

Occupational Health and Safety in the Gig Economy: Risks Among App-Based Delivery and Ride-Share Workers

Dr. Amit Sachdeva^{1*}, Mr Nasim Ahmed², Mrs. Tamanna Rahman³, Dr. Anju Sachdeva⁴

¹Assistant Professor, Department of Community Medicine, Indira Gandhi Medical College, Shimla, Himachal Pradesh

²Independent Researcher, Guwahati Assam, India Email: nasim@iarcon.org

³MSc in Herbal Science and Technology, Anandaram Dhekial Phookan College under Guwahati University, Assam

⁴Physiotherapist, Shimla, Himachal Pradesh

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Abstract: App-based delivery and ride-share work has expanded rapidly, providing accessible income opportunities and flexible work arrangements while transferring many occupational risks from firms to individual workers. Delivery riders and ride-share drivers face a distinctive combination of road-traffic hazards, prolonged sitting or riding, adverse weather, air pollution, fatigue, violence, psychosocial stress and income insecurity. These risks are intensified by algorithmic management: platform-determined incentives, customer ratings, opaque work allocation, route monitoring and time-sensitive performance targets can indirectly encourage long hours, distracted driving and unsafe road behaviour. Current evidence consistently identifies road injury, musculoskeletal symptoms, fatigue and psychological distress as important concerns, but its quality is limited by cross-sectional designs, convenience samples, self-reported outcomes and poor recording of gig-worker status in routine occupational and injury databases. Workers classified as independent contractors may lack minimum-wage protection, paid leave, employer-funded health coverage, workers' compensation and effective grievance mechanisms. India's platform workforce is projected to grow substantially, making occupational protection an urgent public health priority. The Code on Social Security, 2020, implemented within India's labour-law reforms, formally recognizes gig and platform workers and provides a basis for portable social-security benefits and aggregator contributions. Nevertheless, social-security recognition alone does not establish enforceable occupational safety standards. A comprehensive response should include safe payment systems, algorithmic transparency, maximum work and driving-hour protections, accident and health insurance, ergonomic interventions, accessible rest facilities, heat and air-pollution precautions, violence-prevention measures and worker participation in platform governance. Future research must establish prospective occupational cohorts, link platform exposure data with health outcomes and evaluate whether regulatory and platform-level interventions reduce injuries without reducing workers' incomes.

Keywords: gig economy; platform work; occupational health; delivery riders; ride-share drivers; algorithmic management.

INTRODUCTION

Digital labour platforms have transformed urban transport, food delivery and last-mile logistics. Through smartphone applications, platforms match consumer demand with workers who provide rides or transport food, groceries and parcels. These arrangements can lower barriers to employment, allow workers to choose when to log in and provide supplementary income. Their apparent flexibility, however, coexists with substantial economic dependence, limited control over how work is allocated and weak access to conventional occupational protections.

The International Labour Organization distinguishes location-based platforms, where services are performed in a specified physical place, from online web-based platforms. Ride-share driving and delivery work are prominent forms of location-based platform labour. The ILO's multinational

assessment found that platform work was commonly characterized by variable earnings, unpaid waiting time, work-related expenses and dependence on algorithmic systems for task allocation and performance evaluation.[1]

The occupational risks of delivery and ride-share work should not be reduced to ordinary road hazards. The platform business model shapes when, where and how workers travel. Payment per task, peak-hour incentives, acceptance-rate requirements, customer ratings and the threat of account deactivation can influence risk-taking. Workers may technically be free to reject a task, yet economically unable to do so. Occupational safety therefore depends not only on helmets, seat belts and traffic rules but also on the organization of work.

This review critically examines the physical, psychosocial and environmental risks faced by app-based delivery riders and ride-share drivers, the mechanisms through which platform management affects safety, recent policy developments and priorities for India.

The Platform Work Environment

Traditional occupational-health frameworks assume an identifiable employer, a defined workplace and an employment relationship through which safety obligations can be enforced. Gig work complicates each assumption. The worker may be legally classified as self-employed, the workplace may encompass an entire city, and management may be exercised through an application rather than a human supervisor.

Platforms determine fare structures, delivery fees, incentive periods, service zones and access to customers. Algorithms may assign tasks, calculate estimated arrival times, monitor location, rank performance and suspend access. These functions resemble managerial control even when contracts describe workers as independent partners.

Workers also supply many of the tools required for work: vehicle, smartphone, fuel, maintenance, mobile data, protective equipment and insurance. When earnings are calculated without accounting for these costs or unpaid waiting time, workers may extend their hours to reach an acceptable net income. Long working hours are therefore both an economic issue and an occupational exposure.

Road-Traffic Injuries

Road injury is the most immediate safety threat, particularly for delivery riders using motorcycles, scooters or bicycles. They operate in congested traffic, repeatedly stop and restart, navigate unfamiliar roads and interact with mobile applications while moving. Rain, heat, poor road surfaces, limited lighting and pressure to complete tasks increase the risk.

Research among delivery workers has identified speeding, red-light violations, abrupt manoeuvres, mobile-phone distraction and inadequate use of protective equipment. In a cross-sectional study of courier and food-delivery electric-bike riders in China, occupational riders represented a vulnerable group with frequent risky road behaviours and crashes.[2] Although traffic systems differ across countries, the underlying conflict between rapid delivery and safe riding is widely applicable.

Hospital records provide a more clinically meaningful picture than self-reported near-misses. An Australian emergency-department review found that injured food-delivery riders sustained a range of fractures, soft-tissue injuries and other trauma. The study also showed that commercial delivery status was often poorly recorded, making the true burden difficult to quantify.[3] Under-recognition in injury records means that official statistics may substantially underestimate occupational harm.

Payment systems can influence risk. Per-delivery earnings encourage workers to maximize completed tasks, while incentive thresholds can produce intense work near the end of a shift. Customer-facing countdowns and “fast delivery” promises may create pressure even when platforms formally advise compliance with traffic rules. Safety messaging cannot neutralize a remuneration system that rewards speed.

Ride-share drivers face somewhat different risks. Cars offer greater physical protection than motorcycles, but drivers spend long periods on the road, frequently use navigation and platform interfaces, work during late-night or peak-demand periods and may drive while fatigued. Waiting for bookings in unsafe locations and accepting passengers with unknown intentions create additional security concerns.

Algorithmic Management, Stress and Risk-Taking

Algorithmic management is central to the occupational-health profile of gig work. Workers may not know why some tasks are offered, how fares are calculated, how ratings affect future allocation or what evidence is used when an account is suspended. This uncertainty produces a form of continuous performance surveillance without corresponding access to a supervisor who can explain or correct a decision.

A study of Taiwanese food-delivery motorcycle riders found that workload and time pressure increased job stress, while job stress was associated with distraction and risky riding behaviour.[4] These findings are important because they connect apparently individual road behaviour with upstream work organization.

Useche and colleagues similarly reported that work-related stressors and fatigue predicted occupational crashes among delivery riders.[5] Although observational studies cannot establish every causal pathway, the consistency of associations supports a plausible sequence: unstable earnings and high task demand encourage longer or more intense work; prolonged work increases fatigue and stress; and fatigue impairs attention, reaction time and judgement.

Customer ratings may also have psychosocial effects. A low score can affect access to work even when the cause lies outside the worker's control, such as traffic congestion, restaurant delay, incorrect navigation or customer unavailability. Workers may respond by rushing, accepting unreasonable requests or tolerating abusive behaviour to avoid complaints.

The language of flexibility can obscure these constraints. Flexibility is meaningful when workers can choose hours without financial penalty. It is considerably weaker when workers must remain logged in during incentive windows, chase surge pricing or work excessive hours to cover vehicle repayments and household expenses.

Musculoskeletal and Other Physical Health Risks

Delivery riders experience prolonged static posture, repeated mounting and dismounting, whole-body vibration and the physical handling of loads. Back, neck, shoulder, wrist and knee symptoms may arise from poor vehicle ergonomics, heavy delivery bags, uneven roads and long shifts.

A Chennai study of 2,553 male e-commerce and food-delivery workers reported low backache in 31%, headache in 25% and red or irritated eyes in 21%.[6] The cross-sectional design and historical data-collection period limit causal interpretation, but the findings demonstrate that occupational morbidity extends beyond crashes.

Ride-share drivers experience prolonged sitting, limited opportunities to stretch and repeated exposure to vibration. Sedentary work may contribute to back pain, reduced physical activity and cardiometabolic risk. Drivers may avoid drinking water to reduce toilet stops or delay meals to remain available during high-demand periods. Irregular meals, restricted restroom access and insufficient sleep can become routine rather than occasional inconveniences.

Delivery bags require careful ergonomic design. A bag that is heavy, poorly balanced or inadequately secured can alter posture and vehicle stability. Maximum-load limits should consider the combined weight of food, packaging and the bag itself rather than leaving workers to judge whether a task is physically safe.

Heat, Air Pollution and Adverse Weather

Gig workers spend much of their working day in outdoor or traffic environments. Delivery riders are directly exposed to heat, ultraviolet radiation, rain, cold and air pollution. Ride-share drivers experience traffic-related pollution within vehicles, particularly when ventilation systems are inadequate or windows remain open.

Heat exposure can cause dehydration, headache, reduced concentration, heat exhaustion and increased crash risk. These effects may interact: a rider who is dehydrated and fatigued may respond more slowly to traffic hazards. Climate change and more frequent extreme-heat events make this an increasingly important occupational issue.

Platforms can detect weather conditions and worker location in real time, creating an opportunity—and an obligation—to implement protective responses. During hazardous heat, storms, flooding or severe air pollution, platforms should reduce performance pressure, suspend unrealistic time targets and compensate workers for interrupted work. Merely displaying a weather warning transfers responsibility to the worker without addressing the economic pressure to continue.

Rest areas with drinking water, toilets, shade, charging facilities and basic first aid are essential occupational infrastructure. Yet delivery riders are often expected to wait outside restaurants, residential complexes or commercial buildings without access to these facilities.

Violence, Harassment and Discrimination

Ride-share and delivery workers enter private vehicles, homes, apartment complexes and unfamiliar neighbourhoods, frequently at night. They may face robbery, assault, sexual harassment, verbal abuse, caste or religious discrimination, threats from customers and conflicts with other transport providers.

Women workers encounter additional risks, including harassment, stalking, unsafe sanitation facilities and platform systems that may not account for gendered safety concerns. Emergency buttons are useful only when responses are rapid, location data are accurate and workers are not penalized for abandoning a task.

Customer anonymity and weak grievance systems create an imbalance. Platforms often possess extensive information about workers while workers receive limited information about customers. Safety requires

Table 1: Evidence Summary and Preventive Priorities

Occupational hazard	Platform-related mechanism	Likely health outcome	Evidence limitation	Priority intervention
Road crashes	Per-task payment, time pressure, app interaction and long hours	Fatal and non-fatal injury, disability and income loss	Gig-worker status poorly captured in crash and hospital records	Safe scheduling, no speed-linked incentives, app lockout while moving and comprehensive accident insurance
Fatigue	Extended shifts, night work, unpaid waiting and income targets	Impaired attention, microsleep, crashes and psychological distress	Working time fragmented across multiple platforms	Aggregate driving-hour limits and mandatory rest periods
Musculoskeletal strain	Prolonged sitting or riding, vibration, heavy bags and poor vehicle ergonomics	Back, neck, shoulder and knee pain	Mostly cross-sectional and self-reported evidence	Ergonomic vehicle guidance, load limits, adjustable bags and rest breaks
Heat and weather	Outdoor work and financial pressure to continue during extreme conditions	Dehydration, heat illness and impaired driving	Limited exposure measurement	Heat-action protocols, paid stoppages, water, shade and protective equipment
Air pollution	Prolonged exposure in congested traffic	Respiratory and cardiovascular effects, eye irritation and headache	Few longitudinal gig-worker cohorts	Exposure reduction, appropriate masks during severe pollution and cleaner vehicles
Violence and harassment	Customer interaction, night work and unfamiliar locations	Physical injury, anxiety, trauma and attrition	Under-reporting and weak gender-specific data	Customer verification, emergency response and refusal without penalty
Psychosocial stress	Ratings, surveillance, opaque algorithms and deactivation risk	Anxiety, depressive symptoms, burnout and unsafe behaviour	Causal direction difficult to establish	Algorithmic transparency, human appeals and worker participation
Income and benefit insecurity	Independent-contractor classification and work-related expenses	Presenteeism, delayed treatment and financial distress	Net earnings often poorly measured	Minimum earnings after expenses, paid sick leave and portable social protection
Infection exposure	Contact with passengers, restaurants and households	Respiratory and other communicable infections	Exposure varies by service and epidemic context	Sick-pay protection, hygiene supplies and outbreak-specific protocols

verified customer accounts, rapid human support, the ability to refuse unsafe tasks without rating penalties and transparent procedures for investigating violence.

Mental Health, Social Isolation and Financial Insecurity

Psychological distress arises from uncertain earnings, debt, customer aggression, isolation, long hours and fear of sudden deactivation. Unlike conventional workplaces, gig work offers few opportunities for stable collegial relationships or supervisor support. Workers may interact with one another informally at restaurants or waiting locations, but platforms rarely create formal peer-support systems.

Financial insecurity is itself an occupational-health exposure. Fuel-price increases, vehicle repairs, penalties or illness can eliminate earnings. Because workers are paid per task, taking time off for fever, injury or emotional distress directly reduces income. This creates **presenteeism**—working despite illness or exhaustion.

During infectious-disease outbreaks, the absence of paid sick leave can also create a public health risk. Workers interact with multiple customers and businesses each day. A system that economically compels symptomatic workers to continue working undermines infection control.

Mental-health programmes should not consist solely of wellness messages or helpline numbers. Stress generated by unsafe incentive systems, unpredictable pay and arbitrary deactivation cannot be solved through individual resilience training. Prevention requires modification of the work environment.

Public Health Significance

Gig-worker safety is not only an employment issue. Road crashes affect pedestrians and other road users, fatigue can compromise passenger safety, and lack of sick leave can increase infectious exposure. Occupational injuries generate emergency-care costs, disability and loss of household income.

The platform workforce is often young, migrant and economically vulnerable. An injury can therefore affect several dependants and reinforce cycles of debt. Because workers are geographically dispersed and classified outside conventional employment, they may remain invisible to occupational-health services.

The public also benefits from rapid, inexpensive delivery and transport, but part of the true cost may be shifted to workers, families and healthcare systems. A public health approach should make these externalized costs visible.

Global Policy Developments

Countries have taken different approaches to worker classification, minimum earnings, insurance, collective bargaining and algorithmic transparency. The central controversy is whether platform workers are genuinely independent or economically dependent workers who require employment-like protections.

A binary choice between employee and self-employed status may not address all realities. However, creating a third category must not become a mechanism for providing fewer rights than standard employment. Regardless of legal classification, certain protections should be universal: safe work, non-discrimination, social security, transparent pay, access to injury compensation and the right to challenge automated decisions.

The WHO's assessment of meal-delivery applications notes that delivery riders may lack adequate training, protective equipment and workers' compensation, demonstrating that the food-delivery system has consequences beyond consumer nutrition.[7]

Indian Perspective

NITI Aayog estimated approximately 7.7 million gig workers in India in 2020–2021 and projected that the workforce could reach 23.5 million by 2029–2030. It also acknowledged that these estimates were indicative because of limited data.[8] Delivery and transport constitute visible segments of this workforce, particularly in rapidly urbanizing cities.

Indian workers face dense and heterogeneous traffic, extreme heat, air pollution, variable road quality and limited public rest infrastructure. Many use two-wheelers purchased through loans, making temporary withdrawal from unsafe work economically difficult. Migrant workers may also lack local social networks and easy access to healthcare.

India's Code on Social Security, 2020 formally defined gig workers, platform workers and aggregators. Following implementation of the labour-law reforms, the government stated that aggregators would contribute 1–2% of annual turnover—subject to a ceiling linked to payments to workers—to a social-

security fund. The framework provides for government-notified benefits, registration through e-Shram and portability across platforms.[9]

This is an important development, but eligibility for social-security schemes is not equivalent to enforceable occupational safety. The framework must be translated into readily claimable accident, disability, health and maternity benefits. Workers should not have to navigate complex documentation after an injury or prove which platform was responsible when working across several applications.

State initiatives, including welfare-board legislation, can supplement national provisions, but fragmented schemes risk unequal protection. Portability and national minimum standards are essential.

Recent Advances

Platform technology can contribute to prevention. Applications can detect prolonged driving, excessive speed, hazardous weather and repeated nighttime work. Navigation can be designed to discourage unsafe turns and prevent manual interaction while a vehicle is moving. Crash detection can automatically initiate emergency support.

The same technology can also intensify surveillance and pressure. Safety systems should therefore be co-designed with workers, independently audited and separated from punitive performance monitoring. A fatigue alert has limited value if rejecting the next task reduces the worker's rating or incentive.

Data portability is another emerging priority. Workers should be able to access records of hours, earnings, deductions, ratings and incidents across platforms. These data are necessary for verifying wages, insurance eligibility and cumulative driving time.

Challenges and Limitations

The research base remains fragmented. Most studies are cross-sectional, focus on male delivery riders and rely on self-report. Ride-share drivers, women workers, disabled workers, smaller cities and workers using several platforms are under-studied.

Denominators are uncertain because platforms rarely disclose the number of active workers or total hours worked. Counting injuries without measuring exposure can misrepresent risk. Routine hospital, police and mortality data seldom identify whether a person was performing platform work when injured. Healthy-worker bias is also possible: workers with severe pain, illness or stress may leave the sector and disappear from studies of active workers. Conversely, workers experiencing difficulties may be more likely to participate in surveys.

Research access should not depend entirely on voluntary platform cooperation. Independent investigators need privacy-protective access to aggregated data on work hours, task pressure, crashes and deactivation.

Future Directions and Policy Priorities

The first priority is an explicit occupational-safety framework for location-based platform work. Platforms should assess hazards, provide training and protective equipment, record injuries and modify systems that create foreseeable risk.

Payment should be based on realistic service times and should not reward speeding. Minimum-earnings standards should account for waiting time and work-related expenses. Working-time protections must aggregate hours across platforms to prevent fatigue being hidden by multi-apping.

All workers should receive no-fault accident and disability coverage from the moment they log in, including time spent waiting and travelling to collect an order. Paid sick leave, health coverage and compensation for extreme-weather stoppages are also necessary.

India should establish a national surveillance system linking e-Shram registration, platform data, police crash records, emergency departments and insurance claims while protecting confidentiality. Standardized indicators should include injuries per million working hours or kilometres, work-related deaths, musculoskeletal symptoms, heat illness, violence, fatigue and mental-health outcomes.

Worker organizations must participate in setting safety standards and reviewing algorithmic changes. Automated deactivation should never occur without a comprehensible reason, access to evidence and timely human appeal.

Prospective cohorts and natural experiments are needed to determine whether rest rules, earnings guarantees, algorithmic transparency, safer delivery estimates and insurance reforms improve health. Studies should measure unintended effects, including whether

CONCLUSION

App-based delivery and ride-share work offers flexibility and income opportunities, but its occupational risks are neither accidental nor unavoidable. Road crashes, musculoskeletal strain, fatigue, heat, pollution, violence and psychological distress are shaped by the interaction between urban hazards and platform-controlled work organization.

The available evidence is consistent in identifying serious concerns, although precise risk estimates remain limited by weak surveillance and predominantly cross-sectional research. Algorithmic management deserves particular attention because time pressure, rating systems, opaque allocation and income incentives can influence safety without appearing as direct managerial commands.

India's formal recognition of gig and platform workers and its emerging social-security framework represent important progress. The next step is to convert recognition into enforceable and accessible protection. Occupational safety cannot depend on workers individually purchasing insurance, resisting unsafe incentives or absorbing income loss when ill.

A fair gig economy requires that flexibility be preserved without making insecurity its price. Platforms, governments and consumers all benefit from delivery and ride-share services; responsibility for safe work must therefore be shared rather than transferred to the worker with the least bargaining power.

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