

## COVID-19 and the *One Health* approach: a systematic review

### COVID-19 e a abordagem *One Health* (Saúde Única): uma revisão sistemática

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#### ABSTRACT

**Introduction:** In December 2019, was identified in Wuhan, China, the presence of a new coronavirus, called SARS-CoV-2, responsible for COVID-19, which quickly spread throughout the world in a pandemic manner. The natural history of the disease adapts itself in an emblematic way in the One Health approach, which are disease control strategies that seek more broadly to discuss the inseparable aspects of human, animal and environmental health. **Objective:** The aim of the study was to conduct a systematic review of the literature on the application of the concepts of One Health in the current pandemic context of COVID-19. **Method:** The study followed the PRISMA guidelines for the preparation of systematic reviews. The databases searched were PubMed, Scopus, Web of Science, Lilacs and Google Scholar. The search terms used were (COVID-19 OR SARS-CoV-2 OR 2019-nCoV) AND “One Health”. **Results:** In the qualitative synthesis, 62 publications were included, 28 (45.2%) presented proposals for COVID-19 health surveillance through the One Health approach and 34 (54.8%) only reported the importance of this approach in controlling the virus. There was an increase in publications on the two themes over the months analyzed. **Conclusions:** Biological issues (investigations related to viruses, hosts and biotechnology) were the most discussed topics as One Health strategies, to the detriment of social, economic and behavioral issues. Government policies must be adopted to guarantee multiprofessional health actions. It is also up to professionals to promote and apply this concept, in an articulated and interdisciplinary way. The applicability of One Health in the pandemic context experienced by COVID-19 is imperative.

**KEYWORDS:** COVID-19; One Health; Systematic Review

#### RESUMO

**Introdução:** Em dezembro de 2019, foi identificado em Wuhan, China, em pessoas que frequentavam um mercado úmido, a presença de um novo coronavírus, denominado SARS-CoV-2, responsável pela COVID-19, que rapidamente se espalhou pelo mundo de forma pandêmica. A história natural da doença se adapta de forma emblemática na abordagem *One Health* (Saúde Única), que são estratégias de controle de doenças que buscam de forma mais ampla discutir os aspectos indissociáveis da saúde humana, animal e ambiental. **Objetivo:** Realizar uma revisão sistemática de literatura sobre a aplicação dos conceitos de Saúde Única no atual contexto pandêmico da COVID-19. **Método:** O estudo seguiu a recomendação PRISMA para elaboração de revisões sistemáticas. As bases de dados pesquisadas foram PubMed, Scopus, *Web of Science*, Lilacs e *Google Scholar*. Os termos de pesquisa utilizados foram (COVID-19 OR SARS-CoV-2 OR 2019-nCoV) AND “*One Health*”. **Resultados:** Na síntese qualitativa foram incluídas 62 publicações, 28 (45,2%) apresentavam propostas para a vigilância em saúde de COVID-19 por meio de abordagem *One Health* e 34 (54,8%) apenas relataram a importância dessa abordagem no combate ao vírus. Foi observado um incremento das publicações sobre os dois temas ao longo dos meses analisados. **Conclusões:** Questões biológicas (investigações relacionadas ao vírus, aos hospedeiros e à biotecnologia) foram os temas mais discutidos

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como estratégias de *One Health*, em detrimento das questões sociais, econômicas e comportamentais. Políticas governamentais devem ser adotadas para garantir as ações multiprofissionais de saúde. Cabe também aos profissionais a promoção e a aplicação deste conceito, de forma articulada e interdisciplinar. A aplicabilidade da *One Health* no contexto pandêmico vivenciado pela COVID-19 é imperiosa.

**PALAVRAS-CHAVE:** COVID-19; *One Health*; Revisão Sistemática

## INTRODUCTION

The coronaviruses (CoV) are a group of enveloped single-stranded RNA viruses that can infect people and animals. These belong to the subfamily Orthocoronavirinae, family Coronaviridae, in the order Nidovirales<sup>1</sup>. They are classified into four genera: Alpha, Beta, Gamma, and Deltacoronavirus. The first two genera can infect humans and these pathogens have a global distribution<sup>1</sup>. In animals, these CoV can produce respiratory, gastrointestinal, liver, and neurological disease<sup>2,3</sup>.

Seven pathogenic CoV to humans have already been identified<sup>2</sup>. The most frequently encountered symptoms are of a common cold and for most of these etiologic agents, rarely occurs a severe infection of the lower respiratory tract, such as pneumonia, mainly in children, the elderly, and immunocompromised patients<sup>4,5</sup>.

In the last two decades, three episodes of zoonotic overflow were observed - when an etiologic agent of animal origin starts to infect humans - involving CoV<sup>3,6</sup>. These were important for their lethality, magnitude, and transcendence when they brought great impact to the health services on the planet<sup>3</sup>.

The first CoV to cause an epidemic was Sars-CoV-1, registered in 2002 as the etiologic agent of a Severe Acute Respiratory Syndrome (SARS), initially registered in Guangzhou (Guangdong, China), causing 8,422 cases and 916 deaths in 29 countries on the five continents<sup>7</sup>.

Ten years after SARS, another highly pathogenic CoV emerged in the Middle Eastern countries as the cause of the Middle East Respiratory Syndrome (MERS). A total of 2,494 cases were confirmed, including 858 deaths. Cases have been reported globally but most of these have been reported in Saudi Arabia<sup>8</sup>.

In December 2019, in Wuhan, China, the presence of a new CoV, called SARS-CoV-2, responsible for COVID-19, was identified in people who attended a wet market, which quickly spread throughout the world in a pandemic manner<sup>5</sup>.

In common with the three episodes, epidemiological investigations showed that the emergence of pathogens was due to zoonotic overflow, in which these CoV, which previously infected wild animals, began to infect humans, causing serious diseases in an epidemic manner<sup>3,6</sup>. It was also observed that these zoonotic escapes were driven by the cultural practices of using wild animals - bats, snakes, civets, pangolins - as part of their diet and as a delicacy in the food of the populations of Asia<sup>1,3</sup>. Associated

with this aspect are the fragile sanitary and regulatory laws of these countries for the commercialization and inspection of the production and sale of wild animals that are the propagators of these pathogens<sup>1,3</sup>.

In this sense, *One Health* appears, which, in a broader way, seeks to discuss the inseparable aspects of human, animal, and environmental health<sup>9</sup>. According to this approach, there are four areas that influence the sanitary situation of a given territory: the environment, social issues, and economic and behavioral aspects. This collaborative approach understands that the health status of human beings is related to the health of animals and that both populations (men and animals) affect the environment in which they coexist and are equally affected by that environment<sup>9</sup>. This broader understanding of health situations has enabled the adoption of more effective strategies on the determinants of health-illness-care in the areas of health services<sup>9</sup>. Among the premises of *One Health*'s performance are the multidisciplinary approach and interdisciplinary collaborations, seeking the benefit of health care, in its broadest aspects, for human beings, animals, and the environment<sup>9</sup>.

Seeking to carry out an assessment of *One Health* strategies that are being adopted and proposed at the global level to face the COVID-19 pandemic, this study aimed to conduct a systematic literature review on the application of the concepts of *One Health* in the current context of the COVID-19 pandemic.

## METHOD

### Systematic review protocol

The guidelines and procedures of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) were followed in the present study<sup>10</sup>. No protocol was used to assess the quality of the publications included in the study.

### Search strategy and eligibility criteria

Publications that reported on the COVID-19 pandemic and the *One Health* approach as a health surveillance strategy were researched until May 2, 2020. Original articles, opinion articles, editorials, reviews, letters to editors, comments, short communications, perspectives, special reports, and interviews were included in the systematic review. In addition to peer-reviewed



publications, preprints were also considered. Five databases were searched, including PubMed, Scopus, Web of Science, Literatura Latino-Americana e do Caribe em Ciências da Saúde (Lilacs), and *Google Scholar*. The databases were searched by one of the researchers using the variation of the search terms (COVID-19 OR SARS-CoV-2 OR 2019-nCoV) AND “One Health”. Articles in languages other than English and Portuguese were excluded from this systematic review. Considering the date of the first confirmed COVID-19 case reports, searches were limited to articles published in 2020. Articles that presented the One Health approach and the new coronavirus were selected to be analyzed in this study.

### Data tracking

A search was carried out in the database and the publications were accessed. The tracking took place as follows:

- Only publications that reported the One Health approach and the new coronavirus were included;
- The summaries of the stored publications were read and, if necessary, the introduction and/or results and discussion sections were carefully investigated to ensure that the publications met the inclusion criteria;
- Two independent reviewers screened titles and abstracts according to eligibility criteria. Disagreements were discussed and later resolved by consensus;

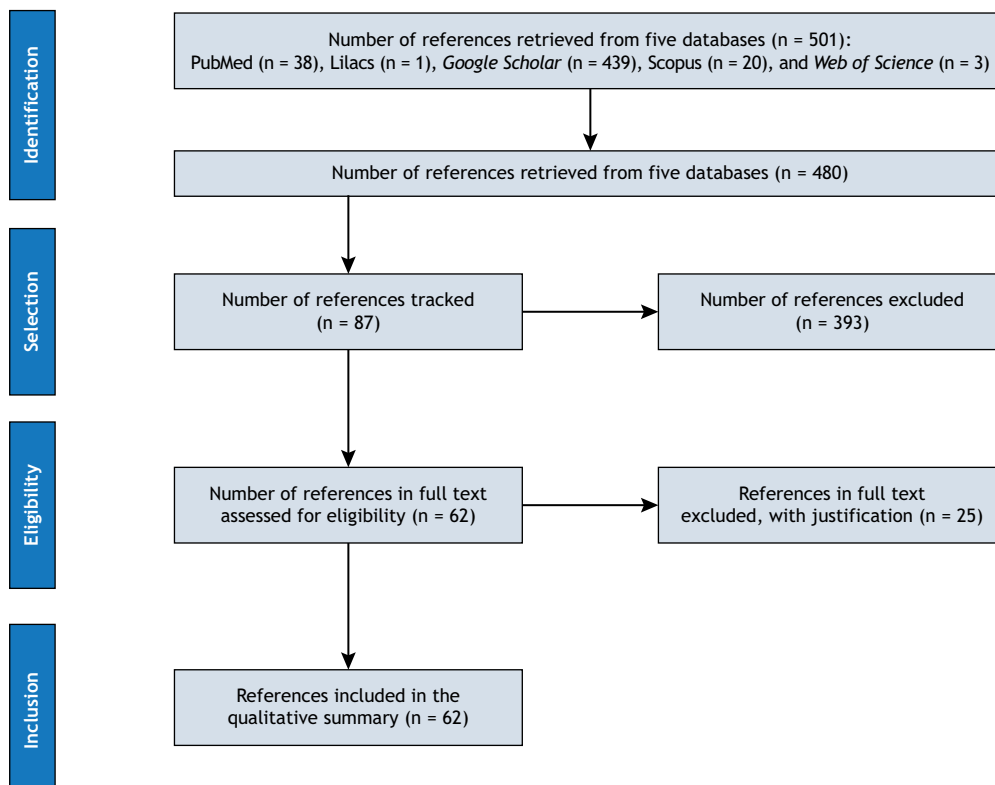
- All publications identified were reviewed. Each publication’s references were searched manually for other studies of interest in this review.

### Data extraction and synthesis

The following categories of data were collected: authorship, publication title, journal title, type of publication, date of publication, and proposals for COVID-19 health surveillance based on the One Health approach. Those publications that did not propose specific One Health strategies but reported their importance in combating COVID-19 were collected and presented separately. One of the reviewers performed data extraction and the other reviewer assessed the accuracy of the extracted data.

## RESULTS

Duplicates between databases were excluded (n = 21), and the electronic search procedure recovered 480 publications. After reading the titles and abstracts, 87 texts were conducted for a full reading. With 25 exclusions (did not directly discuss the relationship between COVID-19 and the One Health approach: n = 5; the terms COVID-19 and One Health were only in the authors’ affiliation or in the publication references: n = 20), 62 publications were considered for the preparation of the qualitative synthesis (Figure 1).



Source: Elaborated by the authors, 2020.

Figure 1. Flowchart of the systematic review.



**Table 1.** Descriptive characteristics of studies on COVID-19 included with One Health proposals.

Authors	Type of publication	Periodical	Authors' country of origin	One Health proposals
Amirian, Levy <sup>11</sup>	Review article	<i>One Health</i>	United States	Use of the drug remdesivir for human, veterinary, and agricultural use.
Bhatia <sup>12</sup>	Perspective	<i>Indian Journal of Medical Research</i>	India	Sensitive surveillance system at the human-animal interface.
Bonilla-Aldana et al. <sup>13</sup>	Editorial	<i>Advances in Animal and Veterinary Sciences</i>	Colombia and India	Collaboration between human, animal, and environmental health sectors at regional, national, and international levels.
Connolly <sup>14</sup>	Original article	<i>Global Policy</i>	Scotland	Discussion on the growing urbanization and decrease of animal habitats. Alert to the need for social scientists to pay attention to the concept of One Health.
Decaro et al. <sup>15</sup>	Original article	<i>Research in Veterinary Science</i>	United States and Italy	Use of veterinary medicine experience in the control of other coronaviruses that affect animals for the formulation of measures against COVID-19.
Dilcher et al. <sup>16</sup>	Editorial	<i>New Zealand Medical Journal</i>	New Zealand	Robust and rapid communication systems between countries, to ensure that new pathogens are quickly identified, characterized, and contained, if possible.
Zowalaty, Järhult <sup>17</sup>	Original article	<i>One Health</i>	Sweden and Arab Emirates	Surveillance of SARS-CoV-2 in wild hosts, including with genetic analysis; knowledge of the ecology of the virus, so that high-risk transmission situations can be avoided; social/behavioral science measures to prevent interactions between human populations and reservoir animals; detection of reservoir hosts and removal of these animals from live animal markets or markets rigorously tested for the virus; reduction of human-human transmission, with a focus on social sciences (behavior change for prevention, in infected or sick people); legislation and collaborative measures between the sectors of agriculture and public health, with a focus on biosafety and education on zoonotic diseases.
Foddai et al. <sup>18</sup>	Editorial	<i>One Health</i>	Denmark, Sweden, and Italy	Consideration of veterinary experience (legislation/surveillance) obtained in animal diseases may offer additional knowledge to the public health response to COVID-19.
Foddai et al. <sup>19</sup>	Original article	<i>One Health</i>		Use of a real-time surveillance protocol for COVID-19 adapted from a veterinary methodology.
Gollakner, Capua <sup>20</sup>	Short communication	<i>Veterinaria Italiana</i>	Italy and Denmark	Harmonization of guidelines for surveillance and intervention in wild species, in captivity, and in companion animals to facilitate the understanding of viral propagation in new host populations and prevention of panzooty.
Hemida, Ba Abdulllah <sup>21</sup>	Original article	<i>One Health</i>	Saudi Arabia and Egypt	Monitoring the virus in natural hosts and possible intermediate hosts; decontamination of public environments; change in personal habits and lifestyle.
Jacobsen <sup>22</sup>	Comment	<i>The Lancet</i>	United States	Detection of etiological agents in farm animals and wild animals, creating an alert system for human pandemics.
Kahn <sup>23</sup>	Comment	<i>International Journal of Epidemiology</i>	United States	Protection of wildlife habitats such as tropical forests to prevent overflow events from zoonotic pathogens.
Lal <sup>24</sup>	Editorial	<i>Journal of Soil and Water Conservation</i>	United States	Protection of soil, water, and air. Changing the values of society, lifestyle, and business promoting the sustainable use of the environment.
Leroy et al. <sup>25</sup>	Editorial	<i>One Health</i>	France	Studies to establish the risk of transmission of COVID-19 from humans to pets (reverse zoonosis), as well as infected animals being sources of infection for humans.
Lorusso et al. <sup>26</sup>	Original article	<i>One Health</i>	Italy	Greater participation of veterinarians and veterinary medicine methodologies in public health.

Continue



Continuation

Authors	Type of publication	Periodical	Authors' country of origin	One Health proposals
Lorusso et al. <sup>27</sup>	Editorial	<i>Veterinaria Italiana</i>	Italy	Maintain natural barriers between natural reservoirs of zoonotic viruses and society; classify zoonotic diseases concerning their potential to cause pandemics, the magnitude in humans and animals, and whether they represent a potential agent of bioterrorism; innovative diagnostic technologies, including genetic sequencing of zoonotic pathogens and creation of global databases; change in the training of veterinarians, with a deeper understanding of bioinformatics, genomics, social sciences, statistics, and ecology.
Messmer <sup>28</sup>	Comment	<i>Human-Wildlife Interactions</i>	United States	Health education carried out by professionals from the One Health area in order to promote knowledge about zoonoses associated with wild animals, without instigating in society the idea that these are disease-transmitting pests that must be eliminated.
Paul et al. <sup>29</sup>	Comment	<i>BMJ Global Health</i>	Belgium and France	Global health policies should not be designed to respond to threats on a case-by-case basis but should take a holistic approach; global health protection policy, without fragmentation, with considerations for each context; long-term policies to reduce collective and individual risks, such as environmental factors and social inequities.
Renda, Castro <sup>30</sup>	Original article	<i>European Journal of Risk Regulation</i>	Belgium	Greater integration of the areas of animal health and human health.
Singh, Ofirin <sup>31</sup>	Editorial	<i>WHO South-East Asia Journal of Public Health</i>	India	Truly resilient health systems, with the participation of different sectors of public power, science, and society.
Sun et al. <sup>32</sup>	Review article	<i>Trends in Molecular Medicine</i>	China and United States	Interdisciplinary performance between human health professionals with veterinarians and zoologists; surveillance (by diagnosis) in domestic and farm animals, to prevent the expansion of host species or inter-species transmission of new coronaviruses to humans.
Thool <sup>33</sup>	Original article	<i>International Journal of Scientific Research &amp; Engineering Trends</i>	India	Maintain the species barrier between natural reservoirs of zoonotic pathogens and human society.
Tilocca et al. <sup>34</sup>	Short communication	<i>Microbes and Infection</i>	Italy	Molecular investigation of different coronaviruses compared to COVID-19.
Tilocca et al. <sup>35</sup>	Original article	<i>Microbes and Infection</i>	Italy	Mapping of coronavirus epitopes in different geographical areas, in the human and animal population, for the adoption of more adequate containment measures.
Broucke <sup>36</sup>	Editorial	<i>Health Promotion International</i>	Belgium	Greater interaction between researchers in the areas of Health Promotion and Sustainable Development with the One Health initiative, which has very similar characteristics.
Wang et al. <sup>37</sup>	Letter to the editor	<i>Journal of Infection</i>	China and Canada	Epidemiological investigations among domestic and farm animals; restrictive laws in relation to the wildlife market.
Weng <sup>38</sup>	Opinion article	<i>Acta Medica Mediterranea</i>	China	Increase the technical capacity of teams for the prevention of epidemics and research in Public Health; interventions to control the population's psychological crises; guarantee of personal protective equipment for everyone involved in epidemic periods; surveillance, prevention, and control in the "weak period" of the epidemic.

Source: Elaborated by the authors, 2020.

The types of publications found were varied, namely: 18 (29.1%) editorial, 13 (21.0%) original articles, nine (14.5%) letters to the editors, seven (11.3%) review articles, six (9.7%) comments, three (4.8%) short communications, two (3.2%) opinion articles, two (3.2%) perspectives, one (1.6%) special report, and one (1.6%) interview. Authors from 42 countries were found representing five continents (Tables 1 and 2). Only one publication

(1.6%) was in Portuguese and the rest in English. A publication in Italian was found during database searches but was excluded because it did not meet the inclusion criteria. Among these publications, 28 (45.2%) presented proposals for COVID-19 health surveillance through the One Health approach, with a wide variety of proposals. Investigations related to viruses, hosts, and biotechnology were the most frequent proposals (19; 67.9%).



Table 2. Characteristics of studies on COVID-19 included with reports of the importance of the One Health approach.

Authors	Type of publication	Periodical	Authors' country of origin
Ahmad, Hui <sup>39</sup>	Letter to the editor	<i>Human Vaccines &amp; Immunotherapeutics</i>	China
Burkle <sup>40</sup>	Special report	<i>Prehospital and Disaster Medicine</i>	United States
Chatterjee et al. <sup>41</sup>	Review article	<i>Indian Journal of Medical Research</i>	India
Chaves, Bellei <sup>42</sup>	Editorial	<i>Revista de Medicina</i>	Brazil
Chen et al. <sup>43</sup>	Letter to the editor	<i>Journal of Infection</i>	China
Dhama et al. <sup>44</sup>	Review article	<i>Preprints*</i>	India, Nepal, Colombia, and Poland
Fasina <sup>45</sup>	Perspective	<i>Asian Pacific Journal of Tropical Medicine</i>	South Africa
Helmy et al. <sup>46</sup>	Review article	<i>Journal of Clinical Medicine</i>	Egypt, United States, and Germany
Jørgensen, Neves <sup>47</sup>	Letter to the editor	<i>Tidsskrift for Den norske legeforening</i>	Norway
Kapata et al. <sup>48</sup>	Editorial	<i>International Journal of Infectious Diseases</i>	Zambia, Nigeria, Congo, Germany, Ethiopia, and England
Kilic et al. <sup>49</sup>	Opinion	<i>Northern Clinics of Istanbul</i>	Turkey
Kock et al. <sup>50</sup>	Comment	<i>Lancet Planet Health</i>	United States, Germany, Tanzania, Vietnam, and England
Lum, Tambyah <sup>51</sup>	Editorial	<i>Singapore Medical Journal</i>	Singapore
Mackenzie, Willians <sup>52</sup>	Editorial	<i>Microbiology Australia</i>	Australia
Malik et al. <sup>53</sup>	Original article	<i>Preprints*</i>	India, Japan, Colombia
Malik et al. <sup>54</sup>	Review article	<i>Preprints*</i>	India, Nepal, and Colombia
Malik et al. <sup>55</sup>	Short communication	<i>Veterinary Quarterly</i>	India, Iran, and Thailand
Marty, Jones <sup>56</sup>	Editorial	<i>One Health</i>	Australia
Murdoch, French <sup>57</sup>	Editorial	<i>New Zealand Medical Journal</i>	New Zealand
Musa et al. <sup>58</sup>	Letter to the editor	<i>The Journal of Infection in Developing Countries</i>	China, Pakistan, and Sudan
Parry <sup>59</sup>	Letter to the editor	<i>Forensic Science International: Reports</i>	United States
Qian et al. <sup>60</sup>	Comment	<i>Infectious Diseases of Poverty</i>	China
Ravikumar et al. <sup>61</sup>	Original article	<i>International Journal of Recent Scientific Research</i>	India
Rodriguez-Morales et al. <sup>6</sup>	Editorial	<i>Le Infezioni in Medicina</i>	Colombia, Peru, United States, Italy, and Venezuela
Rodriguez-Morales et al. <sup>62</sup>	Review article	<i>Journal of Pure and Applied Microbiology</i>	Colombia, India, and Nepal
Stoffel et al. <sup>63</sup>	Letter to the editor	<i>Transboundary and Emerging Diseases</i>	Switzerland
Trilla <sup>9</sup>	Editorial	<i>Medicina Clínica</i>	Spain
Vicente <sup>64</sup>	Letter to the editor	<i>Revista da Sociedade Brasileira de Medicina Tropical</i>	Brazil
Wilson, Chen <sup>65</sup>	Editorial	<i>Journal of Travel Medicine</i>	United States
Xiong et al. <sup>66</sup>	Original article	<i>BioRxiv*</i>	China and Canada
Yadav et al. <sup>67</sup>	Original article	<i>Indian Journal of Medical Research</i>	India
Yassine, Shah <sup>68</sup>	Entrevista	<i>Expert Review of Anti-infective Therapy</i>	Qatar
Zumla, Niederman <sup>69</sup>	Editorial	<i>Current Opinion in Pulmonary Medicine</i>	United States and England

Source: Elaborated by the authors, 2020.

\*Preprint repository.

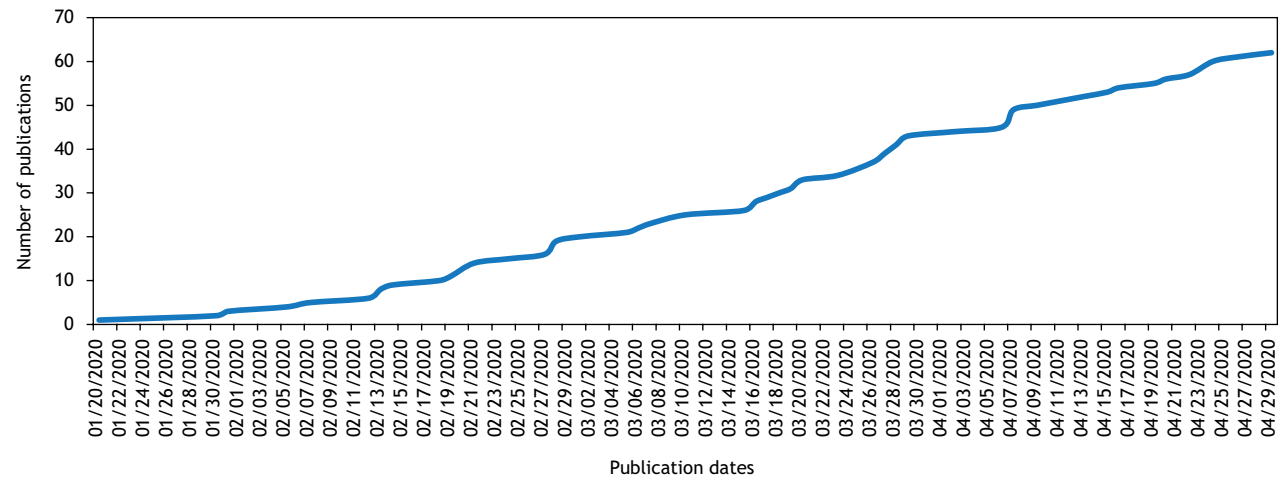
The participation of veterinarians in One Health strategies for the control of COVID-19, using the surveillance protocols and accumulated experiences in this area, was also frequent (6; 21.4%) (Table 1). Another 34 (54.8%) publications only reported the importance of this approach in fighting the virus (Table 2).

During the evaluated period, an increase in the number of publications was observed over the months of 2020 (Figure 2).

## DISCUSSION

During the evaluated period, an increase in the number of scientific publications was observed, mainly opinion and short format publications. The original articles that presented concrete proposals were the minority. It was also observed a comprehensiveness in the themes presented, which are in accordance with the premises of One Health.





Source: Elaborated by the authors, 2020.

**Figure 2.** The number of publications with the One Health approach for COVID-19 according to the search criteria of the systematic review, according to its publication date.

The One Health approach has been widely discussed in recent decades and arises from the need to provide an interdisciplinary response to problems that affect human, animal, and environmental health<sup>70</sup>. The applicability of the concept (One Health) was motivated by the rapid changes that occurred in the last decades in the population demographic density, urbanization, population expansion (allied to the invasion of ecosystems), intensification of extractive practices, and the consumption of food and energy sources (renewable or not) from the planet<sup>71</sup>.

The term One Health was initially adopted with great enthusiasm by veterinarians and international agencies in charge of zoonoses control, mainly the Food and Agriculture Organization (FAO), World Health Organization (WHO), and World Organization for Animal Health (OIE). Around the world, this group of professionals has promoted the One Health concept to address issues such as food security, antimicrobial resistance, climate change, and human-animal bonding<sup>72</sup>.

The emergence of zoonotic viruses with the potential to cause pandemic diseases, including extensive human mortality, has created several international crises<sup>73</sup>. In this regard, governments and scientists around the world have recognized the need for greater multi-professional collaboration to prevent and control zoonoses, and that such collaboration should include not only doctors and veterinarians but also biologists, wildlife specialists, environmentalists, anthropologists, economists, sociologists, and others<sup>71</sup>.

It is estimated that 60% of emerging human pathogens are of zoonotic origin. Of these, more than 71% come from wild animals. These pathogens can change hosts by acquiring new genetic combinations that have altered pathogenic potential, due to changes in behavior or due to the socio-economic, environmental, or ecological characteristics of the hosts<sup>74</sup>.

In the COVID-19 pandemic, it was observed that the consumption of wild animals as a protein source may have been responsible for the zoonotic escape of this pathogen in China<sup>75</sup>. Many zoonotic diseases are associated with the consumption of meat from wild animals. Game meat is considered a delicacy in many countries and this aspect has motivated the growth of this new commercial modality<sup>74</sup>. Tracking, capturing, handling, slaughtering in the field, and transporting carcasses involve risks of transmission of pathogens between species<sup>74,76</sup>. In addition, the production and sale of wild animals in farms require inspection of the entire production chain until the slaughtered meat is ingested, a fact that is not strictly followed in many countries<sup>77</sup>.

In the context of the COVID-19 pandemic, One Health approaches have proposed strengthening these collaborations between the human, animal, and environmental health sectors at the regional, national, and international levels<sup>13</sup>. Ideally, approaches should draw on the experiences of different professional classes to deal with the pandemic.

The integration of One Health's actions goes beyond local professional performance but this must be globalized, seeking the development of more robust and interconnected communication systems, which would enable the adoption of a strategy to contain emerging pathogens before their introduction and their establishment<sup>16</sup>.

The search for strategies to improve forms of communication with the population should be discussed in the context of One Health<sup>78</sup>. Thus, the development of education and health promotion actions carried out by One Health professionals can promote knowledge about zoonoses associated with wild animals, without instigating in society the idea that these are disease-transmitting pests that must be eliminated<sup>28</sup>.

Probably, live animal markets play an important role in this process and need to be addressed<sup>17</sup>. However, it is crucial to consider



the cultural context of these markets, which means that social sciences are again important in this process<sup>78</sup>. In addition, this means that the most viable solution may not be to close the markets for live animals but perhaps to “sectorize” them so that fewer different species mix in a specific market and that the specific intermediate hosts for SARS-CoV-2 can be removed from the markets or rigorously tested for the virus<sup>79</sup>.

Among the prevalent practices of One Health recommended in this review, we note the need to adopt eco-epidemiological investigations that make it possible to expand knowledge about the ecology of the virus, its reservoirs, and hosts in order to propose prevention and control measures<sup>17</sup>. The maintenance of barriers between natural reservoirs of zoonotic viruses and society is also proposed<sup>27</sup>.

It was also seen as necessary to insert the One Health professional as manager of the Epidemiological Surveillance and Primary Care systems<sup>29</sup>. Surveillance of emerging pathogens, in order to be effective, must be a continuous programmatic action and cannot be carried out punctually in the face of epidemic outbreaks<sup>80</sup>.

In addition, professionals working in One Health must have robust health information systems that are interconnected between different segments, enabling the monitoring of trends and predictive signaling of urgent situations, which go beyond the emergence of the pathogen but also the local capacities to assist the population<sup>81,82</sup>.

In times of crisis, it is up to the One Health professional to identify the need for interventions to control the psychological situations of the population. In a pandemic, people are more vulnerable, so the identification of these scenarios and the proposition of strategies that minimize the stress generated by the pandemic are extremely important<sup>83</sup>.

## CONCLUSIONS

With the set of articles raised in the systematic review, it was possible to assess that One Health approaches are as broad as its concept and that the pandemic context of COVID-19 can be an important milestone for the establishment of this multidisciplinary approach that has been promoted in recent decades, as the most comprehensive and appropriate solution to health problems.

One Health’s challenge converges to multi-professional practice, taking advantage of different knowledge to solve multi-causal problems. In this sense, the broader understanding of the determinants of health-illness-care must be resumed and discussed in a collaborative manner.

Still on the set of consolidated information, it is evident that biological issues (investigations related to viruses, hosts, and biotechnology) were the most discussed topics as One Health strategies, to the detriment of social, economic, and behavioral issues. Such observation highlights the need for the adhesion of other professional classes (sociologists, economists, and psychologists) as protagonists in the application of the One Health concepts.

No less important, there is a need for government policies, which must be adopted to guarantee multi-professional health actions. Likewise, professional councils should encourage and guide collaborative actions, seeking to provide legal support for One Health activities within each profession.

With the range of proposals discussed here, the applicability of One Health in the pandemic context experienced by COVID-19 becomes imperative. Human and animal health and protection of soil, water, air, and the environment, in general, are inextricably linked. It is up to professionals to promote and apply this concept, in an articulated and interdisciplinary way, seeking to promote the development of society in a sustainable way.

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#### Author's Contributions

Limongi JE - Conception, planning (study design), acquisition, analysis, data interpretation, and writing of the work. Oliveira SV - Planning (study design), acquisition, analysis, data interpretation, and writing of the work. The authors approved the final version of the work.

#### Conflict of Interests

The authors inform that there is no potential conflict of interest with peers and institutions, politicians, or financial in this study.



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