Challenges and Perspectives for Research on Work Ability in Professional Drivers: A Scoping Review

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Abstract: To review studies on work ability (WA) and its relationship with the biopsychosocial factors of professional drivers. We performed a scoping review of articles published until 2021, extracting location, study design, sample characteristics, transport category, WA assessment methods, and health-related factors. Eighteen studies were found in different transport categories around the world. Most of the studies were cross-sectional (15/18, 83%), in a single branch of professional drivers, and the Work Ability Index (WAI) appears as the most common assessment instrument (7/18, 39%). The characteristics of work organization, lack of physical activity, comorbidities, and psychosocial and ergonomic factors are associated with musculoskeletal symptoms and stress in professional drivers. Comparisons of WA and related factors between studies and professional drivers are limited due to the multiplicity of assessment methods.

Keywords: occupational health, professional drivers, work ability, Work Ability Index.

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cause the working environment and job characteristics of professional drivers expose them to specific health problems [9]. For instance, stressful working conditions are associated with health- and lifestyle-related outcomes among taxi drivers, drivers of municipal buses, and intercity bus drivers [11]. High stress at work is also associated with mental health of professional drivers, occurrence of traffic accidents and fines [11]. Understanding the relationship of physical and mental well-being factors can help not only in develop evidence-based interventions to reduce their negative impact on health of professional drivers [11], but also contributes to preventing the expected shortage of qualified professional drivers with the growth of the global supply chain and recent trends in logistics and freight transportation [12]. However, what is known about WA and its relationship with biopsychosocial factors of professional drivers globally is unknow; such ‘evidence map’ or ‘knowledge synthesis’ can further aid in clinical and research decision making. Therefore, this study reports a scoping review of WA in professional drivers as it conveys a preliminary assessment of the potential size and scope of the available literature [13]. This review summarizes, in particular, the areas of consensus and controversy regarding the methods for assessment of WA and the biopsychosocial factors associated with the health of professional drivers, and addresses the challenges in, and strategies for, research in this field.

Methods

Study design and reporting

A scoping review was carried out to identify the nature and extent of the evidence already researched in a systematic, transparent and replicable manner [13]. We followed the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) in our reporting [14].

Information sources and search strategy

The scoping review was conducted in an electronic library database, PubMed, as it is an important database for medical/health sciences, using the combination of the keywords: [drivers AND work ability index], [professional drivers AND work ability], [truck drivers AND work ability], [taxi drivers AND work ability], [bus drivers AND work ability], [bus AND work ability], [occupational factors AND bus drivers] and [professional drivers AND occupational injuries].

Eligibility criteria and selection of sources of evidence

Two researchers independently performed the search and disagreements about eligibility were resolved by consensus. Inclusion criteria comprised primary, original studies published from inception to May 2021. Studies investigating specific health disorders (e.g., cardiovascular, metabolic, sleep, obesity) were excluded. We also excluded studies whose title and/or objective only were the investigation of traffic accidents, studies of discomfort caused by noise, vibration or temperature, as well as gender-specific or mental load-specific comparison studies. Finally, studies focusing on validation of methods, case studies and/or systematic reviews were also excluded.

Data items charting and synthesis of results

The full texts of the included studies were assessed to extract data about the country, study design, characteristics of the sample, transport category, method of assessing WA, and their main findings. The findings were summarized according to the methods for assessment of WA; and the biopsychosocial factors associated with WA.

Results

Figure 1 shows the study flowchart with the stages of this review. Using the search strategy, a total of 474 records were identified, of which 31 duplicates were removed. In sequence, 443 records were screened, and another 9 records were excluded. The remaining 434 records were retrieved and assessed for eligibility: of which exclusions were made due to records investigating specific health disorders (n=165) or other topics (n=246), and other study designs (n=5), yielding 18 included studies for synthesis.

Characteristics of studies

Table 1 summarizes research conducted about the WA of professional drivers; Figure 2 shows the global distribution of research and main characteristics of
published studies. In summary, 18 studies [10, 15–31] were found with professional drivers from different transport categories: metropolitan bus drivers; urban public transport drivers (bus, train, taxi, motorcycle taxi, subway); truck drivers; port truck drivers; and ambulance drivers. Those studies were conducted worldwide, including Brazil [22, 28, 30] with 3 studies; Germany [10, 17], the United States of America [19, 25], and Amsterdam [15, 27] with 2 studies each; and Austria [18], Colombia [26], Ethiopia [16], Sweden [24], Israel [20], Egypt [23], China [21], Croatia [31], and South India [29] with 1 study each. Most of the studies (n=15, 83%) applied a cross-sectional design [10, 15, 16, 18–24, 26, 28–31], whereas others (n=1, 6% each) comprised a longitudinal cohort study [25], a quasi-experimental trial [17], and a randomized controlled trial [27]. A total of 7,977 participants was included in all these studies, ranging from 56 [10] to 2,095 [25] participants. The average age reported varied from 33.4 years for motorcycle taxi drivers [28] to 53.5 years for bus drivers [27].

Assessing WA in professional drivers and associated factors

Table 1 shows the variety of methods used for assessment of WA in professional drivers. The most commonly applied method to assess WA was the Work Ability Index (WAI), appearing in 7 (39%) studies [10, 17, 18, 22, 28, 30, 31]. The WAI was developed by Ilmarinen and their associates in the FIOH in the late 1990s to assess WA given the aging of the population [1–3]. Currently, the WAI is translated into 26 languages, making it a worldwide applied method. For instance, the Portuguese-Brazil version of WAI was introduced in the mid-2000s [32] and its psychometric properties have been investigated for several populations including nurses [34] and workers from the metal-mechanic industry [34]; the reliability of the Portu-
Table 1. Synthesis of research on the work ability in professional drivers (n = 18)

| Author-year (Reference) | Population | Study design | Assessment methods | Summary findings |
|-------------------------|------------|--------------|--------------------|-----------------|
| Karazman *et al* 2000 [17] | Elderly public urban transport (bus, train, subway) drivers (age = 50 years, n = 122) | Quasi-experimental (before-and-after, no control group)* | WAI Effect typology questionnaire | No change in WAI was observed after a 40-week health promotion program including physical and psychological training, stress management and social skills, and diet counselling |
| Kloimüller *et al* 2000 [18] | Bus drivers of public transport system (age = 43.9 years, n = 369) | Cross-sectional* | WAI | WAI was not correlated with age. Subjective stressors and stress symptoms were correlated with WAI |
| Chen *et al* 2005 [19] | Urban taxi drivers (age = 44.5 years, n = 1,242) | Cross-sectional | Nordic Musculoskeletal Questionnaire (NMQ) job dissatisfaction subscale of the Job Contents Questionnaire | Long driving time and several physical and psychosocial factors are associated with high prevalence of low back pain in taxi drivers |
| Sabbagh-Ehrlich *et al* 2005 [20] | Port truck drivers (age = 39 years, n = 160) | Cross-sectional* | The Pittsburgh Sleep Quality Index | Sleeping while driving and sleep disorders are problems suggesting that working conditions are a risk |
| Szeto *et al* 2007 [21] | Bus drivers (age = 46.9 years, n = 481) | Cross-sectional* | Questionnaire of occupational and personal factors and musculoskeletal discomfort Nordic Questionnaire Physical assessment | High prevalence of work-related musculoskeletal disorders among bus drivers in Hong Kong. The areas of the neck, back, shoulder and knee/thigh were related to bus driving, and occupational factors of prolonged sitting and anthropometric incompatibility were related to musculoskeletal discomfort |
| Sampaio *et al* 2009 [22] | Workers from a bus transportation (age = 44 years, n = 126) | Cross-sectional | WAI Job Stress Scale | Psychosocial factors presented the greatest association with WA, and strain was the only significant variable in relation to the WAI |
| Klasan *et al* 2013 [31] | Physicians, nurses/technicians, and drivers (age = 37.6 years, n = 125) | Cross-sectional | WAI Health Organization quality of life scale (WHOQOL-bref) | It was observed that emergency doctors were exposed to public criticism, but there was a greater exposure to danger in the workplace for drivers, in comparison to other groups of employees |
| Van Schaijik *et al* 2017 [15] | Ambulance workers (age = 43.1, n = 506) | Cross-sectional | Physical performance tests Balance test Need for recovery after working time scale (NFR) Impact of Event Scale to assess the level of post-traumatic complaints | No differences between ambulance workers' ability appraisals were found (ambulance drivers and paramedics). The category that predicts overall work ability most was 'raised alertness and judgment ability' in both occupations |
| Staats *et al* 2017 [10] | Truck drivers (age = 48.5 years, n = 56) | Cross-sectional | WAI | The drivers are more open to being interviewed than to filling out questionnaires. They reported a wide variety of health-related problems and an interest in steps to support their physical activity and nutrition and corporate health promotion |
| Hakim *et al* 2017 [23] | Public bus drivers (age = 37.5 years, n = 180) | Cross-sectional | Questionnaire sociodemographic, ergonomic, and occupational characteristics. Nordic Questionnaire | Low back pain was associated with time in professional activity, driving for more than 8 h daily, ergonomic Risk factors and a greater number of accidents while driving the bus |
| Ihlström *et al* 2017 [24] | Bus drivers in urban transport (age = 51.0, n = 232) | Cross-sectional | Self-rated health, general sleep quality, fatigue, general work satisfaction and stress how Likert scale | The split shifts were not associated with increased stress, poorer health, or adverse psychosocial work factors for the entire study sample. However, approximately 30% of the drivers reported problems with split shifts, which in turn was associated with stress, poor health, and negative psychosocial work conditions |
| Study Reference | Study Title | Study Design | Methodology | Results |
|-----------------|-------------|--------------|-------------|---------|
| Wei et al 2017 [25] | Metropolitan bus operators (age=49.0, n=2,095) | Longitudinal cohort study | Questionnaire de occupational injury and exposures of relevant risk factors | The risk of unintentional injury in metropolitan bus operators is higher in females and with increased age. Drive < 7 hours a day and drive limited versus regular bus routes is a higher injury risk for bus operators |
| Useche et al 2018 [26] | Professional drivers working in public transport (city bus drivers, taxi drivers and operators of interurban bus) (age=41.1 years, n=780) | Cross-sectional | Job Content Questionnaire (JCQ) Questionnaire of sociodemographic and driving performance questions | Work stress is an issue that compromises the safety of professional drivers. The statistically significant differences between taxi drivers, city bus drivers, and interurban bus drivers in their expositions to work-related stress may compromise the professional driver’s performance |
| Van Schaiijk et al 2019 [27] | Bus drivers (age=53.5 years, n=90) | Randomized controlled trial | Subscale of the Short Form-36 (SF-36) Work ability score (WAS) Questionnaire of need for recovery from work related fatigue | Work ability and vitality decreased significantly in both groups as the peak season progressed and did not result in significant differences between groups. Work-related fatigue and psychosomatic health complaints increased |
| Teixeira et al 2019 [28] | Motorcycle taxi drivers (age=33.4 years, n=392) | Cross-sectional | WAI Health Organization quality of life scale (WHOQOL-bref) | WAI was correlated with age of motorcycle taxi drivers. Quality of life and work force was associated with WAI |
| Yosef et al 2019 [29] | Long-distance truck drivers (age=37.7 years, n=422) | Cross-sectional | Nordic questionnaire | Physical inactivity, chronic diseases other than low back pain (LBP), perceived improper sitting posture while driving, and perceived job stress were contributing factors of LBP in long-distance truck drivers |
| Machado et al 2019 [30] | Taxi drivers and motorcycle taxi drivers (age=35.6 years, n=292) | Cross-sectional | WAI Questionnaire on sociodemographic and occupational issues Health Organization quality of life scale (WHOQOL-bref) | Taxi drivers had better assessment scores in the physical and psychological domains and overall quality of life. They also showed a better self-perception of their ability to work compared to motorcycle taxi drivers. Both perceived a positive relationship between quality of life and WAI |
| Pradeepkumar et al 2020 [29] | Bus drivers (age=39 years, n=301) | Cross-sectional* | Nordic Questionnaire and also by direct observation | Work-related and lifestyle/health-related factors show significant association with work-related musculoskeletal disorders in bus drivers |

* Study design was not explicit and was inferred by the authors of this manuscript. * Point estimates as reported in cross-sectional studies; baseline values for cohort studies. WAI: Work Ability Index.
health [38].

Factors associated with WA in professional drivers

WA was positively associated with quality of life in professional drivers [28]. Conversely, WA was negatively associated with stress [18, 22] and peak social factors [22], sociodemographic factors [22, 28], and factors of work organization such as overtime and hard work, as well as long journeys, fatigue, irritation, headaches and sleep disorders [18]. Lack of physical activity, health problems, psychosocial conditions and ergonomic problems are also associated with low back pain in professional drivers [16, 19, 21, 23, 29], and physical health in emergency medical professionals was also negatively correlated with the ability to work [31].

Wear was associated with the WA of public transportation workers, suggesting an association of psychosocial factors, but the workers’ age did not present a significant correlation with WA. This can be attributed to the type of research carried out (cross-sectional), in which individuals with greater losses were no longer active at work [22]. Subjective feelings of stress, mental symptoms, and somatic symptoms were strongly correlated with WA in professional drivers in the public transport system [18]. Overall, WA and vitality decrease significantly as the high working season of bus drivers progresses, while work-related fatigue builds up [27]. High alertness and judgmental capacity, specific physical work skills and emotional peak load have a significant association with WA in ambulance drivers [27, 31]. Motorcycle taxi drivers show a good-to-moderate WA for 51%, and in workers aged 40 years or older there was a 31% increase in low WA compared to younger workers [28]. A comparison of the WA of taxi drivers and motorcycle taxi drivers showed less self-perceived work capacity, greater physical and mental capacity, more pathological conditions already diagnosed, greater incapacity to exercise their profession, and worse WAI [30].
Discussion

Areas of consensus

This review identified the main points of consensus regarding methodological aspects and reported findings. There are common methodological aspects among the studies of WA in professional drivers. First, most of the studies comprised cross-sectional surveys [10, 15, 16, 18–24, 26, 28–31] and had predominantly large samples—the 18 studies revised herein average 443 participants. Second, most of the studies focused on a single branch of professional driver activity, as professional drivers have specific work demands about work organization and time of activity and rest, permanence in sitting posture, and postural alternation [7, 8, 23, 29]. Finally, the WAI appears as the most common instrument for assessing WA [10, 17, 18, 27, 28, 30, 31]. The popularity of the WAI, which has been translated into 26 languages and has high reliability in the Portuguese-Brazil language, can be explained by the possibility of surveillance of occupational health indicators over time and in different professions, in addition to being a self-assessment questionnaire that is easy to understand and to apply [1, 18, 22, 28, 32, 33].

There is consensus among the selected outcomes on WA and its associated factors. For instance, it seems that factors related to the work organization—e.g., postures maintained for long periods [16, 19, 21]; lack of place for rest [20]; shift/night work [24]; stress level [18, 22, 24, 29]; overtime and hard work and long trips; as well as fatigue, irritation and headaches [10, 16, 18, 23]—are associated with impairments in physical [10, 16, 19, 21, 23, 29–31], mental [16, 18, 22, 24], and social health aspects [16, 20]. Other associated factors were problems related to stress, musculoskeletal [16, 19, 21, 23, 29] and sleep disorders [18, 20], and these factors can contribute to the risk of accidents [20]. Conversely, the sole 2 studies examining the relationship between age and WA did not find evidence in support of this hypothesis [18, 22]. Altogether, this evidence suggests that research and clinical practice must fully embrace the WA house model proposed in the 2000s and 2010 by the FIOH [4–6].

Areas of controversy

This review identified two main points of controversy. First, we found that studies not using the WAI applied a variety of methods—ranging from properly validated instruments to custom-built ones—for assessing WA considering physical, mental, or social dimensions, which hinders the ability to make comparisons among them and might question the external validity of some of the findings. Likewise, different research methodologies and tools have been used to assess factors associated with WA, valuing research in specific areas, such as mental health [17, 20, 26], physical health [16, 17, 19, 22, 25, 27, 29, 31], quality of life [28, 30], or accident risks [18] alone.

Second, it is unclear whether there is a relationship between WA and musculoskeletal conditions in all categories of professional drivers. A high prevalence of musculoskeletal disorders—mostly affecting the neck, shoulder, lumbar, and knee conditions—was reported in bus drivers [21] and also in urban taxi drivers [19]. Low back pain was associated with the activity in urban taxi drivers [19] and with professional activity time (i.e., driving for more than 8 hours daily), ergonomic risk factors and a higher number of accidents while driving the bus [23], and stress symptoms [18, 22].

Challenges and perspectives for research

Understanding WA is relevant in the context of an ageing world population, as well as in the political, social, and economic factors that are related to the length of stay of healthy and active workers. Based on this review, we raise two main points to be addressed in future studies.

Investigating the context of professional drivers’ work in a more comprehensive way can be useful to infer causation relationships [16]. In addition, considering that WA is a result of different factors that allow workers to stay active at work overtime, longitudinal studies should be a priority. However, the overall participation of professional drivers in longitudinal studies is a major challenge, especially among those working away from home. This helps explain the few studies that applied a longitudinal design [17, 25, 27]. For instance, it was argued that the a long-term assessment of WAI might help in evaluating and monitoring indicators of workers’ complementary exams; and in directing the implementation of programs and strategies for prevention, rehabilitation, maintenance and...
support of WA across ages [33].

Apparently, WA has not been investigated across all categories of professional drivers, and thus the association between WAI with sociodemographic factors and work organization still requires extensive investigation. Stratification by factors such as stress, type of service provided to national transport, in addition to the type of work regime, age, and time of professional activity can have an impact on public policies and prevention of a professional category that at the same time is becoming scarce [12] and is fundamental in road networks and urban mobility systems.

Study limitations

We recognize that this scoping review has its limitations, characterized by the type of review itself, with limitations in its rigor and limitations in its duration, which can therefore lead to a potential for bias [13]. We also recognize the possible limitation due to the lack of an explicit intention to maximize the search in other databases and, therefore, the conclusions are open to biases of potential omissions of evidence.

Conclusion

Work ability (WA) is a subject of research in professional drivers worldwide, with most evidence coming from cross-sectional studies and a shortage of longitudinal research. It is a consensus that WA requires attention because it can be related to physical, mental, and social factors. The characteristics of work organization, lack of physical activity, comorbidities, psychosocial conditions, and ergonomic problems are associated with musculoskeletal symptoms and the stress of professional drivers across different professional categories. It is difficult, though, to compare the factors associated with WA between professional driver categories because of the multiple assessment instruments used.

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Conflict of Interests

None.

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