

# Biosafety and Biosecurity Measures Against Covid-19 and Other High-Risk Zoonotic Diseases

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## Abstract

N/A

The ongoing wide spread of Covid-19, also referred to as 2019-nCoV or SARS-CoV-2, is undoubtedly one of the deadliest zoonotic diseases the whole world has grappled with. As of April 10, 2020, this disease has infected above 1.6 million people in over 200 countries worldwide, and claimed the lives of more than 96,000.<sup>1</sup> Figure 1 shows the distribution of confirmed cases in the first 20 nations with the highest number of Covid-19 patients as of April 10, 2020, the least of which has over 9,000 cases.

**\*\*Figure 1\*\***

With the increasing trend of daily new cases and daily death from the beginning of March to April 9, 2020, as displayed on Figure 2, it could be predicted that this fatal pandemic could last well beyond a year. According to the modeling completed by pandemic intelligence experts at the Imperial College, London, the 2019 novel coronavirus is likely to remain for another 12-18 months.<sup>2</sup> Typically, past pandemics have lasted between one to three years.<sup>3</sup> Examples of such recent pandemics are the H1N1 influenza,<sup>4</sup> SARS-CoV,<sup>5</sup> Ebola,<sup>6</sup> and MERS-CoV,<sup>7</sup> which all lasted for more than 12 months. As the emergence of these novel viruses keep increasing, how could biosafety and biosecurity measures guard against the introduction of the harmful causative organisms to humans in the future?

**\*\*Figure 2\*\***

The terms biosafety and biosecurity are broadly used in diverse frameworks and refer not only to protection of humans and their surrounding environment against lethal biological agents, but also to global deactivation of arms of mass destruction.<sup>8</sup> In the concept of biorisk management, these two terms refer to best practices that prevent the spillover of toxic organisms to human beings and into the environment.<sup>9,10</sup> Although these two terms have been used interchangeably and often denoted with similar meanings, scientists have distinguished between the two concepts. According to Zaki,<sup>11</sup> biosafety involves all the preventive measures undertaken to eradicate strains of pathogenic microorganisms and their potential toxins. On the other hand, biosecurity includes a set of preventive strategies intended to reduce the risk of transmission of infectious diseases in humans, crops, livestock, isolated pests and genetically modified organisms.<sup>12</sup>

The World Health Organization (WHO) has classified disease-causing microorganisms into four different groups based on their principal characteristics, hazardous threat to individuals and the community, and their route of transmission.<sup>13,14</sup> Table 1 presents the four different groups with their associated risk levels.

**\*\*Table 1\*\***

Concluding from the descriptions for the various pathogenic organisms and their risk levels to individuals and the community in Table 1, the novel coronaviruses that cause Covid-19, SARS-CoV, MERS-CoV, and many other pandemic-causing pathogens, could be classified as risk level 4 pathogens. As spillover events keep occurring in recent years, and more of these high-risk emerging infectious diseases (EIDs) are likely to be introduced into the environment, it is necessary for the general public and stakeholders around the globe to institute biosafety and biosecurity measures in preventing the transmission of these biological toxins to mankind, livestock and their inhabitations. Among the core elements of the principles of biosafety measures and biosecurity strategies, the following are principal in guiding against EIDs:

- Effective regulations have to be put in place to avoid and manage intentional exposures to the sources and hosts of pathogenic organisms of medium to high risk levels. Strict observation of such policies around the world will minimize human activities that have caused several spillover events in the past.
- As the sources of novel pathogens have been identified in the past, it is necessary for scientists to inform the general public about the sources and hosts of such toxic organisms. Further research should also be targeted towards identifying these pathogens in animals and plants which are usually exposed to the environment. Such knowledge will help stakeholders and policymakers to notify the general public about the potential spillover events that are likely from contacts with identified sources and hosts of these pathogens.
- The risk assessment of pathogenic diseases of the past and a predicted assessment of likely EIDs in the future should be made available to the general public. Such awareness will inform the mass about the economic, social, and health impacts of these diseases. This will reinforce public adherence to policies and regulations which are instituted to limit contacts with pathogenic sources as people are aware of the potential losses to national and global economy, and the adverse effects on social life and health facilities.
- As health personnel, scientists, and leaders in various capacities often find themselves in the frontline during the emergence of epidemic and pandemic diseases, they need to be trained adequately to guarantee proper apprehension and execution of biosafety procedures to ensure the maintenance of a safe working environment for individuals and the wider community. This will ensure appropriate measures are taken to limit the spread of infections.
- Finally, routine upgrades are required to render instituted biosafety and biosecurity measures more effective and efficient in this ever-changing world. As the etiology and epidemiology of EIDs keep evolving, constant updates to safe practices in health centers around the world are required to adapt these practices to effectively manage the emerging diseases.

As various country-based mitigation measures are being implemented around the world to contain and control the course of Covid-19,<sup>15</sup> it is essential that the above biosafety and biosecurity measures are adopted and implemented to effectively manage the ongoing outbreak, and prevent future emerging infections.

### Declaration of Interests

The authors declare that they have no known competing financial conflicts of interests or personal relationships that could have appeared to influence the work reported in this paper.

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Figure 1. The distribution of Covid-19 in the first 20 nations with the highest cases.<sup>1</sup>

Figure 2. Daily new cases and daily death.<sup>1</sup>

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Table 1. World Health Organization risk group classifications for microorganisms.<sup>13,14</sup>

Risk Group	Individual Risk	Community Risk	Description
1	Low	Low	A microorganism that is unlikely to cause human or animal disease.
2	Moderate	Low	A pathogen that can cause human or animal disease but is unlikely to b
3	High	Low/moderate	A pathogen that usually causes serious human or animal disease but do
4	High	High	A pathogen that usually causes serious human or animal disease and ca

