVID-19, it is pointed out that the consumption of food with antiviral properties can contribute to the improvement of the immune system and have a positive effect on sick patients [11].

In this regard, it is indicated to strengthen biosecurity measures when having contact with productive animals and pets, as well as in the industry, taking into account the indications of international health organizations to face this disease (OIE, 2020; FAO, 2020). There is not yet scientific evidence that food is a vehicle for transmission of SARS-CoV-2 [3,12], nor is COVID-19 considered to be a foodborne disease [2,13,14]. The OIE emphasizes that in order to face COVID-19, the national public health authorities and the Veterinary Services must work closely with the "One Health" approach [12], as this involves surveillance in both humans and animals, as well as sharing information and assessing risks from human-animal interaction. This organization also recommends taking preventive measures to limit contact with animals and thus complying with the basic hygiene measures during handling and care [12]. In accordance with these indications, the objective of this paper is to provide recommendations that will make possible to adopt additional health measures in the dairy production chain in order to minimize the risks of exposure to SARS-CoV-2 and to contribute to the prevention and control of COVID-19.

## Viruses, Importance in the Contamination of Milk and Dairy Products

Milk and dairy products are foods that are exposed to different physical, chemical and biological contaminating agents (pathogenic bacteria, parasites and certain viruses), which can compromise their safety or suitability for consumption. Foodborne diseases (FBDs) from viral origin have emerged in recent years as a significant cause of foodborne illness [13]. Among the human enteric viruses causing FBDs outbreaks are reported to be norovirus (NoV) and hepatitis A virus (HAV) [15]. Other viruses, such as rotavirus, hepatitis E virus (HEV), astrovirus, Aichi virus, sapovirus, enterovirus, coronavirus, parvovirus, and adenovirus, can also be transmitted by food [16].

When comparing the presence of these biological agents in food, viruses are the least common, because they depend on a host for their replication. The most important foodborne viruses are those that infect via the digestive tract and are excreted in faeces and/or vomit, which are infectious to humans when ingested orally [15]. Human viruses can also be transmitted indirectly through contaminated water, air, soil, surfaces or food. In the case of zoonotic viruses, they are transmitted by direct or indirect contact from animals to humans [17].

Coronaviruses are a large family of viruses that can cause diseases in both humans and animals [18]. SARS-CoV-2, a new type of coronavirus first detected in December 2019 in China [19], belongs to the order *Nidovirales*, of the family *Coronaviridae*, subfamily *Orthocoronavirinae*. It is divided into four genera *Alphacoronavirus*, *Betacoronavirus*, *Gammacoronavirus*, and *Deltacoronavirus* [20,21]. According to molecular characterization studies, SARS-CoV-2 is considered a new *Betacoronavirus* belonging to the subgenus *Sarbecovirus* [20].

## Food Safety Management During Covid-19

One of the main problems faced by developed and developing countries in the midst of the current pandemic is the presence of FBDs outbreaks due to the collapse of health systems [22]. Preventing contamination in the food chain will reduce FBDs, as well as the likelihood of new diseases emerging, such as COVID-19. In this regard, it is a challenge to maintain production and inspection operations, export certification, control of imported food, monitoring and surveillance of the safety of the food supply chain, food sampling and analysis, management of food incidents, advice on food safety, and food standards for the industry and the people [2].

The basic management systems for the safety of milk and dairy products in the food industry require a "farm-to-fork" chain approach, and essentially include: Good Agricultural Practices (GAP), Good Manufacturing Practices (GMP), Integrated Pest Management, Sanitation Standard Operating Procedures (SSOP), and Hazard Analysis and Critical Control Points (HACCP) [6,23]. Ensuring the safety of milk and dairy products requires the identification of the contamination of these foods with pathogenic microorganisms, or undesirable substances, causing damage to the health of consumers [6]. It is important to take measures in the milk production chain for COVID-19 because of the probable primary contamination by infection of the animals, or by a secondary contamination by infected persons (sick or asymptomatic).

## Sanitary Measures in the Milk Production Chain

**Dairy Farms:** SARS-CoV-2 infection in milk-producing mammals, although probable, has no evidence in productive practice [24]. It is worth noting that the possibility of breast milk being a vertical transmission route of this virus from

mothers to their children is still under discussion [25]. In the case of animals, it is known that milking is a process that greatly favors the contamination of milk with pathogenic microorganisms, including viruses, which affect both animals and workers. High levels of biosecurity on farms considerably limit the exposure of animals to any zoonotic agent [26], in addition to contributing to food safety. To avoid contamination of milk with SARS-CoV-2 during milking, whether manual or mechanical, it is necessary that workers do not participate in the milking if they show symptoms of respiratory disease, until COVID-19 infection is discarded [23].

Considering that SARS-CoV-2 infection occurs asymptomatically in percentages even higher than 50 %, it is essential that dairy farm workers follow the internationally recommended general health and hygiene measures, restricting access to off-farm personnel as much as possible in order to avoid infection of productive animals or contamination of the milk during milking. Compliance with the Good Hygiene Practices (GHP) is necessary in order to minimize the possibility of contamination by SARS-CoV-2 of the personnel and the milk during the obtaining process [23]. Another important measure is the daily routine of cleaning in the milking room, storage of milk, supplies, bathroom, and dressing room. It is also recommended to wash and disinfect externally the milking units, door handles, instruments, tools, as well as avoid sharing personal items [27].

**Milk Collection Centers:** Milk collection at the cooling centers is an important step in the production chain and can be a key element in spreading the virus, given the risk of contaminating surfaces if they are touched by contaminated hands. In this regard, it is fundamental to take precautions of physical distancing, hygiene and disinfection when producers deliver milk and at the time of collection by the industry. Reducing the number of workers, avoiding hand greetings and respecting the minimum distance between technicians, haulers, producers, and drivers, minimize the chain of possible contamination. Haulers should take special care when moving physically to areas with high rates of infection [22].

At the entrance to each cooling center, the tires of collection trucks and the various means of transport used by producers to carry the milk must be disinfected. It is recommended that the collection trucks be cleaned and disinfected before beginning the milk collection process [27]. Once the procedure has been completed, the containers, jugs, discharge valve, and door handle, should be washed with plenty of water and detergent, and then disinfected with ethanol (78–95%) for 30 s [28].

**Dairy Industry:**SARS-CoV-2 transmission in milk and dairy products may occur as a result of ingestion of these foods without heat treatment, such as raw milk and artisan fresh cheese. A study of MERS-CoV virus in several types of unpasteurized milk showed the presence of the virus up to 72 hours, but with pasteurization at 63°C for 30 minutes, it reached inactivation [29].

The dairy industry has peculiar characteristics like: controlled environments, smooth surfaces and stainless steel equipment, barriers such as clothing, gloves, masks, special footwear, cleaning and disinfection system, as well as strict controls. All of them looking for minimizing contamination and achieving the safety of products intended for consumption by the population. Self-control systems based on Hazard Analysis and Critical Control Points are confirmed as the most effective model developed to guarantee food safety [6].

The milk, either to be consumed as fluid milk or to be transformed into the different dairy products, such as fermented milks, cheeses, butter, ice cream, and concentrated milks, must receive certain treatments in the processing plants. From the public health point of view, with the heat treatment of the milk, the inactivation of pathogenic microorganisms is achieved, the nutritional quality is maintained and its conservation capacity is increased. With pasteurization, it is estimated that SARS-CoV-2 virus will be eliminated from the milk when it reaches temperatures above 63 °C [29].

SARS-CoV-2 stability was determined in a pilot study under different environmental conditions. The virus was stable between four and 14 days, with a reduction of 0.7 log units. At room temperature (22 °C), there was a 3.3 log10 reduction in concentration after 7 days, while reduction was 2.9 log10 at 56 °C for 30 minutes, and then the virus was not detected after 60 minutes. On the other hand, the virus was not detected at 70 °C after 5 minutes [30]. In the case of artisan fresh cheese production, which is one of the main forms of income and a tradition for the cooperative and peasant sector, the pasteurization of the milk is generally not applied, and this could favor its contamination. This

hazard lies in handling, because it is possible that the virus can persist on surfaces or objects used by infected persons handling food.

### Marketing of milk and dairy products:

Providing consumers with safe and nutritious food requires a commitment to safety and quality throughout the food chain from producers to consumers. Given that consumers and the personnel who sell food are at risk of contracting Covid-19 when they are in areas where social distancing cannot be maintained [2], it is essential to ensure their protection during distribution and sale. This requires limiting the number of customers entering establishments to prevent workers from being exposed to potential risks from the virus and keeping doors open to prevent customers from having direct contact with these surfaces [22]. To ensure that physical distancing is respected, both inside and outside the facilities, marks can be drawn on the floor to make it easier to maintain such distances, especially in busy areas like counters and checkouts [2]. Another measure recommended is the payment by credit cards to avoid contamination by coins and banknotes that may be contaminated.

Workers must respect the health and safety measures established to prevent contamination with SARS-CoV-2 by the dealer and consumers [2,31]. An important measure is that food should not be directly exposed during sale to consumers [32]. This requirement prevents a person carrying the virus from contaminating food and, although the use of masks limits this possibility, it is another way of preventing the spread of SARS-CoV-2. The risk of transmission of the virus can also be reduced by identifying points in the facility that are frequently touched for regular cleaning and disinfection [22].

### Surfaces and Environments:

In most food production chains, including the dairy chain, incorrect hygiene and disinfection of surfaces and environments become one of the greatest risks of food contamination. In the case of COVID 19, there are several studies that demonstrate the potential hazard they represent for the transmission of SARS-CoV-2 virus. The direct contact with contaminated surfaces or inanimate objects is another transmission route. Transmission occurs by touching a surface or an object that has the virus on it and then putting hands into the mouth, nose or eyes [2]. This virus can persist on contaminated surfaces [18]. However, this is not considered to be the main route responsible for the spread of the SARS-CoV-2 virus. This persistence is significantly affected by different environmental conditions such as high temperature and low humidity [7].

Surfaces, equipment, instruments, and utensils that come into contact with milk and dairy products, are generally approved materials such as stainless steel, glass and synthetic fibre. These materials facilitate cleaning and disinfection operations while increasing the shelf life of equipment or surface. Kampf et al. [28] described the persistence of several coronaviruses on different surfaces at different temperatures, relative humidity and viral concentration. Data obtained with SARS-CoV-2 indicate its persistence from 24 h to nine days on different surfaces (glass, plastic, metal, paper, wood), with viral concentrations between $10^5$-$10^7$. In a research on different materials, van Doremalen observed that SARS-CoV-2 was more stable on plastic (polypropylene) and stainlesssteel surfaces than on copper or cardboard surfaces. On plastic surfaces, a reduction of the virus from 103.7 to 100.6 TCID50 mL-1 was observed at 72 hours, while on stainless steel surfaces, there was a reduction from $10^{3.6}$ to $10^{0.6}TCID_{50}mL^{-1}$ at 48 hours. No viable SARS-CoV-2 was detected on copper surfaces after four hours or on cardboard surfaces after 24 hours. These data show the importance of food processing, especially milk, to minimize the risk of virus transmission by potentially contaminated food.

In another research carried out at room temperature (22 °C) and humidity of about 65%, on previously infected surfaces of fabric, wood, plastic, stainless steel, glass, and banknotes (~7,8 log $TCID_{50}$ $mL^{-1}$), the virus was not detected after three hours, two, four and seven days, respectively. The presence of the virus was also detected on the surfaces of different objects, including hand sanitizer dispensers [33], thus it is necessary to take into account when sharing these products and equipment that are used by several people.

The frequency of cleaning and disinfection operations of utensils and facilities should be increased with appropriate disinfection agents including ethanol and 2-propanol at concentrations higher than 30 % (v/v) and sodium hypochlorite at 0.1-0.5 %. Extreme care should be taken in the disinfection of surfaces, containers and raw materials that come into contact with food [2]. As a general hygiene indicator, the total aerobic microorganism count can be implemented. This indicator does not provide specific information on viruses, but it does regarding hygiene. In addition, it allows the effectiveness of cleaning and disinfection operations to be checked.

Ventilation must always be maintained in the workplaces [2]. In this sense, a study by Lu et al. [34] noted that the key factor regarding virus infection was the direction of the air conditioning flow in a restaurant in Wuhan City. The mode of transmission was through droplets smaller than five

microns, released when speaking and vaporized in the air, which remained suspended longer and traveled distances greater than one meter, causing the spread of the virus. This is an aspect to take into account in the dairy industries as a possible source of transmission of the virus, if any asymptomatic or infected worker is in the production area.

### Production Chain Workers:

Man along the milk chain, as evidenced in the literature consulted, is the main element of transmission of the virus, hence the importance of a particular analysis. COVID-19 is a respiratory disease. One of the main transmission routes is person-to-person contact through respiratory tract secretions that occur when an infected person speaks, coughs and/or sneezes [35] leading to contamination of surfaces and environments. This contamination could be reduced with the use of the mask for all the staff, as well as its change every three hours [2], regardless whether they present symptoms, because as it is known, the asymptomatic patients may be contagious and thus a potential source of transmission of COVID-19 [36].

To prevent the transmission of the virus COVID-19 among dairy workers, the contact between people who may be infected and those healthy should be minimized. The physical distancing is crucial to prevent the spread of the virus [2]. Strictly controlling the entry of personnel prevents any worker with symptoms (fever, cough, or difficulty breathing) or who has been in contact with someone who is ill, could have access to the facilities [23]. WHO recommends maintaining the minimum distance of one meter among workers [37]. To achieve physical distancing, the staff can be organized into smaller work teams to reduce interaction, as well as increase space on production lines, so that workers do not come into contact [22]. In addition, access by the company's own staff that is not essential to the proper functioning of the company should be limited [2].

Good Hygiene Practices for all personnel involved in the dairy production chain include frequent washing of hands with soap and water for a minimum of 20 seconds [38]. In this regard, it is essential to ensure that hands are properly washed before starting work, and after handling dirty cartons, containers or packaging, waste, garbage, coughing, sneezing, touching the mouth or nose, eating, cleaning activities, among others [39]. It is also recommended to frequently use a hydroalcoholic disinfectant gel or 0.1% sodium hypochlorite, which should be available at various points in the facility. Another measure is the daily change and washing of work clothes, sanitary uniforms and footwear. It is recommended that work uniforms be washed at a temperature of 60-90°C for 30 minutes with an appropriate detergent and disinfectant (chlorine-based bleach) [39,40].

### Training of Human Resources in the Milk Production Chain:

Handling is one of the main sources of contamination of milk and dairy products. To reduce the possibility of the staff contaminating food, they should have basic training in hygiene control throughout the food chain to ensure food safety and suitability. Among the aspects that should be strengthened are: principles of hygiene, disinfection methods reaching all direct and indirect contact surfaces, and safety management systems to minimize SARS-CoV-2 risk of transmission [6]. The staff involved in the production of milk and dairy products should comply with hygiene measures to reduce the likelihood of introducing any risk, which may adversely affect the safety and suitability of food throughout the food chain from the primary production to consumption.

Training has to be designed taking into account the knowledge about the virus, the disease and the behavior in each region, as well as for the whole chain, from the primary producer, the industry, the transporters, the market, and the consumer.

All the above measures are also part of ensuring the production of milk and dairy products, avoiding losses due to the contamination of other pathogens, thus ensuring the availability of these foods, which is a priority for governments when facing the new health requirements and consequences for feeding caused by COVID-19.

## Conclusion

SARS-CoV-2 transmission through milk or dairy products has not been documented, but in view of the potential risk due to infection of milk-producing animals or secondary contamination from infected workers, complementary health measures to those already existing must be applied in all links of milk production.

Limiting the access of people to the facilities; complying with the physical distancing and the use of masks; avoiding contact with people who present respiratory symptoms; frequently washing and disinfecting hands, work surfaces and contact points; as well as complying with the Good Hygiene Practices in each of the links of the dairy production chain, are recommendations that become mandatory requirements for minimizing SARS-CoV-2 virus risk of infection and transmission in the production system, where man plays the key role.

## References


1. WHO (2020) Coronavirus Disease (Covid-19) Dashboard. Coronavirus Official Data.
2. FAO/WHO (2020). COVID-19 and Food Safety: Guidance for Food Businesses: interim guidance.
3. FAO (2020). Novel coronavirus (OID-19). Policy tool.
4. Shen M, Liu C, Xu R, Ruan Z, Zhao S, et al (2020). SARS-CoV-2 infection of cats and dogs?
5. ProMED International Society for Infectious Diseases. (2020) Coronavirus disease 2019 update (70): China (Honk Kong) cat, pets and stock.
6. Martínez E, Aparicio ML, Rodríguez, R. (2020) El saneamiento en la industria alimentaria. Relevancia ante la emergencia del coronavirus SARS COV-2 y COVID-19. Tecnología Láctea Latinoamericana, 106: 20-32.
7. van Doremalen N, Bushmaker T, Morris D, Holbrook MG, Gamble A, et al. (2020) Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1. N Engl J Med 382: 1564-1567.
8. Amirian S (2020) Potential fecal transmission of SARS-CoV-2: Current evidence and implications for public health. International Journal of Infectious Diseases 95: 363-370.
9. Ahmed W, Angel N, Edson J, Bibby K, Bivins A, et al. (2020) First confirmed detection of SARS-CoV-2 in untreated wastewater in Australia: A proof of concept for the wastewater surveillance of COVID-19 in the community. Science of the Total Environment 728: 138764.
10. Marques de Carvalho CA, da Rocha Matos A, Caetano BC, da Costa SP, Geraldinho BR et al. (2020) In Vitro Inhibition of SARS-CoV-2 Infection by Bovine Lactoferrin. bioRxiv preprint.
11. De, De. (2020) Protective Foods to Develop Immunity of Individuals against COVID 19. Research Today 2(5): 287-290.
12. OIE (World Organization for Animal Health). (2020). Questions and Answer on the Covid-19.
13. EFSA (2020) Coronavirus no evidence that food is a source or transmission route.
14. FDA (2020) Food Safety and the Coronavirus Disease 2019 (COVID-19).
15. Forsythe SJ (2020) Foodborne viral pathogens. The microbiology of Safe Foods (3er edn.) Forsythe, John Wiley and Sons, 233-244.
16. Bosch A, Gkogka E, Le Guyader FS, Loisy-Hamon F, Lee A, et al. (2018) Foodborne viruses: detection, risk assessment, and control options in food processing. Int J Food Microbiol 285: 110-128.
17. Boelaert F, Papanikolaou A, Rizzi V, Stoicescu AV (2020) Manual for reporting on zoonosis and zoonotic agents, within the framework of Directive 2003/99/EC, and on some other pathogenic microbiological agents for information derived from the year 2019. EFSA supporting publication 2020: EN-1792. 63 pp.
18. Lake R, Kingsbury J, Hewitt J, Smit E, King, N (2020) Potential for foodborne transmission of COVID-19: Literature Review Update. New Zealand Food Safety Science & Research Centre. 2020.
19. Liu J, Liao X, Qian S, Yuan J, Wang F, et al.(2020). Community transmission of severe acute respiratory syndrome coronavirus 2, Shenzhen, China. Emerg Infect Dis., 26 (6): 1320-1323.
20. Zhu N, Zhang D, Wang W, Li X, Yang B, (2020) A Novel Coronavirus from Patients with Pneumonia in China, 2019. N Engl J Med, 382, 727-733.
21. Chen Y, Liu Q, Guo D (2020) Emerging coronaviruses: genome structure, replication, and pathogenesis. J Med Virol 10.1002/jmv.25681.
22. FAO/ECLAC. (2020) Food system and COVID-19 in Latin America and the Caribbean: Health risks; safety of workers and food safety. Bulletin No 4. Santiago, FAO.
23. Goli M (2020) Review of novel human β-coronavirus (2019-nCoV or SARSCoV-2) from the food industry perspective-Food plant health principles. Food Saf., e12853.
24. McNamara T, Richt JA, Glickman L (2020) A Critical Needs Assessment for Research in Companion Animals and Livestock Following the Pandemic of COVID-19 in Humans. Vector-borne and zoonotic diseases, 20 (6), 393-405. Mary Ann Liebert, Inc.
25. Lackey KA, Pace RM, Williams JE, Bode L, Donovan SM, et al. (2020) SARS-CoV-2 and human milk: what is the evidence? Matern Child Nutr., e13032.
26. European Commission. (2020). COVID-19 and farmed and domestic animals. Questions and Answers.
27. Taverna MA, Villar J, Mascotti M, Costamagnam DA, Signorini ML, et al (2020). Milk Production and COVID-19.
28. Kampf G, Todt D, Pfaender S, Steinmann E (2020) Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents. J Hosp Infect., 104 (3): 246-251.
29. van Doremalen N, Bushmaker T, Karesh WB, Munster VJ (2014) Stability of Middle East respiratory syndrome coronavirus in milk. Emerging Infectious Diseases 20 (7): 1263-1264
30. Chin A, Chu J, Perera M, Hui K, YH L, et al. (2020) Stability of SARS-CoV-2 in different environmental conditions. The Lancet, 1.
31. FSAI (Food Safety Authority Ireland). (2020). COVID-19 (Coronavirus).
32. FDA (2020a). Food safety and availability during the coronavirus pandemic.
33. Ye G, Lin H, Chen L, Wang S, Zeng Z, et al. (2020) Environmental contamination of the SARS-CoV-2 in healthcare premises: an urgent call for protection for healthcare workers. Journal of Infection, 81(2): e1-e5.
34. Lu J, Gu J, Li K, Xu C, Su W, Lai Z, et al. (2020) COVID-19 outbreak associated with air conditioning in restaurant, Guangzhou, China, 2020. Emerg Infect Dis 26 (7): 1628-1631.
35. Chan J, Yuan S, Kok K, Kai-Wang To, Xing F, et al. (2020) A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. The Lancet, 395(10223): 514-523.
36. Kronbichler A, Kresseb D, Yoonc S, Leed KH, Effenbergere M, et al. (2020) International Journal of Infectious Diseases, 98: 180–186.
37. WHO (2020 b) Critical preparedness, readiness and response actions for COVID-19: Interim guidance.
38. WHO (2020 a) Infection prevention and control SAVE LIVES:

Clean Your Hands. World Health Organization

39. WHO/ECLAC (2020) Water, sanitation, hygiene, and waste management for the COVID-19 virus: Interim guidance.

40. Shi J, Wen Z, Zhong G, Yang H, Wang C, et al. (2020) Susceptibility of ferrets, cats, dogs, and other domesticated animals to SARS coronavirus 2. Science 368(6994):1016-1020.

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