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COMMENTARY

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A novel COVID-19 based truck driver syndemic? Implications for public health, safety, and vital supply chains

Michael Kenneth Lemke PhD[1] | Yorghos Apostolopoulos PhD[2] | Sevil Sönmez PhD[3]

[1]Department of Social Sciences, University of Houston-Downtown, Houston, Texas

[2]Complexity & Computational Population Health Group, Texas A&M University, College Station, Texas

[3]College of Business Administration, University of Central Florida, Orlando, Florida

Correspondence
Michael Kenneth Lemke, PhD, One Main Street, Houston, TX 77002.
Email: LemkeM@uhd.edu

Abstract

U.S. long-haul truck drivers traverse great distances and interact with numerous individuals, rendering them vulnerable to acquiring and transmitting coronavirus disease 2019 (COVID-19). Together, the unique co-occurrence of pronounced health disparities and known COVID-19 infection, morbidity, and mortality risks suggest the possibility of a *novel COVID-19 based truck driver syndemic* due to advanced driver age and endemic health issues. In turn, COVID-19 sequelae may perpetuate existing health disparities. The co-occurrence of afflictions may also result in compromised safety performance. To curb the likelihood of a COVID-19 based truck driver syndemic, several action stepsare needed. First, key COVID-19 metrics need to be established for this population. Second, relationships between long-haul trucker network attributes and COVID-19 spread need to bedelineated. Third, mutually reinforcing interactions between endemic health disparities and COVID-19 vulnerability need to be elucidated. Finally, grounded in the aforementioned steps, policies and interventions need to be identified and implemented.

KEYWORDS

COVID-19, health disparities, roadway safety, syndemics, truck drivers

Population mobility and transportation are closely linked with the acquisition and transmission of infectious diseases.[1] The nearly two million US long-haul truck drivers[2] traverse nearly 200 billion miles annually[3] and interact with workers across the transportation and warehousing, retail trade, and manufacturing sectors, as well as roadway travelers and numerous others, rendering them vulnerable to acquiring and transmitting re/emerging infectious diseases.[1] This vulnerability may hold true for coronavirus disease 2019 (COVID-19), which has exhibited prevalent human-to-human transmission and rapid geographic diffusion across transportation routes[4,5]—analogous to how other infectious diseases have been shown to spread through the population of long-haul truck drivers, and to their social and professional contacts, across disparate geographic milieux.[1,6]

An especially troubling prospect of increased COVID-19 infection among long-haul truck drivers is the degree of overlap between already pronounced health disparities that characterize this population[7-10] and the COVID-19 infection, morbidity, and mortality risks currently known.[11-16] These disparities are shaped by the unique occupational milieux of long-haul trucking: unlike other occupations, long-haul truck drivers are away from home for prolonged periods of time and spend all of their working, and the majority of their nonworking hours in worksite environments (eg, warehouses, truckstops); as a result, they are especially reliant on, and vulnerable, to the barriers and resources that characterize these environments.[17] Unfortunately, these environments have been referred to as "healthy living deserts" due to their lack of health-supportive resources,[18] and they excessively expose truck drivers to noxious air pollutants such as carbon monoxide, nitrogen oxides, and particulate matter, with the latter exacerbated by additional exposures to "road dust" while driving.[13,17] These built environment factors, along with harmful work organization characteristics (eg, long workhours, frequent shiftwork, excessive time pressures), both

independently shape health disparities and also influence detrimental lifestyle and behavioral patterns that induce these outcomes, such as poor diet, lack of physical activity, poor sleep health, and high rates of cigarette smoking.[7,9,19-22] Further compounding the health ramifications of these multilevel factors is limited healthcare access, reflected in both poor insurance coverage and lack of available medical services while on the road, leading to failures in screening, diagnosis, and treatment for acute and chronic conditions.[23] As a result of these compounding influences, long-haul truck drivers have been shown to experience severe and disproportionate cardiometabolic and respiratory comorbidities, including obesity, hypertension, diabetes, metabolic syndrome, bronchitis, emphysema, and lung cancer.[7-10,24-27]

Together, the unique co-occurrence of health disparities observed among long-haul truck drivers and known COVID-19 infection, morbidity, and mortality risks suggest the possibility of a *novel COVID-19-based truck driver syndemic*, with widespread implications for public health and safety, and the resilience of vital supply chains. Syndemics have been defined as "the presence of two or more disease states that adversely interact with each other, negatively affecting the mutual course of each disease trajectory, enhancing vulnerability, and which are made more deleterious by experienced inequities."[28] Emerging research pertaining to COVID-19 infection, morbidity, and mortality indicates that long-haul truck drivers are particularly vulnerable, due to health afflictions endemic in this population that put drivers at risk for infection and severe consequences. One important source of potential vulnerability is the relatively advanced mean age of 49 of long-haul truck drivers, which is high compared to other occupations.[29] Older age is generally associated with higher risk of COVID-19 morbidity and mortality[30] and may also render long-haul truck drivers more vulnerable to initial infection through immunosenescence.[31] Other prominent sources of vulnerability to infection, morbidity, and mortality include air pollution exposures, such as those related to particulate matter and smoking[11-13]; cardiovascular diseases, such as obesity, hypertension, and coronary heart disease[14-16,32,33]; and metabolic diseases, such as diabetes.[14-16]

COVID-19 sequela may perpetuate existing health disparities; for example, by exacerbating cardiovascular dysfunction due to damage to the heart[14] and/or worsening metabolic dysfunction through pancreatic injury or acute kidney injury.[34-36] The co-occurrence of existing health disparities and COVID-19 infection may also result in deteriorations in driver roadway safety performance, with implications for other roadway users. Several aspects of cardiovascular and metabolic dysfunction are associated with increased likelihood of sleep disorders, fatigue, and/or roadway crashes.[37,38] Further, certain cardiovascular and metabolic conditions may medically disqualify long-haul truck drivers from operating a commercial motor vehicle.[39] A reduction in the number of medically qualified drivers, especially at a time of increased freight demand during the COVID-19 pandemic,[40] the ongoing long-haul truck driver labor shortage,[29] and the decision to relax hours-of-service regulations for the transportation of freight related to emergency relief efforts,[41] may exacerbate safety-critical work organization characteristics related to scheduling and time pressures, with detrimental impacts to roadway safety and, ultimately, the resilience of vital supply chains.

To curb the likelihood for a COVID-19-based syndemic among long-haul truck drivers, several research- and prevention-oriented action steps are urgently needed. First, key COVID-19 metrics need to be established for this population, including incidence, prevalence, basic reproduction number, and case fatality rate. Data for calculating these measurements could be collected through novel epidemiological studies (eg, cross-sectional; cohort), as well as through adapting or using existing clinical sources, vital statistics systems (eg, National Vital Statistics System),[42] and disease surveillance systems (eg, National Respiratory and Enteric Virus Surveillance System).[43] Second, because traditional statistical analysis cannot adequately detect key network properties that may drive COVID-19 spread,[44] the relationships between the unique social and spatial network attributes of long-haul trucking and subsequent COVID-19 acquisition and spread need to be more clearly delineated. Third, the mutually reinforcing interactions between the endemic health disparities present in long-haul truck drivers and subsequent vulnerability to COVID-19 infection, morbidity, and mortality need to be better understood. In particular, because the key mechanisms that underlie the emergence of syndemics are nested within socioeconomic, healthcare, and other such macro-level domains,[45] the impacts of governmental, corporate, and other policies on the work environments and work organization characteristics that shape truck driver health disparities need to be the urgent foci of such efforts. This will require the integration of systems perspectives into data collection strategies to generate datasets that simultaneously capture these key macro-level forces, other important downstream causal factors, and the array of individual-level COVID-19 and other health and safety afflictions, which could then be analyzed using techniques designed to explore interactions and nonlinear relationships (eg, system dynamics modeling; agent-based modeling).[46,47] Finally, grounded in the knowledge gleaned from the aforementioned action steps, practical and efficacious policies and interventions need to be identified and implemented to protect long-haul truck drivers, their social encounters, roadway users, and the numerous others that are impacted by the health and safety of commercial drivers and the sustainability and viability of the nation's vital supply chain. For example, given the dependency of drivers on their worksite environments, prevention strategies could target these locales to curb COVID-19 spread (eg, hygiene, sanitation, and physical distancing policies; provision of personal protection equipment; screening programs) and/or reducing co-occurring health disparities (eg, increasing availability of medical services, healthful food options, and opportunities for physical activity).

In conclusion, the social and geographic dispersion of long-haul truck drivers, along with the endemic health disparities of

these populations, may render them especially susceptible to COVID-19 infection, morbidity, and mortality. This potential of a novel *COVID-19-based truck driver syndemic* poses an imminent, significant, and widespread threat for public health and safety, and the resilience of vital supply chains. Targeted research- and prevention-oriented action steps are urgently needed to curb the likelihood of the development of this syndemic, especially as mandated physical distancing policies heterogeneously expire, the American economy gradually reopens, and freight volumes increase—along with U.S. long-haul truck drivers' vulnerability to acquiring and transmitting COVID-19.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest.

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AUTHOR CONTRIBUTIONS

ML was principally involved in the writing of the manuscript and contributed to conceptualizing and revising the manuscript. YA and SS each contributed to conceptualizing, writing, and revising the manuscript.

ORCID

Michael Kenneth Lemke http://orcid.org/0000-0002-5921-1473

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