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Sanitary, Hygienic and Organizational Criteria for Reducing the Risk of COVID-19

Oleg Mitrokhin [1], Elena Belova [1,*], Ali Alsaegh [1], Andrey Filin [2], Lyudmila Severova [3] and Margarita Timofeeva [4]

[1] Department of General Hygiene, I.M. Sechenov First Moscow State Medical University, Bld. 2, 2 Bolshaya Pirogovskaya Str., Moscow, Russia; mov1163@yandex.ru (O.M.); ms.ekochina@mail.ru (E.B.); ali0alsaegh@gmail.com (A.A.).

[2] Department of Human Ecology and Environmental Hygiene, I.M. Sechenov First Moscow State Medical University, Bld. 2, 2 Bolshaya Pirogovskaya Str., Moscow, Russia; andrey.filin@mail.ru (A.F.).

[3] Department of Phthisiopulmonology and Thoracic Surgery named after M.I. Perelman, I.M. Sechenov First Moscow State Medical University, Bld. 2, 2 Bolshaya Pirogovskaya Str., Moscow, Russia; lyudmila.severova.1992@mail.ru (L.S.).

[4] Department of Medical Law, I.M. Sechenov First Moscow State Medical University, Bld. 2, 2 Bolshaya Pirogovskaya Str., Moscow, Russia; timofeevainfo@mail.ru (M.T.).

* Correspondence: ms.ekochina@mail.ru (E. B.); ali0alsaegh@gmail.com (A.A.).

Abstract: Novel coronavirus (SARS-COV-2) was identified in December 2019 in the People's Republic of China, and it started emerging as an international healthcare emergency. COVID-19 pandemic might represent the tip of the iceberg, and it is the responsibility of all public healthcare authorities and experts to develop an adequate response using the right protocols and instruments to ensure public safety. As a response to the COVID-19 pandemic, we proposed a set of approaches to prevent the risk of COVID-19: risk assessment criteria, a preventive action plan, an occupational classification system, and sanitary-hygienic principles. All those approaches are beneficial in developing policies and decisions for improving the performance and the outcomes of national and global public health authorities. The risk measurement scale (high risk, medium risk, and low risk) can be used to measure the risk magnitude of contracting coronavirus infection, and to classify occupations according to the coronavirus infectious risk. Furthermore, an essential strategy for reducing the coronavirus risk is introducing sanitary-hygienic principles (time protection, distance protection, and impact scale protection) and the preventive action plan (reconsidering architectural standards, designing and building modular hospitals and modular equipment, and preparing a professional workforce).

Keywords: COVID-19; Coronavirus; SARS-CoV-2; Risk Assessment; Action Plan; Hygiene; Sanitation; Occupational Classification

1. Introduction

The novel coronavirus (COVID-19) outbreak started emerging as an international healthcare emergency, and governments, as a response, began carrying out a set of preventive measures to manage the infectious risk (isolation, quarantine, social distancing, and border closures) [1].

Combining comprehensive risk management, all-hazards, multisectoral and multidisciplinary approaches can establish trust based on cooperation and effective communicative systems that empower community awareness. Moreover, a people-centered community engagement is an essential approach for efficiently using and allocating the local resources to carry out the risk assessments and establishing community resilience [2].

According to the World Health Organization (WHO), the operational readiness of public health authorities as a key element of emergency preparedness will allow a timely, effective, and efficient response [3].

An example of the operational readiness of public health authorities is how the Federal Service for Surveillance of Consumer Rights Protection and Human Wellbeing of the Russian Federation (Rospotrebnadzor) maintained the risk of coronavirus infection by implementing a set of measures comprised of three stages:

1. Preventing or restricting the spread of coronavirus infection in Russia;
2. Preparing connections and health facilities for the possible spread of infection;
3. Enforcement of self-isolation for citizens for more than 30 days and maintaining social support measures [4].

Studies showed that mounting early risk-based approaches to focus on science can provide an organized and sound basis for containment of the pandemic and the development of more specific public health guidance to protect and prevent the spread of disease [5].

Evidence-based risk assessment is an essential tool for public health authorities to encounter epidemics and pandemics. For example, a risk assessment methodology for carcinogenic and non-carcinogenic effects in acute and chronic exposure. Another example is a classification of risk levels in public health when exposed to chemicals that pollute the environment [6–8].

Thus, this study aims to propose a set of approaches to prevent the risk of COVID-19: risk assessment criteria, a preventive action plan, an occupational classification system, and sanitary-hygienic principles.

2. Materials and Methods

Informational, analytical, statistical, and comparative research methods were applied: Based on published scientific research articles and government regulations in the field of hygiene, public health, sanitation, and epidemiology, we developed a COVID-19 Risk Assessment Criteria (RAC), a COVID-19 Occupational Classification System, and a preventive action plan.

3. Results

To assess the risk of contracting coronavirus infection, the following sanitary and hygienic risk assessment criteria (RAC) can be used: infectious dose, time, distance from the infectious source, and shielding.

- Infectious dose (D): according to the number of contacts with patients (people) with laboratory-confirmed COVID-19 [9];
- (n): Number of contacts with patients (people) with laboratory-confirmed COVID-19;
- Contact time in minutes (T): the time of contact with patients with laboratory-confirmed COVID-19 (optimally less than 15 min);
- Distance in meters (H): the distance from the infectious source (optimally up to 2 m) [10];
- Shielding (M): the usage of personal protective equipment (PPE) such as masks, respirators, gloves, and suits [11].

The risk magnitude of contracting coronavirus infection can be measured using the following risk measurement scale: High-Risk (HR), Medium-Risk (MR), Low-Risk (LR) [12]. And accordingly, we suggest using the following formulas to evaluate the risk of contracting COVID-19 infection:

- **High-Risk (HR) =** $D(1+n) \times T \times H \times M$**;**

The Risk Assessment Criteria (RAC) for the High-Risk (HR) of COVID-19 Infection: many contacts with infected people (more than one contact), the distance from an infected person is less than 1 meter, the contact time is more than 15 minutes, and the lack of personal protective equipment (PPE).

- **Low-Risk (LR) =** $D(1) \times T \times H \times M$**;**

The Risk Assessment Criteria (RAC) for the Low-Risk (HR) of COVID-19 Infection: a small number of contacts with infected people (not more than one contact), the distance from an infected person is more than 1 meter, the contact time is less than 15 minutes, and the proper usage of personal protective equipment (PPE).

- **Medium-Risk (MR);**

Medium-Risk (MR) is when the Risk Assessment Criteria (RAC) does not match the Low-Risk (LR) conditions: $LR < MR < HR$.

Reducing the spread of coronavirus infections can be done by using the following sanitary-hygienic principles:

- Time protection (the shorter the time of contact with potential carriers of a mild form of a disease, the lower the infectious risk),
- Distance protection (compliance with social distancing),
- Impact scale protection (the fewer the contacts with possible asymptomatic carriers, the lower the infectious risk).

It is necessary to carry out preventive measures according to the routes of transmission of the coronavirus. However, studies showed that COVID-19 main transmission routes are respiratory droplets and indirect contact, but other vertical transmission routes have yet to be confirmed [13–14].

The human infection risk could be very high due to the length of an exposure time window, the transmission routes, and the structural characteristics during travel or work [15]. In (Table.1), we proposed an occupational classification system according to the coronavirus COVID-19 infectious risk, and in (Table.2), we proposed a COVID-19 Risk Assessment Criteria (RAC). Moreover, we proposed a preventive action plan which can minimize the risk of mass epidemics and infectious diseases.

Table 1. COVID-19 Risk Assessment Criteria (RAC).

Risk Levels	Infectious Dose (Number of Contacts with Infected People)	Distance	Time	Shielding (Personal Protective Equipment)	Ventilation (Being in an Open or Enclosed Space)
High-Risk (HR)	More than 1 contact	Less than 1 meter	More than 15 minutes	Not using any personal protective equipment (PPE)	Being in an enclosed space without ventilation
Medium-Risk (MR)	Failure to meet any of the Low-Risk (LR) criteria				
Low-Risk (LR)	Not more than 1 contact	1–2 meters and more	Less than 15 minutes	Using personal protective equipment (PPE)	Being in an open space or a ventilated area

Table 2. Occupational classification system according to the coronavirus (COVID-19) infectious risk.

Risk Levels	Contact with Patients	Contact with Infected Medical Instruments	Contact with Infected Surfaces, Linen, and Clothes	Contact with Body Fluids Such As Sputum or Saliva	Air Disinfection	Ventilation of Premises
High-Risk (HR)	Without personal protective equipment (PPE)	Without disinfection	Without disinfection	Without personal protective equipment (PPE)	Not carried out	Not carried out
Medium-Risk (MR)	Failure to meet any of the Low-Risk (LR) criteria					
Low-Risk (LR)	With personal protective equipment (PPE)	With disinfection	With disinfection	With personal protective equipment (PPE)	Carried out	Carried out

The Preventive Action Plan (PAP) includes the following measures:

- Reconsidering architectural standards:

Reconsidering architectural standards for building railways, airports, and shopping malls for disinfection (free ventilation, water supply, sewage system, and low ceiling height), also separating the entrances, exits, and parking lots so they will function according to the profile of their activities; these premises can receive and sort patients in case of any epidemiological situation.

- Reprofiling hospitals:

Reprofiling hospitals can be beneficial in managing any epidemiological situation.

- Designing and building modular hospitals and modular equipment:

Designing and manufacturing modular medical equipment, including medical furniture, transportation, and tools for biomaterials collection.

- Providing mobile diagnostic units.
- Preparing a professional workforce:

Preparing a highly qualified medical and non-medical workforce.

- Clear structuring, processing, and reliability of information support:

Preventing panic among the population, and eliminating the appearance of fake news.

Implementing the Preventive Action Plan (PAP) can minimize the spread of mass epidemics and infectious diseases, as well it can improve the readiness of public health authorities on countering biological threats in the short, medium, and long terms.

4. Discussion

Establishing any risk assessment methodology for research purposes should go through four specific stages: (1) hazard identification, (2) dose-response, (3) risk characterization, and (4) informing decisions. These stages are evidence-based processes, and we believe that it is possible to implement them for determining the infectious risk of the novel coronavirus COVID-19 in the population [16–17].

The hazard identification stage involves the following elements: identifying all sources of pollution, determining routes of entry, establishing the routes of exposure, and identifying the exposure duration (exposure time) [18].

Generally, respiratory infections can spread via contact with droplets from expiratory activities (talking, coughing, and sneezing) and aerosol-generating clinical procedures. The current sources of the coronavirus disease are the following: patients infected with SARS-COV-2, patients with the COVID-19 incubation period, biological fluids, objects and surfaces with which a person came into contact, or objects and surfaces in the area of dispersion of aerosols when sneezing or coughing [19–22].

The main routes of transmission are respiratory droplets and direct contact. Any person who is in close contact with an infected individual is at risk of being exposed to potentially infective respiratory droplets. Droplets may also land on surfaces where the virus could remain viable. On surfaces made of different materials such as plastic, metal, or glass, the virus can remain infectious for 2 hours up to 9 days. A high temperature like 30 °C or 40 °C can reduce the persistence duration of highly pathogenic viruses [23–24].

Routes of exposure can be direct (contact with a healthy person) and indirect (through surfaces and objects contaminated with the biological fluid of an infected person) [25–26].

The exposure duration (exposure time) is also essential in identifying the infectious risk of COVID-19. The optimal exposure time with a COVID-19 patient is not more than 15 minutes [27].

Social distance is an effective approach for preventing the spread of coronavirus COVID-19 infection, and can be a criterion for identifying the hazard is the distance be-

tween an infected COVID-19 and a healthy person. Recommendations regarding an optimal social distance for reducing the risk of the coronavirus varies from a public health authority to another: The World Health Organization (WHO) recommends 1 meter; The Centers for Disease Control and Prevention (CDC) of the United States of America recommends 1.8 meters; The Federal Service for Surveillance of Consumer Rights Protection and Human Wellbeing of the Russian Federation (Rospotrebnadzor) recommends 1.5 meters [28–30].

Hazard identification is closely related to assessing the dose-response relationship; the risk assessment in a dose-response relationship is a quantitative-based process that can establish the relationship between the exposure dose (concentration) and the harm incidence in the exposed population [31].

The risk of contracting coronavirus infection can be assessed in a dose-response relationship; the higher the viral concentration of the source, the higher the infectious risk of coronavirus. Accordingly, during assessing the dose-response relationship, a priority should be given to the epidemiological and clinical results [32–33].

The exposure assessment involves determining the severity, the frequency, the exposure routes, and the population's size and nature [31].

It is clear that during the spread of coronavirus infection, determining the environment is a priority to clarify the exposure scenario that describes the movement path from the place of formation to the point of exposure [34].

The COVID-19 Risk Assessment Criteria (RAC), the Preventive Action Plan (PAP), the COVID-19 Occupational Classification System, and the COVID-19 Sanitary-Hygienic Principles are beneficial approaches in developing policies and decisions to improve the performance and the outcomes of national and global public health authorities.

Contact tracing is a key strategy to prevent the further spread of COVID-19, and we believe that RAC can be beneficial in all contact-tracing steps: case investigation, contact tracing, contact support, and self-isolation [35].

Many countries like Bahrain and Kuwait started using smart bracelets and smartphone applications for tracing and monitoring contacts. Moreover, we believe that RAC might be useful while developing contact-tracing technologies such as artificial intelligence (AI) algorithms for mobile applications [36–38].

5. Conclusion

Risk assessment is necessary for preventing the spread of coronavirus (COVID-19), and based on the sanitary-hygienic risk assessment criteria (RAC) the infectious risk of COVID-19 can be high, medium, or low. Accordingly, the following formulas can be used to evaluate its infectious risk:

- High-Risk (HR) = $D(1+n) \times T \times H \times M$; RAC for a High-Risk (HR) of COVID-19 Infection: many contacts with infected people (more than one contact), the distance from an infected person is less than 1 meter, the contact time is more than 15 minutes, and the lack of personal protective equipment (PPE).
- Low-Risk (LR) = $D(1) \times T \times H \times M$; RAC for Low-Risk (HR) of COVID-19 Infection: a small number of contacts with infected people (not more than one contact), the distance from an infected person is more than 1 meter, the contact time is less than 15 minutes, and the proper usage of personal protective equipment (PPE).
- Medium-Risk (MR); Medium-Risk (MR) is when RAC does not match the Low-Risk (LR) conditions: $LR < MR < HR$.

Reducing the infectious risk is possible through the use of the following sanitary-hygienic principles: time protection, (2) distance protection; (3) impact scale protection.

Implementing the Preventive Action Plan (PAP) can minimize the spread of mass epidemics and infectious diseases, as well it can improve the readiness of public health authorities on countering biological threats in the short, medium, and long terms. PAP includes the following principles: reconsidering architectural standards, designing and

building modular hospitals and modular equipment, and preparing a professional workforce. Moreover, an occupational classification system was proposed according to the infectious risk of COVID-19 (high, medium, and low risk).

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