

Article

Structural Equation Model of Work Situation and Work–Family Conflict on Depression and Work Engagement in Commercial Motor Vehicle (CMV) Drivers

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Abstract: The shortage and aging of drivers are not problems limited to the truck industry, but are common in the broader commercial motor vehicle (CMV) industry of Korea. This study investigates the relationships between work situation, work–family conflict, depression, and work engagement of taxi, bus, and truck drivers. We extracted 512 CMV drivers from the 5th Korea Working Conditions Survey. A structural equation model (SEM) was used to investigate the impact of a work situation or work–family conflict on depression and work engagement. Results showed that 38.9% of all respondents had symptoms of depression. In the SEM, a poor work situation (standardized path coefficient = 0.250) and work–family conflict (0.117) significantly affected depression. ‘Enough time’ and ‘feeling well’ were influential variables of work situation. ‘Responsibility’ and ‘concentration’ were influential variables of work–family conflict. Additionally, depression affected work engagement (0.524). ‘Vigor’ and ‘dedication’ were influential variables of work engagement. These results show that the relationships between work situation, work–family conflict, depression, and work engagement of CMV drivers are intricately linked.



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Keywords: structural equation model; professional driver; psychophysiological health; aging

1. Introduction

A commercial motor vehicle (CMV) is any vehicle used to transport goods or passengers for an individual or business [1]. The Korean Standard Classification of Occupations (KSCO) [2] classifies CMV drivers into taxi, bus, truck, and other drivers. Truck drivers are the basis of logistics and transportation in the country, while taxi and bus drivers play an essential role in providing public mobility [3–6]. To drive a certain CMV, drivers require a commercial driver’s license and must pass both skills and knowledge tests [1]. CMV drivers are also required to comply with traffic regulations to ensure the safety of passengers or customers’ goods [1,5].

The work environments of CMV drivers are associated with noise and vibrations, as well as sitting for a long time [5–8]. CMV drivers are also exposed to intense sunlight and glare during the day, and poor lighting, reflections, and neon lights at night [3–5]. On the other hand, bus and taxi drivers may be exposed to wind, heat, cold, noise, odor, and moisture as they open doors [3,4]. Therefore, the work situations of CMV drivers are known to be poor [7,9,10].

CMV drivers’ schedules may vary, and some work weekends, evenings, or early mornings [1,5,6]. Drivers have tiring and stressful work traits, such as prolonged concentration and vigilance, long work hours, tight schedules, shift work, and insufficient rest time [11–13]. Thus, CMV drivers may spend less time with family members, leading to conflict between work and family [14].

CMV drivers play a critical role in the uninterrupted flow of goods and passengers throughout the country [1]. However, in the USA and Canada, the truck industry is

under serious threat due to the aging of drivers [3,15]. In Korea, the percentage of older CMV drivers (≥ 65 years old) has risen sharply from 5.9% in 2010 to 19.3% in 2020. In particular, the proportion of taxi drivers aged ≥ 65 years among Korean taxi drivers was 36.0% in 2020 [16,17]. In Korea, the phenomenon of aging drivers is common in the CMV industry [16].

Many studies explain the relationship between fatigue, sleep problems, and accidents [7,9–13,18,19]. Fatigue in drivers is highly associated with sleep-related problems, causes drowsy driving, and can lead to accidents [9,10,13,18,19]. In order to prevent CMV drivers having accidents, it is important to investigate not only drivers' fatigue and sleep-related problems, but also the relationships between psychological factors. Depression is an essential indicator of the wellbeing of older people [20]. Depression is a mental state characterized by a pessimistic sense of inadequacy [20]. The loneliness of professional drivers may cause depression [20]. The WHO-5 index is an adequate measure in screening for mental wellbeing and depression [21,22]. From 6.8% [23] to 70.3% [24] of truck drivers are reported to have depression. However, there is a lack of studies on depression among taxi and bus drivers. Thus, this study is concerned with the characteristics of depressive symptoms in taxi, bus, and truck drivers.

Factors influencing the depression of older drivers are meaningful for preventing CMV drivers having traffic collisions. This study starts from the hypothesis that the driver's working situation and work–life conflict can affect depression and work engagement. Work situations are social relationships that workers interact with within their work or workplace [7,9,10]. In this study, poor work situations mean negative relationships experienced in their working environment and employment conditions [7]. Poor work situations are common among drivers and can intrude into workers' private lives and lead to depression [9,10,25]. This research created the following hypotheses. First, poor work situations affect depression (Hypothesis 1).

Work–family conflict is the extent of a worker's dissatisfaction with his or her work and family roles in aspects such as time-sharing, participation, and satisfaction [26]. Drivers may spend less time with family members due to extended working hours and irregular schedules, leading to conflict between work and family [14]. Work–life conflict can lead to workers developing mental health problems [13,25]. Thus, this study also hypothesized that work–family conflicts affect depression (Hypothesis 2).

In addition, work engagement is an essential factor in reducing the churn rate of professional drivers [15]. Work engagement is a positive occupational mental state represented by vigor, dedication, and absorption [27]. Engaged workers perform better, are more productive, and have higher levels of job satisfaction [28–30]. Depression is known to affect workers' performance negatively [3,23,24]. Thus, this research created a third hypothesis, that depression affects drivers' work engagement (Hypothesis 3).

Based on the theoretical background, this study examines the relationship between poor work situations (Hypothesis 1) or work–family conflict (Hypothesis 2) and depression. Additionally, this study investigates the relationship (Hypothesis 3) between depression and work engagement. In this study, a structural equation model (SEM) was used to describe the relationships between substantive variables. SEM has the advantage of estimating this kind of interdependence between several variables that reflect measurement errors [7]. Thus, this study intends to merge the relationships to create a more robust model. In other words, the purpose of this study is to verify the SEM that combines the relational equations for the work situation and work–family balance that affects depression, and the relational equation that depression affects work engagement.

2. Materials and Methods

2.1. Data Collection and Subjects

The 5th Korea Working Conditions Survey (KWCS) [31] was conducted by the Korea Occupational Safety and Health Agency to examine the Korean industry's working conditions and risk factors. The 5th KWCS questionnaire is similar to the 6th European Working

Conditions Survey (EWCS) [32]. The 5th KWCS data are open to researchers [31], and the author downloaded the data sets and questionnaires. We extracted driver-related data from the total number of downloaded respondent data. The 5th KWCS data were collected in compliance with the Korean Statistical Act, and this study was conducted according to research ethics in using the data.

The total number of participants in the 5th KWCS was 50,205, consisting of the economically active population aged 15 or older. Out of 50,205 respondents, this study classified 1422 workers in the taxi, bus, and truck industries by the KSCO. Among 1422 respondents, those who worked in office or managerial positions were excluded, and 512 respondents who were purely professional drivers were extracted as the study subjects. The 512 respondents consisted of 228 taxi drivers, 100 bus drivers, and 184 truck drivers. The mean age of the targeted drivers was 54.9 years.

2.2. Research Variables

Table 1 shows latent variables and measurement variables based on references. The research variables consist of latent variables related to poor work situations, work–family conflict, depression, and work engagement. All measurement variables are scored on a Likert scale from 1 to 5.

Table 1. Latent variables and measurement variables.

Latent Variable	Measurement Variable	Variable Abbreviation	Description
Poor work Situation [7]	6 items Q49 in KWCS [31]; Q61 in EWCS [32]	Break, Enough time, Feeling well, Ideas, Useful work, Expected	1. Always ~5. Never
Work–family Conflict [7]	5 items Q38 in KWCS [31]; Q45 in EWCS [32]	Worry, Tired, Family, Concentration, Responsibility	1. Never ~5. Always
Depression [21,24]	5 items Q68 in KWCS [31]; Q87 in EWCS [32]	Fresh, Relax, Active, Pleasure, Interest	1. Most of the time ~5. At no time
Poor work engagement [33,34]	3 items Q71 in KWCS [31]; Q90 in EWCS [32]	Vigor, Dedication, Absorption	1. Always ~5. Never

In this study, the six names and descriptions of the work situation variables are the same as in Shin and Jeong’s study [7]: ‘You can take a break when you wish (Break)’; ‘You have enough time to get the job done (Enough time)’; ‘Your job gives you the feeling of work well done (Feeling well)’; ‘You are able to apply your own ideas in your work (Ideas)’; ‘You have the feeling of doing useful work (Useful work)’; ‘You know what is expected of you at work (Expected)’.

Additionally, the five names and descriptions of the work–family conflict variables are the same as in Shin and Jeong’s study [7]: ‘Worry about work when not working (Worry)’; ‘Too tired after work to do household work (Tired)’; ‘Job prevents giving time to family (Family)’; ‘Hard to concentrate on job because of family (Concentration)’; ‘Family prevents giving time to job (Responsibility)’.

Depressive symptoms are assessed using a 5-item World Health Organization Well Being Index (WHO-5) [21,22]. The WHO-5 is a self-rated measure for depression severity [22,35]. As shown in Table 1, it is expressed by 5 measurement variables for feelings over the last two weeks: ‘I have felt cheerful and in good spirits (Pleasure)’; ‘I have felt calm and relaxed (Relax)’; ‘I have felt active and vigorous (Active)’; ‘I woke up feeling fresh and rested (Fresh)’; ‘My daily life has been filled with things that interest me (Interest)’.

Three items measuring work engagement were recently added to the 6th EWCS and the 5th KWCS questionnaire [31,32]. We used three questions: ‘At my work, I feel full of energy (Vigor)’; ‘I am enthusiastic about my job (Dedication)’; ‘Time flies when I

am working (Absorption)’. These items are acceptable measurement variables for work engagement [33,34].

2.3. Data Analysis and Structural Equation Modelling

First, this study compares the depressive symptoms of taxi, bus, and truck drivers. We used the WHO-5 index criterion [21,22] to screen for respondents with depression symptoms. For the descriptive analysis, χ^2 tests were used to test for equality of distributions of respondents with depression symptoms.

Second, this study established hypotheses based on literature surveys, and the hypotheses are as follows:

Hypothesis 1 (H1). *Poor work situation affects depression.*

Hypothesis 2 (H2). *Work–family conflict affects depression.*

Hypothesis 3 (H3). *Depression affects work engagement.*

This study combines the relationships between depression, work situation, work–family conflict, and work engagement. We used SEM to combine the relational expressions centered on depression. Figure 1 represents the conceptual SEM of this study. It expresses the interrelationships between the hypotheses and shows the composition of latent and measured variables.

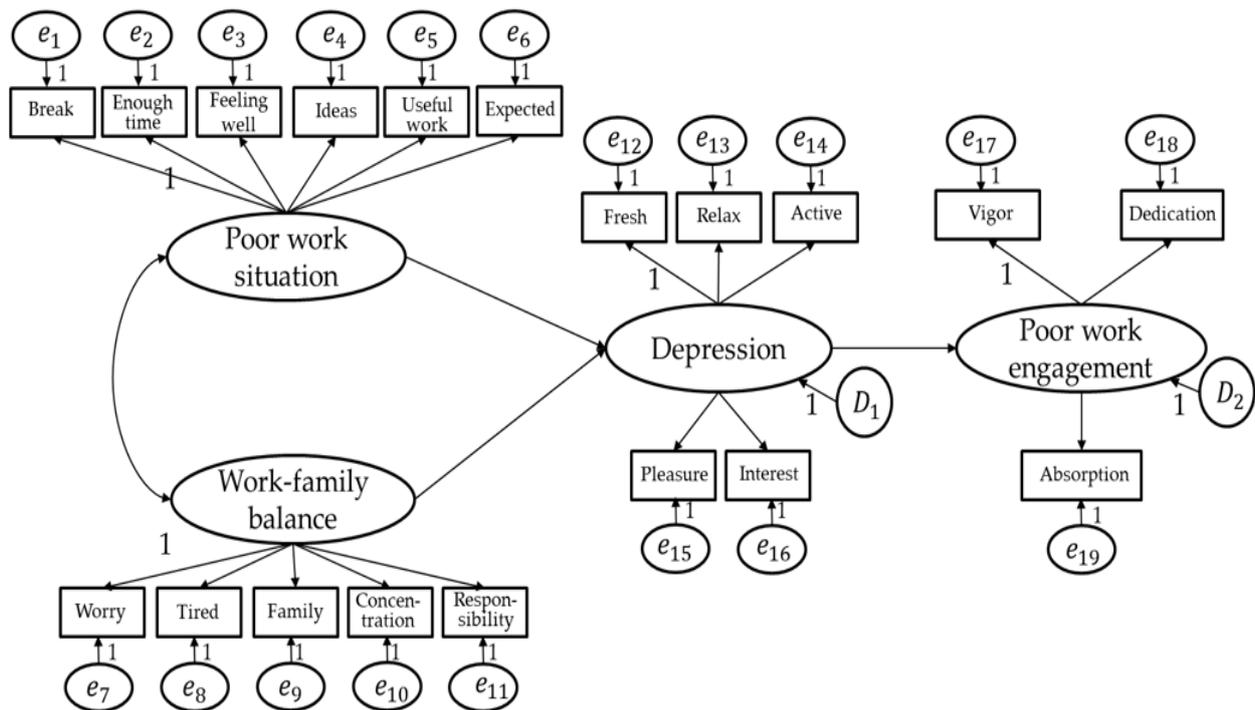


Figure 1. Conceptual structural equation model (SEM) of this study. Rectangle, measurement variable; ellipse, latent variable; Di, disturbance or residual; ei, measurement error.

2.4. Reliability Analysis and Model Fit Test

Reliability analysis was used to confirm the internal consistency of the measurement variables. The measurement variables for each latent variable were analyzed for internal consistency using Cronbach’s α value. Additionally, a factor analysis through Varimax factor rotation was performed to assess the construct validity.

In this study, the model was verified by a model fit test and composite reliability analysis. The model fit test was performed using the goodness of fit indices, such as χ^2 and p values, NFI, CFI, GFI, TLI, and RMSEA values. Composite reliability of the model was analyzed by average variance extracted (AVE), composite reliability (CR), and correlation coefficients between variables. SPSS version 18.0 and AMOS 18 were used as statistical analysis tools.

3. Results

3.1. Distributions of Respondents with Depression Symptoms

Table 2 shows the distribution of respondents with depression symptoms by driver type. There was no significant difference in the distribution of respondents among taxi, truck, and bus drivers ($\chi^2 = 0.846$, $p = 0.655$). However, 31.6% of total CMV respondents showed depression symptoms. This result indicates that symptoms of depression are not limited to truck drivers only.

Table 2. Distribution of depression symptoms by driver type.

Depression Symptoms	Taxi	Bus Yes	Truck	Total
No	136 59.6%	65 65.0%	112 60.9%	313 61.1%
Yes	92 40.4%	35 35.0%	72 39.1%	199 38.9%
Total	228 100.0%	100 100.0%	184 100.0%	512 100.0%

Table 3 shows the distribution of depression symptoms by age group. There was no significant difference in the distribution of respondents with depression symptoms by age group ($\chi^2 = 1.598$, $p = 0.450$). This result indicates that depression symptoms appear across all age groups of CMV drivers.

Table 3. Distribution of depression symptoms by age group (years).

Depression Symptoms	<50	50 s	≥60	Total
No	91 65.5%	123 58.9%	99 60.4%	313 61.1%
Yes	48 34.5%	86 41.1%	65 39.6%	199 38.9%
Total	139 100.0%	209 100.0%	164 100.0%	512 100.0%

3.2. Results of Reliability and Validity Analysis

Table 4 shows the results of factor analysis for internal consistency. Two measurement variables (useful work and expected) used to measure poor work situations were removed by Cronbach's α . In the results of reliability analysis, the total standardized Cronbach's α value was 0.841. Thus, the internal consistency was satisfactory according to the results of the reliability analysis.

Table 4. Results of factor analysis.

Factor	Measurement Variables	Component			
		1	2	3	4
Depression	Pleasure	0.881	0.062	0.027	0.157
	Fresh	0.860	0.119	0.091	0.103
	Active	0.851	0.103	0.050	0.170
	Interest	0.837	−0.068	0.063	0.082
	Relax	0.825	0.099	0.083	0.188
Work–family conflict	Responsibility	−0.069	0.815	0.052	0.183
	Concentration	−0.054	0.791	0.017	0.177
	Family	0.202	0.778	0.092	−0.061
	Tired	0.270	0.741	0.080	−0.077
	Worry	0.000	0.681	−0.040	0.170
Poor work situation	Break	0.007	−0.001	0.797	−0.100
	Enough time	0.117	0.033	0.742	0.165
	Ideas	0.037	0.038	0.675	0.148
Poor work engagement	Feeling well	0.096	0.092	0.639	0.325
	Dedication	0.197	0.124	0.129	0.793
	Absorption	0.103	0.085	0.187	0.737
	Vigor	0.348	0.150	0.131	0.732
Instrument Total	% of Variance	30.10%	15.89%	12.31%	7.51%

In Table 4, the factor analysis using Varimax rotation constructed four factors: (1) depression, (2) work–family conflict, (3) poor work situation, (4) poor work engagement. Bartlett’s test was significant ($p < 0.001$), and the Kaiser–Meyer–Olkin (KMO) test was also significant ($0.851 > \text{criteria} = 0.60$). According to the reliability and factor-analysis results, variables and component-factors showed acceptable reliability and construct validity.

3.3. Results of Model Fit and Hypothesis Testing

The results of model fit tests were $\chi^2 = 266.487$ and $p < 0.001$ (good fit: $p < 0.001$), NFI = 0.935 (good fit: > 0.9), CFI = 0.961 (good fit: > 0.9), GFI = 0.942 (good fit: > 0.9), TLI = 0.952 (good fit: > 0.9), RMSEA = 0.052 (good fit: < 0.06). Therefore, it was evaluated as a good fit in the model fit results. Additionally, composite reliability analysis showed that CR values were between 0.732 and 0.890 (acceptable criteria: > 0.70). The AVE values of each component factor were greater than the correlation coefficients between variables. Thus, the model showed strong composite reliability.

Table 5 represents the results of hypothesis testing for the proposed relationships. In Table 5, a poor work situation has a positive effect on depression ($p < 0.001$). Additionally, work–family conflict has a significantly positive impact on depression ($p = 0.019$). Thus, H1 and H2 are statistically supported. Similarly, depression has a significant effect on poor work engagement ($p < 0.001$). H3 is therefore statistically supported.

Table 5. Results of hypothesis testing for the proposed relationships.

Hypothesis	Paths	Standardized Coefficient (r)	Critical Ratio	p-Value	Result
H1	Poor work situation Depression	0.250	4.325	<0.001	Supported
H2	Work–family conflict Depression	0.117	2.348	0.019	Supported
H3	Depression Poor work engagement	0.524	10.581	<0.001	Supported

3.4. Results of Structural Equation Modelling

Figure 2 represents the final model of this study. As shown in Figure 1, a poor work situation affects depression (standardized path coefficient = 0.250). It can be interpreted that poor work situations increase the likelihood of depression. ‘Enough time’ (0.699) and ‘feeling well’ (0.671) are the influential variables of work situations.

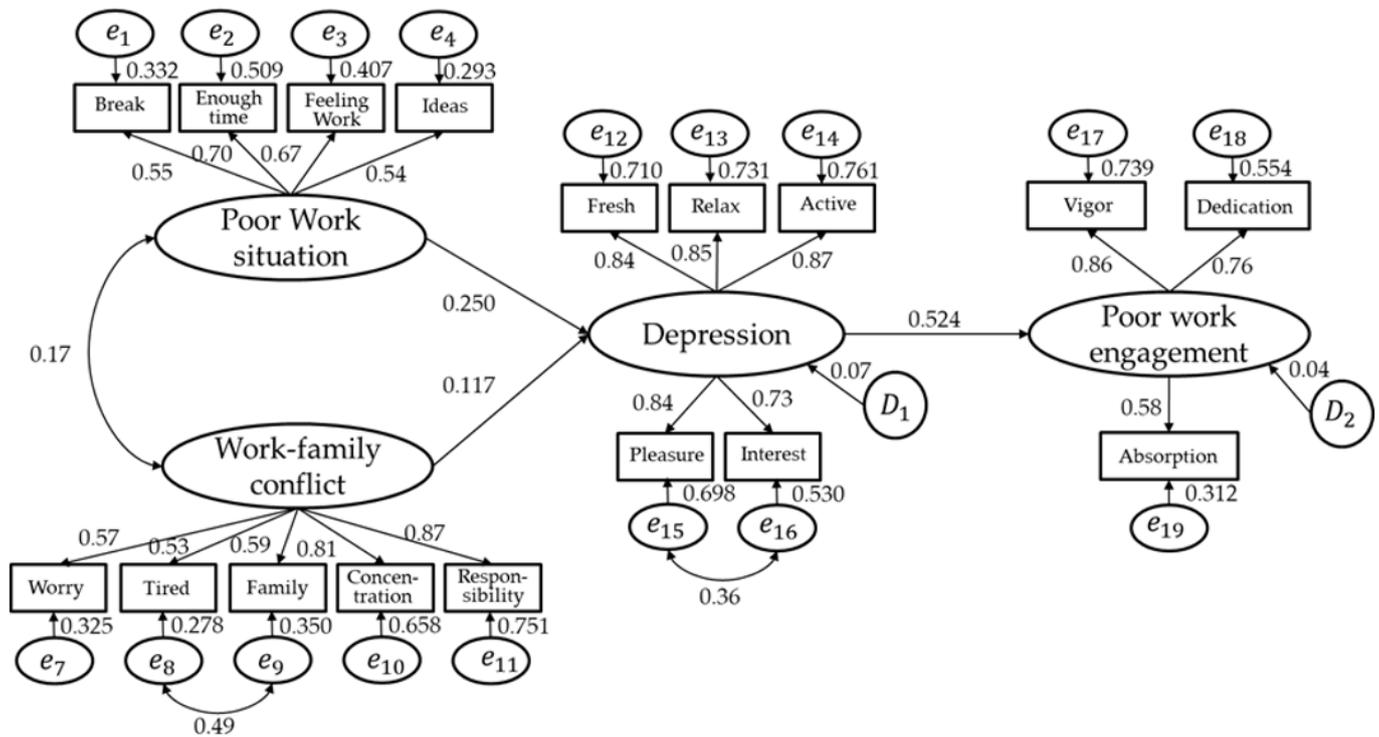


Figure 2. Final model of this study. Rectangle, measurement variable; ellipse, latent variable; D_i , disturbance or residual; e_i , measurement error.

Work–family conflict has a significant impact on depression (0.117). In other words, a higher level of work–family conflict may lead to a higher level of depression. ‘Responsibility’ (0.868) and ‘concentration’ (0.810) are influential variables of work–family conflict.

Depression is more affected by the level of poor work situation (standardized path coefficient = 0.250) than the level of work–family conflict (standardized path coefficient = 0.117). ‘Active’ (0.873), ‘relax’ (0.854), ‘fresh’ (0.843), ‘pleasure’ (0.837) and ‘interest’ (0.731) are influential variables of depression. In other words, all five items used in the depression test are influential variables.

The level of depression affects poor work engagement (standardized path coefficient = 0.524). That is, a lower level of depression may lead to a higher level of work engagement. ‘Vigor’ (0.860) and ‘dedication’ (0.758) are influential variables of work engagement.

4. Discussion

The problem of driver’s depression is a crucial problem to be solved in the transportation industry, along with the shortage of drivers. This study investigated the characteristics of depressive symptoms in taxi, bus, and truck drivers and their interrelationships between influencing factors. In this study, 38.9% of total respondents showed depression symptoms. There was no difference in the distribution of respondents with depression symptoms by driver type or age group. The rate of depression symptoms in this study was higher than that of the study on truck-driver depression [23,24]. These results indicate that symptoms of depression are not limited to truck drivers but are prevalent among CMV drivers in

Korea. Therefore, it is important to understand the factors influencing depression and the effects of depression on driving performance or accidents.

This study examines the relationships between driver's depression and psychological factors in CMV drivers. The results of this study are consistent with previous results that show work situations have a significant influence on depression. Poor work situations are common in CMV drivers [3–8,11–13]. The CMV driver's task is mentally demanding because they must cope with conflicting requests [36–40]. They must work with contradictory demands, where passengers' service demands and the maintenance of tight schedules in dense traffic conditions are not necessarily congruent [37–40]. Bus and taxi drivers report safety risks, including time pressure, stress from traffic, passenger distraction, violence from passengers, and negligence of other road users [39–41]. In this study, work situations are mainly represented by 'enough time' and 'feeling well'. Positive working environments or conditions can improve work situations [41]. Hours-of-service regulations can contribute to improving the working conditions of CMV drivers [15]. Many countries have hours-of-service and electronic-logging-device regulations for commercial buses and trucks [15,42,43]. Jensen and Dahl [43] argued that shifting the focus from driving-time control to fatigue management could improve the working conditions of truck drivers without loss of traffic safety. Comprehensive efforts to improve work situations are encouraged in order to derive better health outcomes, because extensive efforts can increase effectiveness and participation [44,45].

Exposure to long driving hours, irregular work schedules, social isolation, physical inactivity, and whole-body vibrations can impact drivers' health and well-being [20,43]. Depression, loneliness, and isolation are common in truck drivers [20,23,24]. Depression may occur due to work–family conflict, lack of rest, and poor working conditions [20,23,24,46]. To prevent depression, CMV drivers should try to keep in touch with family and friends, eat healthy, exercise, find a hobby, or take the time to relax [46]. CMV drivers lack many support and healthcare resources while out on the road, away from home for extended periods of time [43]. The improvement of mental aspects is important for drivers' health and well-being [43–45]. Workplace health and wellness programs are recognized to improve the health, satisfaction, and productivity of employees [47]. Some studies suggest psychological counseling as a means to improve drivers' quality of life [48]. Additionally, the workplace-health-promotion program emphasizes changes in health behavior [49]. Additionally, an integrated support plan that includes occupational health and wellness programs, stress management skills training, and mental health support can be useful [36]. A well-being program that provides nutritional guidelines and educational activities for long-distance drivers, using rest zones or stations, can also be effective [50]. In addition, personalized health interventions are necessary for underserved truck drivers, because health-promotion data was not sufficiently tailored to the target group's mindset [51]. Lemke and Apostolopoulos [36] recommended interventions with a system-based approach, integrating workplace health promotion and occupational health and safety, because individual-level interventions are not sustainable and insufficient to improve health and wellness.

The transportation industry is under serious threat due to driver turnover and aging [15]. The truck industry of the U.S. has a problem insofar that it is unable to attract young workers who value wellbeing and work–life balance [15]. Work engagement is an important indicator of occupational wellbeing for both employees and organizations [52]. Companies can cut turnover rates significantly by implementing a quality employee engagement and recognition program [53]. In this study, depression affects work engagement. In Korea, the low wage of CMV drivers is a major cause of hindering the influx of young people [17]. A key factor for driver shortage and turnover is compensation [15,17]. Wages are important to attract and retain qualified drivers [15]. It is necessary for a hybrid approach that covers everything from a better work-engagement program reducing depression, to the real solution of raising driver wages. Occupational safety and health management are becoming more and more important for older drivers [54]. The use of safety technology can affect driver engagement and retention [15].

5. Conclusions and Limitations of the Study

This study has a limitation. This study used 5th KWCS data, but it was impossible to characterize all types of CMV drivers. Thus, the results may not be transferred to other cultures or countries with different economic or industrial structures. Further research is expected that reflects national characteristics or large-scale subjects. Additionally, depression was screened by the WHO-5 index without an accurate clinical diagnosis. Thus, the generalization of the results requires attention.

Despite these limitations, this study suggests that depressive symptoms are prevalent among taxi, bus, and truck drivers in Korea. Work situations and work–family conflict affect depression in CMV drivers. Additionally, depression affects work engagement. That is, the work situation, work–family conflict, depression, and work engagement of CMV drivers are intricately linked.

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