A Literature Review: Applying Behavioral Change Theory to Promote Sedentary Behavior Reduction and Physical Activity Among Truck Drivers

Pawena Narasri, RN, MSN[1]

Extended Abstract

Sedentary behavior has become a major cause of several diseases. Commercial drivers are at risk of high levels of sedentary behavior, especially truck drivers. Working conditions are an important barrier to healthy behaviors. The total sitting time for truck drivers might be higher than for other occupations. Limited evidence exists of the total sitting time for truck drivers. Therefore, interventions to reduce sedentary behaviors and increase physical activity are needed among truck drivers. The objectives of this article are 1) to review the theory-guided intervention in truck drivers and 2) to describe and provide an example of intervention using an integrated behavior model for reducing sedentary behaviors and increasing physical activity. The review found diverse interventions aimed at reducing sedentary behavior and promoting physical activity across age groups (children, adolescents, adults, or older adults) and settings (community, hospital, or worksite), addressing various health conditions. Delivery methods, including face-to-face and online approaches, vary. These interventions typically incorporate multiple components such as health education, self-monitoring, behavioral targets, or goal-setting. The principal guiding theories are social cognitive theory and the transtheoretical model. The integrated behavior model can serve as a guiding framework for interventions targeted at truck drivers, and the results may be utilized for other commercial drivers.

Journal of Thailand Nursing and Midwifery Council 2023; 38(4) 425-433

Keywords sedentary behavior/ physical activity/ truck driver/ behavioral change theory

Received 13 August 2023, Revised 5 December 2023, Accepted 7 December 2023

[1]*Teaching Assistant, Ramathibodi School of Nursing, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Thailand, E-mail: pawena.nar@gmail.com*

การทบทวนวรรณกรรม: การประยุกต์ทฤษฎีการปรับเปลี่ยนพฤติกรรมในการส่งเสริมการลดพฤติกรรมเนือยนิ่งและส่งเสริมกิจกรรมทางกายในผู้ขับรถบรรทุก

ปวีณา นราศรี พย.ม.[1]

บทคัดย่อขยาย

พฤติกรรมเนือยนิ่งเป็นสาเหตุสำคัญหนึ่งของการเกิดโรคต่าง ๆ ผู้ขับขี่ยานพาหนะเชิงพาณิชย์มักจะมีพฤติกรรมเนือยนิ่งในระดับสูง โดยเฉพาะผู้ขับรถบรรทุก เนื่องจากสภาพการทำงานเป็นอุปสรรคสำคัญต่อการปรับเปลี่ยนพฤติกรรมด้านสุขภาพ เนื่องจากคนขับรถบรรทุกใช้เวลาขับรถเป็นเวลานาน จึงมีแนวโน้มที่มีความเสี่ยงในการเกิดพฤติกรรมเนือยนิ่งมากกว่ากลุ่มอาชีพอื่น การศึกษาเกี่ยวกับพฤติกรรมเนือยนิ่งและผลลัพธ์ทางด้านสุขภาพของผู้ขับขี่รถบรรทุกมีอยู่จำกัด ดังนั้นการศึกษาเกี่ยวกับโปรแกรมเพื่อลดพฤติกรรมเนือยนิ่งและส่งเสริมการออกกำลังกายจึงเป็นสิ่งจำเป็นสำหรับคนขับรถบรรทุก บทความนี้มีวัตถุประสงค์เพื่อ 1) ทบทวนทฤษฎีการปรับเปลี่ยนพฤติกรรมเพื่อลดพฤติกรรมเนือยนิ่งในคนขับรถบรรทุก และ 2) อธิบายและนำเสนอตัวอย่างการใช้แบบจำลองพฤติกรรมแบบผสมผสานเพื่อลดพฤติกรรมเนือยนิ่งและส่งเสริมการออกกำลังกาย ผลการทบทวนวรรณกรรมพบว่า มีโปรแกรมหลากหลายที่มุ่งเน้นการลดพฤติกรรมนั่งเฉยและส่งเสริมกิจกรรมทางกายทั้งในกลุ่มอายุ (เด็ก วัยรุ่น ผู้ใหญ่ หรือผู้สูงอายุ) และสถานที่ที่แตกต่างกัน (ชุมชน โรงพยาบาล หรือสถานที่ทำงาน) เพื่อลดปัญหาสุขภาพ ลักษณะของโปรแกรมมีความหลากหลายทั้งที่ดำเนินการโดยตรง ณ ที่ตั้งและแบบออนไลน์ โปรแกรมประกอบด้วยกิจกรรมหลายรูปแบบ เช่น การให้ความรู้ด้านสุขภาพ การติดตามตนเอง และการตั้งเป้าหมายพฤติกรรม ทฤษฎีหลักที่ใช้ในการปรับเปลี่ยนพฤติกรรม ได้แก่ ทฤษฎีปัญญาสังคมและแบบจำลองขั้นตอนการเปลี่ยนแปลง แบบจำลองพฤติกรรมดังกล่าวสามารถนำไปเป็นแนวทางในการพัฒนาเป็นโปรแกรมใช้ผลลัพธ์เป็นนโยบายสำหรับผู้ขับขี่ยานพาหนะเชิงพาณิชย์ประเภทอื่นได้

วารสารสภาการพยาบาล 2566; 38(4) 425-433

คำสำคัญ พฤติกรรมเนือยนิ่ง กิจกรรมทางกาย ผู้ขับรถบรรทุก ทฤษฎีการปรับเปลี่ยนพฤติกรรม

วันที่ได้รับ 13 ส.ค. 66 วันที่แก้ไขบทความเสร็จ 5 ธ.ค. 66 วันที่รับตีพิมพ์ 7 ธ.ค. 66

[1]*ผู้ช่วยอาจารย์ โรงเรียนพยาบาลรามาธิบดี คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล E-mail: pawena.nar@gmail.com*

Introduction

Truck drivers encounter various barriers to adopting a healthy lifestyle, including prolonged shifts, irregular work schedules, and a lack of sufficient sleep. Notably, prolonged shifts can increase the susceptibility to sedentary behavior (SB). There is insufficient evidence regarding the overall sitting time among truck drivers. However, their work hours extend up to 11 consecutive hours,[1] exceeding the average sitting time observed in other populations.[2] SB has emerged as an unhealthy habit among truck drivers, contributing significantly to the development of various diseases.

Sedentary behavior refers to activities characterized by minimal energy expenditure, typically below 1.5 to 2.0 metabolic equivalents (METs).[3] METs measure an individual's caloric expenditure relative to their basal metabolic rate. SB includes activities such as sitting, watching television, using computers, and lying down. Insufficient physical activity is associated with the development of various diseases. Physical activity (PA) comprises all movements that lead to increased energy expenditure,[4] such as walking, running, household chores, and various sports activities.[5] The World Health Organization (WHO) has stated that engaging in moderate- and vigorous-intensity PA positively influences health outcomes. Recommendations for physical activity vary according to age and health conditions.[6]

The WHO has issued guidelines on SB and PA across all age groups. For adults aged 18-64 years, the recommendation is to minimize sedentary time as much as possible. Moreover, it is recommended to engage in moderate-intensity aerobic physical activity for at least 150-300 minutes per week, along with muscle-strengthening activities on at least 2 days a week.[6] The global trend towards SB and reduced PA is on the rise. In the population aged 15 years and older, one-third did not meet the recommended levels of physical activity necessary for achieving health benefits and preventing diseases.

In the driving population, there is limited evidence regarding the extent of SB or PA. A study indicated that truck drivers had sedentary time of up to 13 hours per day, with an average daily physical activity of approximately 12 minutes.[7] According to self-reports, 75% of truck drivers perceived that they did not meet the recommended levels of PA. They have cited barriers to reducing SB, including insufficient time for breaks and limited availability of safe parking. Drivers perceive low self-efficacy in reducing sedentary behavior during work shifts due to the necessity of sitting and working for extended hours. Additionally, they report moderate self-efficacy before or after work shifts. Furthermore, engaging in PA may conflict with other commitments and activities in their daily lives.[8]

Sedentary behavior is a recognized risk factor associated with an increased risk of obesity, chronic diseases, and mental illness.[9] A previous systematic review on the health status and mental well-being of truck drivers indicated prevalent sedentary behavior, limited access to healthy food, and time constraints. The evidence highlights that this population tends to exhibit cardiometabolic risk factors, including overweight, high blood pressure, high blood glucose, and poor mental health.[10] Consequently, addressing the elevated levels of sedentary behavior and inadequate physical activity is crucial, particularly within the driving population, to improve health outcomes and prevent chronic diseases.

To address the health challenges within the truck

driver population, an Integrated Behavioral Model (IBM) is considered as a guiding framework for intervention. IBM is well-suited for addressing this health issue and population because it incorporates both individual and environmental factors to comprehensively address the problem. Several studies have employed IBM as a framework to predict the levels of physical activity.[11-14] However, there is limited research that utilizes the three main constructs of IBM to develop interventions and measure the levels of both PA and SB.

Critical Evaluation of an Intervention for the Selected Public Health Issue in Peer-Reviewed Literature

Interventions targeting the reduction of sedentary behavior (SB) and promotion of physical activity (PA) have been implemented across diverse age groups (children, adolescents, adults, or older adults), settings (community, hospital, or worksite), and for various health conditions, including diabetes.[15-18] Delivery methods for these interventions vary, including face-to-face and online approaches. They often incorporate multiple components such as health education, self-monitoring, behavioral targets, or goal-setting. The principal theories guiding these interventions are social cognitive theory (SCT) and the transtheoretical model.[19] However, there is limited evidence concerning interventions specifically designed for truck driver populations. Therefore, this review focuses on interventions within these worksites.

Previous systematic reviews have indicated that interventions targeting SB have demonstrated significant effects, resulting in an approximate reduction of 39.6 minutes of total sitting time per 8 hours.[20] Physical activity interventions within workplace settings adopt a multi-level approach, addressing individual, organizational, and environmental factors. These interventions consisted of diverse components, including PA education, consultation, sit-stand workstations, and incentivized programs. The outcomes of such interventions primarily impact job performance, influencing factors such as absenteeism and productivity.[21] Some workplace interventions also target the reduction of musculoskeletal symptoms.[22] Moreover, a prior meta-analysis highlighted the substantial impact of active workstations on altering PA levels among employees.[23]

The use of theory to guide interventions has been constrained in prior studies involving truck drivers. Nevertheless, theories have been applied to guide interventions in alternative worksites. For instance, the BearStand intervention was executed in a workplace, addressing both individual and environmental aspects. The SCT guided the intervention, incorporating constructs (self-efficacy), outcome expectations, environmental support, and self-regulation. Participants showed satisfaction and active engagement with the intervention. It is worth noting that this study was a process evaluation, lacking specific outcome measures such as self-efficacy or sedentary time.[24]

Taxi drivers share similar characteristics with truck drivers, as they often spend several hours in a vehicle. This study employed community-based participatory research (CBPR) as an intervention. The research methodology comprised two phases: qualitative and quantitative. A focus group was conducted to identify barriers to adopting healthy behaviors, followed by health education, and health screening for the participants. The findings revealed that the drivers perceived their health status as fair or poor. Moreover, they acknowledged experiencing

more sedentary behavior compared to individuals in other occupations. The researcher used this information to develop the intervention.[25]

The interventions demonstrated strength in clearly identifying the included constructs and specifying the target population in these studies. Some studies utilized qualitative research to design interventions effectively to the context of the target population. Nevertheless, shortcomings were observed as they did not provide clear descriptions of activities associated with these constructs. Furthermore, not all outcomes within each construct or behaviors, including SB and PA, were consistently measured. Markedly, there was an absence of interventions specifically tailored for truck drivers. Subsequent studies should describe intervention components in accordance with the constructs outlined in the selected theory. Moreover, outcomes should be systematically measured based on these components and the anticipated results.

Description of Theoretically-based Intervention

The intervention can be guided by the Integrative Behavioral Model (IBM), derived from the theory of reasoned action (TRA) and theory of planned behavior (TPB). IBM comprises three core constructs: attitude, perceived norm, and personal agency.[26] Attitude includes both experiential and instrumental aspects. Perceived norm includes injunctive and descriptive norms. Personal agency involves perceived control and self-efficacy. These three constructs influence the intention to engage in the behavior, leading to actual behavior. Additional factors influencing actual behavior encompass knowledge and skill, salience of the behavior, environmental constraints, and habit.[26]

Details of intervention for reducing sedentary behavior and increasing physical activity

The intervention can be guided by the three primary constructs, along with selected additional factors from the IBM. It begins with individual interviews conducted with truck drivers, using a semi-structured questionnaire. The questions are based on six constructs: experiential attitude, instrumental attitude, injunctive norm, descriptive norm, perceived control, and self-efficacy. The interviews can be analyzed through deductive thematic qualitative analysis, and the intervention can be tailored based on the insights gathered from these individual interviews.

The intervention consists of seven activities, with the initial one emphasizing perceived injunctive, and descriptive norms. This activity involves providing health education to both truck drivers and managers, focusing on the impact of SB and PA on health outcomes and work productivity. Participants, including truck drivers and managers, will receive printed materials and a mobile application detailing the benefits of reducing SB and increasing PA. This activity aims to enhance positivity in both instrumental and experiential attitudes toward reducing SB and increasing PA. Additionally, the inclusion of managers in this intervention is expected to influence perceived injunctive and descriptive norms.

Activity 2 centers on enhancing perceived control and self-efficacy. This involves providing health education and personalized consultation on strategies to increase PA and reduce SB. The first coaching session will be conducted as an in-person group meeting with truck drivers volunteering for the intervention. Subsequent consultation sessions

will be held online, with one session per week. An inclusive mobile application will be developed for participant registration, providing health education on PA techniques and precautions for each activity, accessible at any time. The application will also feature a platform for recording overall steps, total SB time, and total PA time. Additionally, all participants will be provided with a smartwatch that links to the application. This comprehensive activity aims to enhance knowledge and skills for PA performance, ultimately contributing to increased perceived control, and self-efficacy.

Activity 3 centers on enhancing experiential attitude, utilizing both online and face-to-face platforms. The goal is to positively impact attitudes and perceived norms regarding the reduction of SB and the increase in PA. Motivational interviewing (MI) will be employed to facilitate attitude change among participants. Following the provision of information, this activity serves as a formative evaluation to assess participants' increased positivity toward reducing SB and increasing PA. Additionally, it provides a platform for participants to express their feelings about engaging in these behaviors, reflecting their experiential attitude. This phase can be conducted through in-person meetings, video conferences, or phone calls, based on participants' preferences. It is essential for the interventionist to undergo training in MI before implementing this intervention.

Activity 4 centers on perceived norms, utilizing a focus group discussion involving both managers and truck drivers. This process aims to evaluate perceptions of SB and PA among managers and truck drivers, influencing beliefs about engaging in PA and its impact on health outcomes, and work performance. Additionally, discussions will encompass break times during work shifts, safe parking, and health screening. This phase will be conducted through in-person meetings, with each focus group comprising no more than eight participants, including one interventionist, one note-taker, truck drivers, and managers. The interventionist will seek permission to audio record the discussion. This intervention is designed to encourage managers to recognize the significance of improving health outcomes by reducing SB and increasing PA, fostering heightened subjective and descriptive perceived norms among truck drivers, and ultimately boosting their intention to adopt these behaviors.

Activity 5 is geared towards enhancing increased perceived control and self-efficacy. Online consultations regarding physical activity (PA) and goal monitoring to reduce SB and increase PA will take place, with one session per week. The truck drivers will establish an online group to share experiences, discuss facilitators, and barriers to engaging in PA. This activity aims to assist participants in recognizing the factors that either support or hinder these behaviors, ultimately contributing to heightened perceived control, and self-efficacy. The outcome is an increased intention to reduce SB and increase PA.

Activity 6 centers on perceived norms, particularly focusing on descriptive norms. Participants will be encouraged to submit their ideas for reducing SB, with an award given for the most popular vote. Informational posters on reducing SB and increasing PA will be distributed as stickers in every truck. This activity is designed to influence participants' beliefs about the prevalence of these behaviors among their peers, reinforcing positive descriptive norms within the truck-driving community.

Activity 7 targets subjective norms within the framework of motivation to comply. Weekly, participants'

total steps will be communicated to their managers, and the top three contributors with the highest total activity time will receive a gift card incentive. Moreover, a monthly basic health screening will be implemented, covering body mass index (BMI), waist and hip circumference, blood pressure levels, and musculoskeletal symptoms. This activity aims to enhance motivation and attitudes towards positive behaviors, ultimately contributing to an increased intention to adopt, and maintain those behaviors.

Evaluation Related to Sedentary Behavior and Physical Activity

An evaluation related to sedentary behavior and physical activity includes both short-term and long-term features. The short-term evaluation includes both subjective and objective measurements, occurring prior to the intervention and subsequently at 3 and 6 months post-implementation. Subjective measures involve questionnaires covering attitudes toward sedentary behavior and physical activity (3 items), subjective norms (3 items), descriptive norms (2 items), perceived behavioral control (3 items), self-efficacy (2 items), and intention to use (2 items). The measurement utilizes a semantic differential scale, with scores ranging from -3 to +3 or 1 to 7. Examples of scale descriptors include unlikely-likely, bad-good, disagree-agree, difficult-easy, and could not-certain.

An additional short-term evaluation involves self-reports of sedentary behavior and physical activity levels. The questionnaire employed for self-report in this study is the short version of the International Physical Activity Questionnaire (IPAQ). This instrument gauges the time spent per day or week in vigorous and moderate activities, walking, and sitting. It will be administered prior to the intervention's implementation and subsequently at the 3- and 6-month marks.

The objective measures include daily step counts and sedentary time, monitored through a smartwatch. The outcomes will be automatically transferred to the interventionist at the end of each week. The long-term outcomes include work performance, absenteeism, and work productivity. Furthermore, health outcomes will be assessed, incorporating measurements for musculoskeletal symptoms, body mass index (BMI), blood pressure, and blood glucose levels.

Conclusion

The intentions to reduce sedentary behavior and increase physical activity in truck drivers can be influenced by the attitudes, perceived norms, and personal agency of key stakeholders, including truck drivers and managers. The Integrative Behavioral Model (IBM) offers a comprehensive framework for nursing interventions aimed at truck drivers, with the objective of reducing SB and promoting increased PA. Evaluating outcomes should span both short-term and long-term effects. The study findings hold potential for recommending effective interventions tailored to the unique context of commercial drivers.

References

1. Schubert H. The Balance Small Business [Internet]. 2019 [cited 2022 May 5]. How Long Is a Truck Driver Allowed to Drive For? Available from: https://www.thebalancesmb.com/freight-trucking-dot-hours-1361484
2. Yang L, Cao C, Kantor ED, Nguyen LH, Zheng X, Park Y, et al. Trends in Sedentary Behavior Among the US Population, 2001-2016. JAMA 2019;321:1587-97.

3. Panahi S, Tremblay A. Sedentariness and Health: Is Sedentary Behavior More Than Just Physical Inactivity? Front Public Health [Internet]. 2018 [cited 2022 May 4]. Available from: https://www.frontiersin.org/article/10.3389/fpubh.2018.00258
4. CDC. Adult Physical Activity Information [Internet]. 2019 [cited 2022 May 4]. Available from: https://www.cdc.gov/nchs/nhis/physical_activity/pa_glossary.htm
5. World Health Organization. More physical activity [Internet]. 2021 [cited 2022 May 4]. Available from: https://www.who.int/teams/health-promotion/physical-activity
6. Bull FC, Al-Ansari SS, Biddle S, Borodulin K, Buman MP, Cardon G, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. Br J Sports Med 2020;54(24):1451-62.
7. Varela-Mato V, O'Shea O, King JA, Yates T, Stensel DJ, Biddle SJ, et al. Cross-sectional surveillance study to phenotype lorry drivers' sedentary behaviours, physical activity and cardio-metabolic health. BMJ Open 2017;7(6):e013162.
8. Mullane SL, Connolly D, Buman MP. The Perceived Value of Reducing Sedentary Behavior in the Truck Driving Population. Front Public Health 2019;7:214.
9. CDC. Health - Long-Haul Truck Drivers | NIOSH | CDC [Internet]. 2021 [cited 2022 May 5]. Available from: https://www.cdc.gov/niosh/topics/truck/health.html
10. Guest AJ, Chen YL, Pearson N, King JA, Paine NJ, Clemes SA. Cardiometabolic risk factors and mental health status among truck drivers: a systematic review. BMJ Open 2020;10(10):e038993.
11. Mirzayi C, Ferris E, Ozcebe H, Swierad E, Arslan U, Ünlü H, et al. Structural equation model of physical activity in Turkish schoolchildren: an application of the integrated behavioural model. BMJ Open 2021;11(12):e046317.
12. Beville JM, Umstattd Meyer MR, Usdan SL, Turner LW, Jackson JC, Lian BE. Gender Differences in College Leisure Time Physical Activity: Application of the Theory of Planned Behavior and Integrated Behavioral Model. J Am Coll Health 2014;62(3):173-84.
13. Branscum P, Bhochhibhoya A. Exploring Gender Differences in Predicting Physical Activity Among Elementary Aged Children: An Application of the Integrated Behavioral Model. Am J Health Educ 2016;47(4):234-42.
14. Patterson MS, Meyer MRU, Beville JM. Potential Predictors of College Women Meeting Strength Training Recommendations: Application of the Integrated Behavioral Model. J Phys Act Health 2015;12(7):998-1004.
15. Ekelund U, Tarp J, Fagerland MW, Johannessen JS, Hansen BH, Jefferis BJ, et al. Joint associations of accelero-meter measured physical activity and sedentary time with all-cause mortality: a harmonised meta-analysis in more than 44 000 middle-aged and older individuals. Br J Sports Med 2020;54(24):1499-506.
16. Freak-Poli RL, Cumpston M, Albarqouni L, Clemes SA, Peeters A. Workplace pedometer interventions for increasing physical activity. Cochrane Database Syst Rev 2020;7:CD009209.
17. Ramsey KA, Rojer AGM, D'Andrea L, Otten RHJ, Heymans MW, Trappenburg MC, et al. The association of objectively measured physical activity and sedentary behavior with skeletal muscle strength and muscle power in older adults: A systematic review and meta-analysis. Ageing Res Rev 2021;67:101266.
18. Rodriguez-Ayllon M, Cadenas-Sánchez C, Estévez-López F, Muñoz NE, Mora-Gonzalez J, Migueles JH, et al. Role of Physical Activity and Sedentary Behavior in the Mental Health of Preschoolers, Children and Adolescents: A Systematic Review and Meta-Analysis. Sports Med Auckl NZ 2019;49(9):1383-410.

19. Chase JAD. Interventions to Increase Physical Activity Among Older Adults: A Meta-Analysis. The Gerontologist 2015;55(4):706-18.
20. Chu AHY, Ng SHX, Tan CS, Win AM, Koh D, Müller-Riemenschneider F. A systematic review and meta-analysis of workplace intervention strategies to reduce sedentary time in white-collar workers. Obes Rev Off J Int Assoc Study Obes 2016;17(5):467-81.
21. Grimani A, Aboagye E, Kwak L. The effectiveness of workplace nutrition and physical activity interventions in improving productivity, work performance and workability: a systematic review. BMC Public Health 2019;19:1676.
22. Parry SP, Coenen P, Shrestha N, O'Sullivan PB, Maher CG, Straker LM. Workplace interventions for increasing standing or walking for decreasing musculoskeletal symptoms in sedentary workers. Cochrane Database Syst Rev 2019(11).
23. Cao C, Liu Y, Zhu W, Ma J. Effect of Active Workstation on Energy Expenditure and Job Performance: A Systematic Review and Meta-analysis. J Phys Act Health 2016;13(5):562-71.
24. Wilkerson AH, Bridges CN, Wu C, McClendon ME, Walsh SM, Patterson MS, et al. Process Evaluation of the BearStand Behavioral Intervention: A Social Cognitive Theory-Based Approach to Reduce Occupational Sedentary Behavior. J Occup Environ Med 2019;61(11):927-35.
25. Murray KE, Buul A, Aden R, Cavanaugh AM, Kidane L, Hussein M, et al. Occupational health risks and intervention strategies for US taxi drivers. Health Promot Int 2019;34(2):323-32.
26. Glanz K, Rimer BK, Viswanath K. Theory of Reasoned Action, Theory of Planned Behavior, and the Integrated Behavioral Model. In: Health Behavior Theory, Research, and Practice. 5th ed. Jossey-Bass; 2015. p. 95-124.