

Mini Review

Risk assessment of corona virus: Implementing hierarchy of hazard control in workplaces

Fatma Demircan Yildirim¹ and Ismail Ekmekci^{2*}

¹Department of Occupational Health and Safety, Institute of Science, Istanbul Commerce University, Kucukyali, Istanbul, Turkey

²Department of Industrial Engineering, Faculty of Engineering, Istanbul Commerce University, Kucukyali, Istanbul, Turkey

Received: 17 February, 2021

Accepted: 01 March, 2021

Published: 02 March, 2021

*Corresponding author: Ismail Ekmekci, Department of Industrial Engineering, Faculty of Engineering, Istanbul Commerce University, Kucukyali, Istanbul, Turkey, E-mail: iekmecci@ticaret.edu.tr

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Introduction

The novel coronavirus or the other name Severe Acute Respiratory Syndrome coronavirus-2 (SARS-CoV-2), was first identified in Wuhan, China, in December 2019 among a group of patients that have the same symptoms of viral pneumonia. Due to the socio-economic factors in Zhuhai, Wuhan and globalization have also accelerated the spread of infectious diseases to the other parts of China and the world [1,2], The World Health Organisation (WHO) declared Covid-19 a public health emergency of international concern as of 1 February 2020 and epidemic as pandemic on 12 March 2020. The virus spreads very rapidly and globally, as of 25 February 2021, there have been more than 113 million confirmed cases of Covid-19, including more than 2.5 million deaths, reported to WHO. Although initiation of vaccination have raised hopes of bringing the pandemic under control, the recent news about the mutated variant of the novel coronavirus associated with recent infections make governments and people concerned about the future. WHO is warning that back to old normals is likely to take a long time, possibly several years due to the time required to manufacture and distribute millions of doses of vaccine.

Coronaviruses are the largest group of viruses and have caused three global outbreaks in the last 20 years, Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS) and the most recent Covid-19 pandemic, that have many similarities [3]. However, the origin of the novel SARS-CoV-2 is unclear so far while the causative agents

of SARS and MERS have known [4]. Covid-19 mostly affects the pulmonary system in addition to extrapulmonary organ and systems including the cardiac, gastrointestinal, hepatic, renal, ocular, and dermatologic, which could have significant health consequences [4-8]. Recent studies suggest that the risk of serious infection and mortality associated with Covid-19 differs between different ethnic groups and races, and men are at higher risk than women [9]. Low sensitivity and specificity of antibody tests used in the diagnosis of both symptomatic and asymptomatic Covid-19 patients poses a major challenge to managing the outbreak [10].

Besides the effects on health, a worldwide pandemic has major effects on the global economy, travel, trade, tourism, food, education, consumption and eventually, investment and financial markets, therefore effects people even who do not infected. The economic impact would take a hit in Gross Domestic Product (GDP) ranging from 3-6% depending on the country in a mild scenario; in severe scenarios, it is more than 10%, and in some countries, more than 15% [11] and global economic losses of the Covid-19 outbreak is estimated to reach up to \$8.8 trillion [12]. For this reason, governments try to open businesses in order to overcome the pandemic with the least economic loss. As businesses work towards reopening in part or full, safe workplaces must be provided for any return to the workplace in a way that cares for employees and safeguards their health and wellbeing with *new normals*. Being in close with other co-workers, not only put workers at high risk for disease, but also increase transmission of the virus. At this point Occupational Health and Safety (OHS) professionals



have been challenging with managing the risks of Covid-19 in workplaces with mindful of advice and restrictions that continue to change.

The United States (US) Occupational Health and Safety Administration (OSHA) and Centers for Disease Control and Prevention (CDC) have issued health-based risk assessment strategies and recommendations for current Covid-19 pandemic that are consist of various engineering controls, administrative processes, and proper use of appropriate Personal Protective Equipment (PPE) [13,14] compatible with the US National Institute for Occupational Safety and Health (NIOSH) hierarchy of hazard controls [15]. These strategies focuses on three main measures for prevention: wearing mask, maintaining social distancing of at least 2 metres and frequent and thorough hand-washing [16].

Covid-19 can be brought under control by taking effective measures in the workplaces along with the measures to be taken on the society [17]. The objective of this study is to provide considerable expertise in the occupational hygiene and exposure science and professional communities that can contribute helping employers and workers to contain and delay the spread of Covid-19.

Exposure assessment

The major route of transmission of Covid-19 is droplet, close contact and touching surfaces contaminated by them and then touching nose, mouth and eyes [18]. The virus can remain viable for two/three days on plastic and metallic surfaces [19]. Droplet spread was detected over 6-8 m and coronavirus could spread beyond 1-2 m in a concentrated packet through coughs or sneezes [20] and the risk of corona virus transmission at 1 m could be 2-10 times higher than at 2 m [21]. However, infection transmission with contaminated water, stools, with subsequent feco-oral route have also been reported [19,22]. Infection is transmitted by symptomatic patients but can also occur from asymptomatic people also before onset of symptoms [23]. Long incubation time before onset of symptoms is the greatest challenge to prevent spread.

Risk management

Since the major transmission routes of corona virus are contact and inhalation, transmission can be stopped in the workplaces by preventing the two factors, virus and worker, come together. Elimination of transmission routes, identification and preventing of high contact activities, decreasing viral load, identification of exposure levels and vulnerable workers must be determined by applying hierarchy of hazard controls. This means putting in place the control measures to first eliminate the risk and if this is not possible, minimize worker exposure.

Based on work activities contagion can be lower or higher depending on several factors: e.g. work sector; need for close contact or need for repeated or extended contact with people known to be or suspected of being infected [24]. Therefore, OSHA has divided job tasks into four risk exposure levels from

very high to lower risk group and the most workers in the world will likely fall in the lower exposure risk or medium exposure risk levels [14].

Elimination and substitution are the best ways to mitigate the risks [25] therefore many companies have started working from home as a temporary or alternative working arrangement. However the International Labour Organisation (ILO) estimates that close to 18 per cent of workers have occupations that are suitable for working from home [26].

Engineering controls are the second option to reduce the hazard/risk at source without relaying to worker behavior. Structural measures like simple screens and barriers may offer some degree of protection from Covid-19 compared to the more open interactive style of work [27]. Although, the viral particles are too small to be contained by even the best High Efficiency Particulate Arresting (HEPA) and Minimum Efficiency Reporting Value (MERV) filters, proper filter installation and maintenance can help to reduce the risk of airborne transmission [28]. Additionally, higher outside air fractions and higher air exchange rates in workplaces may help to dilute the indoor contaminants, including viral particles, from air that is breathed within buildings.

Administrative controls limit exposure by scheduling shorter work times in contaminated areas or by implementing other "rules". Implementation of the hygiene rules with providing hand sanitizer, disinfecting wipes, facial tissues, and with simple instructions to employees to alter behavior was shown to significantly reduce the phage on fomites and hands [29].

Frequent cleaning of surfaces with proper cleaning agents [30] and disinfection of hands with alcohol based sanitizers can reduce the transmission of pathogenic agents [31,32] at a greater of phage concentrations of 85.4% [33]. However, sanitizers are volatile chemicals and the effects are relatively short lived due to evaporation, so the best defense for to stop transmission of virus is to ensure public health hygiene and sanitation interventions, such as the use of soap, hand sanitizers, surface disinfectants, and behavior modification [29,34]. More persistent surface cleaning treatments, the use of nanomaterials such as nano-silver, may be used to reduce surface viral load [35]. Nanoparticle treated air filters can also reduce the airborne virus concentration [36]. Nevertheless, disinfection procedures of equipments in hospitals and wards must be provided in high attention against patients in isolation precautions because of higher bacterial loads and a potential higher CFU load [37,38].

Sharing equipment and tools in the working environment must be avoided as much as possible, and all employees must use the areas and items identified for themselves. Critical locations with high risk must be disinfected frequently to reduce pathogen contamination. Mid-day disinfection of high-touch surfaces can produce measurable viral load reductions, and even greater reductions can be achieved by adding the use of hand hygiene products.



Since behavior change is difficult and requires sustained motivation and support, nevertheless most efforts to change behaviours have had limited success [39], training is crucial for employees' support for of any safety plan. Employees must be trained about Covid-19, transmission routes, prevention methods, hygiene rules, social distancing techniques and PPE.

As WHO and other institutions have recommended, wearing proper mask or PPE is one of the major defence to coronavirus [16]. Face mask use could result in a large reduction in risk of infection, with stronger associations with N95 or similar respirators compared with disposable surgical masks or similar [40]. However, using PPE must not take the place of primary prevention interventions.

Conclusion

Corona virus is a biological hazard that no one knows when pandemic will end. Therefore we all have to learn to live with pandemic by transforming our behaviors, habits, houses, schools and workplaces according to the "new normals" based on reducing the infection risk. The major of the society is not yet infected and OHS measures to be taken at workplaces will prevent the occurrence of next waves of the pandemic and ensures the increase of cases in *acceptable limits*.

In order to minimize the health risk of coronavirus in workplaces, OHS specialists should make appropriate recommendations for all employees. Despite the lack of knowledge about coronavirus and experience in managing pandemic, risk assessment process should based on the principles for determining appropriate risk management steps to reduce transmission in the workplace, facilitating business continuity, and advancing worker well-being. In order to minimize the effects of both current and future outbreaks, risk management process should include on an integrative approach that combines the best available scientific data with psychosocial and community factors.

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Citation: Yildirim FD, Ekmecki I (2021) Risk assessment of corona virus: Implementing hierarchy of hazard control in workplaces. *Arch Prev Med 6*(1): 003-006. DOI: <https://dx.doi.org/10.17352/apm.000027>