

# COVID-19 Pandemic

## *What Has Work Got to Do With It?*

Since the start of the COVID-19 global pandemic more than 200 countries and territories have experienced devastating public health, social, and economic effects. Among those falling ill in large numbers in the United States are workers in occupations or industries deemed “essential,” critical to maintaining services to society during the pandemic. While definitions vary, “essential workers” typically include workers in health care, food and agriculture, manufacturing, emergency response, and transportation.<sup>1</sup> Essential workers whose work cannot be done from home, or those who work in close proximity to others (increasing the risk of exposure) also tend to have lower incomes.<sup>2,3</sup> Some groups of essential workers are at increased risk of COVID-19.<sup>4</sup> As well, African American and Latinx communities have been particularly hard hit by the coronavirus, with a disproportionate number of infections and deaths.<sup>5–8</sup> Black, Native American, and Hispanic/Latinx workers are more likely to be essential workers who work in person and close to others and have lower incomes compared with white workers.<sup>2</sup> Immigrant workers are also more likely to be essential workers than native-born workers.<sup>9</sup> One study reported racial/ethnic disparities in job characteristics such as inability to work from home and work in public safety, public utility, food or health care.<sup>10</sup> African American and Latinx workers are disproportionately represented in manufacturing, grocery,<sup>11</sup> meatpacking,<sup>12</sup> and transit,<sup>13</sup> which have also seen widespread workplace outbreaks of COVID-19.

In this paper, we examine two issues that impact on the magnitude and severity of the Covid-19 epidemic among workers—those work-related factors that increase the likelihood of exposure to SARS-CoV-2 and to infection (differential exposure) among workers, including being an essential worker, and work-related risk factors impacting the severity (differential vulnerability) of COVID-19 illness. Stressful working<sup>14</sup> and low-income living conditions<sup>15</sup> increase the risk of comorbid conditions, such as cardiovascular disease (CVD), hypertension, and diabetes, as well as impaired immune function, all of which increase the likelihood of severe illness if exposed to SARS-CoV-2.<sup>16–18</sup>

Figure 1 provides a model of the overlapping and intersectional relationships between COVID-19 and work that also helps to explain the disparities in exposure, infection, and severe outcomes by race-ethnicity and socioeconomic status (SES).

### **Factors Impacting the Likelihood of SARS-CoV-2 Exposure and Infection Among Workers**

Essential work is characterized by several features that increase the likelihood of infection. Essential workers are more likely to work away from home (eg, in manufacturing, health care, as warehouse workers, first responders) and that brings them in close contact with the public (eg, grocery store workers, food service workers), as well as in close proximity with their coworkers in indoor environments that may not be properly ventilated (eg,

meatpackers) nor where social distancing is possible. This increases the likelihood that these workers are exposed to SARS-CoV-2.<sup>19</sup> Other essential workers, such as health care workers and bus drivers, also come into close contact with the public; drivers may not be protected (especially if they only have cloth masks) as they work in close quarters with the public in crowded buses,<sup>13</sup> while health care workers, often with inadequate personal protective equipment (PPE), are face-to-face with patients ill with COVID-19 and thus resulting in higher infection rates among these workers.<sup>13,20</sup>

Additional factors impacting the likelihood of infection are race and ethnicity. African Americans and Latinx people are among those at higher risk for contracting COVID-19 and have higher rates of hospitalization and fatality.<sup>5–7,10</sup> This is due, in part, to greater socioeconomic disadvantages and discrimination which increases the rate of comorbid conditions, reduce their access to and the quality of health care.<sup>15,17</sup> In addition, African Americans and Latinx people are more likely to be employed in essential in-person (in-person—work at the usual workplace as opposed to at home or remotely) close-contact jobs.<sup>2</sup> For example, they are twice as likely as other workers to work in the animal slaughtering and processing industries (locations of major COVID-19 outbreaks).<sup>19</sup> Racial/ethnic and SES COVID-19 disparities, also result from workers of color and poorer workers being more likely to live in densely populated areas where crowding increases the risk of exposure,<sup>5</sup> to live in households with workers who must work close to others, and households with at least two generations of adults.<sup>2</sup>

### **Factors Impacting the Severity of Infection Among Workers**

As occurs with other coronaviruses severe acute respiratory syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS-CoV), COVID-19 can lead to acute respiratory distress syndrome as a consequence of viral pneumonia. Epithelial cells of the respiratory tract that express angiotensin-converting enzyme 2 (ACE2) on their surface appear to be the predominant entry for the virus into the respiratory tissues. The ACE2 is part of the renin-angiotensin-aldosterone system (RAAS) which is critical for the homeostasis of the cardiorespiratory system. The SARS-CoV-2, appears to interrupt the RAAS pathway and downregulate the ACE2 leading to respiratory dysfunction and major lung damage. In addition, uncontrolled COVID-19 has been shown to provoke an atypical immune response by triggering a cytokine storm where pro-inflammatory cytokines and chemokines such as tumor necrosis factor- $\alpha$ , interleukin-1 $\beta$ , and interleukin-6 are overproduced by the immune system causing multi-organ damage.<sup>21,22</sup> It also causes coagulation abnormalities, including clotting and other thromboembolic events, such as pulmonary embolism. Recent studies have shown that susceptibility to and the outcome from COVID-19 are strongly associated with preexisting CVD and the relationship between COVID-19 and CVD is bidirectional.<sup>23</sup> COVID-19 has been shown to promote cardiovascular damage, such as myocardial injury, arrhythmias, coronary heart disease, and venous thrombosis. It is therefore postulated that COVID-19 may also directly influence and infect different heart muscle cells, such as cardiomyocytes, endothelial cells, and pericytes independent of respiratory issues, leading to major cardiovascular failure.<sup>24–26</sup> The pre-existence of comorbid conditions appear

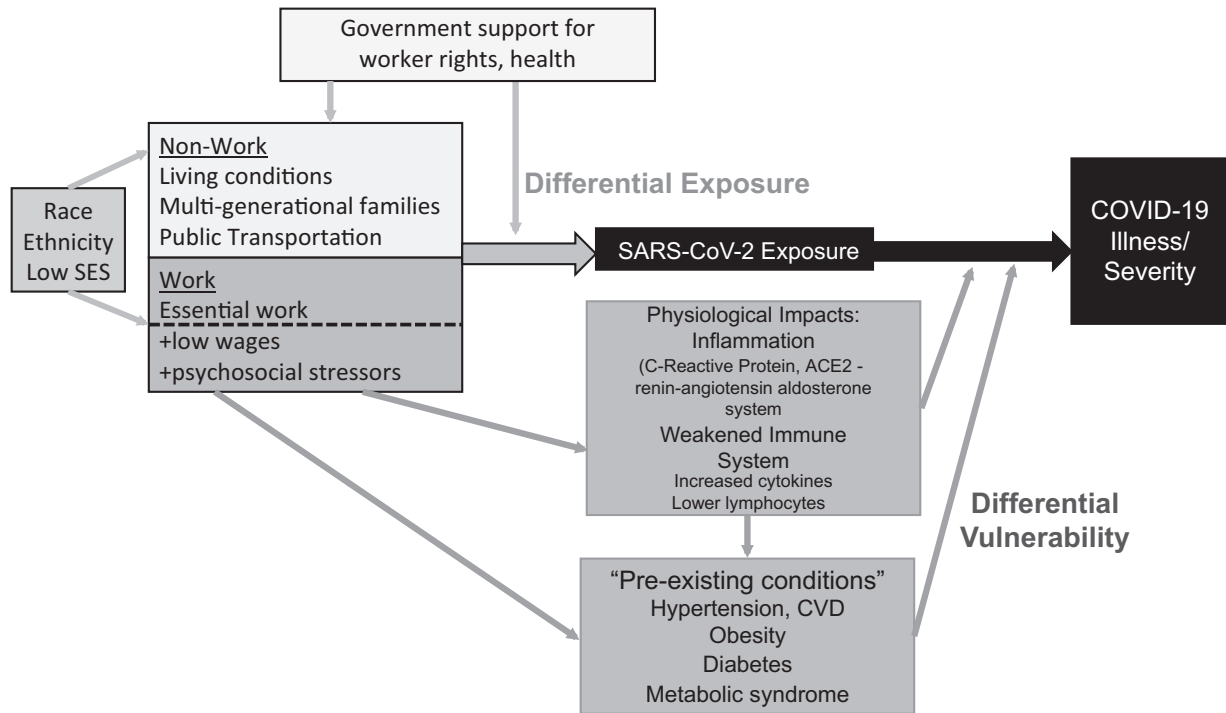
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**FIGURE 1.** Socioeconomic status, race/ethnicity, working conditions, and risk of SARS-CoV-2 infection and COVID-19 severity. Note: “Differential exposure” refers to greater exposure to SARS-CoV-2 and risk of infection among “essential workers”, workers of color and among people experiencing lower socioeconomic working and living conditions. “Differential vulnerability” refers to risk factors (resulting from living and working conditions) that increase COVID-19 severity, if an individual is infected by SARS-CoV-2.

to enhance the ability of the virus to take root and further damage the cardiovascular system.

We suggest that chronic exposure to stressors, including psychosocial workplace stressors, interact with COVID-19 related sequelae. Stress also increase the body’s neural and endocrine responses, a process named “allostasis.”<sup>27</sup> Another effect of chronic stress exposure is immune function suppression which increases susceptibility to infection over time. Elevation of cortisol is a natural hormonal response to acute stress, which increases the immune response and is initially anti-inflammatory. However, chronic activation may lead to resistance and accumulation of stress hormones and increase cytokine production which compromises the immune response.<sup>28</sup>

Over the past 40 years, research has identified a number of workplace psychosocial risk factors that provoke the stress response and contribute to risk of illnesses, such as burnout, depression, anxiety,<sup>29</sup> elevated blood pressure (hypertension), and CVD.<sup>14</sup> Workplace stressors, such as high job psychological demands combined with low worker control over those demands (known as “job strain”) elevate “allostatic load.”<sup>30</sup> Low levels of coworker and supervisor support also increase the risk of illness created by high job demands.<sup>31</sup> Another work stressor (ERI or effort-reward imbalance) is an imbalance between employee efforts and low rewards for those efforts.<sup>32</sup> Overall, in addition to job strain and ERI, there are a substantial number (more than 12) of documented workplace stressors, including stressful organizational climate, harassment, inflexible scheduling, job insecurity, long working hours, and work-life conflict contributing to disease.<sup>33–35</sup> The severity of COVID-19 is heightened in those with these comorbid health conditions.<sup>24,36,37</sup> Bus drivers, for example, are among the groups of essential workers in which substantial elevations of blood pressure are associated with their work.

Chronic stress, including that caused by work stressors, will cause an increase in pro-inflammatory cytokines and

dysregulation of the immune system, which can lead to activation of latent viruses. In adults, positive associations have been reported between chronic work stressors and inflammatory markers such as C-reactive protein (CRP). High levels of CRP, an indicator of elevated CVD risk, is associated with increased risk of SARS-CoV-2 infection.<sup>21,22,38,39</sup> For example, caregivers experience longer healing time from wounds due to lower lymphocyte accumulation, higher cytokines production, and lower antibody production after vaccinations.<sup>25,40</sup>

Work stressors can affect individuals cumulatively throughout their working lives and the risk of developing comorbid conditions increases substantially with age, in part due to chronic exposure to workplace stressors.<sup>41</sup> Also, as people age, the immune system weakens and the body’s ability to regulate the cortisol response to both physical and psychological stressors decreases. Some research suggests that older adults have difficulty terminating cortisol production in response to stress.<sup>42,43</sup> At the cellular level, in some research chronic exposure to stressors has also been linked to shortened telomere length in adults. The length of telomeres is directly related to SES and poverty,<sup>44,45</sup> that is, the lower the SES the shorter the telomeres. Furthermore, low SES may lead to accelerated aging during stress exposure and lower immune response significantly increasing the likelihood of manifest infection with SARS-CoV-2 and severity of symptoms.<sup>46</sup> In addition, the unhealthy behaviors promoted by work stressors (lack of physical activity, unhealthy eating, alcohol and drug use, and lack of adequate sleep) further contribute to development of chronic diseases, accelerated aging, and lowered immunity level.<sup>47</sup>

The risk of a CVD event is increased up to 40% in those who are exposed to the above-mentioned work stressors compared with those who are not.<sup>33,48</sup> Work stressors also contribute to increased risk of a second CVD event<sup>49,50</sup> if returning to work and facing the

same job stressors as well as an increased likelihood of not returning to work at all. As a matter of fact, the risk of a recurrent cardiovascular event is increased by 65% in employees with “job strain” or and other psychosocial work stressor risk factors.<sup>26,51,52</sup> Workers who have suffered a cardiovascular event or have comorbid conditions also are more likely to take time off from work due to their illnesses. How these factors impact on the ability of essential workers to continue at work during the current pandemic requires further investigation.

Racial and ethnic disparities in work exposures contribute to both the likelihood and severity of infection, since workers of color are more likely to be working in essential jobs in-person and close to others,<sup>2</sup> and have work stress-related chronic conditions. Social and physical distancing to reduce contacts between non-household members to reduce COVID-19 transmission to susceptible individuals, may be less effective in low-income neighborhoods. Many low-income workers of color live in multi-generational households, with older family members who are at higher risk of severe outcomes if exposed to the virus. These essential workers face the dilemma of continuing to work and potentially exposing older family members in the household.<sup>2</sup> Prevention of COVID-19 among essential workers requires an examination not only of those factors increasing exposure to the virus but also of the working conditions that contribute to comorbidities and immune disruption.

### Work Stressors During COVID-19 Pandemic

Essential in-person work pays lower than median wages<sup>2</sup> and may also have higher than average prevalence of work stressors. However, during the COVID-19 pandemic, it is clear that stressors have increased in various essential occupations (and perhaps most occupations) due to the threat of infection requiring constant vigilance to avoid infection and the adoption of new demanding behavioral norms, such as mask wearing, social and physical distancing, and isolation which may cause additional effects on mental health.<sup>23</sup> Job insecurity is a compelling work stressor during this pandemic, especially for essential and precarious workers. Many workers have either lost their jobs, are afraid of losing their jobs, or fear being infected, and/or transmitting the infection to their households and family members.<sup>53,54</sup> Additional factors that contribute to work stress include struggles to manage work-life/family balance while working either from home or at the workplace, managing children’s online education, having childcare, and trying to learn new skills related to technology and communication. Job demands have become heightened for some during the COVID-19 pandemic.<sup>55,56</sup> Workers who were previously struggling with mental health issues are now experiencing heightened stressors, which further increases their vulnerability. An increasing proportion of young people are reporting suicidal ideation during the pandemic and many adults are reporting burnout.<sup>16,57</sup> Increasing opioid fatalities have also been reported during the pandemic.<sup>58</sup> Moreover, unhealthy behaviors such as increased alcohol consumption, eating poorly, and exercising less, as a way of coping with the stress of the pandemic, contribute to the development of chronic diseases, and can further increase the severity of infection.<sup>17</sup>

### CONCLUSION AND RECOMMENDATIONS

Essential in-person workers are at greater risk of SARS-CoV-2 infection due to their living and working conditions bringing them into closer contact with those already infected, and at greater risk of more severe infections when exposed to SARS-CoV-2 due to their higher rate of comorbid conditions and immune system disruption possibly related to chronic exposure to work stressors.

The first step in protecting essential workers and all other workers is to protect them from becoming infected in the first place, an imperative that is still not being addressed adequately during the pandemic. Providing personal protective equipment (PPE),

including masks, improved ventilation, and practicing social and physical distancing must be done at the workplace and while going to and from work. Fortunately, some state occupational health agencies are now implementing new work environment regulations that provide for enforceable workplace protections.<sup>59</sup>

In addition to improved workplace safety and health, changes are needed that make it possible for essential workers to properly protect themselves and practice social and physical distancing in their homes and communities. Essential workers who earn lower incomes, have little paid sick leave, and have little job security are less likely to be able to follow public health recommendations, such as isolation or quarantining during this pandemic.<sup>5,7</sup> Many workers are unable to quarantine when they get sick since it could jeopardize their jobs, income, and health care. These economic constraints contribute to the spread of the virus in workplaces and communities. Examples of this were documented in meatpacking and farm worker virus outbreaks, where some workers were reluctant to get tested or to stay at home if exposed because of possible wage or job loss, and were also encouraged by management to work while exposed or even while symptomatic.<sup>60,61</sup>

Essential workers would benefit from social policies that provide for paid family leave and fair workers’ compensation benefits. Needed, most importantly, are protocols and enforceable regulations that provide for safe workplaces and for adequate sick leave without penalty or fear of job loss if they become ill. While the Congress passed the Family’s First Coronavirus Act and the CARES Act that requires employers to pay for extended family leave or sick pay for their employees, it does not apply to employers with over 500 employees. In addition, workers may not know their rights or may be afraid to even get tested if it means they could not continue working and providing for their families.<sup>62</sup>

A second critical step to successfully protect all workers from COVID-19, in the absence of a definitive medical treatment or a vaccine, is to address the work environment and its culture, including psychosocial work stressors.

Occupational psychosocial risk factors predate the COVID-19 epidemic, but they contribute to exposure, susceptibility to infection, and severity of illness during the pandemic. Workers of color, who make up a larger percentage of essential in-person workers and have the highest rate of COVID-19 infections and deaths, are made even more vulnerable due to the widespread preexistence of comorbid conditions caused by stressful living and working conditions. This puts them in a higher risk category<sup>10</sup> for serious disease after exposure. Reducing the presence of comorbid conditions requires eliminating their social and occupational causes. Doing so will reduce a workers’ likelihood of comorbid illnesses, such as diabetes, hypertension, and CVD, and thus reduce susceptibility to severe COVID-19 illness now and in future pandemics.

Finally, this pandemic underscores the deep inequities in this country that existed long before SARS-CoV-2 and which have now been further highlighted. Addressing economic and social inequities as well as unhealthy working conditions is paramount. Of course, many of these are long-standing inequalities that will need to be remedied as we move ahead. What all workers need right now is safe and healthy work, the ability to practice social and physical distancing, access to affordable medical care, living wages, and to be treated with dignity and respect. As it stands now, many workers are compelled to go to unhealthy workplaces and work even when ill, which contributes to the continuing epidemic.

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