



Original article

Qualitative Study of Multilevel Barriers and Facilitators Associated With Physical Activity and Diet Among Long-haul Truck Drivers



Noe C. Crespo^{1,2,*}, Daniel Manzo^{1,3}, Vanessa Perez¹, Eric R. Walsh-Buhi⁴, Jerel P. Calzo^{1,2}

¹ School of Public Health, San Diego State University, San Diego, CA, USA

² Institute for Behavioral and Community Health, San Diego State University, San Diego, CA, USA

³ Moores Cancer Center, University of California San Diego Health, La Jolla, CA, USA

⁴ School of Public Health, Indiana University Bloomington, Bloomington, IN, USA

ARTICLE INFO

Article history:

Received 5 October 2023

Received in revised form

16 April 2024

Accepted 23 April 2024

Available online 18 May 2024

Keywords:

Access

Occupations

Sedentary

Work environment

ABSTRACT

Background: Long-haul truck drivers (LHTD) experience disproportionately greater chronic disease risk, which may be influenced by both occupational and lifestyle factors. This study aimed to explore the multilevel factors associated with LHTD's diet and physical activity (PA).

Methods: Thirty in-depth interviews were conducted with LHTD in the Southern California border region. Interview questions captured occupational and lifestyle factors relating to PA and diet at multiple levels and were analyzed using thematic analysis.

Results: Emergent themes relating to both diet and PA included time constraints, attitudes and perceived beliefs, and accessibility of environments to engage in PA and healthy eating. Themes specific to PA were weather conditions and flatbed job duties. Themes specific to diet included access to refrigerators/microwaves and social interactions.

Conclusion: Findings from this study can inform the development of tailored, multi-level interventions to encourage PA and healthy dietary behaviors among LHTD.

© 2024 Occupational Safety and Health Research Institute. Published by Elsevier B.V. on behalf of Institute, Occupational Safety and Health Research Institute, Korea Occupational Safety and Health Agency. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

The trucking industry and truck drivers are essential to the United States economy, providing goods to industry, including food, healthcare, transportation, waste removal, retail, manufacturing, and finance [1]. Long haul truck drivers (LHTDs), also known as OTR (over-the-road) truckers, are those who haul transport across state lines generally covering distances of more than 250 miles [1]. Long work hours, swing shifts, and pressure to meet delivery schedules characterize the work of LHTDs [2]. These occupational demands can contribute to greater sedentary time and irregular sleeping patterns, and to higher body mass index (BMI) and fatigue [3]. A survey of LHTDs revealed that 69% were obese (body mass index [BMI] of 30 or higher) and 17% were morbidly obese (BMI of 40 or higher) compared to only 30% and 7% of U.S. working adults, respectively [4]. These are troubling trends since obesity, low

cardiovascular fitness, and unhealthy eating patterns are important risk factors for multiple chronic conditions including cancer and cardio-metabolic disease (e.g., type 2 diabetes) [5,6].

LHTDs are less likely to exercise regularly or follow a healthy diet compared to the general population due to various individual, interpersonal, and occupational factors [7]. This can contribute negatively to their health status, work performance, and occupational safety. For instance, truck drivers who are obese are at a twofold higher risk of a highway crash per mile driven than non-obese drivers [7]. Common barriers to a healthy lifestyle include a transient work environment, lack of knowledge and skills regarding exercise and weight management, perceived barriers to accessing healthy foods, time limitations, and the costs of purchasing healthier meals [8]. Findings from the National Survey of Long-Haul Truck Driver Health and Injury in the U.S. have indicated a need for targeted interventions and continued surveillance through

Noe C. Crespo: <https://orcid.org/0000-0002-2302-5257>; Daniel Manzo: <https://orcid.org/0000-0001-9505-7947>; Vanessa Perez: <https://orcid.org/0000-0001-9057-5489>; Eric R. Walsh-Buhi: <https://orcid.org/0000-0002-1690-5352>; Jerel P. Calzo: <https://orcid.org/0000-0002-4656-1052>

* Corresponding author. 9245 Sky Park Ct, San Diego, CA, 92123, USA.

E-mail address: ncrespo@sdsu.edu (N.C. Crespo).

repeated data collection to meet the health needs of LHTDs [9]. There is a critical need to better understand the lives of LHTDs and how the occupation of truck driving affects drivers' PA, diet, and various aspects of their health.

The built environment is also an important determinant of health. LHTD's work environment includes truck stops, truck plazas, trucking terminals, warehouses, truck cabs, rest areas, and other highway facilities. Because of their mobility and multiple work locations, truck drivers are dependent on and vulnerable to the environmental exposures of these settings [7]. There is growing evidence that truck drivers' work settings are particularly unhealthy, since they provide few opportunities for healthy eating and exercise [10,11]. Therefore, investigating the role of truck stop environments on the health behaviors of LHTDs is an important next step. In addition, there is a lack of research addressing factors at multiple levels and how the interplay of these factors influences driver's health and health behaviors [10]. Implementing changes at various levels of the Socio-Ecological Model (SEM) can promote PA and a healthy diet [12], yet little is known about the multilevel factors that influence the PA and dietary habits of LHTDs, specifically. Therefore, the purpose of this study was to identify multi-level factors (barriers and facilitators) that contribute to PA and diet among LHTDs.

2. Materials and methods

2.1. Setting

LHTD's settings were defined as the truck stops, truck plazas, trucking terminals, warehouses, truck cabs, rest areas, highway facilities, and other land parcels that could be accessed safely on foot or by long-haul tractor-trailers, also known as 18-wheelers [9]. LHTDs were interviewed within truck stops located in the Southern California border region (Otay Mesa, San Diego), California's largest commercial land border port and one of the busiest commercial border crossings in the U.S. [13]. The location of these truck stops is considered representative of many national truck stops since these are characterized by transient long-haul trucking and a consistent and high level of trucking activity.

2.2. Participant recruitment and enrollment

Participants for this study were 30 LHTDs who met the following eligibility criteria: they were (1) currently working as a truck driver, (2) 18 years of age or older, (3) able to speak English

and/or Spanish, (4) working full time as a truck driver (at least 30 hours per week), (5) experienced as a truck driver for at least six months, and (6) a driver of a long-haul tractor-trailer across state lines and within U.S. Exclusion criteria were: 1) self-reported limitations to walking leisurely for at least 20 minutes (including mobility restrictions), and 2) having doctor prescribed dietary restrictions. This study was approved by the Institutional Review Board of San Diego State University (2018) and each participant provided informed consent prior to any study activities.

Recruitment occurred in pre-established truck stops where a table was set up to offer free health screenings and information about this study. Truck drivers who expressed interest were provided information on the study and screened for eligibility. Participants were also recruited via word-of-mouth; study personnel asked participants whether they knew of other drivers who met the study criteria (i.e., snowball sampling). Purposeful attempts were made to recruit both male and female LHTDs. Interviews took place in a common seating area of the truck stop, an outdoor seating area, a trucking lounge, or a restaurant with permission of the manager or owner of the truck stop.

2.3. Data collection

2.3.1. Measures

2.3.1.1. Demographics. An interviewer-administered survey was used to collect demographic data including sex, age, race/ethnicity, marital status, living arrangement, income, education, and work experience-related questions.

2.3.1.2. Health behaviors, barriers, and facilitators. Guided by the SEM (Fig. 1), an interview guide was employed to ask participants questions about their PA, exercise, and eating habits during work time (i.e., while on the road and at truck stops), during rest/leisure times, and when at home. To address the multiple levels of the SEM, a probing strategy was used to inquire about varying sources of social support, social and environmental barriers and facilitators, and occupational-related factors (e.g., trucking company policies). Participants were also prompted to describe their perceptions of what constitutes healthy meals and challenges and facilitators to engaging in PA, exercise, and healthy eating. Additional questions involved drivers' preferences for PA, their exercise habits within the past 2 weeks, and barriers and facilitators to reducing sedentary behavior. Interview length ranged from 25–45 minutes, with an average of 35 minutes.

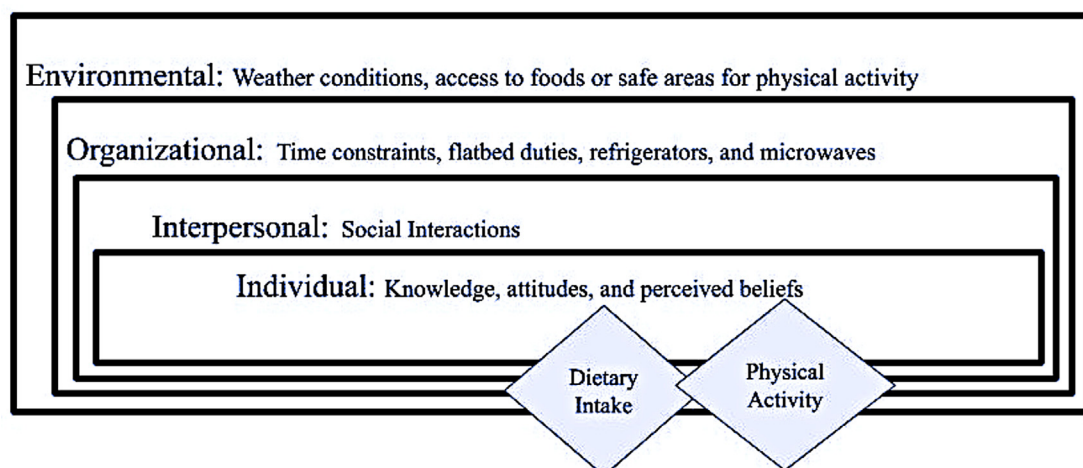


Fig. 1. Social-ecological model among long-haul truck drivers.

2.4. Rigor and trustworthiness

To increase rigor and trustworthiness in data collection and analysis, four techniques were employed [14]: (1) *Bracketing* involved clarifying research bias from the beginning of the study and the use of a reflexive team approach throughout the course of data collection and analysis [15]. (2) *Peer debriefing* sessions were conducted between one of the study team members and the interviewers after each session of data collection to review preliminary data. (3) *Reference adequacy* was provided by audio recording the interview sessions and by taking brief notes of nonverbal language when coding and analyzing data. (4) *Interrater reliability* involved establishing intercoder agreement with a second coder. Reliability was maintained during data analysis by periodically calculating interrater reliability [16].

2.5. Data analysis

Audio recordings of all the interviews were transcribed verbatim, translated to English (if in Spanish), and reviewed by two study team members before beginning analysis to ensure the accuracy and trustworthiness of the data [17]. Interviews conducted in Spanish were first transcribed in Spanish by a Spanish-speaking team member, and then translated to English. Translations were kept as literal as possible, except where minor modifications were necessary to preserve conversational style and meaning [18]. Once interviews were transcribed and translated, a qualitative analysis software (NVivo) [19] was used to analyze recurring themes across all the collected data. First, researchers created a codebook using thematic template analysis to establish codes for transcripts. The thematic template analysis allows to establish a coding template based on a subset of data which is then applied to further data [20]. This process is in line with the Brooks and King's six-phase framework which allows for the coding template to be revised and refined as the coding process continues [16]. In creating codes for the data, two transcripts were preliminarily coded to establish an initial coding template with *a priori* codes guided by the Socio Ecological Model (SEM) and objectives of the project. During the process of creating the coding template, one coder reviewed and developed meanings independently from the key statements and was blinded to the meanings developed by the second coder; and the first coder then convened and developed consensus meanings for each key statement. Using this initial coding template entered into the qualitative analysis software, five additional transcripts were coded independently by the two coders to revise and refine the coding template until reaching sufficiency and saturation when no new themes emerged [21]. During this process, each code was given an explicit definition to ensure coding reliability. Once no new revisions were necessary, the finalized coding template was applied to the entire data set. Themes common to both PA and diet and separately for PA and diet were identified. Periodic checks occurred after every five transcripts were coded to assess for intercoder reliability. After coding all interviews, a final assessment of intercoder reliability was performed resulting in an overall mean interrater reliability Kappa score of 0.77, which is considered *substantial* agreement [22]. Quantitative data collected through demographic questionnaires were summarized using descriptive statistics.

3. Results

3.1. Demographics

Participants' age ranged from 25 to 65 years, most were male (28 of 30), and reported having 6 months to 45 years of experience

as a commercial driver. Most participants reported having at least a high school or equivalent education level, being company employees, and as non-Latino (Table 1).

3.2. Thematic categories for both diet and PA

There were three prominent themes identified that were common in both PA and diet: (1) time constraints, (2) attitudes and perceived beliefs, and (3) accessibility to food options or exercise facilities and safe walkways. These themes are described in detail below, followed by supporting quotes from interviewees. Table 2 summarizes the three themes and representative quotes.

3.3. Time constraints

Participants consistently expressed that *time constraints* greatly influenced both their PA and dietary behaviors. The meaning captured by this theme was oriented around the long and irregular schedules influencing drivers' behaviors. One major barrier preventing truck drivers from establishing committed exercise plans was described as follows: "the restraints of what we do pretty much keeps us driving all day long." Even though PA varied amongst drivers, most described little-to-no PA. When asked what made it difficult for them to be active or stay active, drivers described time constraints stemming from their work demands and schedule.

Time constraints were also major factors in dietary behaviors. Although some drivers indicated that they were able to prepare meals during their downtime, most drivers expressed that they had

Table 1
Participant demographic characteristics

n = 30	Mean	SD
Age	40	11.5
Sex	N	%
Male	28	93%
Education level		
Less than high school	6	20%
High school or equivalent	12	40%
Certificate, training program, or associates	9	30%
Bachelor's or higher degree	3	15%
Marital status		
Single	11	37%
Married	13	43%
Separated	2	7%
Divorced	4	13%
Employment status		
Owner-operator	7	23%
Company employee	23	77%
Race		
White	12	40%
Black or African American	6	20%
Asian	1	3%
East Indian	1	3%
Other	10	34%
Ethnicity		
Hispanic or Latino	9	30%
Living arrangement		
Live alone	7	24%
Live with partner alone	9	30%
Live with family	10	33%
Live with friends/roommates	1	3%
Live in truck	3	10%

3 participants had missing data for age.
SD = Standard Deviation.

Table 2
Common themes and quotes for both diet and physical activity

Theme	Description	Notable quotes
Time constraints	Long and irregular schedules influencing drivers health behaviors	<p>"The restraints of what we do pretty much keeps us driving all day long."</p> <p>"There's not enough good food and there's not enough time. So it's a, it's a sacrifice."</p>
Individual attitudes and perceived beliefs	Benefits of health behaviors, enjoyment in behaviors, support, internal motivation, and abilities and skills to perform behaviors	<p>"I have no problems with obesity or anything like that. No not me. I do not dedicate myself much to looking for healthy food for myself, and I do not feel that it affects me so much."</p> <p>"We don't have the ability to move, we just sit. No matter what you do, how good your food is you're going to get fat," "We have other issues other than trying to exercise," and "It can just be hard once you've sat for a long period of time, it's hard to get yourself unseated."</p> <p>"My fiancé has actually helped me figure out things that I can make on my own in my truck with what limited resources."</p>
Lack of access	Accessibility or lack thereof of fresh and healthy foods, microwaves, refrigerators, as well as safe areas to be physically active	<p>"I can do calisthenics and, and uh, cardio, but um, it's a little bit dangerous. Running around the truck stop."</p> <p>"When you're in a truck you pretty much sometimes take what you can get or what you can see. I don't like Wendy's but I'm obligated to eat because that's the only thing around."</p> <p>"I have anything on the road that I can have at home. And vice versa. The new trucks, we got microwaves in them, refrigerators. You can shop for yourself, cook for yourself if you so choose."</p> <p>"It's pretty close to the same thing because I bring a lot of food from home with me because I cook in the truck. I have a microwave. I have a refrigerator. So, I bring a lot of stuff with me to cook so there's not really much difference."</p>

difficulty in prioritizing and balancing their time to plan and/or prepare their own meals. One driver said, "There's not enough good food and there's not enough time so it's a sacrifice." Drivers explained they had competing priorities they'd rather do during their downtime and that they would rather call their friends and family, browse social media, take naps, or decompress by watching a movie rather than being physically active or preparing a meal.

3.4. Attitudes and perceived beliefs towards PA and diet

Another theme identified was related to *individual attitudes and perceived beliefs* towards PA and diet. Participants noted that enjoyment in being physically active and exercising positively influenced their decision to maintain active lifestyles. Truckers mentioned being more alert, feeling energized, and improvement in their physical health as a benefit of being physically active. Many drivers expressed the desire to exercise to better manage their blood pressure, diabetes, and weight, and that sedentary behaviors were their default behavior in their occupation. Sedentary behavior was viewed as a constant challenge to resist, even by drivers who consistently lived an active lifestyle. Despite the sedentary nature of the occupation, some drivers believed they could at least walk leisurely every day during their downtime (i.e., off-shift). A driver commented,

"You can usually walk after driving, take in everything that's around you. Instead of just running around and then being done ... I might walk by somebody and start having a conversation about whatever reason. At least walking, I'm still getting exercise. But I'm not like I guess straining myself to exercise."

Most drivers were self-aware of their eating habits and expressed desires to eat more vegetables and to be intentional with eating healthy snacks and drinks. Positive attitudes towards

healthy eating were influenced by the belief they could better manage their health and the perceptions that they had support from family. Drivers noted that family, especially spouses, attempted to make conscious efforts to support them in healthier eating habits by helping them cook meals or preparing meals for them that had healthier options to eat while on the road. For example, a driver mentioned, "My fiancé has actually helped me figure out things that I can make on my own in my truck with what limited resources."

Some drivers' attitudes towards being physically active and healthy eating were positive, however, others believed it was nearly impossible to achieve. Drivers expressed a lack of motivation to change their sedentary behaviors. For example, one driver said "We don't have the ability to move, we just sit. No matter what you do, how good your food is, you're going to get fat." "We have other issues other than trying to exercise," and "It can just be hard once you've sat for a long period of time, it's hard to get yourself unseated." Another driver commented, "You will get sick anyway so why not simply eat however, you like," and others stated, "I don't like well balanced meals," or "I have no problems with obesity or anything like that. No not me. I do not dedicate myself much to looking for healthy food for myself, and I do not feel that it affects me so much."

3.5. Accessibility

The third theme identified was *accessibility*, which reflected the availability of safe areas to be physically active, readiness of fresh and healthy foods, as well as access to places for storing and cooking food. Most drivers felt that having access to various selections of healthy foods in restaurants and truck stops would help increase their consumption of healthier foods. Respondents expressed feeling confined to truck stop settings that did not allow for purchasing healthy meals as a barrier to eating healthy. A driver commented,

“When you’re in a truck, you pretty much sometimes take what you can get or what you can see. I don’t like Wendy’s, but I’m obligated to eat because that’s the only thing around.” When asked what a healthy meal consisted of, a driver mentioned, “Probably the buffet. The meatloaf with mac n’ cheese, mashed potatoes, and gravy. That’d be about the healthiest meal I could get unless I eat at Denny’s.” Aside from the difficulty in finding affordable fresh produce and foods nearby, drivers expressed the hassle of parking tractor-trailers when wanting to purchase groceries outside of truck stops where there is limited parking. These occupational settings not only encouraged unhealthy eating at rest areas and truck stops, but also made it difficult to purchase meals near the truck since few had alternate locations. On the contrary, having access to a microwave, refrigerator, stovetop, or oven was one of the most frequently referenced enablers to healthier eating when on the road. A driver commented, “I have anything on the road that I can have at home. And vice versa. With the new trucks, we got microwaves and refrigerators. You can shop for yourself, cook for yourself if you so choose.” Drivers relied on these amenities for storing and heating meals, which facilitated healthier eating.

Accessibility and the built environment were also noted as important contributors PA. A few drivers expressed pleasure of engaging in sightseeing and walking leisurely in nearby trails, when available. A driver responded, “Seeing these new places like Cali, I always look for walks, that’s how I stay active, being that I can’t move that much [while driving], walking helps.” Yet, many drivers expressed the limited space surrounding truck stops and the hazards posed by walking around moving vehicles. Some drivers said that having exercise facilities at truck stops would enable them to be more active while they are on the road. A driver commented, “truck stops need more fitness centers so please do that for us.”

Physically inactive drivers conveyed that this would encourage them to be more active, and some were willing to stop at truck stops solely for the purpose of utilizing these facilities. Yet, one opposed this by stating, “I’ve seen [exercise facilities] in truck stops and they don’t get used” and indicated that drivers can instead walk around the parking lot for exercise if they wanted.

3.5.1. Thematic categories for PA only

3.5.1.1. Weather conditions. Weather conditions were consistently described as barriers or facilitators to engaging in PA (see Table 3). One driver indicated, “If it’s colder outside nobody want to get out of their trucks to walk, run, or do anything” and another said, “I can’t do anything in those cold states ...”. However, more favorable weather was supportive of PA as one driver indicated, “When it’s warmer, I like to get out and walk around outside”.

3.5.1.2. Flatbed job duties. Drivers who drove flatbed trailer trucks indicated that they were able to get exercise as a function of performing work tasks. One driver said, “on flatbed, I get a lot of exercise as far as tarping, strapping down, and chaining up”. Another driver said, “exercise because of work happens every two days for maybe an hour”.

3.5.2. Thematic categories for diet only

3.5.2.1. Refrigerators and microwaves. Facilitators to eating healthy and maintaining a consistent diet included having access to a refrigerator and microwave in their truck (see Table 3). This facilitates storing meals prepared at home that can be consumed when drivers are out on the road. For example, one driver said “I bring a lot of food from home with me because I cook in the truck. I have a microwave. I have a refrigerator ...” Another driver indicated that

Table 3
Themes and quotes for physical activity and diet only

Theme	Description	Notable quotes
Physical activity only		
Weather conditions	Weather pattern descriptions such as sunny, cold, hot rain, and snow influencing physically active	<p><i>“If it’s cold outside nobody wants to get out of their trucks to walk, run, or do anything”</i></p> <p><i>“when it’s warmer, I like to get out and walk around outside”</i></p> <p><i>“I can’t do anything in those cold states. But as long as I’m in the south or far west then I’m cool”</i></p>
Flatbed job duties	Specific of flatbed drivers roles and responsibilities regarding the labor intensive work	<p><i>“intentional exercise is not existent. [But] exercise because of work happens every two days for maybe an hour,” another driver stated “On flatbed, I get a lot of exercise as far as tarping, strapping down, and chaining up. So, for me, I get exercise once a day or once every other day.”</i></p>
Diet only		
Refrigerators & microwaves	Ability to store food and make healthier meals on the road with access to refrigerators and microwaves	<p><i>“I have anything on the road that I can have at home. And vice versa. The new trucks, we got microwaves in them, refrigerators. You can, you can shop for yourself, cook for yourself if you so choose.”</i></p> <p><i>“It’s pretty close to the same thing because I bring a lot of food from home with me because I cook in the truck. I have a microwave. I have a refrigerator. So, I bring a lot of stuff with me to cook so there’s not really much difference.”</i></p>
Social interactions	Familial and spousal support as well as hospitable restaurants social interactions	<p><i>“My fiancé has actually helped me figure out things that I can make on my own in my truck with what limited resources.”</i></p> <p><i>“She is like, but canned veggies and fruit and stuff like that, that way at least it’s canned and it’s not going to go bad right away and use it to make tuna salad or chicken salad ... we kind of test stuff like that out at home. So that way I know, not necessarily what I’m doing, but how to it to where it’s not going to go bad and I’m not wasting food.”</i></p>

having a microwave in his truck allows him to take homemade meals, “I have anything on the road that I can have at home. The new trucks, we got microwaves in them ...”

3.5.2.2. Social interactions. Family and spousal support was viewed as an important contributor to eating healthy. As noted above, one driver indicated, “My fiancé has actually helped me figure out things that I can make on my own in my truck with what limited resources”. Another driver indicated that their spouse assists them in buying storable foods and planning meals: “She is like, buy canned veggies and fruit and stuff like that, that way at least it’s canned and it’s not going to go bad right away and use it to make tuna salad or chicken salad”.

4. Discussion

The results of this study show that several factors contribute both positively and negatively to PA and diet among LHTDs, and that these factors are multifactorial operating at multiple levels. A prominent barrier identified was time constraints resulting from inconsistent work schedules and fatigue after long hours of driving. This contributed to continual sedentary behavior and unhealthy eating even during leisure time. These findings are consistent with studies in other occupations with similar work characteristics and scheduling demands. For example, shiftwork and long work hours among healthcare workers are associated with less healthy dietary choices and lower leisure-time physical activity [23]. The current study, however, provides additional contextual information *unique* to LHTD. For example, the sedentary nature of driving a large truck across states demands that drivers spend many hours, over several consecutive days, sitting in a stationary position, preventing time to exercise or to prepare healthy meals. Even during rest time from driving, LHTD reported opting to spend available downtime in sedentary behaviors rather than engaging in PA, exercise, or preparing a healthy meal. These barriers are unique to LHTDs, given that they likely do not have the option to go home to rest or to exercise due to how far they are away from their homes and since there are few or no accessible facilities to support PA, exercise, or meal preparations. An exemption to this was among truck drivers who drive flatbed trailers. These types of trucks can require greater physically demanding tasks for loading and unloading compared to enclosed trailers, and this was described as a positive contributor to their PA. Research is still inconclusive on the unique contributions of occupational PA to employee’s health [24]; therefore, it is important to promote non-occupational leisure time among LHTD such as walking and stretching, and recreational activities that require standing or movement (e.g., sightseeing, going shopping).

Self-discipline and social support emerged as important individual- and interpersonal-level factors contributing to PA and healthy eating. Some drivers indicated that they were able to overcome temptations to eat unhealthy foods and spending excessive time in sedentary behaviors without needing anyone else to tell them to do so. Those who reported having strong self-discipline and reported a more altruistic attitude toward self-care also showed higher values towards healthful choices. In addition, they described being able to consistently prepare meals with their partners at home, which made it easier to continue preparing their meals when on the road. These findings support previous literature regarding the mediating role that social support plays in healthy eating [25]. It was also noted that partners/spouses play an important role in building discipline at home by modeling healthy and practical food preparation strategies. Research shows that

support from multiple sources, including the workplace and partners or spouses, is protective and beneficial for health and well-being at work [26,27]. This study confirms previous research and further contextualizes the important role of a spouse/partner in supporting healthy eating, reducing sedentary behavior, and increasing PA among LHTDs. Intervention research is needed to study how social support systems can be leveraged among LHTDs to promote the adoption of exercise/PA and healthy eating behavior. For example, intervention strategies may purposefully involve partners/spouses of LHTDs to model, support, and sustain PA and healthy dietary behaviors. Such strategies can involve regular/frequent video/mobile calls between LHTDs and their partners/spouses where both engage in walking while talking to each other, and interactive video/virtual calls involving food preparation demonstrations. Future research can evaluate the effectiveness of these and similar social support strategies among LHTDs.

Attitudes and perceived beliefs showed both positive and negative influences on PA and diet. Many respondents indeed believed they needed to be active and eat healthier to better manage preexisting health conditions. Additionally, respondents believed that they would use a gym, safe walkway, and/or healthier and affordable food options if they were available in and/or near truck stops. Previous research has shown that incentivizing employees to get involved in wellness programs results in higher employee participation and helps employees stay motivated to make long-term behavior changes [28]. One previous intervention (the SHIFT study) [11] used motivational interviewing techniques, group weight loss challenges with monetary incentives, and behavioral monitoring to promote weight loss and healthy lifestyle changes among U.S. truck drivers. SHIFT resulted in a modest reduction in BMI and self-reported improvements in fruit and vegetable consumption and PA. A previous qualitative study of truck drivers revealed the need to tailor health information for truck drivers using various channels [29]. The present study supports the need for more research to develop, implement, and evaluate tailored programs and environmental strategies among LHTDs (e.g., exercise rooms and facilities, increasing availability of fresh fruits and vegetables) at truck stops and truck terminals. Additional strategies can include offering more flexible work schedules to allow for daytime leisure activities such as engaging in active recreational activities and supporting innovative meal aids. Recently, for example, there are commercial options to buy or pre-order fully prepared meals, which are nutritionally balanced and that can be delivered to any location. Trucking companies can partner with these companies to provide subsidized, reliable, and nutritious meals to LHTDs and/or these meals can be made available to LHTDs at strategic and convenient locations (e.g., pickup boxes, like Amazon delivery drop-off and pickups).

The built environment and weather conditions are also important contributors to population health [30]. In alignment with other studies, truck drivers in this research reported a lack of access to healthy foods and an unsafe environment to engage in PA [2,31]. This represents an opportunity to advocate for the creation of walking paths and trails near truck stops and terminals to make walking safe and easy for truck drivers. Such efforts will take a strong and continuous investment by trucking companies and other stakeholders, which can yield long-term economic and health benefits. However, in locations with extreme weather conditions, it is important to build indoor or shaded facilities where truckers can engage in PA and exercise. Some participants indicated that access to refrigerators and microwaves plays an important role in storing prepared foods from home and preparing meals inside their trucks. A previous systematic literature review of 38 studies showed that food

and PA environments in trucking facilities were characterized as poor and that truckers experienced many environmental barriers to healthy eating and PA [30]. Taking advantage of low-cost leverage points such as providing drivers with proper refrigeration and cooking equipment may make meaningful positive impacts on the ability of drivers to overcome barriers towards eating healthier.

A prior systematic literature review of weight loss interventions among truck drivers showed that multi-component and multi-level strategies are more effective than single-component strategies, and that clinically meaningful weight loss is achievable [32]. However, a key limitation of the literature was a small number of randomized controlled studies and the high risk of bias. Previous qualitative studies have also shown that social and cultural factors may be more influential to truck driver's health than individual-level factors [33]. Thus, greater and stronger evidence, particularly from experimental studies, is needed to adequately inform occupational policies promoting a holistic approach to the health of truck drivers which can also lead to broader benefits such as reducing road accidents and employee retention. This study provides important qualitative information that can be used to inform such policies and future research efforts.

4.1. Strengths and limitations

This research is not devoid of limitations. Study limitations include potential social desirability response bias and sampling bias. Strengths, however, include reaching thematic saturation and substantial interrater reliability. In addition, this study provides unique contextual qualitative data on multi-level factors that contribute to PA and diet among truckers on the U.S.-Mexico border.

5. Conclusion

Findings from this qualitative study indicate that truck drivers' dietary and PA behaviors are positively and negatively influenced by multiple occupational, environmental, and psychosocial factors. Specific intervention targets for future research include: 1) promoting positive attitudes and beliefs towards healthy eating and PA including self-discipline strategies to maintain behavior change and increasing social support via spousal/partner involvement (individual and interpersonal level), 2) partnering with the corporate world to minimize work strain on their employees and address time constraints with time management strategies and via innovative company policies (organizational level), which could impact worker job satisfaction and lead to multiple benefits for companies (e.g., lower absenteeism) and 3) increasing access to walkways, exercise facilities, minifridges, and microwaves at truck stops (environmental level).

Funding

This study was funded in part by an intramural grant at SDSU (University Grants Program).

CRedit authorship contribution statement

Noe C. Crespo: Writing – review & editing, Writing – original draft, Methodology, Investigation, Funding acquisition, Conceptualization. **Daniel Manzo:** Writing – original draft, Methodology, Formal analysis, Data curation. **Vanessa Perez:** Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Eric R. Walsh-Buhi:** Methodology, Funding acquisition, Conceptualization. **Jerel P. Calzo:** Methodology, Investigation, Conceptualization.

Conflicts of interest

The authors report there are no competing interests to declare.

Acknowledgments

We extend a special thanks to the truck stop staff for offering their facilities to conduct the interviews and the participants for providing their time and invaluable feedback. We would also like to thank Emily Greenstadt, Franchesca Ramirez, Lydia Alcalá, Angela LaRue, Emily Nicholas, Hannah Hutchison-Parker, Alma Behar, and Ankita Kalraiya for their assistance in conducting this study.

References

- [1] Trucking AA. Annual trucking trends report shows impact of pandemic on industry. 2022. Available from: <https://www.trucking.org/news-insights/annual-trucking-trends-report-shows-impact-pandemic-industry>.
- [2] Apostolopoulos Y, Shattell MM, Sönmez S, Strack R, Haldeman L, Jones V. Active living in the trucking sector: environmental barriers and health promotion strategies. *J Phys Act Health* 2012;9(2):259–69.
- [3] Caruso CC. Possible broad impacts of long work hours. *Ind Health* 2006;44(4):531–6.
- [4] Sieber K. Long-haul truck driver health survey results. Centers for Disease Control and Prevention. 2015. Available from: <https://blogs.cdc.gov/niosh-science-blog/2015/03/03/truck-driver-health/>.
- [5] Carbone S, Del Buono MG, Ozemek C, Lavie CJ. Obesity, risk of diabetes and role of physical activity, exercise training and cardiorespiratory fitness. *Prog Cardio Dis* 2019;62(4):327–33.
- [6] Booth FW, Roberts CK, Laye MJ. Lack of exercise is a major cause of chronic diseases. *Comprehens Physiol* 2012;2(2):1143.
- [7] Lemke MK, Meissen CJ, Apostolopoulos Y. Overcoming barriers in unhealthy settings: a phenomenological study of healthy truck drivers. *Glob Qual Nurs Res* 2016;3:233393616637023.
- [8] Greene BL, Miller JD, Brown TM, Harshman RS, Richerson GT, Doyle JJ. Economic impact of the BP DownShift Program on blood pressure control among commercial driver license employees. *J Occup Environ Med* 2009;51(5):542–53.
- [9] Sieber WK, Robinson CF, Birdsey J, Chen GX, Hitchcock EM, Lincoln JE, et al. Obesity and other risk factors: the national survey of the U.S. long-haul truck driver health and injury. *Am J Ind Med* 2014;57(6):615–26.
- [10] Apostolopoulos Y, Lemke MK, Hege A, Sönmez S, Sang H, Oberlin DJ, et al. Work and chronic disease: comparison of cardiometabolic risk markers between truck drivers and the general US population. *J Occup Environ Med* 2016;58(11):1098–105.
- [11] Olson R, Wipfli B, Thompson SV, Elliot DL, Anger WK, Bodner T, et al. Weight control intervention for truck drivers: the SHIFT randomized controlled trial, United States. *Am J Public Health* 2016;106(9):1698–706.
- [12] Passey DG, Robbins R, Hegmann KT, Ott U, Thiese M, Garg A, et al. Long haul truck drivers' views on the barriers and facilitators to healthy eating and physical activity: a qualitative study. *Inter J Workplace Health Manage* 2014;7(2):121–35.
- [13] Advantage T. Community information, otay Mesa. 2017. Available from: https://www.titleadvantage.com/mdocs/Otay_Mesa202018.pdf.
- [14] Guba EG, Lincoln YS. *Naturalistic inquiry*. Newbury Park: SAGE; 1985.
- [15] Barry CA, Britten N, Barber N, Bradley C, Stevenson F. Using reflexivity to optimize teamwork in qualitative research. *Qual Health Res* 1999;9(1):26–44.
- [16] Brooks J, McCluskey S, Turley E, King N. The utility of template analysis in qualitative psychology research. *Qual Res Psychol* 2015;12(2):202–22.
- [17] Poland BD. Transcription quality as an aspect of rigor in qualitative research. *Qual Inquir* 1995;1(3):290–310.
- [18] Nikander P. Working with transcripts and translated data. *Qual Res Psychol* 2008;5(3):225–31.
- [19] QSR I. NVivo© 2013.
- [20] Braun Virginia CV, Hayfield N, Terry G. Thematic analysis. *Handb Res Methods Heal Soc Sci* 2019.
- [21] Nelson J. Using conceptual depth criteria: addressing the challenge of reaching saturation in qualitative research. *Qual Res* 2017;17(5):554–70.
- [22] McHugh ML. Interrater reliability: the kappa statistic. *Biochemia Medica* 2012;22(3):276–82.
- [23] Caruso CC. Negative impacts of shiftwork and long work hours. *Rehabil Nurs* 2014;39(1):16–25.
- [24] Cillekens B, Lang M, Van Mechelen W, Verhagen E, Huysmans MA, Holtermann A, et al. How does occupational physical activity influence health? An umbrella review of 23 health outcomes across 158 observational studies. *Br J Sports Med* 2020;54(24):1474–81.
- [25] Yoshikawa A, Smith ML, Lee S, Towne SD, Ory MG. The role of improved social support for healthy eating in a lifestyle intervention: *texercise Select*. *Public Health Nutri* 2021;24(1):146–56.

- [26] Hämmig O. Health and well-being at work: the key role of supervisor support. *SSM Popul Health* 2017;3:393–402.
- [27] Khan CM, Stephens MA, Franks MM, Rook KS, Salem JK. Influences of spousal support and control on diabetes management through physical activity. *Health Psychol* 2013;32(7):739–47.
- [28] Mattke HLJ, Caloyeras A. Incentives for workplace wellness programs: they increase employee participation, But Building a Better Program Is Just As Effective. 2015. Available from: www.rand.org.
- [29] Gorczynski PF, Edmunds S, Lowry R. Enhancing physical activity knowledge exchange strategies for Canadian long-haul truck drivers. *Inter J Workplace Health Manage* 2020;13(2):139–52.
- [30] Renalds A, Smith TH, Hale PJ. A systematic review of built environment and health. *Fam Commun Health* 2010:68–78.
- [31] Apostolopoulos Y, Sönmez S, Shattell M, Haldeman L, Strack R, Jones V. Barriers to truck drivers' healthy eating: environmental influences and health promotion strategies. *J Workplace Behav Health* 2011;26(2):122–43.
- [32] Pritchard EK, Kim HC, Nguyen N, van Vreden C, Xia T, Iles R. The effect of weight loss interventions in truck drivers: systematic review. *Plos One* 2022;17(2):e0262893.
- [33] Caddick N, Varela-Mato V, Nimmo MA, Clemes S, Yates T, King JA. Understanding the health of lorry drivers in context: a critical discourse analysis. *Health* 2017;21(1):38–56.