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Trends in parcel delivery driver injury: Evidence from NEISS-Work

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ABSTRACT

Introduction: The rise of e-commerce has rapidly increased the proportion of goods delivered directly to customers' homes. These increases have placed notable demands on delivery personnel, with potential health and safety consequences. In this paper, we examined trends in parcel delivery driver injury through analyses of injuries treated in emergency departments (ED) in the United States from 2015 through 2022. *Methodology:* We explored trends among Couriers and Messengers as well as Postal Service personnel as designated by Bureau of Census (BOC) industry codes. We estimated counts and rates of injuries per 10,000 full time worker equivalents and examined demographics (e.g., age, sex) and other characteristics (e.g., source of injury, injury diagnosis) associated with these injuries. *Results:* We found that: (1) ED-treated injury rates between 2015 and 2022, among both the Postal Service and Couriers and Messengers, have demonstrated an upward trajectory, contrasting with overall U.S. industry injury rates, which have trended downward; and (2) while ED-treated injury rates for these industries have taken different paths over time, both industries' ED-treated injury rates have converged toward a position much higher than average. Moreover, we found that female personnel and young personnel disproportionately experienced ED injuries. *Conclusions:* In addition to calling attention to worrying injury trends among delivery drivers, we conclude that the current data landscape prevents the development of a nuanced picture of injury trends and hazards. These limits inhibit exploration of many specific hazards, and therefore preventive measures that would be designed based on such specific exploration. *Practical Applications:* Our results serve both as a foundation toward improved safety practices in an industry that continues to experience rapid changes and as a step toward motivating updated data collection and dissemination practices that could help understanding of the modern workplace injury landscape.

1. Introduction

In recent years, e-commerce has rapidly increased the proportion of goods delivered directly to customers' homes, placing notable demands on delivery personnel (Iacobucci et al., 2022), with potential health and safety consequences. Parcel delivery drivers perform many roles including operating large vehicles, lifting and moving parcels of various sizes, and navigating varied and unpredictable working environments over the course of their routes (Reiman, 2021). These roles carry risks that can lead to injury or death. At the same time, the burgeoning of e-commerce has introduced major private entities, notably Amazon, to the logistics industry alongside traditional mainstays like UPS and the Postal Service. As of 2022, 97.7% of all parcels by volume in the United States were delivered by the Postal Service (31.7%), UPS (24.3%), Amazon Logistics (22.6%), and FedEx (19.1%) (Pitney Bowes, Inc., 2023). Changes to the parcel delivery industry (e.g., emergence of new organizations, efficiency demands, and delivery speed expectations) are causes for concern as increased volumes run up against changing company policies, work environments, and work cultures (Alimahomed-Wilson, 2020; Strategic Organizing Center, 2022).

Prior work has highlighted that parcel delivery drivers face notable injury risks. Across the past two decades, the parcel delivery industry in the United States has ranked among the top 10 most dangerous industry categories in terms of overall injury rates (Pan et al., 2006; U.S. Bureau

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of Labor Statistics, 2023). Industry categories that capture parcel delivery drivers are also consistently ranked among those with the highest injury risk in workers' compensation claims (Smith & Williams, 2014), and regularly appear on the Bureau of Labor Statistics' (BLS) list of industries with the highest incidence rates of nonfatal occupational illnesses and injuries resulting in days away from work (DAFW) (U.S. Bureau of Labor Statistics, 2023). Recent research has investigated the impact of e-commerce specifically, finding that growth in parcel shipping volumes—particularly through the COVID-19 pandemic—coincided with increases in both the number of injuries to delivery personnel as well as the rate of these injuries, measured per full time equivalent (FTE) employees for the industry (Iacobucci et al., 2023). These results suggest that the increase in injuries may be outpacing the growth of the industry. Nevertheless, limitations of common occupational surveillance systems make research in this area challenging, requiring additional data sources to provide a better understanding of burden and trends.

A central problem to obtaining an accurate count of occupational injuries is that certain workplace injuries may not be recorded, leading to potential underestimation of workplace incidents and corresponding injuries (Azaroff et al., 2002). For example, a worker may seek treatment for an injury without reporting it to a supervisor, or conversely, a worker might report an injury to a supervisor who fails to appropriately record it. Occupational injury and illness databases, including the Survey of Occupational Injuries and Illnesses (SOII), maintained by the BLS, and the Industrial Tracking Application (ITA), maintained by the Occupational Safety and Health Administration (OSHA), are leading data sources for tracking occupational injuries and illnesses, but are vulnerable to such issues.

One specific issue is that these data sources depend on the employers keeping accurate records and submitting those records correctly to the monitoring agency (Iacobucci et al., 2023). These processes can lead to underreporting, perhaps in part because employers are motivated to minimize the appearance of danger in the workplace or because they may infrequently use these systems and may not be in the habit of regular reporting (e.g., in the case of small or midsize organizations). This interpretation is corroborated by findings from: (a) follow-up surveys of SOII respondents, indicating misunderstanding of recordkeeping processes; and (b) prior research linking SOII data to other workplace injury data sources, indicating gaps in reporting (Wuellner et al., 2016; Rogers, 2020). Additionally, some businesses and/or subsets of their workers may not be required to report to SOII/ITA or have workers' compensation coverage. In particular, gig economy workers—many of whom work in the courier/delivery space—have nontraditional work arrangements, and therefore may not be included in such systems (O'Connor et al., 2020).

Emergency department data provides a critical, and often underutilized, data source when examining workplace safety and can help fill gaps and increase understanding of burden, trends, and characteristics of these injuries. Therefore, in the face of a dynamic delivery landscape in which e-commerce continues to drive change and a data landscape that inhibits easy understanding of injury trends in this sector, this study pursues two main research questions:

1) What are the recent trends in delivery personnel injuries according to national estimates from a representative sample of emergency departments (EDs)?
2) How do injury trends in the private sector, where e-commerce is causing particularly rapid changes, compare to the U.S. Postal Service over the same period?

2. Methods

2.1. Data source and study sample

This study used data extracted from the occupational supplement to the National Electronic Injury Surveillance System (NEISS-Work). NEISS-Work consists of a national, stratified sample of U.S. hospitals that operate 24-hour EDs (National Institute for Occupational Safety and Health Division of Safety Research, 2023). The sample consists of ~ 67 geographically distributed hospitals. Injuries at work treated in EDs are identified by trained abstractors who code information from the medical record for each case. Cases are identified as work-related if a patient was working for pay or other compensation, volunteering with an organized group (e.g., a firefighter), or engaged in agricultural production activities at the time of injury. A workers' compensation claim is not required for inclusion. NEISS-Work is restricted-access data maintained by the National Institute for Occupational Safety and Health (NIOSH). The data used in this study were provided by request and consisted of precomputed summaries generated by NIOSH staff to comply with data restrictions. Review was completed by the appropriate IRB and designated as Not Human Subjects Research (NHSR). This activity was also reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.[§].

NEISS-Work uses the BLS Occupational Injury and Illness Classification System (OIICS) to categorize: (a) type of event/exposure and (b) the source of injury for recorded injuries and illnesses[1] (Bureau of Labor Statistics, 2012). Data included injuries from 2015, the first year that industry codes were assigned in NEISS-Work, through 2022, the most recent year for which data were available. Cases were restricted to employees aged 18 years or older and were selected to correspond with workers engaged in parcel delivery using Bureau of Census (BOC) industry codes.

BOC industry codes are assigned to cases in NEISS-Work based on the event narrative included with each case, which gives information about the person, circumstances, and activity they were performing at the time of injury. To ensure the most accurate BOC industry codes are assigned, the NIOSH Industry and Occupation Computerized Coding System (NIOCCS) is initially used to automatically code narratives to standardized codes (National Institute for Occupational Safety and Health, 2024). Once this initial step is completed, a trained coder manually reviews the coded data and corrects any incorrect codes or assigns codes if one was not assigned. The coder follows a coding algorithm and uses available occupational information (occupation, business type, and employer) to assign the best industry code. Once the coder completes all code assignments, a sample of cases is selected to perform a quality check. Any changes noted during the review are made to all affected cases within the full data set. Although occupation is used when available as part of the industry coding process, specific occupations are not consistently available for coding within the NEISS-Work.

We included Postal Service employees (BOC = 6370) and Couriers and Messengers (BOC = 6380). While BOC 6370 includes all Postal Service employees, including for example, mail sorting and customer service roles, a slight majority—and by far the largest single detail category—of employees (52.4%) consists specifically of Postal Service Mail Carriers who actively perform deliveries (Bureau of Labor Statistics, 2023). BOC 6380, Couriers and Messengers, includes private parcel shipping firms like UPS and FedEx.[2] While the Couriers and Messengers code also contains some other delivery and ancillary personnel, 84.9% work in Transportation and Material Moving Occupations, while more granularly 44.2% work in the role of Driver/Sales Workers and Truck Drivers, which denotes a delivery role specifically (Bureau of Labor Statistics, 2023). Unfortunately, it is not possible to differentiate firms or roles with more granularity. Nevertheless, as these other companies are

[1] While estimates are for both injuries and illnesses, we hereon refer solely to injuries because they make up nearly all the cases in the analysis.

[2] These codes correspond to North American Industrial Classification System Codes 491,100 (Postal Service) and 492XXX (Couriers and messengers).[§] See e.g., 45C.F.R. part 46.102(l)(2), 21C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.

also engaged in local delivery of parcels, they are likely germane to the current analysis, even as they make up a small minority of remaining parcel volume. Specific occupations are not coded, and thus, not available from NEISS-Work. We therefore rely on industry codes, which we use here to delineate delivery firms, but which may include some employees at those companies who are not drivers. Nevertheless, these codes largely delineate drivers, as the segments of companies like UPS and FedEx involved in other activities, for example retail stores, copy services, and third party logistics services, are classified under separate industry codes (NAICS Association, 2024a; NAICS Association, 2024b; NAICS Association, 2024c; SICCODE.com, 2024).

Labor force estimates for each industry, which were used to provide a denominator to calculate injury rates, were obtained using the Employed Labor Force (ELF) query system (National Institute for Occupational Safety and Health Division of Safety Research, 2023). This system provides employed worker population estimates based on the Current Population Survey (CPS), maintained by BLS. This system was used to obtain the number of workers for each year for both industries in terms of the number of FTE workers aged 18 years or older. FTE estimates were used rather than number of workers because this measure facilitates a more comparable measure of injury incidence per time worked and because it allows comparisons to estimates from other sources like the SOII.

2.2. Measures and statistical analysis

Because NEISS-Work data are restricted, our analysis is limited to variables for which estimates could be provided by request and had sufficient sample size to produce stable estimates, per NIOSH reporting requirements. The primary outcome measure consisted of injury count estimates disaggregated by year, sex, age group, injury event, injury source, and diagnosis group. See Table 1 for more information about these variables.

Estimates and 95% CIs were calculated by NIOSH research staff following protocols for minimum sample size. Average annual rates were calculated by taking the national estimates of nonfatal injuries from NEISS-Work and dividing them by estimates of FTE employees for each industry category obtained from the ELF. These estimates were then multiplied by 10,000 to express the results in terms of injuries per 10,000 FTE employees. Confidence intervals were computed for rate estimates according to the procedure outlined in the Work-RISQS documentation (National Institute for Occupational Safety and Health Division of Safety Research, 2023).[3]

3. Results

3.1. Overall ED injury trends

In total, between 2015 and 2022, for workers 18 years old and older, there were an estimated 151,000 injuries to Postal Service employees treated in EDs (CI = 97,000, 206,000) and an estimated 182,000 injuries to Couriers and Messengers treated in EDs (CI = 124,000, 241,000) (Table 1).

The annual estimate of ED-treated injuries to Postal Service employees has been relatively consistent over time (Panel A of Fig. 1). Across the observed period, 17,000 injuries (CI = 9,000, 26,000) occurred in 2015, followed by moderate year-over-year increases before peaking at 21,000 (CI = 13,000, 29,000) in 2019, and returning to the same low of 17,000 (CI = 12,000, 23,000) in 2020. The injury estimate increased again in 2022 to 22,000 injuries (CI = 12,000, 31,000). However, estimates were characterized by wide, overlapping confidence intervals across the entire time frame.

By contrast, the number of injuries to workers in the Courier and Messenger industry treated in EDs has consistently increased, from a low of 13,000 (CI = 8,000, 17,000) in 2015, increasing every year except from 2018 to 2019—in which the figure remained the same—to a high of 35,000 (CI = 22,000, 48,000) by 2022. Again, it is worth noting that the CIs were wide, particularly for 2020, 2021, and 2022.

Reviewing rates of ED-treated injuries per 10,000 FTE employees adds crucial perspective to the above trends. While overall rates of ED-treated injuries were typically higher for Postal Service employees across time, there were apparent differences in overall trends (Panel B of Fig. 1).

The rate of ED-treated injuries for Postal Service employees rose from 264 per 10,000 FTE (CI = 191, 337) in 2015 to 337 (CI = 265, 408) in 2017 before decreasing to a low of 242 (CI = 192, 291) ED-treated injures per 10,000 FTE in 2021. However, the injury rate spiked from this low point in 2021 to the highest observed rate in 2022, at 359 injuries per 10,000 FTE employees (CI = 282, 436). By contrast, the rate of injuries per 10,000 FTE for workers in the Couriers and Messengers industry increased between 2015 and 2018, after which the trend flattened, though maintaining an overall upward trajectory.

It is important to further parse the figures behind these trends. At the point where the count of injuries among Postal Service workers peaked (2019), the number of Postal Service employees shrunk year over year thereafter, while the numbers of Couriers and Messengers began increasing. These changes, which represent the denominators for computing rates, explain why the rate of Courier and Messenger injury remains flat after 2019 despite large increases in injury count estimates. Meanwhile, growth of injury count estimates among Postal Service employees in 2022—which climbed just higher than the 2019 figure—resulted in a large spike in the injury rate that year, again due to a decrease in the total number of FTE employees.

Of note, CIs were large across estimates, given underlying sample size constraints, and while these point estimates can provide valuable information on potential patterns in trends, changes were not statistically significant. To provide additional context for these trends, data points and a trendline for injuries across all industries is included in panel B, also from NEISS-Work. The rate for all industries showed a steady decline from 182 injuries per 10,000 FTE employees in 2015 (CI = 158, 206) to 128 in 2020 (CI = 113, 142). The rate for all industries subsequently rose again, reaching 151 (CI = 131, 172) by 2022, placing it close to the pre-pandemic figure of 157 (CI = 140, 173) in 2019. These rates were also substantially lower than those for either parcel delivery industry segment examined here.

3.2. Injuries by recorded demographics

3.2.1. Injuries by sex

Further differences were observed after disaggregating by demographic variables (Table 1). In terms of sex, 57% (86,000, CI = 49,000, 123,000) of ED-treated injuries among Postal Service employees involved females, while 43% involved males (65,000, CI = 45,000, 85,000). Among workers in the Courier and Messenger industry, however, only 31% (56,000, CI = 34,000, 79,000) of ED-treated injuries involved females, while 69% (126,000, CI = 89,000, 163,000) of ED injuries involved males.

Because employment is not equally distributed by sex, however, examination of rates per 10,000 FTE employees shows that the disparity is more pronounced than indicated by counts alone (Panel A of Fig. 2).

[3] Since standard error values are not provided for the specific BOC industry codes used in this paper, we used values for "Transportation and moving material occupations," the closest available approximation. CIs were not calculated for disaggregated rates other than by year because appropriate SE values are not available for those categories.

Table 1
National estimates of emergency department-treated occupational injuries for Postal Service and Courier and Messenger industries for workers 18 years of age or older, NEISS-Work, 2015–2022.

	Postal Service (BOC = 6370)			*Couriers and Messengers (BOC = 6380)*		
	National Estimate	95% CI	Weighted %	National Estimate	95% CI	Weighted %
Total	151,000	(97,000, 206,000)	100%	182,000	(124,000, 241,000)	100%
Year						
2015	17,000	(9,000, 26,000)	11%	13,000	(8,000, 17,000)	7%
2016	18,000	(11,000, 26,000)	12%	16,000	(9,000, 23,000)	9%
2017	20,000	(12,000, 28,000)	13%	18,000	(13,000, 23,000)	10%
2018	20,000	(11,000, 29,000)	13%	21,000	(14,000, 27,000)	12%
2019	21,000	(13,000, 29,000)	14%	21,000	(13,000, 28,000)	12%
2020	17,000	(12,000, 23,000)	11%	27,000	(15,000, 39,000)	15%
2021	16,000	(10,000, 22,000)	11%	32,000	(20,000, 45,000)	18%
2022	22,000	(12,000, 31,000)	15%	35,000	(22,000, 48,000)	19%
Sex						
Male	65,000	(45,000, 85,000)	43%	126,000	(89,000, 163,000)	69%
Female	86,000	(49,000, 123,000)	57%	56,000	(34,000, 79,000)	31%
Age Group						
18–24	9,000	(6,000, 13,000)	6%	40,000	(26,000, 54,000)	22%
25–34	39,000	(22,000, 57,000)	26%	55,000	(39,000, 71,000)	30%
35–44	34,000	(22,000, 46,000)	23%	38,000	(25,000, 51,000)	21%
45–54	35,000	(21,000, 48,000)	23%	31,000	(17,000, 44,000)	17%
55+	34,000	(21,000, 47,000)	23%	19,000	(11,000, 26,000)	10%
Injury Event						
Violence and other injuries by persons or animals	16,000	(12,000, 21,000)	11%	15,000	(11,000, 19,000)	8%
Transportation incidents	11,000	(7,000, 14,000)	7%	14,000	(9,000, 19,000)	8%
Falls, slips, trips	33,000	(23,000, 43,000)	22%	31,000	(18,000, 43,000)	17%
Exposure to harmful substances or environments	5,000	(2,000, 7,000)	3%	6,000	(4,000, 9,000)	3%
Contact with objects and equipment	26,000	(15,000, 38,000)	17%	39,000	(27,000, 51,000)	21%
Overexertion and bodily reaction	60,000	(30,000, 89,000)	40%	76,000	(46,000, 106,000)	42%

The rates of injury[4] among males were similar across both industry categories, with 218 ED injuries per 10,000 FTE employees among Postal Service workers and 211 among Couriers and Messengers. Rates of injury among females, however, were nearly twice as high as males for the Postal Service (408 injuries per 10,000 FTE employees), and substantially higher than for male employees in the Courier and Messenger industry (327 per 10,000 FTE employees).

3.2.2. Injuries by age

Distributions of ED-treated injuries by age also exhibited differences (Table 1). Postal Service injuries were mostly distributed away from the youngest group, with those aged 18–24, accounting for only 6% (9,000, CI = 6,000, 13,000) of total injuries. The bulk of injuries were distributed approximately equally among the remaining categories, with the largest figure of 26% (39,000, CI = 22,000, 57,000) among those aged 25–34, while the remaining categories of 35–44, 45–54, and 55 + accounted for approximately 23% each. Courier and Messenger employees, by contrast, saw injury counts concentrated among younger groups, with 22% (40,000, CI = 26,000, 54,000) involving those 18–24, 30% (55,000, CI = 39,000, 71,000) among those 25–34, and 21% (38,000, CI = 25,000, 51,000) among those 35–44, meaning that employees younger than 45 accounted for approximately 73% of ED injuries to Courier and Messenger employees, compared to 55% among persons employed by the Postal Service.

In both industry categories, rates of injury were higher among younger age groups (Panel B of Fig. 2). The Postal Services' highest rate of injury was among the 25–34 age group (411 ED injuries per 10,000 FTE employees), and second highest among the 18–24 group (394 per 10,000 FTE), before continuing to diminish with higher age groups. The highest rate for Couriers and Messengers was among the 18–24 age group (317) and tapered downward as age increased. The rate among Postal Service employees appeared higher than for Couriers and Messengers across all age groups, but it remains unclear if these differences were statistically significant.

3.3. Events leading to injury, injury sources, and diagnosis groups

While there were commonalities between the two industry segments by type of event, a few differences emerged. As displayed in Table 1, the most common events leading to injury for Postal Service employees were overexertion and bodily reactions (40%, 60,000, CI = 30,000, 89,000); falls, slips, and trips (22%, 33,000, CI = 23,000, 43,000); contact with objects and equipment (17%, 26,000, CI = 15,000, 38,000); and violence and other injuries by persons or animals (11%, 16,000, CI = 12,000, 21,000). By contrast, the most common events leading to injury for Couriers and Messenger employees were overexertion and bodily reaction (42%, 76,000, CI = 46,000, 106,000); contact with objects and equipment (21%, 39,000, CI = 27,000, 51,000); falls, slips, and trips (17%, 31,000, CI = 18,000, 43,000); violence and other injuries by persons or animals (8%, 15,000, CI: 11,000, 19,000); and transportation incidents (8%, 14,000, CI = 9,000, 19,000). Both industry categories experienced similar numbers and proportions of transportation incidents but rank differed due to differing proportions of more common injury events.

Finally, some differences emerged in the sources of injuries and diagnoses following the injury (Fig. 3).

The most common sources of injuries among Postal Service employees included persons, plants, animals, and minerals (29%, 44,000, CI = 29,000, 59,000),[5] followed by structures and surfaces (21%, 31,000, CI = 21,000, 41,000), containers, furniture, and fixtures (20%, 30,000, C = 13,000, 46,000), and vehicles (13%, 20,000, CI = 14,000, 27,000). In comparison, the most common injury sources for Couriers and Messengers were containers, furniture, and fixtures (27%, 49,000,

[4] We were not able to produce confidence intervals for rates other than for overall and by year, as appropriate coefficients for the requisite equations given by Work-RISQS are not published at that level of granularity. Differences between these estimates should therefore be interpreted with caution.

[5] This category includes "living organisms (including infectious and parasitic agents) and their products, as well as raw metallic and nonmetallic minerals" (*16*).

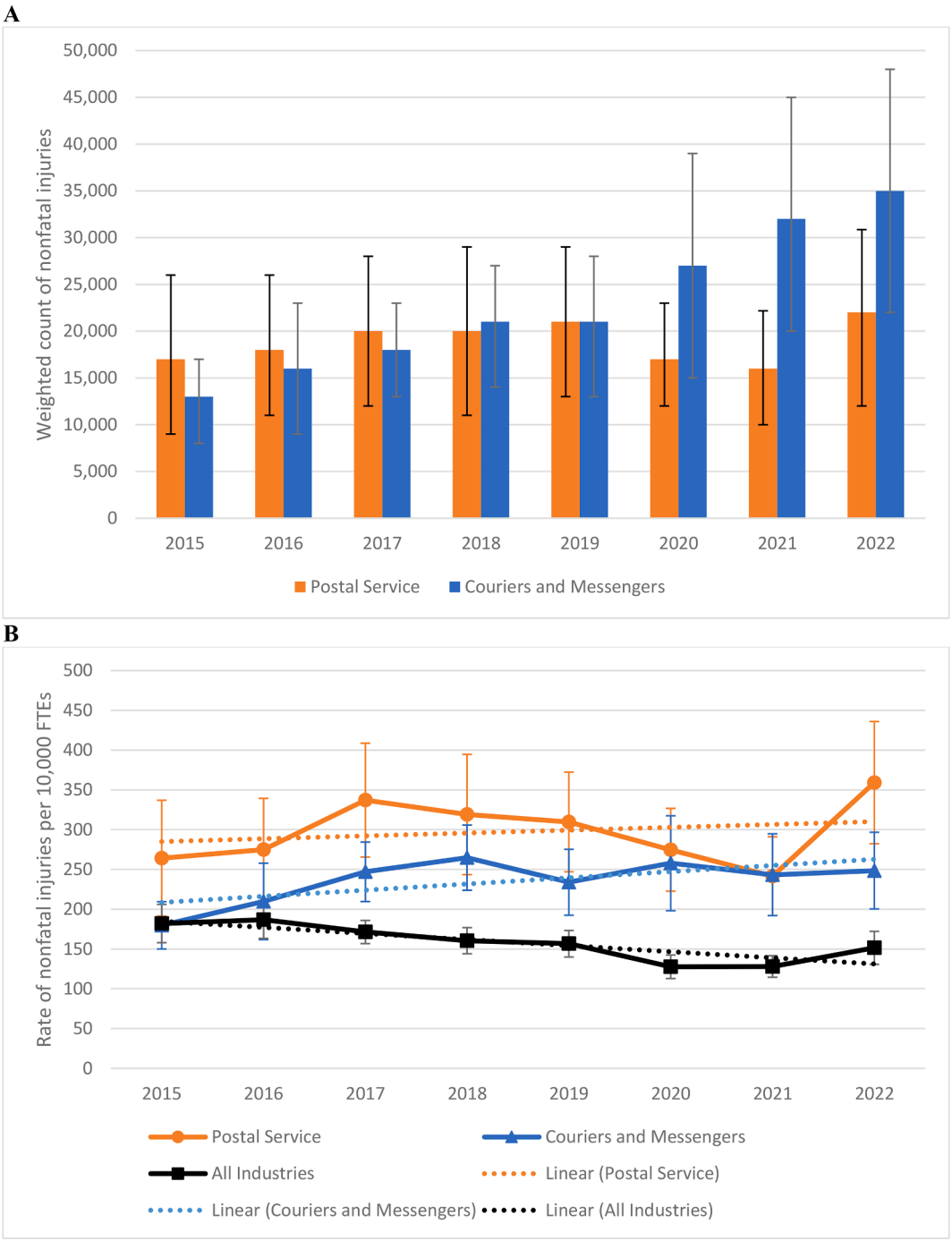

Fig. 1. (A) Weighted estimates of nonfatal injuries to Postal Service and Couriers and Messengers treated in emergency departments, 2015–2022. (B) Rates of nonfatal injuries per 10,000 FTE[a] treated in emergency departments, 2015–2022 (NEISS-Work). [a] Denominator data used to compute rates sourced from Employed Labor Force query system (NIOSH, 2023). FTE employees include those working in the selected industries as their primary or secondary job.

CI = 31,000, 67,000), persons, plants, animals, and minerals (21%, 39,000, CI = 28,000, 50,000), and vehicles[6] (16%, 30,000, CI = 20,000, 40,000).

The types of injuries suffered, identified by diagnosis groups (Fig. 3, Panel B), were similarly distributed, with an excess of 78% of injuries for both industries causing a strain or sprain, other or not stated injury,[7] or a hematoma, contusion, abrasion, or crushing injury. It is nevertheless difficult to fully ascertain if these are truly similar distributions, given the large proportion did not have a classifiable diagnosis.

[6] Note that while vehicles are often the source of injury for transportation incidents, they can also be the source of other types of injury incidents, for example, that took place while the vehicle was parked. For this reason, it is not inconsistent that there are more injuries with source "vehicle" in the data than there are for the event "Transportation incidents" (*16*).

[7] "Other" includes ingested or aspirated foreign object, burns, amputation, avulsion, foreign body, dental injury, nerve damage, anoxia, hemorrhage, electric shock, poisoning, submersion, dermatitis, conjunctivitis.

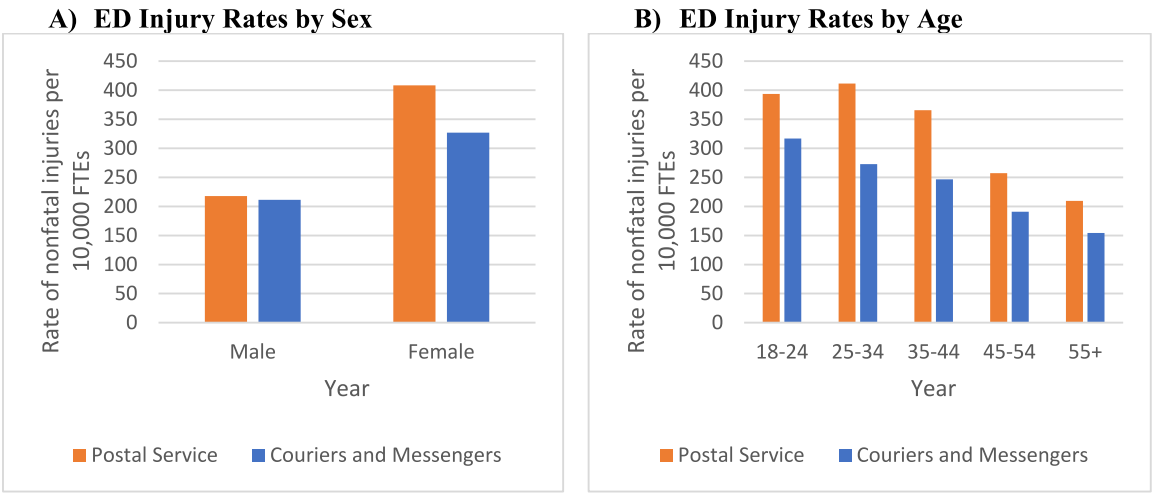

Fig. 2. Emergency department-treated occupational injury rates by demographic, 2015–2020.

4. Discussion

4.1. Overall trends

From 2015 to 2022, estimated ED-treated injuries for the Postal Service remained relatively stable over time, with a smaller number of treated injuries from 2020 to 2021 before an increase in 2022. Over the same period, the number of ED-treated injuries among Couriers and Messengers appeared to grow year over year for every observed interval except for 2018–2019. This upward trend—at least for Couriers and Messengers—is consistent with data from other sources, including the SOII and OSHA ITA (Iacobucci et al., 2023). Specifically, the figures observed here parallel—and are within the CIs of—SOII estimates showing fewer than 15,000 injuries resulting in days away from work in 2017 and rising to over 27,000 by 2021. Nevertheless, it is important to note that this comparison is imperfect, as NEISS-Work estimates ED-treated injuries, while the SOII reflects injuries resulting in days away from work (Iacobucci et al., 2023).

Examination of rates revealed a flatter, but nevertheless upward trend, which we highlight by including trend lines in panel B of Fig. 1. ED injury rate estimates remained higher for the Postal Service, as compared to Couriers and Messengers, for nearly the entire study period, albeit not statistically significant. The shallow, but upward, trend for Couriers and Messengers is also consistent with recent injury rate estimates from the SOII, with the same caveat noted above.

Recent increases in injury counts and rates are cause for concern. The rate of injury was substantially higher and statistically significant for both targeted industries than the rate for all industries, which declined for every year from 2017 to 2021, before rising again in 2022. These figures come amidst rapid growth newer entrants to the Courier and Messenger industry (e.g., Amazon), as well as major changes to some traditional entities, like the Postal Service (Strategic Organizing Center, 2022; United States Postal Service, 2023; Sainato, 2023; Heckman, 2023).

Nevertheless, it is not possible to attribute any specific cause to the trends observed here given the data at hand. Moreover, while it is not possible to parse the impact of the COVID-19 pandemic on the above trends, data suggests that while workplace illnesses rose during the period following 2020, workplace injuries decreased substantially (National Safety Council, 2021). International research has revealed similar trends in Austria and Korea, with workplace injuries dropping substantially after the onset of lockdowns (Huber et al., 2022; Baek et al., 2021). Thus, it is difficult to say how much of the increases observed between 2020 and 2022 were the result of increased occupational hazards, the return to work as the pandemic eased, or a combination of those factors.

4.2. Demographics: Sex and age

4.2.1. Differences by sex

Stratifying ED injuries by sex, the Postal Service saw over 20,000 more female employees admitted to the ED for injuries than male employees. The opposite was true for Couriers and Messengers, with around 70,000 more male employees sent to the ED than female employees. However, rates of injury indicated that disproportionate ED incidences persisted for females in both job categories, despite male employees being overrepresented in both industry categories (See the distribution of FTE employees by sex shown in Panel A of Fig. 4). Rates of injury to female employees were high compared to their male counterparts, especially for the Postal Service, where the rate was nearly twice that of male employees across the study period.

Data from the SOII corroborate this disparity, at least for Couriers and Messengers: Between 2015 and 2022, the estimates from the SOII indicate 43,060 injuries that resulted in days away from work occurred among female employees, and 113,540 occurred among males, which—using the same denominators from ELF—corresponded to a rate of 251.4 injuries per 10,000 FTE employees for female Couriers and Messengers and 190.4 for males (U.S. Bureau of Labor Statistics, 2024).[8] While these estimates from SOII are consistently smaller than those for NEISS-Work, one explanation for which *could* be underreporting, it is also possible that the differences are attributable to the differences in scope between the two sources (Wuellner et al., 2016).

While similar data are not available for the Postal Service, a 2021 Government Accountability Office report found—while controlling for career vs. non-career status, age, tenure, race/ethnicity, and job role—that female employees were 19% more likely to suffer injury than males (United States Government Accountability Office, 2021). This figure was over 30% specifically for female city carriers (United States Government Accountability Office, 2021), reinforcing safety concerns about last-mile delivery in urban areas as freight volumes continue to increase (Iacobucci et al., 2022).

These disparities stand in contrast to overall ED visit rates for

[8] Since the BLS uses their own denominators for rates, based on the sampled establishments, and does not support the use of CPS data for these calculations, rates calculated using ELF numbers are approximations, at best. Nevertheless, since BLS does not publish sex-specific rates, we include these approximations as a point of comparison that suggests the NEISS-Work figures are not anomalous.

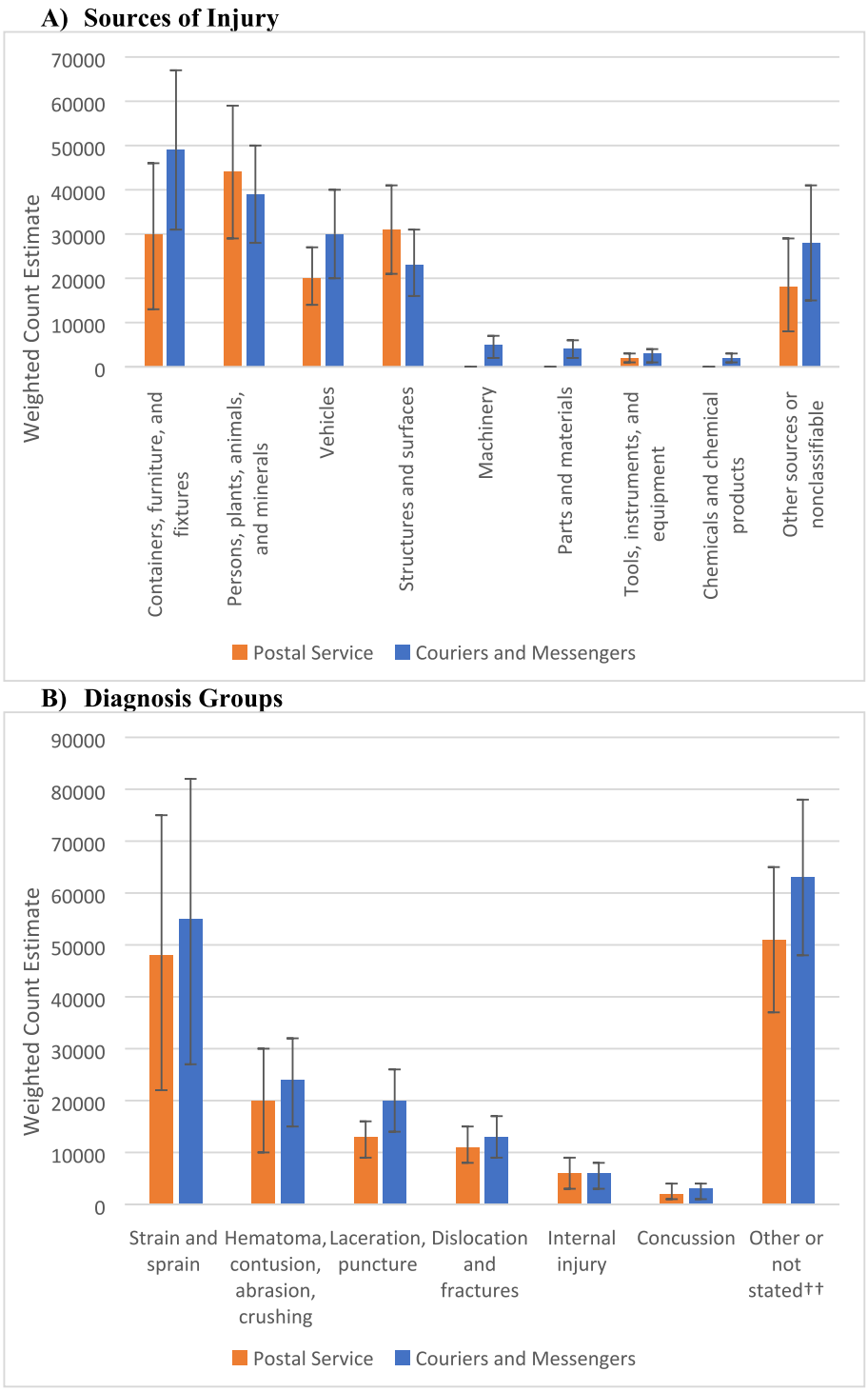

Fig. 3. Injury Source and Diagnosis Group Count Estimates. Note: Categories whose estimates do not meet NEISS-Work minimum reporting standards are not displayed. Estimates are displayed in descending order of Courier and Messenger count estimates to ease interpretation, except the "Other" categories.

working-aged men and women. In 2021, men (ages 20–64) had an ED visit rate for any injury of 8,563 per 100,000 and women (ages 20–64) had a rate of 5,998 per 100,000, or about 1.4 times higher for men than women (Centers for Disease Control and Prevention, 2023). In comparison, female Postal Service workers experienced 408 injuries per 10,000 FTE employees, compared to 218 among their male counterparts, or about 1.9 times higher.

A substantial body of research has shown differences in injury based on gender across different occupations, given selection effects that differentially sort male and female workers into different job segments (Biswas et al., 2021). More research is required, however, to document differential trends in injuries among workers in the same industry segments, as is the case here (Biswas et al., 2021). It may be that female employees take on different roles within these industries, that the types of injuries they suffer are different, that they are more likely to present to the ED or seek care for their injuries, or that other complex factors are at play, and each of these possible explanations could inform potential prevention efforts.

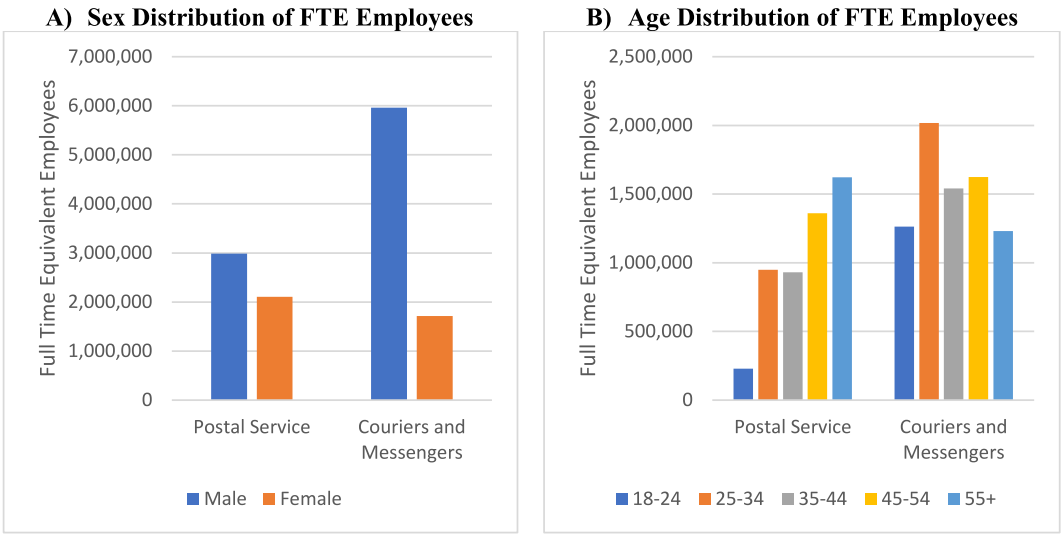

Fig. 4. Sex and Age Distributions of FTE Employees by Industry. Note: FTE employees include those working in the selected industries as their primary or secondary job.

4.2.2. *Differences by age group*

Count estimates of ED-treated injuries by age tended to reflect the age distribution of the underlying workforce, especially for Couriers and Messengers (See Panel B of Fig. 4). For instance, it is true that there are comparatively few injuries among 18–24-year-old employees of the Postal Service, but it is also true that there are few employees aged 18–24 compared to other age groups. Injury rates, however, are higher for younger workers, which corroborates prior figures showing longer-tenured Postal Service workers are less injury prone (United States Government Accountability Office, 2021). Indeed, the Postal Service has recently redoubled efforts to rely on full-time, career employees and minimize temporary, short-tenure workers (United States Postal Service., 2021). Examination of rates shows that in general, younger workers are at higher risk of injury across both industries, with rates of injury tending to attenuate with higher age groups. This pattern is similar to documented injury rate trends by age for U.S. workers in general, at least for young workers compared to their adult counterparts (Guerin et al., 2020). Overall injury rates for all U.S. workers by age tend to follow a U-shaped curve, with those aged 16–24 and 45 to 64 injured at higher rates than those 25 to 44 (Centers for Disease Control and Prevention, 2020). While we saw a decrease in injury from the youngest age groups moving up to older ones in our data, we did not observe a similar increase among older workers in the results we present here.

Data from the SOII, however, reveal a pattern contrasting to the ED estimates revealed here, at least for Couriers and Messengers (Postal Service employees are out of scope for the SOII) (U.S. Bureau of Labor Statistics, 2020). Rather than a concentration among younger employees, SOII data indicate fairly high rates across all ages, especially those 35–44, 45–54, and 16–24 (362.6, 335.3, and 320.9 injuries resulting in days away from work per 10,000 FTE, respectively) ((*32*, authors' analysis).[9] While it is beyond the scope of this analysis to investigate the exact cause of this disparity, it may be that the types of injuries experienced by younger employees are different from—and more likely to yield ED visits than—the types experienced by older employees, which may be more related to repetitive strain, and so forth. Indeed, the preponderance of injuries (40% for Postal Service workers and 42% for Couriers and Messengers, see Table 1) were related to overexertion and bodily reaction, while the plurality of employees is concentrated away from the youngest and oldest age group categories. Unfortunately, it is not possible to explore this relationship with the data at hand.

Data restrictions from sample size prevent analysis of injury types by age using NEISS-Work data. Nevertheless, the interpretation that injury type prevalence could vary by age may be bolstered by analysis of lost time injuries among postal workers, with prior research finding that younger employees are less likely to lose time due to injury and that they lose fewer hours when they do, indicating potentially different injury types and effects based on age (United States Government Accountability Office, 2021).

5. Continued barriers to injury reporting and analysis

While this study used a unique and useful source of data from which to view trends in parcel delivery driver injury, several barriers remain to accurately understanding these trends. For instance, it is unclear how injuries to gig workers, such as those driving for services like Amazon Flex, would be recorded. Prior work suggests they are likely not recorded in sources maintained by BLS or OSHA, since these sources only collect data about company employees, and gig workers are typically employed as contractors (Iacobucci et al., 2023). These workers may also be less likely to seek ED care as these roles may not provide health insurance or workers compensation. Moreover, companies like Amazon and FedEx continue to rely in part or in full on a contractor model of employment for their delivery services, in which their delivery personnel nominally work for a third party (Strategic Organizing Center, 2022). Such arrangements further entail that injuries to these workers may not be reliably captured by datasets like SOII and OSHA's ITA (Iacobucci et al., 2023). Nevertheless, NEISS-Work may better capture injuries from this subset of drivers, since they are selected through admission to the ED rather than: (a) through their firm being selected for inclusion in a survey like the SOII, or (b) via the existence of a workers' compensation claim, which is contingent on having coverage.

Moreover, the current data landscape makes it difficult to gain insight about the relationships between these injury trends and the geographies in which they occur. Neither the national-level SOII nor NEISS-Work contain any accessible information as to the geographical locations where injuries occurred, and OSHA's ITA is limited to the establishments where drivers work. Finally, the aforementioned data sources do not provide the exact role or activity in which each worker was engaged at the time of injury, at least in the summaries made available for analysis. Additional granularity could greatly enhance understanding of typical hazards and potential prevention measures.

[9] See prior note about using ELF denominators to approximate rates from BLS data.

6. Limitations

The chief limitation of this study is that NEISS-Work estimates only contain ED-treated injuries, and therefore omit work-related injuries treated elsewhere or those not receiving treatment. Cases are also only included to the extent to which they are identifiable as work-related, and this capture may be incomplete depending on information available to ED personnel at the time of treatment (e.g., lack of information from worker, incomplete medical records). Errors in abstraction may also occur as hospital coders process these data. Moreover, because NEISS-Work relies on a relatively small hospital sample, some estimates were small, and the corresponding CIs were wide. Additionally, we are unable to control for impacts of the COVID-19 pandemic, which likely influenced observations for 2020 onward. Finally, it is not possible using the current data to analyze observed trends by the specific job being performed, and we can therefore only speculate as to why these trends present this way. For example, we found an extreme disparity in rate of injury based on sex, with female employees far more likely to experience ED-treated injuries than their male counterparts. This apparent disparity merits further investigation.

7. Conclusions

In terms of our original research questions, we found the following: (a) ED-treated injury rates among the Postal Service and Couriers and Messengers have demonstrated an upward trajectory. This trend contrasts with that of overall U.S. industry injury rates, which have trended downward. As an example, while the injury rate for Couriers and Messengers was virtually the same as the injury rate for All Industries in 2015, at the most recently available data point, the rate for Couriers and Messengers exceeded the rate for All Industries by around 100 injuries per 10,000 FTE employees. (b) While ED-treated injury rates for these industries have taken different paths over time, both industries' ED-treated injury rates have converged toward a position much higher than average.

The rise and continued acceleration of injuries across the examined industry categories are a call both for more granular data to better understand specific hazards experienced by delivery personnel as the parcel delivery industry—including both private companies and the Postal Service—continues to grow in both size and importance to the overall goods delivery system. Rates of injury in these industries remain high compared to the average, while injury counts for Couriers and Messengers have grown precipitously. Even if this growth is largely accounted for by industry growth, it still represents more people being injured on the job and should serve as a call for renewed efforts to prevent injury to these workers. The prevalence of overexertion and bodily reaction is consistent with many of the day-to-day tasks performed by delivery drivers, and could also be related to speed and efficiency demands, which points to the relationship between these activities and this injury type as a potential path for future research (National Safety Council, 2024).

Moreover, the fact that the results presented here corroborate overall trends in injury growth from other sources like SOII and OSHA ITA, while highlighting differences in factors like age, highlight the usefulness of triangulating these patterns with multiple data sources and types. For example, the recently published *Model Minimum Uniform Crash Criteria* intended to be used by states to report crash data is recently added a field that indicates if a crash involved a parcel delivery vehicle, which has historically not been available in most crash data (National Highway Traffic Safety Administration, 2024).

8. Practical Applications

Our results first provide impetus for the parcel delivery industry, regulators, and public health professionals to revisit standard safety practices, the impacts of recent industry changes on safety, and the interactions between company safety culture and injury outcomes. Moreover, we suggest that as new data become available, research should continue to identify which groups are most at risk, the specific mechanisms that produce these risks, and which preventive measures may most effectively mitigate these risks. Further, we suggest that these findings should feed back into data collection efforts, improving occupational and transportation injury surveillance. In particular, we point to efforts toward a "system of systems" approach to occupational hazard surveillance, which would support consistent data collection and sharing of resources across agencies, prioritize data collection on hazards and exposures in addition to health outcomes, and more readily allow comparisons across data collected by different agencies, among many other advantages (National Academies of Sciences, Engineering, and Medicine, 2018).

CRediT authorship contribution statement

Evan Iacobucci: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Suzanne Marsh:** Writing – review & editing, Data curation. **Rebecca Naumann:** Writing – review & editing, Formal analysis, Conceptualization. **Noreen McDonald:** Writing – review & editing, Project administration, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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