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LETTER TO THE EDITOR

Heat illness and renal injury in mail and package delivery workers

To the Editor,

According to Occupational Safety and Health Administration (OSHA) data, heat-related illnesses (HRIs) are common in mail and package delivery workers, including employees who work for the largest delivery companies in the United States. A review of OSHA's severe injury report (SIR) database from January 2015 to December 2019 found 213 heat-related hospitalizations (HRH) among employees of the three largest delivery companies: the United States Postal Service (USPS), United Parcel Service (UPS), and Federal Express (FedEx).[1] During this 5-year period, USPS and UPS reported more heat-related hospitalizations than any other single US company in any industry.

To compare the HRH incidence rates among these three companies, we obtained publicly available data about workforce size.[2-4] Because USPS is a federal agency, OSHA's SIR database captures all USPS hospitalizations nationwide, whereas the SIR database does not capture UPS and FedEx hospitalizations that occur in states with OSHA-approved State Plans. For this reason, to enable a fair inter-company rate comparison we limited the rate analysis to states in which private companies are under the authority of Federal OSHA. Using population data from the 2018 American Community Survey, we estimated that 58.3% of the delivery workforce resides in federal OSHA states.[5] After these adjustments, the HRH incidence in these employers was 5.8 per 100 000 worker-years at USPS, 12.3 per 100 000 worker-years at UPS, and 0.4 per 100 000 worker-years at FedEx (Table 1).

Workers at all three companies encounter similar heat stress hazards: hot weather, working in heat-retaining, enclosed spaces, metabolic heat production from walking and carrying packages, and infrequent access to bathroom facilities with resultant inadequate hydration in some workers. Media reports indicate that many USPS and UPS workers deliver mail and packages from vehicles that lack air conditioning, whereas a higher fraction of FedEx vehicles apparently have air conditioning.[6-8] This finding may partially explain why USPS and UPS had higher HRH incidence rates than FedEx. UPS and USPS accounted for 97.7% (208 of 213) of the reported hospitalizations among the three companies; and UPS' HRH incidence was more than double that of USPS (Table 1). Potential reasons for this magnitude of difference include: handling of heavier packages more frequently, and variations in work schedule, but this warrants additional study.

HRIs experienced by mail and package delivery workers have included heat exhaustion, dehydration, heat cramps, and heat-related fatalities. Some of these incidents led to OSHA inspections and General Duty Clause citations.[9-11] In addition, occupational exposure to excess heat can cause both acute and chronic kidney injury.[12] Acute kidney injury (AKI) is a sudden loss of the kidneys' ability to filter waste products from the blood. Heat-related AKI can occur via two mechanisms. Profuse sweating can produce dehydration, and heat strain causes circulatory changes that reduce blood flow to internal organs, resulting in decreased function and prerenal AKI. Prerenal AKI is often temporary and reversible with intravenous fluid administration, but this does not preclude long-lasting sequelae, especially among those with underlying kidney disease, the prevalence of which has increased concurrently with diabetes and obesity epidemic in the United States.[13-16] The second mechanism of heat-related AKI is rhabdomyolysis. Physical activity in hot conditions causes breakdown of skeletal muscle tissue, releasing chemicals such as myoglobin that harm the kidneys' internal structures.[17]

There is also evidence that heat stress can cause chronic kidney injury. Animals suffer renal injury after repeated bouts of heat-induced dehydration.[18] Recently, an epidemic of chronic kidney disease of unknown etiology (CKDu) has affected agricultural workers in Central America and other regions.[19] Although CKDu is likely multifactorial, one postulated mechanism of CKDu involves repeated episodes of heat strain and dehydration which can cause chronic kidney damage in relatively young workers with no other risk factors like diabetes or hypertension; that is further exacerbated by exposure to various agricultural toxicants.[19,20]

The SIR database revealed that US mail and package delivery workers have experienced serious heat-related AKI while at work. Eight (3.8%) of 213 HRH reports submitted by these three employers indicated that the worker was admitted to the hospital because of kidney injury. Of these eight AKI cases, six were reported by USPS and two by UPS (Table 1). Of note, illness descriptions in SIR may be incomplete because they are limited to brief narratives supplied by the employers. Many of the HRH records in SIR stated only that the worker suffered "heat exhaustion" or "dehydration." Because AKI is a known complication in outdoor workers who are hospitalized with HRIs, it is likely that SIR substantially undercounts work-related AKI cases if they are classified only as "heat exhaustion."[12,21,22] Furthermore, the SIR database excludes HRIs that were not severe enough to require inpatient hospitalization. Our analysis also excluded many smaller, delivery companies that may employ untrained workers who may also be at risk. Other limitations of the SIR data include non-reporting of AKI as a separate diagnosis, lack of information from employers on pre-existing conditions, and overall underreporting of occupational injuries in the US as a whole.

TABLE 1 Summary of severe injury reports of heat-related hospitalizations in employees of three large mail and package delivery companies, January 2015 to December 2019

Employer	Number (column %) of heat-related hospitalizations in OSHA SIR database	Number of workers (entire US)	Number (column %) of heat-related hospitalizations in OSHA SIR database (federal OSHA states only)	Estimated number of workers (federal OSHA states only)	Heat-related hospitalization rate in federal OSHA states (cases per) 100 000 worker/y	Number of heat-related acute kidney injury cases
United States Postal Service	121 (57%)	523 790	88 (49%)	305 370	5.8	6
United Parcel Service	87 (41%)	240 000	86 (48%)	139 920	12.3	2
Federal Express	5 (2%)	420 000	5 (3%)	244 860	0.4	0

Abbreviations: OSHA, Occupational Safety and Health Administration; SIR, severe injury report.

For these reasons, we believe the true burden of AKI at mail and package delivery companies is much higher than the eight cases identified in SIR. We hypothesize that workers in this industry might also be at risk of heat-related chronic kidney injury, similar to the CKDu observed in agricultural workers. This unrecognized adverse outcome may occur in other industries with heat-related illness, such as construction. To the best of our knowledge, no one has explored the epidemiology of heat-related AKI beyond agriculture; and future studies of this health outcome should be explored.

The National Institute of Occupational Safety and Health, the employers, and labor organizations that represent mail and package delivery workers represent three key stakeholders who could collaborate to address the issue of AKI and CKD using a public health approach. Potential areas for intervention include: (a) educating mail and package delivery workers about proper hydration during hot weather, self-monitoring via their urine color, comparing pre- and postshift weights, risk mitigation strategies, awareness of personal pre-existing conditions that increase worker risk, and how to recognize the early signs of HRI. (b) Assessing employers' adherence to HRI prevention plans that emphasize fluid replacement, using a standardized approach. (c) Assessment of HRI occupational risk factors such as excess physical activity from high delivery quotas, lack of air conditioning, and access to cool facilities for breaks, and insufficient access to bathroom facilities, which may result in reduced fluid consumption and exacerbate dehydration. (d) Development of a surveillance program to assess temporal associations between weather and creatinine levels, and collect more complete data on occupational HRIs and associated medical complications like kidney injury. These recommendations are important to prevent HRI and AKI in delivery workers, especially as the prevalence of underlying risk factors like diabetes and hypertension continue to increase in the US population overall.

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CONFLICT OF INTEREST

The author declares that there is no conflict of interest.

AUTHOR CONTRIBUTION

CT was responsible for the study concept, the data analysis, drafting the work or revising it critically for important intellectual content, final approval of the version to be published, and agrees to be accountable for all aspects of the work in ensuring that questions

related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

DATA AVAILABILITY STATEMENT

All data used in this study are publicly available from the Occupational Safety and Health Administration website.

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