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Work-Related Accidents and Their Predictors Among Delivery Drivers in Egypt: A Cross-Sectional Study

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Abstract

Background: *The rapid growth of the delivery sector, driven by online shopping and the COVID-19 pandemic, has raised safety concerns for delivery drivers, particularly work-related accidents and injuries. This study aimed to estimate the frequency of work-related accidents and injuries among delivery drivers and to identify potential predictors associated with these accidents in Egypt.* **Methods:** *A descriptive cross-sectional study with an analytical component was conducted among 172 delivery drivers recruited from gathering areas in Mansoura, Egypt. Participants were interviewed using a semi-structured questionnaire.* **Results:** *Among participants, 57.0% reported at least one work-related road accident during their career, with most accidents (91.8%) resulting from collisions with other vehicles. All injured drivers sustained at least one post-accident injury, most commonly contusions (93.9%). The lower limbs were the most frequently affected body parts (80.6%). After adjusting for confounders, the multivariable logistic regression analysis revealed that the following workplace exposure factors were significantly independent predictors of work-related accidents: being a university student or graduate (AOR = 2.86, 95% CI: 1.35-6.08), having more than five years of driving experience (AOR = 4.62, 95% CI: 2.15-9.94), and using mobile phones while driving (AOR =3.22, 95% CI: 1.56-6.64).* **Conclusions:** *This study showed a high frequency of work-related road accidents among delivery drivers in Egypt. Key predictors included higher education, extensive driving experience, and mobile phone use while driving. These findings underscore the need for targeted interventions, including safety training, regulation of mobile phone use, and awareness campaigns, to mitigate accident risk among delivery drivers.*

1. Introduction

The delivery business has grown rapidly over the past few years, aided by the rise in online shopping, especially for food and beverages [1]. Additionally, with the onset of the coronavirus disease 2019 (COVID-19) pandemic, delivery drivers suddenly found themselves in the spotlight. As more and more people adhere to the stay-at-home order, delivery drivers continue to fulfill customer orders [2, 3].

Home delivery is not limited to online shopping. Deliveries were conducted long before the Internet appeared, including mail, bulk goods, furniture, electrical appliances, televisions, and washing machines delivered to homes. Today, even traditional retailers have become part of the online shopping market by developing their online sales channels [4].

The Egyptian e-commerce and delivery sector has grown significantly over the last decade, covering retail, groceries, meals, and pharmaceuticals [5, 6, 7]. This expansion has increased reliance on mostly informal delivery drivers, with about 6 million young men and women working in the field,

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according to the Minister of Social Solidarity [8]. In response, the government launched the "Your Road is Safe" program to provide social and health insurance, financial assistance, and promote safer riding [8]. However, without clear regulations, delivery drivers face economic risks from workplace injuries and lack social benefits like paid leave [9]. The new Labor Law No. 14 of 2025 formally recognizes and regulates platform-based work, offering protections such as minimum wage, legal contracts, and access to specialized labor courts, though enforcement remains a challenge [10].

Based on fieldwork observations, delivery drivers fall into two main employment types: salaried employees and independent/self-employed drivers. Salaried employees work for online marketplaces or delivery companies like Amazon and Talabat, or for individual shops, restaurants, or pharmacies. Their tasks are similar but vary in workflow; those employed by individual establishments typically have fixed shifts aligned with business hours and deliver items specific to their workplace, such as meals or groceries. Orders are often received via direct phone calls, with the business dispatching the driver. In contrast, drivers for delivery companies usually operate through app-based platforms with more flexible schedules. They may deliver multiple shipments from a central warehouse within a designated area or make individual, on-demand pickups from various stores or restaurants. Independent drivers serve individuals and small businesses or act as subcontractors, earning payment per job.

In Egypt, two- and three-wheelers are increasingly popular for commercial transport because they are fuel-efficient, affordable, suitable for poor road conditions, and easily maneuverable through traffic, making delivery faster, more convenient, and cost-effective [11, 12]. However, accidents involving these vehicles are more common in developing countries like Egypt, due to factors such as weak traffic laws and enforcement, poor road infrastructure, lack of regular maintenance, crowded traffic, and business use of motorcycles. The issue is worsened by dangerous driving, high speeds, inadequate licensing, substance abuse, and riders neglecting protective helmets [11, 13].

Research has consistently shown that delivery drivers rank among the highest in occupational injury risk. Aside from road accidents, delivery drivers are susceptible to various other occupational injuries. While nonfatal injuries were typically caused by continuous workplace exposures (e.g., repetitive strain, contact with objects/equipment), fatalities were almost exclusively caused by transportation incidents [14].

Various studies worldwide suggest that multiple factors contribute to road traffic accidents (RTAs) and fatalities among two- and three-wheeler riders. These include rider-related, environmental, and vehicle-related factors [15-18]. Additionally, Zheng et al. [19] examined whether demographic and work-related traits of delivery riders influence their perceived time pressure and if this, in turn, affects riding behaviors. Fatigue levels of delivery riders were also presumed to be impacted by time pressure. Moreover, unsafe behaviors, fatigue, and work-related and demographic characteristics were suggested to influence riders' crash involvement.

The most common work-related risk factor for accidents and injuries among delivery drivers was time pressure due to constant roadwork and the demand to deliver items quickly. While the primary benefit of delivery work is earning income proportional to effort, this also endangers safety, as drivers may prioritize speed over safety [20]. These conditions often lead to risky riding behaviors and route violations, increasing the risk of fatal accidents [21, 22]. To meet customer expectations for rapid deliveries, earn more by completing more orders, and avoid company fines for delays, drivers often speed, use mobile phones while driving, run red lights, skip breaks, and work non-stop [23].

Besides RTAs, package delivery poses many hazards that can cause slip-and-fall accidents. Aside from road irregularities, delivery drivers encounter a never-ending list of premise hazards, including stairs, stairwells, fences, pets, and garbage cans [24].

To our knowledge, few studies have examined work-related hazards impacting the health and safety of delivery drivers, especially within the Egyptian context. This gap in the literature motivated this study. Its aim is to estimate the frequency

of work-related accidents and injuries among delivery drivers and identify potential predictors. Specifically, the study asks: What is the frequency of such incidents among Egyptian delivery drivers, and what factors are associated with their occurrence?

2. Methods

2.1. Study Design and Study Period

This descriptive cross-sectional study was conducted from July 2023 to March 2024 among delivery drivers in Mansoura City, Dakahlia Governorate, Egypt. The study followed the STROBE guidelines for reporting observational studies [25].

2.2. Study Population

Data were collected from delivery drivers at gathering and waiting areas outside restaurants, pharmacies, and delivery company offices in Mansoura City, the capital of Dakahlia Governorate. This city serves as a hub for medical, commercial, and administrative services for residents and surrounding suburban regions and villages. Inclusion criteria were delivery drivers aged 18 to less than 60 years, with at least six months of experience, either working independently or under temporary or permanent contracts. Exclusion criteria included individuals with chronic diseases such as epilepsy, uncontrolled diabetes, or severe visual impairment to reduce confounding from health-related limitations that could independently affect accident risk and influence associations with work-related exposures.

2.3. Sampling Strategy

Due to practical constraints, convenience sampling was used, as reaching all delivery drivers for simple random sampling was unfeasible. Supervisors and officers explained the study and helped identify willing drivers. Volunteer supervisors arranged small group interviews of 8–10 drivers. Recruitment was based on availability and willingness, considering different work systems, economic activities, and shifts. A total of 172 drivers meeting the criteria provided informed written consent.

2.4. Study Tools

After reviewing the literature, a semi-structured, interview-based questionnaire was developed to meet the study requirements. Before the main survey, it was translated into Arabic and validated for content and clarity to ensure suitability for the study population. Content validity was assessed by a panel of three experts—two in occupational health and one in public health research—who evaluated relevance, comprehensiveness, and clarity. Feedback resulted in minor wording adjustments to ensure the items were easily understood by delivery drivers with diverse educational backgrounds.

An external pilot study with 20 delivery drivers aimed to test reliability, assess completion time, and identify data collection obstacles. It found that data collection took approximately 15–20 minutes per participant. However, limited driver availability during work hours—about 5 minutes of free time—necessitated involving delivery supervisors to facilitate interviews during rest breaks. The study also highlighted challenges interviewing drivers using cars and tricycles due to their schedules and smaller populations; consequently, the final study focused mainly on motorcycle and bicycle riders. The questionnaire was adjusted for clarity and to streamline data collection before the main study, with pilot data excluded from final analysis.

The questionnaire had three sections with 44 items, mainly closed-ended questions, plus a few open-ended ones for details like durations, past jobs, and causes of accidents. The first section gathered socio-demographic data, including age, sex, residence, education, marital status, family income (monthly per capita from all sources) [26], and smoking history. The second covered occupational history, such as work duration, workdays/week, hours/day, shift times, types of products delivered, vehicle used, other part-time/past jobs (if any), and perceived time pressure and effort-reward imbalance. The third assessed driving experience, safety measures adoption, risky behaviors, daily riding hours [12], and work-related accidents and injuries, including causes, injury type, and affected body regions. Most responses were binary (yes/no) or

categorical (multiple-choice), with few numerical or open-text answers. The complete questionnaire is in Supplementary Material. All interviews were conducted by the first author, who had prior practical experience in data collection during her academic training, to ensure consistency.

2.5. Statistical Analysis

Data were analyzed using IBM SPSS for Windows, Version 25.0 (IBM Corp., 2017). Categorical data were tested for significance with Chi-square, Fisher's exact test (FET), or Monte Carlo Exact Probability (MEP) as appropriate. Normality of numerical data was assessed with the Kolmogorov-Smirnov test and visualized with histograms and Q–Q plots. Data were presented as mean ± SD for parametric or median (min–max) for non-parametric. A binary logistic regression with forward stepwise (Wald) method identified independent predictors of work-related accidents. Variables significant in bivariate analysis were included to develop a parsimonious model of key predictors. The stepwise approach adjusts for confounding by evaluating each variable's contribution while controlling for others, resulting in a model adjusted for covariates affecting the exposure-outcome relationship. Adjusted odds ratios (AOR) and 95% confidence intervals were calculated. P-values ≤ 0.05 were considered statistically significant.

3. Results

A total of 172 delivery drivers from Mansoura City consented to participate in the study.

3.1. Participants' Demographics

Regarding the socio-demographic characteristics of the delivery drivers, all were male, with a mean age of 26.9 ± 7.6 years. About 50% of them were secondary school graduates, either general or technical, and 40.7% were university students or graduates. A large proportion (66.9%) were from urban areas; 65.1% were single, and about half (54.7%) had a family income per month that just met routine expenses. About half (52.9%) of the delivery drivers were either current (38.4%) or former (14.5%) cigarette smokers, while the remaining 47.1% were non-smokers (Table 1).

3.2. Employment Arrangements of the Studied Sample

The majority (93.6%) of study participants were salaried employees on temporary contracts (renewed annually), with 58.7% employed by delivery companies or online marketplaces and 34.9% working directly for individual shops, restaurants, or pharmacies. Only 6.4% were self-employed or worked independently.

3.3. Work-Related Accident Frequency and Distribution

Concerning the frequency and distribution of work-related accidents among the delivery drivers, more than half (57.0%, n=98) reported experiencing at least one work-related road accident during their time working as delivery drivers. Among those, nearly half (43.9%) had more than 3 accidents during their careers. With a mean number of reported accidents by each driver of 2.7 ± 1.93 accidents. They all reported having at least one post-accident injury. The majority (93.9%) of injuries were contusions, primarily lower limb(s) injuries (80.6%), with 52% requiring hospital assistance. These accidents were more frequently caused by collisions with other vehicles (91.84%) (Table 2).

3.4. Work-Related Accidents and Participants' Demographics

Drivers who were university students or graduates had a statistically significantly higher frequency of reported accidents (68.6%) than those with lower educational levels. Similarly, current smokers had a statistically significantly higher frequency of reported accidents (71.2%) compared to ex-smokers and non-smokers. However, no statistically significant associations were found between work-related accidents and other socio-demographic variables such as age, residence, marital status, or monthly family income (Table 3).

Table 1. Socio-demographic characteristics of the delivery drivers (n = 172).

Variable	Mean ± SD
Age, years	26.9 ± 7.6
Gender	N (%)
Male	172 (100.0%)
Education level	
Basic education and less[a]	16 (9.3%)
Secondary school (general/technical)	86 (50.0%)
University student or graduate	70 (40.7%)
Residence	
Rural	57 (33.1%)
Urban	115 (66.9%)
Marital status	
Single	112 (65.1%)
Married	52 (30.2%)
Divorced	8 (4.7%)
Family income per month	
In debt	26 (15.1%)
Just meets routine expenses	94 (54.7%)
Meets routine expenses and emergencies	39 (22.7%)
Able to save/invest money	13 (7.6%)
Smoking status	
Non-smoker	81 (47.1%)
Ex-smoker	25 (14.5%)
Current smoker	66 (38.4%)

[a] *This category includes illiterate, primary, or preparatory education.*

Table 2. Frequency and distribution of work-related accidents among the delivery drivers (n = 172).

Variable	Total (n= 172) n (%)
The overall prevalence of having at least one work-related accident during career duration	98 (57.0)
Variable	Total (n= 98) n (%)
Number of work-related accidents for each driver	
<3	55 (56.1)
≥ 3	43 (43.9)
Having at least one-time post-accident injury	98 (100.0)
Site of injury due to the accident(s) [a]	
Scalp	17 (17.3)
Eye(s)	3 (3.1)
Nose	18 (18.4)
Mouth	13 (13.3)
Trunk	15 (15.3)
Upper limb(s)	34 (34.7)
Lower Limb (s)	79 (80.6)
Type of injury due to the accident(s) [a]	
Contusion	92 (93.9)
Cut wound	17 (17.3)
Laceration	14 (14.3)
Fracture	25 (25.5)
Others (abrasion, dislocation, burn)	4 (4.1)
Cause of accident	
Collision with another vehicle	90 (91.8)
Collision with an object	2 (2.0)
Trip, slip, or fall	6 (6.1)
Required hospital assistance	51 (52.0)

[a] *Categories are not mutually exclusive.*

3.5. Work-Related Accidents and Occupational Characteristics

Referring to occupational characteristics, the frequency of work-related accidents was statistically significantly higher (67.2%) among delivery drivers who were on the job for 25 months or more, compared to those who worked less than 25 months (P = 0.023). Regarding the types of products delivered, the frequency of accidents was highest among delivery drivers who delivered medications and cosmetics (62.5%), followed by those who delivered food and/or groceries (61.4%), compared to those who delivered other products (38.2%). The difference was statistically significant (p = 0.048). Regarding the type of vehicle used, the frequency of accidents was higher among delivery drivers who used motorcycles (64.1%) than among those who used bicycles or other vehicles (p = 0.007). However, no statistically significant differences were observed for other occupational characteristics (Table 4).

Table 3. Work-related accidents among the delivery drivers and their socio-demographic characteristics (n = 172).

Variable	Total (172)	Work-related accidents		Test of significance P-Value
		No n=74 n (%)	Yes n=98 n (%)	
Age in years				
18-24	78	38(48.7)	40(51.3)	χ^2=0.4.94
25-30	60	23(38.3)	37(61.7)	P=0.176
31-40	22	6(27.3)	16(72.7)	
>40	12	7(58.3)	5(41.7)	
Education level				
Basic education and less	16	11(68.8)	5(31.3)	χ^2=8.918
Secondary school	86	41(47.7)	45(52.3)	P=0.012
University student or graduate	70	22(31.4)	48(68.6)	
Residence				χ^2=0.233
Rural	57	26(45.6)	31(54.4)	P=0.629
Urban	115	48(41.7)	67(58.3)	
Marital status				
Single	112	53(47.3)	59(52.7)	MEP=0.106[#]
Married	52	20(38.5)	32(61.5)	
Divorced	8	1(12.5)	7(87.5)	
Family income per month				
In debt	26	9(34.6)	17(65.4)	χ^2=4.48
Just meet routine expenses	94	39(41.5)	55(58.5)	P=0.213
Meet routine expenses and emergencies	39	22(56.4)	17(43.6)	
Able to save/invest money	13	4(30.8)	9(69.2)	
Smoking status				
Non-smoker	81	46(56.8)	35(43.2)	χ^2=12.222
Ex-smoker	25	9(36.0)	16(64.0)	P=0.002
Current smoker	66	19(28.8)	47(71.2)	

χ^2: Chi-Square test, FET: Fisher's Exact Test, MEP: Monte Carlo Exact probability, [#]95% CI [0.100-0.112], 10,000 iterations.

3.6. Work-Related Accidents and Driving Experience

Delivery drivers with more than 5 years of driving experience had a statistically significant higher frequency of work-related accidents (P<0.001). Moreover, there was a statistically significant difference in the frequency of work-related accidents among delivery drivers who indicated using mobile phones while driving (P=0.001) or having traffic violations before (P=0.011). However, the frequency of accidents did not show any statistically significant differences in relation to other driving/riding experience or risky behaviors among delivery drivers (Table 5).

3.7. Predictors of Work-Related Accidents

To identify the predictors of work-related accidents among delivery drivers, we applied a multivariable logistic regression model using the Wald forward selection method. In the final step of the analysis, it was found that being a university student or graduate (AOR = 2.86, 95% CI: 1.35-6.08), having more than 5 years of driving experience (AOR = 4.62, 95% CI: 2.15-9.94), and using a mobile phone while driving (AOR =3.22, 95% CI: 1.56-6.64) were significantly associated with significant increased odds of work-related accidents. In contrast, delivering products other than food, groceries, medications, or cosmetics was significantly associated with

Table 4. Work-related accidents among the delivery drivers and their occupational characteristics (n = 172).

Variable	Total (172)	Work-related accidents		Test P-Value
		No n=74	Yes n=98	
		n (%)	n (%)	
Work duration (months)				
6-12	60	34(56.7)	26(43.3)	χ^2=7.561
13-24	45	18(40.0)	27(60.0)	P=0.023
≥25	67	22(32.8)	45(67.2)	
Number of working hours/ days				
≤8	67	34(50.7)	33(49.3)	χ^2=2.67
>8	105	40(38.1)	65(61.9)	P=0.102
Number of working hours/ weeks				
≤48	61	31(50.8)	30(49.2)	χ^2=2.34
>48	111	43(38.7)	68(61.3)	P=0.126
Average daily driving hours (n=169)				
<5	7	1 (14.3)	6 (85.7)	χ^2=2.48
5-10	123	52 (42.3)	71 (57.7)	P=0.288
>10	39	18 (46.2)	21 (53.8)	
Time of work shift				
Daytime only	41	20 (48.8)	21 (51.2)	χ^2=2.35
Both daytime and nighttime	92	41 (44.6)	51 (55.4)	P=0.504
Nighttime only	13	5 (38.5)	8 (61.5)	
Rotating shifts	26	8 (30.8)	18 (69.2)	
Employer category				
Delivery company or online marketplace	101	46 (45.5)	55 (54.5)	χ^2=6.519
Individual shops, restaurants, or pharmacies	60	20 (33.3)	40 (66.7)	P=0.038
No (self-employed)	11	8 (72.7)	3 (27.3)	
Type of products delivered				
Food and/ or groceries	113	44 (38.6)	70 (61.4)	χ^2=6.082
Medication & cosmetics	24	9 (37.5)	15 (62.5)	P=0.048
Others	34	21 (61.8)	13 (38.2)	
Type of vehicle used				
Bicycle	45	24 (53.3)	21 (46.7)	χ^2=9.953
Motorcycle	117	42 (35.9)	75 (64.1)	P=0.007
Others	10	8 (80.0)	2 (20.0)	
Other jobs besides delivery				
No	161	71 (44.1)	90 (55.9)	FET,
Yes	11	3 (27.3)	8 (72.7)	P=0.355
Perceived time pressure	159	64 (40.3)	95 (59.7)	χ^2=6.59 P=0.01

χ^2: Chi-Square test, FET: Fisher's Exact Test.

a reduced likelihood of such accidents (AOR = 0.33, 95% CI: 0.13-0.83) (Table 6).

AORs are mutually adjusted for all other variables in this final multivariable model. The variables significant in bivariate analysis ($p < 0.05$) were entered into a forward stepwise (Wald) logistic regression: education level, smoking status, work duration, employer category, type of products delivered, type of vehicle used, perceived time pressure, driving experience, use of a mobile phone while driving, and having traffic violations before.

Table 5. Work-related accidents among the delivery drivers and their driving/riding experience and risky behaviors.

Variable	Total [a] (n = 169)	Work-related accident		Test of significance P-Value
		No (n=71) n (%)	Yes (n=98) n (%)	
Driving experience (years)				
≤5	93	51(54.8)	42(45.2)	χ^2=13.966
>5	76	20(26.3)	56(73.7)	**P<0.001***
Don't have a driver's license	66	33(50)	33(50)	χ^2=2.836 P=0.092
Don't have training in driving (self-taught/friends & family)	80	38(47.5)	42(52.5)	χ^2=1.878 P=0.171
Don't examine the vehicle daily before driving	27	15(55.6)	12(44.4)	χ^2=2.420 P=0.120
The mirrors, horn, and backlight don't work well	45	23(51.1)	22(48.7)	χ^2=2.084 P=0.149
Don't adhere to speed limits	33	12(36.4)	21(63.6)	χ^2=0.537 P=0.464
Drive while tired	167	71(42.5)	96(57.5)	χ^2=1.466 P=0.226
Don't comply with wearing PPE like helmets and seatbelts	91	38(41.8)	53(58.2)	χ^2=0.005 P=0.942
Don't leave a safety gap with other vehicles	38	21(55.3)	17(44.7)	χ^2=3.534 P=0.06
Don't respect traffic lights & road signs	27	13(48.1)	14(51.9)	χ^2=0.497 P=0.481
Use a mobile phone while driving	98	31(31.6)	67(68.4)	χ^2=10.315 **P=0.001***
Had traffic violations before	69	21(30.4)	48(69.6)	χ^2=6.415 **P=0.011***

*[a] 3 participants making deliveries on foot excluded, χ^2: Chi-Square test, *statistically significant.*

Table 6. Predictors of work-related accidents among the delivery drivers (n = 172).

Variable	B	P-Value	AOR (95%CI)
Education level			
Basic education and less (r)			1
University student or graduate	1.051	**0.006**	2.86(1.35-6.08)
Type of products delivered			
Food and/ or groceries (r)			1
Other than food, groceries, medications, or cosmetics	-1.106	**0.019**	0.33(0.13-0.83)
Driving experience in years			
≤5 (r)			1
>5	1.531	**<0.001**	4.62(2.15-9.94)
Use a mobile phone while driving (r)	1.169	**0.002**	3.22(1.56-6.64)

r: reference group, AOR: adjusted odds ratio, β: Regression coefficient, CI: Confidence Interval.
Constant= -0.926, Overall % predicted =71%, Model χ^2, p-value=47.786, <0.001.

4. Discussion

The most vulnerable road users—pedestrians, cyclists, and motorcyclists—account for over half of all road traffic fatalities [27]. In Egypt, the Central Agency for Public Mobilization and Statistics (CAPMAS) reported 55,991 road traffic injuries (RTIs) in 2022, an 8.7% increase from 51,511 in 2021. Dakahlia Governorate had the highest number, with 12,051 cases. Delivery drivers face higher crash risks due to greater exposure, especially motorcyclists [29]. This study examines work-related accidents and their predictors among delivery drivers. About 57.0% reported at least one work-related road accident, and 43.9% experienced more than three. Studies from Italy and China show a high prevalence: Boniardi et al. [30] found that 39.0% of delivery riders were involved in at least one collision in the past year. In comparison, Wang et al. [31] reported that 76.5% experienced crashes within 1.5 years of starting the profession. Christie and Ward [32] noted that young male drivers who rely on vulnerable modes such as bicycles and motorcycles are at high risk. Nearly 80% of our sample were 30 or younger, all male, and about 94% used mainly motorcycles or bicycles. Factors contributing to accidents include heavy workloads, strict deadlines, poor road conditions, distraction, limited driving skills (e.g., on wet roads), and heavy loads [30, 31, 33]. Our study found that being a university student or graduate was independently associated with a higher odds of work-related accidents (AOR=2.86, 95% CI [1.35-6.08], p=0.006). This contradicts previous research suggesting educated riders have better safety awareness and lower violation rates [34, 35]. Wang et al. [36] indicated that education does not directly affect crash risk but influences it indirectly through familiarity with traffic regulations. Consistent with our findings, higher education levels correlated positively with traffic accident rates in Indian states [37], possibly because more educated drivers may be overconfident and pass other vehicles recklessly [37, 39]. Surprisingly, drivers with over five years of experience were more likely to have work-related accidents (AOR=4.62, 95%CI [2.15-9.94], p<0.001). While lack of experience is often cited as a risk, more experienced drivers may become desensitized to hazards, overestimate their skills, or drive more recklessly, especially given longer exposure and fatigue [22, 35, 38, 39]. Furthermore, our study findings showed that using mobile phones while driving was an independent predictor of the likelihood of work-related accidents (AOR=3.22, 95%CI [1.56-6.64], p=0.002). Similarly, in a meta-analysis by Elvik [40], the risk of an accident was at least three times greater for those who used a mobile phone while driving (MPUWD) than for those who did not. MPUWD is distracting, occurs frequently, and poses a significant risk of crashes for delivery drivers [32, 33].

The study found a higher, but statistically insignificant, rate of accidents among delivery drivers working over 48 hours weekly. This trend may reflect fatigue from extended hours. Numerous studies link driver fatigue to increased accident risk, rising with longer hours, more deliveries, and greater travel distances [19, 30, 41, 42]. Drivers delivering products other than food, groceries, medication, or cosmetics were less likely to experience work-related accidents (AOR=0.33, 95%CI [0.13-0.83], p=0.019). The pressure to make quick deliveries often leads to risky behavior and accidents [42]. Food, groceries, and medication deliveries face strict deadlines, unlike more flexible schedules for items like electronics. Useche et al. [43] highlighted that stress and fatigue in food delivery can cause crashes. Christie and Ward [32] found that less pressured riders violate traffic less and have fewer collisions. Flexible deadlines also help riders avoid adverse weather, reducing accidents. While time pressure is a known risk factor linked to stress and risky driving [19, 20, 33], it was not an independent predictor in our multivariate analysis, possibly operating through behaviors like mobile phone use, product type, or experience. Most (94.2%) respondents were motorcycle or bicycle riders, who are more prone to crash injuries [44]. All those involved in accidents reported injuries, mostly minor but some severe—mostly affecting the lower limbs (80.6%) and requiring hospital care (52%). Boniardi et al. [30] noted similar injury patterns in Italy. The most common cause of accidents was collisions with other vehicles (91.8%). Some studies report collisions with vehicle doors [45, 46], while others cite solo injuries during non-vehicle

crashes [46, 47]. Recent research suggests targeted safety interventions, including training on safe riding, infrastructure improvements like motorcycle lanes, and enforcement of rest breaks and manageable delivery quotas [48-52]. First aid training is also recommended to help responders reduce injury severity. These findings support a comprehensive strategy involving policymakers, employers, and platform developers to enhance delivery workers' safety.

4.1 Strengths and Limitations

Our study has both strengths and limitations. To our knowledge, it is the first to explore work-related accidents and predictors among delivery drivers in Egypt, filling a significant gap in occupational health research. However, limitations include its cross-sectional design with stepwise forward logistic regression, which identifies associations but cannot establish causality, requiring future studies for confirmation. Self-reported data may introduce bias, including underreporting of risky behaviors. The small, non-probability sample limits representativeness and generalizability. All participants were male due to the local demographic, limiting the assessment of gender differences and the applicability to female drivers. Excluding drivers with chronic conditions that may affect accident risk also limits understanding of their role. Participation was limited to available, willing drivers at the time of data collection. Since the study was conducted in Mansoura City, caution is advised when generalizing findings to all Egyptian drivers or similar occupational groups elsewhere.

Several methodological aspects should also be noted. The questionnaire, though validated by experts, lacked formal reliability metrics. Data collection was performed by a single interviewer without standardized training, possibly introducing bias. The multivariate logistic regression did not include model diagnostics such as goodness-of-fit, multicollinearity, or residual analysis. Although age was a potential confounder, with 80% of participants under 30, the approach to age adjustment in the multivariate model needs clarification. These limitations affect the study's generalizability and robustness.

5. Conclusion

The current cross-sectional study revealed that a considerable proportion of delivery drivers reported work-related accidents. Factors significantly associated with accident occurrence included being a university student or graduate, having more than five years of driving experience, and using a mobile phone while driving. These findings underscore the importance of targeted preventive measures—such as road safety training, regulation of mobile phone use, and tailored awareness campaigns—to support and safeguard this occupational group.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

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Author Contribution Statement: M.E. identified the research gap and developed the study idea. M.E., K.D., and O.Y. prepared the study protocol, methodology, sampling strategy, and questionnaire. O.Y. conducted the literature review, participated in writing, interviewed participants, collected data, performed statistical analysis, contributed to writing the results, preparing tables, and drafting the discussion, and served as the corresponding author. O.Y. and K.D. prepared the reference list. M.E., K.D., and A.E. contributed to the interpretation of results, statistical analysis, table preparation, and writing and reviewing the discussion and conclusion.
All authors reviewed and approved the final manuscript.

Declaration on Use of AI: No chatbot was used.

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