

A Revision and Expansion Study of the Occupational Safety, Health and Well-being (SHW) Scale for Chinese Ride-Hailing Drivers: Based on Literature Review and Empirical Testing

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DOI Link: <http://dx.doi.org/10.6007/IJARBS/v15-i12/27059>

Published Date: 01 December 2025

Abstract

The occupational safety, health and well-being (SHW) of ride-hailing drivers is receiving increasing attention from society. This is not only related to the safety and health of the drivers themselves, but also to the safety of passengers, and affects the sustainable development of the ride-hailing economy. To comprehensively understand the research results on SHW from previous studies, this study systematically reviewed relevant research in the Web of Science and Scopus databases from 2016 to 2025. This study aims to achieve two main research objectives: (1) to identify the key factors influencing the SHW of ride-hailing drivers; and (2) to revise and expand the SHW scale for the unique context of ride-hailing drivers in China, so as to improve its measurement accuracy and applicability in this group. The results show that the SHW problem of ride-hailing drivers has become an obstacle to the sustainable development of China's ride-hailing economy and road safety, requiring the implementation of corresponding measures for different influencing factors. This study highlights the importance of SHW and revises a scale that can effectively measure the SHW of ride-hailing drivers, leading to a deeper understanding of SHW.

Keywords: Safety, Health and Well-being (SHW), Chinese Ride-Hailing Drivers, Ride-hailing Economy development, Scale Revision

Introduction

Occupational safety, health and well-being (SHW) is a comprehensive concept, which characterizes an individual's quality of life in terms of occupational safety, health and job-related environmental, organizational and psychosocial factors (Chari et al., 2022). Occupational safety involves personnel engaged in occupations and promotes a safe and healthy working environment and climate (Mishra, 2017). Occupational health encompasses both physical and mental health (Pronk, 2021). Well-being encompasses both objective and subjective factors, namely physical and mental health, and is manifested in emotional, social,

economic, intellectual and mental health (Pronk, 2020). Drawing on NIOSH's five-domain framework, the study regroups worker well-being into three dimensions: Safety, Health and Well-being.

Concerns about SHW are becoming more prominent as it assumes a more important role in individuals, families, workplaces, communities, and society (Chari et al., 2018). Fostering SHW both on and off the job enhances employees' overall quality of life (Rogers & Schill, 2021). Therefore, the employee SHW in the workplace has a critical impact (Pronk & Ochiai, 2020). The workplace and working conditions determine employee SHW (Sorensen et al., 2021). Examining the working conditions and environment of Guangdong's ride-hailing drivers is pivotal for understanding their SHW.

The ride-hailing industry provides electronic ride-hailing services through Internet technology platforms, completely changing the traditional transportation industry (Vega-Gonzalo et al., 2024) and is growing rapidly around the world, offering consumers a new type of travel option (Zhu et al., 2019; McKenzie, 2020; Vega-Gonzalo et al., 2024). According to the research data from Betzers Consulting, the global taxi market size was \$123.559 billion in 2024, and it is projected to grow at an annual rate of 12.3% from 2024 to 2029 (Betzers Consulting, 2025). It is also estimated that the e-hailing market size will increase to \$141.5 billion by 2028 (2024 Ride-hailing Global Industry Report), and the number of ride-hailing users increased from 1.63 billion in 2022 to 1.75 billion in 2024 (2024 Ride-hailing Market Annual Report, 2025). The number of ride-hailing users and orders continues to grow globally, and ride-hailing has become an important component of urban transportation (Tirachini, 2020; Brail, 2022).

The flexible employment model of ride-hailing drivers has undermines the stability of jobs in traditional employment systems, the forfeiture of traditional employment-linked social protections and benefits, damage to occupational health (Midžović, 2020), infringement of workers' economic and social security rights, and an increase in discrimination and victimisation in the workplace (Van, 2003; Slađ ana et al., 2021; Li, 2022), and also increases work-life conflicts for labourers (Rubery, 2016). The lack of safety inspections of the vehicles operated by ride-hailing drivers creates potential road safety hazards (Jiang & Wang, 2020), and the unlimited extension of labour time by ride-hailing drivers to obtain rewards from the platform creates occupational safety and health problems (Wu & Li, 2018).

Fielbaum and Tirachini (2021) stated that ride-hailing drivers are exposed to health and injury risks, with more than 97% of ride-hailing drivers having suffered from risky situations, most commonly when assigned to drive in unsafe places. The majority of ride-hailing drivers' working hours are at night, particularly between 8pm and 6am. Some ride-hailing drivers endure extremely long working hours, with more than 30% of drivers working 10 hours and more per day, and even 4.7% working 16 hours and more (Fielbaum & Tirachini, 2021), which creates a significant safety risk for safe driving (Mao, 2020).

Ride-hailing drivers face opaque and often disappointing earnings; many cannot even track their true take-home, drivers cannot be clear about the full details of their income (Fielbaum & Tirachini, 2021), and in fact the hourly wage per unit of ride-hailing drivers in some cities is below the local minimum wage (Henao, 2019; Fielbaum & Tirachini, 2021). With the number of vehicles increasing year by year and the road network expanding, China faces more serious

road traffic accidents than other countries (Fleiter & Watson, 2015; Xu, 2018). Travel patterns and physical health significantly impact the well-being of ride-hailing drivers (Chen et al., 2022). Furthermore, income level, living conditions, and social status have the greatest impact on the travel well-being of ride-hailing drivers (Zulkefli et al., 2023).

According to the "2023 China Ride-hailing Driver Health Research Report", 75% of drivers work for over 10 hours a day, and more than half of them are in a "sub-health" state due to chronic fatigue. Spending long hours in a confined space without changing positions leads to problems such as shoulder periarthritis and lumbar intervertebral disc protrusion. 38.68% of drivers have symptoms of cervical spondylosis. The peak hours for receiving orders often coincide with meal times, and the lack of regular meal schedules and long-term irregular diet easily trigger gastritis (Useche et al., 2024). Due to the difficulty in finding a place to relieve themselves, inability to park, and missing orders because of going to the toilet, drivers are forced to drink less water and go to the toilet less frequently, which leads to conditions such as kidney stones, bladder and urinary tract stones, and prostatitis (Huo et al., 2023). Moreover, due to the low level of physical activity, the risk of diabetes and cardiovascular diseases for ride-hailing drivers increases significantly, with the risk of diabetes increasing by 88% and the risk of heart disease increasing by 14% (2023 China Ride-Hailing Driver Health Survey Report, 2024). It can be seen that the SHW of ride-hailing drivers has been trapped in multiple health pitfalls due to "long working hours, prolonged sitting, and difficulties in eating, drinking, defecating and urinating". There is an urgent need for a scale and intervention plan that is tailored to their actual situation to understand the situation and break through the deadlock. In summary, studying SHW among ride-hailing drivers matters for spotting factors that raise accident risk, which can help develop safety countermeasures, driver training programmed and industry regulations (Mao et al., 2020), as well as improve road safety management (Liu et al., 2022). Previous studies on the SHW issues of ride-hailing drivers in China have been limited, failing to comprehensively summarize the various influencing factors. This study provides a literature review and summary of the factors influencing SHW among ride-hailing drivers in China. The results of this study contribute to a better understanding of the SHW issue among ride-hailing drivers in China. A deeper understanding of the causes will enable ride-hailing platforms and relevant government departments to address this problem and take timely action to protect drivers' SHW. This will also contribute to the healthy and sustainable development of China's ride-hailing economy.

Aims and Methods

Aims

This study aims to examine and summarize the literature on ride-hailing drivers' SHW in China from published empirical evidence and review research.

Searching Method

Research searching in WOS and Scopus databases was conducted in August 2025. The study's timeframe was restricted to the period from January 2016 to January 2025 to examine only research with updated and relevant information concerning the presenting problem. Searching terms contained combinations of the following keywords: "occupational safety, health and well-being" OR "safety, health and well-being" OR "occupational safety, health" OR "overall well-being" and "drivers," OR "ride-hailing drivers".

Only studies that met the following criteria were added to this study: (i) The target population must be Chinese drivers, (ii) The target sample organization: Chinese ride-hailing platforms, (iii) The paper language must be English, (iv) The articles were empirical as well as review articles. (v) The articles must have been published in 2016-2025.

Searching Outcomes

The research process involved a manual search of the Scopus and Web of Science databases. Researchers reviewed the articles, and the papers that investigated the impact of SHW were identified as potentially relevant to the study.

Boolean logic (AND, OR, AND NOT) combines terms as search strings to guarantee precision in selecting studies. Whereas the operator AND was used to reduce the search yield, the operator OR increased the search yield, and the operator "AND NOT" excluded specific terms. By searching for articles from 2016 to 2025 with the keywords "occupational safety, health and well-being" or "overall well-being", this study found 6,948 articles in Web of Science (6,028 from 2020 to 2025) and 88 articles in Scopus (83 from 2020 to 2025). Adding "and "drivers," or "ride-hailing drivers" to the search criteria yielded 63 articles in Web of Science (58 from 2020-2025) and 13 articles in Scopus (10 from 2020-2025), totalling 76 papers. This indicates that research on ride-hailing drivers (SHW) has received significant scholarly attention and extensive study in the last five years.

This paper, after removing duplicates from these 76 papers, identified 42 papers. The two authors independently reviewed the titles and abstracts of these remaining 42 papers. After further screening, 24 papers remained. The two authors then evaluated the full text of these 24 papers according to the inclusion and exclusion criteria. Following the evaluation, 15 in-depth studies on SHW from 2020-2025 that met all evaluation criteria were ultimately selected (Figure 1).

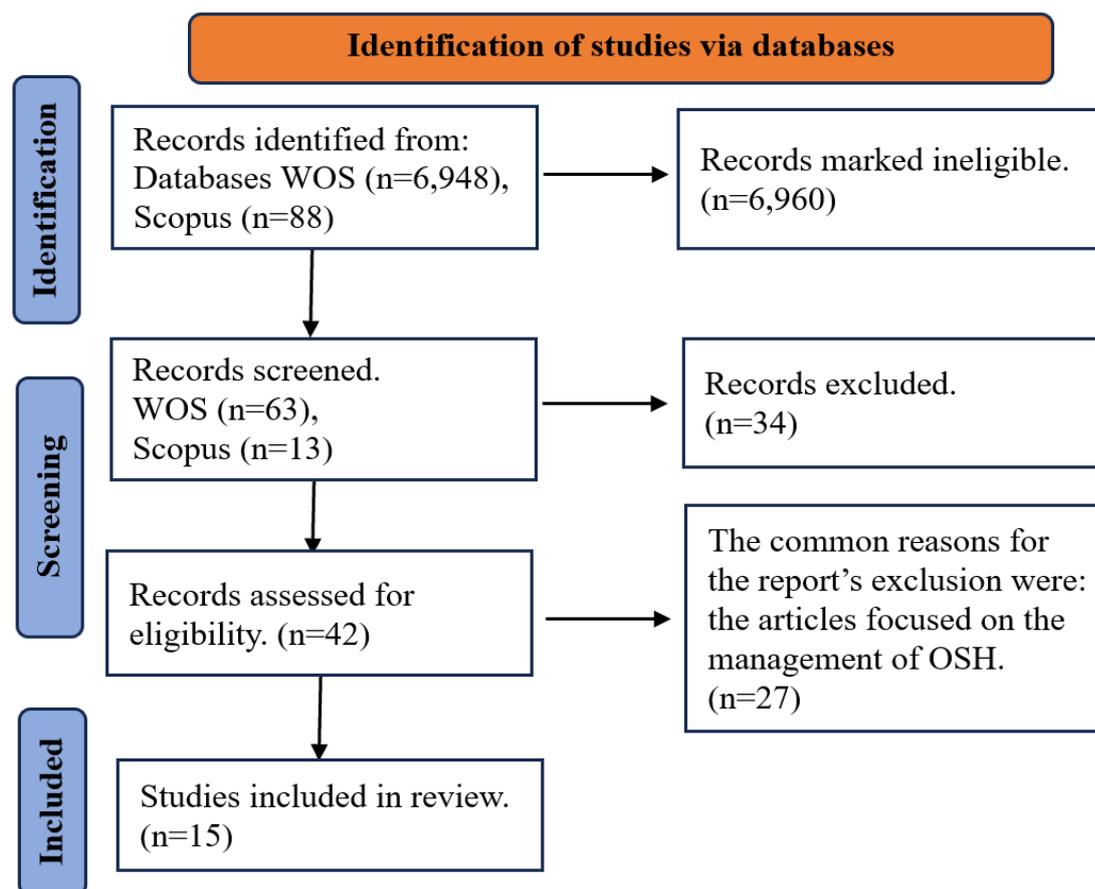


Figure 1 Study Selection

Quality Appraisal

This study followed the literature review guidelines proposed by Cooper (1998). The literature evaluation included Researchers, Main variables, Sample Characteristics, and Major Findings. Table 1 lists these evaluation elements. Based on the guidelines, the two authors evaluated 15 studies and reached a consensus. As shown in table 1.

Table 1

Literature studies related to Safety, Health and Well-being (SHW)

Researchers	Main variables	Sample Characteristics	Major Findings
Mattila et al., (2021)	SHW, Work efficiency, Physical load, Threats of violence	Small Business in Finland 26 Emergency Medical Services (EMS) staff	Work efficacy, physical load, and threat of violence are related to SHW. Work area awareness is positively correlated with SHW. Good work atmosphere positively affects SHW. Worker turnover and work area sizes are negatively correlated with SHW. Safety training, organization-developed safety and health procedures, social support, and workplace collaboration positively affect SHW.
Mattila et al., (2022)	SHW, working community, co-workers support, work atmosphere	58 people responded from 4 Small and medium-sized enterprises	Working community, co-workers support, work atmosphere effect SHW.
Robertson et al., (2021)	SHW, Total Worker Health (TWH) Program	92 New England Healthcare hospitals	Participatory employee total health (TWH) programs positively affect SHW, while effective communication on SHW by senior management and employee commitment to change have a positive impact on SHW.
Bargar et al., (2025)	SHW, well-being, Safety, Health	16 petrochemical industries in Iran	Safety, health and well-being (SHW) indicator. Indicators related to "well-being" need to be given more attention than those related to "safety" and "health".
Pronk et al., (2021)	SHW, Total Worker Health (TWH) Program	750 U.S. SME employees	Employee total health program (TWH), organizational participation, organizational action plan, and experience rating positively affect SHW. Leadership change, worker engagement, culture, processes, and improved working conditions influence SHW.
Schall Jr & Chen, (2022)	SHW, OSH, safety leadership, managing role boundaries, job crafting	COVID-19 remote workers	Occupational safety and health positively affect happiness. Safety leadership, managing role boundaries, and job crafting positively affect SHW.
Taffere et al., (2020)	SHW, occupational safety and health, Occupational exposure, labor inspection	552 workers in Ethiopia	Labour inspections, safety audit systems, and personal protective equipment (most common) were (inversely linked to) occupational exposure, job rotation and job dissatisfaction were (strongly tied to) occupational exposure, and occupational exposure was negatively associated with SHW.
Collins et al., (2021)	SHW, For-profit ownership, Workplace Integrated Safety and Health (WISH)	Directors of Nursing (MON) for 543 nursing homes in the United States	Workplace Integrated Safety and Health (WISH), along with workplace safety and health policies and practices, positively shapes SHW. For-profit ownership has nothing to do with SHW.
Nagler et al., (2021)	SHW,	5 food service sites at large	Leadership commitment, employee involvement, positive working conditions,

	Working conditions, data-driven changes, compliance with safety and health rules	multinational companies in the Greater Boston area Food Service Workers	and comprehensive collaborative strategies positively affect SHW, while compliance with safety and health rules and data-driven changes positively affect SHW.
Tappura et al., (2023)	SHW, work climate, colleagues support, work-related equipment	9 SMEs representing manufacturing industry and industrial services in Finland	Work climate, colleagues support, work-related equipment effect SHW.
Manu et al., (2023)	SHW, Government policies, Safety culture management, Organizational support mechanisms, Mental Health	223 workers in the construction industry in China, Nigeria and Ghana	Safety and health policies, corporate safety culture management, and key organizational support mechanisms positively influence SHW. Employee work efficiency and mental health positively affect SHW.
Sorensen et al., (2021)	SHW, working conditions, workplace integrated safety and health (WISH)	3 small-to-medium manufacturing businesses, 42,43 Indicators	Both of integrated systems approaches, effective policies, programs and practices, WISH Assessment enhance SHW.
Peters et al., (2020)	SHW, integrated organizational TWH [®] intervention	Subcontractors in the commercial construction industry	Theory-driven participatory approach and integrated organizational TWH [®] intervention enhance SHW.
Tamers et al., (2020)	SHW, Total Worker Health [®] (TWH) approach	Racial/ethnic minorities and immigrant workers in U.S.	Total Worker Health [®] (TWH) approach enhances SHW. Both of work-life interventions, work stress, corporate social responsibility (CSR), skill related to SHW.

According to the recent findings in Table 1, it is shown that the antecedent influencing variables of SHW are mainly work engagement (Nagler, 2021; Pronk et al., 2021), working conditions, organisational support, workload, or social support (Manu et al., 2024; Mattila 2021; Sorensen et al., 2021; Sorensen et al., 2018; Chen, 2022; Peters et al., 2020; Mattila et al., Tappura et al., 2023), and job satisfaction (Taffere, 2020). Both of work-life interventions, work stress, corporate social responsibility (CSR), skill related to SHW (Tamers et al., 2020). In addition to the specific working conditions of ride-hailing drivers, this study also discovered many factors that influence the SHW (Side Shift Work) of ride-hailing drivers. According to the research framework proposed by MacKenzie et al. (1998) (which includes factors for employees' return to work after injury, apart from individual factors, also including economic, social, and job-related factors). This study categorizes the factors influencing the SHW of ride-hailing drivers into four categories: individual factors, job-related factors, economic factors, and social factors.

Firstly, Individual Factors

Driving skill among ride-hailing drivers (including safe driving behaviors, experience, and the ability to manage distractions) are closely related to the risk of car crashes for ride-hailing

drivers (Mao et al., 2020), poor driving skill or risky behaviors (such as violations, aggressive driving, or frequent use of mobile applications while driving) increase the likelihood of accidents and injuries, which is detrimental to the occupational safety and health of ride-hailing drivers (Shi et al., 2022; Li et al., 2021). Good driving skill not only help drivers stay safe in complex traffic conditions, but also effectively reduce the risk of accidents caused by improper driving (Singh & Kathuria, 2024).

Furthermore, ride-hailing drivers with higher driving risk perception tend to have lower accident risk rates because they often have better safety awareness, avoid dangerous behaviors such as distracted driving or speeding (Hou & Guan, 2020), and accurately identify potential hazards in the traffic environment and take safe driving actions (Li et al., 2021; Baran et al., 2024). Lower driving risk perception is associated with an increase in dangerous behaviors like mobile phone use behind the wheel, aggressive maneuvers, and traffic violations, all of which increase collision risk and endanger the safety of drivers and passengers (Hou & Guan, 2020; Shi et al., 2022). However, some scholars have found that ride-hailing drivers with high driving risk perception have a moderate level of overall safety awareness (Hou & Guan, 2020), mainly because the economic pressures, long working hours, and job instability faced by ride-hailing drivers weaken their driving risk perception and encourage unsafe driving behaviors (Peng et al., 2025). Algorithmic management and the pressure to maximize profits may force drivers to ignore perceived risks, drive while fatigued, or use their phones while driving, which can easily lead to accident risks (Bartel et al., 2019; Jaydarifard et al., 2023; Lefcoe et al., 2023). Therefore, driving skill (Cao et al., 2025) and perceived driving risks (Chen, 2024) have a significant impact on SHW of ride-hailing drivers.

Secondly, from a Job-Related Factors Perspective

Job stress can affect drivers' health and well-being at work (Sonnetag et al., 2023), lead to the dangerous driving behaviors of ride-hailing drivers and road accidents (Amoadu et al., 2023). Ride-hailing drivers are a vulnerable group (CHEE, 2025). They are exposed to unique job stress (such as algorithmic management, long or irregular working hours) and unfavorable working conditions (Radzlan et al., 2023), which exacerbate the fatigue and unhealthy behaviors of drivers, leading to musculoskeletal pain, psychological distress, and a decline in overall health-related quality of life (Louzado-Feliciano et al., 2022). The long working hours leave drivers physically and mentally drained, keeping them under prolonged job stress, readily triggering emotional exhaustion, diminished work motivation, and similar issues, thereby affecting their occupational safety and health as well as their sense of well-being (Jaydarifard et al., 2023; Shafira et al., 2024). Consequently, drivers develop assorted physical ailments alongside mental-health complaints—stress, curtailed sleep, and burnout. (Bauer 2019; Jaydarifard et al., 2024). This also affects the drivers' emotional state and interactions with passengers, thereby influencing driving behavior and occupational safety outcomes (Xing et al., 2025; Li et al., 2021).

Moreover, work-family conflict emerges as the important antecedent of employees' psychological and physical health, showing a negative link to their well-being (Rony et al., 2023). The nature of ride-hailing drivers' work requires long hours on the road, leaving ride-hailing drivers little time to juggle work and family demands. (Fielbaum & Tirachini, 2021), thereby heightening work-family conflict, lowering job satisfaction, and eroding occupational

well-being (Shin & Jeong, 2020), exacerbating psychological stress leads to physical and mental unhealthiness (Tang et al., 2024; Huo et al., 2023).

One of the main reasons for the decline in employees' physical health is effort-reward imbalance (Ge et al., 2021). Ride-hailing drivers require long-term commitment, but their income is not always proportional to their efforts (Bokányi & Hannák, 2020). This effort-reward imbalance affects driving performance and road safety (Rosenbloom, 2022), leading to dangerous driving behaviors and traffic accidents (Amodu et al., 2023). Collectively, job stress, work-family conflict, and effort-reward imbalance operate as core stressors impairing ride-hailing drivers' physical and mental health.

Thirdly, from an Economic Perspective

economic strain also shapes health outcomes: poor well-being repeatedly tracks economic adversity (Sims et al., 2020), with economic strain itself serving as a pivotal stressor (Friedline et al., 2021; Steptoe et al., 2020). Especially, Chinese ride-hailing drivers are facing heavy financial burdens (Peng et al., 2025). Dissatisfaction with income can lead to ride-hailing drivers quitting their jobs and affect occupational well-being (Fielbaum & Tirachini, 2021). Because of the central manifestation of economic strain is income, and the majority of ride-hailing drivers self-reported income dissatisfaction, leading to job dissatisfaction and affecting occupational well-being (Fielbaum & Tirachini, 2021). GOH et al. (2020) and Dubbelman (2021) found that most ride-hailing drivers earn less than the local minimum wage. The investigation into the reasons for the resignation of ride-hailing drivers has revealed that the most common reason is insufficient income (Firmman and Tirachini 2021).

In addition, ride-hailing drivers' income models and the nature of their work result in significant economic strain and economic insecurity for them (Fielbaum & Tirachini, 2021). Due to the unstable income and its influence by various factors, drivers often need to work long hours to make ends meet (Lefcoe et al., 2024; Fielbaum & Tirachini, 2021). This economic strain not only affects their job satisfaction but also has negative impacts on their mental health and family life (Andrés & Alejandro, 2021; Fielbaum & Tirachini, 2021). Because the economic strain on ride-hailing drivers weakens their awareness of driving risks and encourages unsafe behaviors (Jaydarifard et al., 2025). The economic burden of ride-hailing drivers is closely related to an increased risk of car accidents and deterioration of health (Cao et al., 2025), and family financial debts further exerts a negative influence on physical health outcomes (Tang et al., 2024). It can be seen that economic strain and economic insecurity also have an impact on the SHW levels of ride-hailing drivers.

Lastly, from a Social Perspective

Social support for ride-hailing drivers encompasses various forms of support from family, friends, colleagues, and the platform (Sedighi et al., 2021; Nguyen & Ha, 2022). Studies indicate that robust social support markedly buffers employees' job stress, bolsters mental health, and elevates both job satisfaction and well-being (Ali & Sivasubramanian, 2024). Social support can significantly enhance the career identity of ride-hailing drivers, alleviate their psychological pressure, and improve their career security. Lack of social support leads to risky driving behaviors and road accidents among ride-hailing drivers (Amodu et al., 2023). Social support thus constitutes a key determinant of ride-hailing drivers' SHW levels.

It can be seen that driving skill, driving risk perception, job stress, work-family conflict, effort-reward imbalance, economic strain, economic insecurity and social support may all affect the SHW levels of ride-hailing drivers in Guangdong Province. This study draws on the research framework of MacKenzie et al. (1998) (which includes factors for employees to return to work after injury, apart from individual factors, and also includes economic, social and job-related factors), and divides the factors affecting the SHW of ride-hailing drivers into four categories: individual factors (driving skill and driving risk perception), job-related factors (job stress, work-family conflict and effort-reward imbalance), economic factors (economic strain and economic insecurity) and social factors (social support). This study also found that these factors not only directly impact drivers' SHW, but also exert an indirect influence through job crafting.

Specifically, drivers with higher driving skill (Costantini et al., 2022; Fielbaum & Tirachini, 2021), higher driving risk perception (Watson, 2023; Costantini et al., 2022), and those with greater social support (Wang et al., 2020) are more frequently adopt the three types of job crafting strategies: task, relational, and cognitive (Mello et al., 2021; Geldenhuys et al., 2021), thereby increasing income and job satisfaction. Furthermore, drivers experiencing high job stress (Kossek & Ollier-Malaterre, 2020; Bakker et al., 2020), individuals experiencing intense work-family conflict (Saleem et al., 2024; Zhang et al., 2020), and those with effort-reward imbalance (Montoro et al., 2022) can alleviate work anxiety and workload through cognitive crafting and task crafting (Montoro et al., 2022). In addition, drivers with higher economic strain (Rogiers et al., 2021) and drivers with higher economic insecurity (Buonocore et al., 2020) may restructure their task strategies to obtain more profitable orders and improve job satisfaction.

Furthermore, demographic variables such as gender, age, work pattern, years of driving, marital status, education, and household income have been studied in predicting SHW among ride-hailing drivers. Atombo & Wu (2022) pointed out that male drivers are more likely to take aggressive actions in traffic jams and passenger disputes, and their accident probability is 1.25 times that of women (Cullen et al., 2021; Aldred et al., 2021). However, women have a higher risk of hospitalization after accidents, and their job satisfaction and occupational health levels are lower than men's (Hernández-Rodríguez et al., 2022). Young drivers, who have not yet gained industry recognition, often set higher goals and experience greater work pressure (Amoadu et al., 2024), and their collision probability is significantly higher than other groups (Cullen et al., 2021). Regarding work patterns, full-time drivers are online 8–12 hours or even longer daily (Dubbelman, 2021), and fatigue driving increases the risk of accidents (Chen et al., 2019; Wang et al., 2020). Although their income is higher, the work-life imbalance leads to decreased life satisfaction (Li et al., 2021). Part-time drivers work 4–6 hours daily, with greater flexibility in their schedules, less work-family conflict, and higher levels of happiness (Zhang et al., 2020), but lower income weakens their economic satisfaction (Wu & Liu, 2021).

New drivers are unfamiliar with platform rules and lack emergency judgment, resulting in high driving risks (Li et al., 2018; Zhang & Li, 2021). However, due to low expectations and high enthusiasm, their happiness level is not the lowest (Chen et al., 2020). Experienced drivers, despite their superior skills and low accident rate (Wu et al., 2020), are prone to chronic conditions such as cervical and lumbar spine problems (Zhang et al., 2019) and may

experience boredom with repetitive tasks, thus negatively impacting their work-life balance (SHW) (Chen & Liu, 2020).

Regarding marital status, married drivers often have heavier family responsibilities, leading to greater diligence. Family support can buffer stress (Wang et al., 2020; Li et al., 2021), but balancing family responsibilities fragments their work time, increasing conflict and stress (Zhang & Li, 2021; Barck-Holst et al., 2022). Unmarried drivers, on the other hand, value freedom and flexibility but lack family emotional support, making them more prone to loneliness and helplessness under pressure, which in turn affects their SHW (Chen & Wang, 2020). Higher education levels lead to faster adoption of new platform technologies, better communication and service skills, and stronger safety knowledge and health management awareness, resulting in better SHW (Survival Risk). (Zhang et al., 2019; Sedighi et al., 2021; Peters et al., 2021). However, highly educated drivers have higher expectations for income and work environment; insufficient platform rewards can also lower SHW (Chen et al., 2020; Arrondo et al., 2021).

Household income is significantly positively correlated with SHW: low-income drivers are forced to work longer hours to maintain their household income, leading to increased work stress and burnout, and consequently, decreased well-being (Smith et al., 2005; Peters et al., 2021). In conclusion, demographic factors such as gender, age, work pattern, driving experience, marital status, education, and income shape the SHW of ride-hailing drivers through different pathways, requiring control and attention in subsequent scale revisions and intervention designs.

Revision and expansion of the Occupational Safety, Health and Well-being (SHW) Scale

This study adapted and expanded a 68-item questionnaire developed by the National Institute for Occupational Safety and Health (NIOSH) to assess safety, health, and well-being (SHW). The measurement tool has been consistently reliable in prior studies, reporting a Cronbach's alpha coefficient of 0.93 (Chari et al., 2022). The model fit was assessed using the following indices: AIC = 30780.44, RMSEA = 0.06, CFI = 0.78, and SRMR = 0.07 (Powers et al., 2025). In a study involving 206 healthcare workers in Italy, results were favorable, demonstrating a strong model fit, reflected in CFI and TLI values between 0.96 and 0.99, RMSEA between 0.03 and 0.07, adequate scale reliability (α coefficients) above 0.7, and factor structures aligning with theoretical expectations (Fontana et al., 2023). Overall scale reliability was confirmed, with both Cronbach's α and McDonald's ω reaching 0.82 and 0.84, respectively (Chawłowska et al., 2022). The reported Cronbach's alpha values range from 0.82 (Chawłowska et al., 2022) to 0.93 (Chari et al., 2022).

The instrument has demonstrated adequate reliability and validity, with high internal consistency (α) and often very good (>0.93) statistical values for CFI and TLI model fit (Chari, 2022). To date, more than 60 publications have cited this measure. According to Chari (2022), the tool can support and encourage practical workplace applications and research use, and it is general enough to be applied to multiple occupations, industry sectors, and worker groups (Chari, 2022; Pronk et al., 2021).

This questionnaire, designed specifically for SHW, has demonstrated sufficient reliability and validity and has been empirically validated as a reliable tool for comprehensively assessing

worker SHW (Pronk et al., 2021). The tool comprises five key dimensions: (1) job evaluation and experience; (2) workplace policies and culture; (3) physical work environment and safety climate; (4) health status; and (5) family, community, and social involvement (Chari et al., 2022). Based on the research objectives of this study, these five areas are summarized into three dimensions: safety, health, and well-being, as shown in Table 2.

Table 2

Dimensions of safety, health and well-being

	Domains	Dimensions
Safety, Health and Well-being (SHW)	Workplace physical environment and safety climate.	Safety
	Health status.	Health
	Work evaluation and experience; Workplace policies and culture; Home, community, and society.	Well-being

This tool has demonstrated good reliability and validity, with high internal consistency (α coefficient), and the statistical values for the goodness of fit of the CFI and TLI models are generally very high (>0.93) (Chari, 2022). To date, more than 60 papers have cited this questionnaire. Chari (2022) points out that this tool can support and facilitate practical workplace applications and research uses, and has sufficient generality to be applied to a variety of occupations, industries, and worker groups (Chari, 2022; Pronk et al., 2021).

Question Pool Construction

Based on a literature review, the National Institute for Occupational Safety and Health (NIOSH) adopted the "Safety-Health-Wellbeing" three-dimensional framework, combined with semi-structured interviews with ride-hailing drivers, to adapt the original 68 items into an initial question pool of 118 items (16 safety items, 41 health items, and 61 wellbeing items). All items used a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree).

Testing and Reliability/Validity Analysis

A total of 580 questionnaires were distributed to ride-hailing drivers in Guangdong Province, China, using purposive sampling. 516 valid questionnaires were returned. The proportion of males was 82.05%. Regarding work type, the majority of the sample (57.92%) were full-time, while 42.08% were part-time. 62.55% of the sample selected "1-5 years" of service. Regarding marital status, the highest percentage (55.60%) were "married or cohabiting with a partner," while 36.68% were unmarried. 54.25% had a high school education, and 39.38% had a bachelor's degree or higher. Regarding last year's family income, the majority of the sample (27.80%) had an income between 100,000 and 149,999 yuan. Outer loadings (safety dimension 0.788, health dimension 0.9, well-being dimension 0.931), Cronbach's alpha 0.888, Composite reliability 0.888, HTMT values all <0.85 , mean extracted variance (AVE) 0.142–0.449, indicating that the scale has good reliability and validity. The specific items of the scale are shown in Table 3.

Table 3

Occupational Safety, Health and Well-being Scale for Ride-Hailing Drivers (Revised and Extended Version, 118 Questions)

Dimension	No.	Item Content
Safety	S1	I think my workplace is safe.
	S2	My ride-hailing organization Management reacts quickly to solve the problem when talked about safety hazards.
	S3	My ride-hailing organization Management insists on thorough and regular safety audits and inspections.
	S4	My ride-hailing organization Management provides all the equipment needed to do the job safely.
	S5	My ride-hailing organization Management invests a lot of time and money in safety training for workers.
	S6	My ride-hailing organization Management listens carefully to workers' ideas about improving safety.
	S7	My ride-hailing organization Management gives safety personnel the power they need to do their job.
	S8	On my present job, I satisfied about the environmental conditions (heating, lighting, ventilation, etc.)
	S9	On my present job, I satisfied about the pleasantness of the work environment.
	S10	I feel discriminated against in my job because of my age.
	S11	I feel discriminated against in my job because of my race or ethnic origin.
	S12	I feel discriminated against in my job because of my gender.
	S13	In the past 12 months, I sexually harassed by anyone while I was on the job.
	S14	In the past 12 months, I exposed to physical violence while I was on the job.
	S15	In the past 12 months, I bullied, threatened, or harassed in some other way by anyone while I was on the job.
	S16	In the past 12 months, I have been in a situation where some of my ride-hailing organization or coworkers put me down or were condescending to me, made demeaning remarks about me, or addressed me in unprofessional terms.
Health	H1	In general, my health is good.
	H2	During the past 30 days, my physical health (includes physical illness and injury) was not good.
	H3	I have arthritis.
	H4	I have other musculoskeletal disorders (for example, back pain, neck pain, other pain).
	H5	I have asthma.
	H6	I have lung disease, other than asthma (for example, chronic obstructive pulmonary disease [COPD], chronic bronchitis, emphysema).
	H7	I have cancer.
	H8	I have depression.
	H9	I have diabetes.
	10	I have heart disease.
	H11	I have high blood pressure.
	H12	I have ever had chronic insomnia.

H13	During the past 30 days, your mental health (includes stress, depression, anxiety, and problems with emotions) was not good.
H14	I experience stress with my health.
H15	I experience stress with my finances.
H16	I experience stress with my family or social relationships.
H17	I experience stress with my work.
H18	Over the last 2 weeks, I bothered by feeling down, depressed, or hopeless.
H19	Over the last 2 weeks, I bothered by little interest or pleasure in doing things.
H20	Over the last 2 weeks, I bothered by feeling nervous, anxious, or on edge.
H21	Over the last 2 weeks, I bothered by not being able to stop or control worrying.
H22	In a typical week, I get at least 20 minutes of high intensity physical activity. (High intensity activity lasts at least 10 minutes and increases your heart rate, makes you sweat, and may make you feel out of breath; examples are running, fast cycling, and strenuous, continuous lifting of heavy objects.)
H23	In a typical week, I get at least 30 minutes of moderate intensity physical activity. (Moderate intensity activity lasts at least 10 minutes and requires more effort than is needed for typical everyday tasks; examples are brisk walking, gardening, and continuous lifting of light objects.)
H24	I use cigarettes.
H25	I use cigars.
H26	I use pipes.
H27	I use smokeless tobacco.
H28	I use electronic cigarettes.
H29	I have many drinks of alcoholic beverages in a typical week (One drink = one beer, glass of wine, shot of liquor, or mixed drink.)
H30	During the past year, I had more than four drinks if I am a male, or more than three drinks if I am a female, on any single day. (One drink = one beer, glass of wine, shot of liquor, or mixed drink.)
H31	Think of the foods that are a part of my normal diet. I eat Many servings of fruits and vegetables in a normal day. (One serving is any of the following: 1 cup raw leafy greens [about the size of a small fist]; 1/2 cup of other vegetables [cooked or raw]; 1 medium piece of fruit [about the size of a baseball]; 1/2 cup chopped, cooked, or canned fruit; or 3/4 cup vegetable or fruit juice.)
H32	I get many hours of sleep usually at night.
H33	In the past 7 days, I felt sleepy while at work.
H34	I have serious difficulty concentrating, remembering, or making decisions because of a physical, mental, or emotional condition.
H35	I was limited in the kind or amount of work I can do because of a physical, mental, or emotional problem.
H36	In the past month, I did not concentrate enough on my work.
H37	In the past month, I found myself not working as carefully as I should.
H38	In the past month, I did not work at times when I was supposed to be working.
H39	In the past month, I got less done than other workers.

	H40	During the past 12 months, I experienced some work-related injuries.
	H41	I experienced work-related injuries in the past 12 months, some of them require first aid or medical treatment, change in job activities, or lost time from work.
Well-being	WB1	Overall, I am satisfied with my job.
	WB2	I am satisfied with my wages.
	WB3	I am satisfied with the benefits provided by my ride-hailing organization.
	WB4	I am satisfied with my chances for advancement on the job.
	WB5	I can count on my ride-hailing organization for support when I need it.
	WB6	I can count on my coworkers for support when I need it.
	WB7	I feel my job is secure.
	WB8	I am given a lot of freedom to decide how to do my own work.
	WB9	I never seem to have enough time to get everything done on my job.
	WB10	The work I do is meaningful to me.
	WB11	The work I do serves a greater purpose.
	WB12	I feel enthusiastic at work.
	WB13	I feel energetic at work.
	WB14	I feel content at work.
	WB15	I feel at ease at work.
	WB16	I feel anxious at work.
	WB17	I feel angry at work.
	WB18	I feel gloomy at work.
	WB19	I feel discouraged at work.
	WB20	I feel fatigue at my work.
	WB21	My work inspires me.
	WB22	I am immersed in my work.
	WB23	When I get up in the morning, I feel like going to work.
	WB24	At my ride-hailing organization, I am treated with respect.
	WB25	My ride-hailing organization values my contributions.
	WB26	My ride-hailing organization cares about my general satisfaction at work.
	WB27	My ride-hailing organization is willing to extend resources in order to help me perform my job to the best of my ability.
	WB28	I receive recognition for a job well done.
	WB29	I trust the management at my ride-hailing organization.
	WB30	My ride-hailing organization is committed to employee health and well-being.
	WB31	My ride-hailing organization encourages me and provides opportunities to engage in healthy behaviors, such as being physically active, eating a healthy diet, living tobacco free, and managing my stress.
	WB32	My ride-hailing organization offered health insurance.
	WB33	My ride-hailing organization offered assistance with education/tuition.
	WB34	My ride-hailing organization offered Retirement (retirement savings).
	WB35	My ride-hailing organization offered paid disability leave.
	WB36	My ride-hailing organization offered other paid leave (for example, bereavement, emergency, jury duty).
	WB37	My ride-hailing organization offered ability to take unpaid leave.
	WB38	My ride-hailing organization offered on-site medical care.
	WB39	My ride-hailing organization offered employee assistance programs (such as programs that help workers with personal or work-related problems).

	WB40	My work available health education and promotion programs (wellness programs).
	WB41	My work available on-site fitness centers or gym membership discounts (includes a gym and/or space for group classes).
	WB42	My work available common spaces or activity hubs (areas for group activities, such as socializing, exercise classes, etc.)
	WB43	My work available smoking cessation programs.
	WB44	My work available alcohol and substance programs.
	WB45	My work available stress management programs.
	WB46	My work available access to healthy lunch and snack options.
	WB47	The demands of my job interfere with my personal life.
	WB48	The demands of my personal life interfere with my work on the job.
	WB49	I have the freedom to vary my work schedule.
	WB50	I have the freedom to work wherever is best for me.
	WB51	In general, I satisfied with my life.
	WB52	I worry right now about not being able to maintain the standard of living I enjoy.
	WB53	I worry right now about not having enough income to pay my normal monthly bills.
	WB54	I get the social and emotional support I need from friends, family, or others outside of work.
	WB55	In general, I take part in voluntary or charitable activities.
	WB56	In general, I take part in domestic caregiving activities (for example, children, elderly or disabled relatives/ friends, but not in a volunteer or charity setting).
	WB57	In general, I take part in home maintenance tasks (for example, cooking, cleaning, and repairs).
	WB58	In general, I take part in socializing with friends, family, others.
	WB59	In general, I take part in taking training or education courses.
	WB60	In general, I take part in sporting, cultural, or leisure activities.
	WB61	In general, I take part in relaxation or planned solitary activities.

Note: S=safety, H=health, WB=well-being.

Conclusion

Conclusion This study reviewed international literature on driving risk perception (SHW) over the past decade and identified its influencing factors. Based on the occupational characteristics of ride-hailing drivers, the study summarized the factors affecting SHW levels among Chinese ride-hailing drivers, including individual factors (driving skill, driving risk perception), job-related factors (job stress, work-family conflict, effort-reward imbalance), economic factors (economic strain, economic insecurity), and social factors (social support). Furthermore, based on this research, this study modified the original SHW questionnaire into a "ride-hailing driver version" to measure drivers' SHW levels. The final scale consisted of 118 items and demonstrated good reliability and validity. The new scale accurately reflects the SHW pain points of drivers—long hours on the road, unstable income, and being chased by algorithms—providing a practical assessment tool for platforms and policymakers, and preparing for future intervention research.

At the theoretical level, this study applies Conservation of Resource Theory (COR) to the gig economy group of ride-hailing drivers in China, expanding the empirical application of COR

within the research context of "Emerging Economy and Occupational Safety, Health and Well-being (SHW)". Using COR as a lens, focusing on the ride-hailing scenario of "long driving hours, unstable income, and resource depletion," this study is the first to introduce the comprehensive construct of "safety, health and well-being" (SHW) into research on China's gig economy, broadening the application boundaries of COR. It clarifies 4 categories and 9 core factors influencing the SHW of ride-hailing drivers, supplementing the COR's "loss-gain" dual-path model with new contextual evidence of the "platform economy-resource spiral," filling the gap in previous research's insufficient attention to the gig economy.

This study enriches the cross-cultural evidence of the "resource spiral" mechanism within the platform economy through COR and provides a new theoretical lens for research on SHW in gig occupations. This study integrates individual resources (driving skills, driving risk perception), work resources (social support), and sources of resource depletion (job stress, work-family conflict, effort-reward imbalance, economic strain, and economic insecurity). This lays the groundwork for future research to validate the applicability of the "resource depletion-dominated" path in the gig economy context: the superposition of multiple depletion sources significantly predicts lower SHW levels, while key resources such as skills and social support have a beneficial effect on mitigating depletion and maintaining SHW.

In terms of measurement tools, this study follows the COR (contextual fit-resource equivalence) principle, using the five domains of the NIOSH SHW framework as a blueprint, summarizing them into three dimensions: Safety, Health, and Well-being. The original SHW questionnaire was revised and validated into a "ride-hailing driver version" to measure the SHW levels of ride-hailing drivers. The new scale transforms the unique attrition sources of gig workers into quantifiable indicators, filling the gap in the lack of localized, highly reliable and valid assessment tools for the gig worker group. It provides platforms and policymakers with a practical assessment tool, enabling subsequent COR-oriented intervention experiments and policy evaluations to have comparable quantitative benchmarks.

In summary, this paper not only extends COR theory from traditional organizational contexts to the digital platform gig worker context, providing a replicable integrated model, measurement tools, and empirical evidence for the "Resource Conservation - Gig Worker Health" research agenda, but also echoes the policy needs of the "Healthy China 2030" Plan Outline for precise governance of health risks for emerging occupational groups, contributing both theoretical explanation and operational tools to the sustainable development of the gig economy.

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