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Mapping Contextual Factors Influencing Physical Activity Behavior of People with a Physical Demanding Job

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Abstract People with a physically demanding job have an unhealthy disbalance in occupational and leisure-time physical activity (PA). We aimed to understand which contextual factors influence this disbalance, and explore opportunities for lifestyle interventions that could restore this disbalance. We applied a contextmapping study with six production workers from a Dutch coating department. Participants filled in a sensitizing booklet with PA-related activities, and were interviewed afterwards. Participants reported reasons for (not) being active in leisure-time using an experience sampling method. Our results indicate that main reasons for being inactive during leisure time were their believes that occupational PA is enough for a healthy lifestyle, and the need to rest after work. Results show that lifestyle interventions should tackle workers inadequate risk perception and over-exhaustion to empower them to shift their PA behavior in a healthier direction. This indicates the need for a holistic approach targeting both home and working environments.

Keywords Holistic approach · Lifestyle intervention · Occupational health · Physical activity paradox · Life-long health · Prevention

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1 Background

People with a physically demanding job tend to have poorer health than people with sedentary jobs, even when adjusted for relevant health, lifestyle, and socioeconomic factors (Li et al. 2013). That is surprising since physical activity (PA) is important to prevent multiple chronic diseases (WHO 2010) and workers with a physically demanding job move the whole day at work. This is called the 'physical activity paradox' and can be explained by the differences in occupational and leisure-time PA (Hallman et al. 2015). Leisure-time PA (LTPA) is usually executed in short moderated or high-intensity bouts of predominantly aerobic activities followed by long recovery periods, whereas occupational PA (OPA) includes tasks like manual handling, repetitive work, and prolonged static postures, over long periods without sufficient recovery (Holtermann et al. 2020). While LTPA improves cardiorespiratory fitness, delivering this kind of strenuous physical work for ≥40 h/week is likely to cause fatigue and thereby inactive (or sedentary) behavior in leisure time (Arias et al. 2015; Bláfoss et al. 2019). This suggests that people with physically demanding jobs are at risk for potentially negative health consequences of OPA and may not benefit from the positive health effects of LTPA. In current occupational health research, interventions for this population typically focus on either the home or work environment. As demonstrated by Prince et al. (2021) these kinds of interventions have limited impact on workers in physically demanding jobs, thus emphasizing the need for new directions for these workers. In a first step to develop a more holistic PA intervention that target the home and work environment, we explored the personal and contextual factors driving PA behavior in people with physically demanding jobs.

2 Methodology

We used two methods in this study: contextmapping to explore which contextual factors influence PA behavior, and an experience sampling method (ESM) to determine which of these factors were most important for our participants. The study was performed in collaboration with a metal processing company. We recruited workers (18–67 years) of the coating department since these have high physical workload during their work.

In pairs, the workers must hang up, take down and carry products such as bars, tubes, and beam sets (20–60 kg), and some products must be coated by hand. They have to finish about 150 rounds in one day, so they must hang up and take down a product every three minutes. Workers with severe physical limitations were excluded. Workers signed an informed consent form before participating.

2.1 Contextmapping

With contextmapping we explored the experiences, needs, motivations and preferences of people with a physically demanding job since peoples ' underlying thoughts, feelings, and desires cannot be explored with standard methods like interviews and observations. Visser et al. (2005) state that contextmapping gives "access to a hidden world of user experience, and thereby build[s] a better understanding of it" (p. 122). Thus, generative methods like contextmapping can be used to explore tacit and latent knowledge, enabling people to express their values and desires in words (Sanders and Stappers 2012) (Fig. 1).

Contextmapping defines that people's current experiences are often influenced by past memories and future dreams. Therefore, we asked participants to first describe their present experiences and recall memories through a sensitizing workbook, and reflect on these experiences and identify future desires through semi-structured interviews.

2.1.1 Sensitizing

Using a workbook to sensitize participants for the topic of interest, increases the quantity and quality of participants' recollection and contributions in a subsequent interview (Visser et al. 2005). In our study, each participant therefore received a workbook with short assignments around the central topic of OPA and LTPA (Fig. 2). The assignments were split over four days and aimed to encourage participants to access, express, and reflect on their experiences, motivations, barriers and preferences. Little stickers with ambiguous pictures and emoticons were added to the package to trigger deeper thoughts and feelings and encourage participants to work on it.

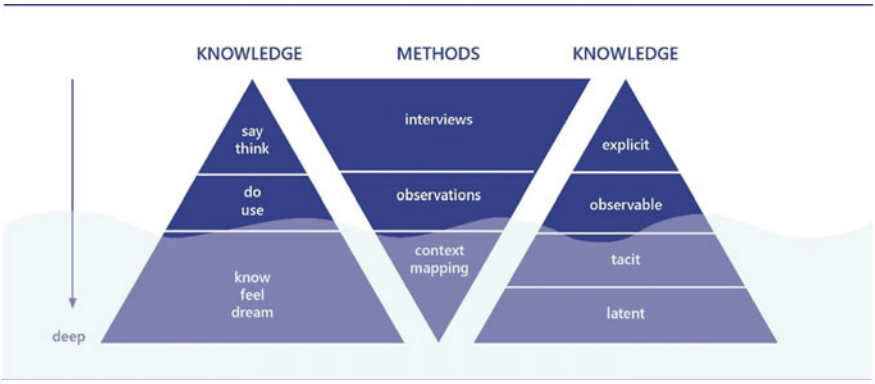

Fig. 1 This illustration shows that generative methods are needed to access deeper knowledge

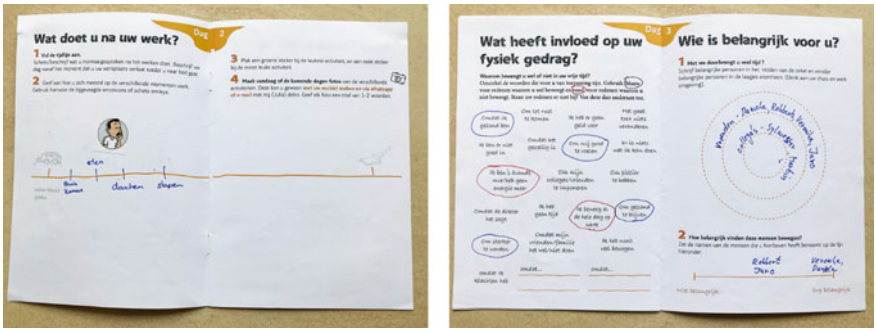

Fig. 2 Filled in examples of the workbook

2.1.2 Interviews

After the workbook was completed, we performed semi-structured interviews with all participants. The script was based on the structure of the sensitizing booklets, and was personalized for each participant depending on their answers from the workbooks. The interviews included questions regarding patient's experiences, needs and motivations for PA behavior, and were executed by JB.

2.2 Experience Sampling Method

ESM was applied to facilitate self-reporting of reasons for being (not) active in the home environment. ESM is a common method for studying what people do, think, and feel during their daily lives (Larson and Csikszentmihalyi 2014). We installed two boxes at the participants' homes for four days (Fig. 3).

Both boxes had seven buttons with labels next to it, describing factors that influence the PA behavior of the participants (Table 1). The factors were based on literature, expert-interviews and the contextmapping study.

The researcher explained to the participants how to use the boxes. The boxes were placed in strategic spots, to trigger the use of the boxes. For example, box 2 was placed near the door so participants were triggered to use it when they were going outside. The boxes were connected to a router, sending data to the researchers. Data were saved on a TU Delft cloud and represented in a dashboard using Grafana. This set up has been developed in Studiolab at TU Delft (Beckmann 2022).

Fig. 3 Left: the router that is connected to the two boxes next to it. Right: the box 2 was placed in a participant's home

Table 1 Labels of the two boxes. Labels describe factors that influence the PA behavior of the participants. Box 1 focused on reasons for being inactive, box 2 provided reasons for being active

Box 1: I am not moving because:	Box 2: I am about to move because:
I don't feel well	It helps me to relax
I want to relax	It makes me feel good
I am exhausted	I want to be fitter/stronger
I don't have time	A friend/family member asked me
I don't know what I should do	I have chores
Nobody is free	I want to go outside/somewhere
Other reasons	Other reasons

2.3 Analysis

Data of the contextmapping study were analyzed according to the six phases approach of Clarke and Braun (2014), using a thematic analysis framework. First, data from the interviews were organized and prepared for the analysis. Field notes were transcribed and written down on post-its using Miro. Quotes were translated to English. Second, relevant quotes and thoughts were noted to familiarize with the data. Lean coding was applied to identify recurrent labels (Creswell 2018). We sorted the data into 10 categories and clustered and labelled the post-its, resulting in 66 codes. Using overlapping codes and categories, 30 initial themes were identified. A diagram was generated that represents relationships among these identified themes. Finally, we used the COM-B model to sort and categorize themes. The COM-B model provides a systemic approach to understand behavior of a person, describing the capability, opportunity and motivation required for behavior (Fig. 4) (Michie et al. 2011; Ellis

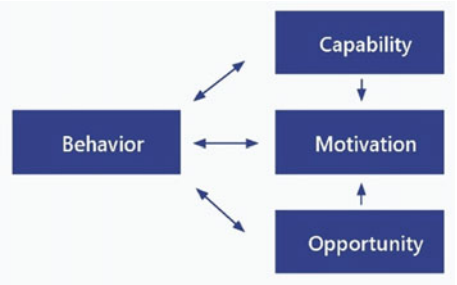

Fig. 4 COM-B model (Michie et al. 2011)

et al. 2019). For ESM, only descriptive statistics (i.e. the relative number each button was pressed) were calculated.

3 Results

Six male workers participated in the context mapping study, aged 31–59 (average 43) years and had the Dutch, Polish, Spanish, Slovakian and Somalian nationality. Four of the six have a partner/family in Netherlands. Identified themes were structured according to the COM-B model, representing factors influencing production workers' capability, opportunity, and motivation for healthy PA behavior (Fig. 5). We labelled each factor with a green (facilitator) or red tag (barrier). Factors that could be a barrier and facilitator received both tags. The most important factors are described below.

3.1 Capabilities

Psychological. All participants knew it is important to perform PA to stay healthy. They could not explain why exactly PA is essential, but they did connect it to better health. However, none of the participants was aware of the differential health effects of occupational OPA and LTPA, indicating an incorrect risk perception as barrier for healthy PA.

> "I have enough sport at work" (male, 53 years old)

Physical. All participants emphasized that they are extremely exhausted after work. Although they would like to be more active during leisure, they spent all of their energy at work.

> "[…],we are working there 10 h, that is the problem why we do nothing after work, because we are tired." (male, 31 years old)

Fig. 5 Overview of the most prevalent factors that influence workers capability, motivation and opportunity for a healthy PA behavior (Green tag = Facilitator; Red tag = barrier)

In addition, some participants reported that they stopped active behaviors due to health complaints or signs of ageing. The physical work is taking toll on their body, limiting LTPA.

3.2 Motivation

Reflective. Because participants believe that their OPA provides enough health benefits, they are not motivated to be active in leisure-time anymore, and feel they deserve time to relax. Furthermore, some participants mentioned that they do not participate in LTPA because they do not want to risk their job.

> "I am watching football. If I would play football, it would be a risk. If I would get injured, I could not go to work tomorrow." (male, 40 years old)

However, the attitude of some workers towards a healthy lifestyle was positive. They reported that they had changed their lifestyle recently, stopped smoking, adopted a healthy diet, and/or started moving in leisure time.

Automatic. Although most participants reported that LTPA energizes them and makes them feel good, many participants developed a habit of inactivity during leisure time. They were aware of the immediate positive effects of PA, but have difficulty

initiating it. Workers had a routine of showering, eating and relaxing after work, and mentioned that they only move if they really have to (e.g. to do groceries or for other chores).

3.3 Opportunities

Physical—work environment. Participants perceived high work pressure in their work, as workers mentioned production goals were increased each year while the number of workers were reduced. Consequently, workers need to work harder, and often skipped breaks and worked overtime. All participants mentioned work load increasing exhaustion and limiting opportunities for LTPA.

> "Like now, I would like to do some sports, but I just don't have time for it." (male, 59 years old)

Workers did not have the autonomy to decide what time they work or take a break, because when the line starts running, they must be present. The team leader does try to take their wishes into account for his planning.

Physical—home environment. Participants mentioned that safe recreational facilities like parks, football places or shops near home facilitate LTPA. They indicated that they prefer moving in nature and that they like cycling because of the well-arranged cycle paths in the Netherlands.

> "Yes I live close to the woods, so we go into the woods for an hour, one-and-a-half." (male, 59 years old)

Social—Working environment. Participants indicated that there is a certain 'macho culture' in their sector, where workers are intended to work hard and do not complain. This macho culture can overstrain workers' body and negatively influence PA behavior.

> "I think the culture is pretty good,… these people go for it and don't complain and you don't even have to tell them to do this or that faster, they understand that very well…" (male, 59 years old)

Social—Home environment. All participants have social roles and responsibilities at home that keep them from being physically active, such as chores, taking care for their family and maintain relationships with friends.

> "Most of the time my wife cleans up, but I have to do something from time to time, otherwise my wife gets angry." (male, 53 years old)

However, social responsibilities can facilitate PA behavior too. Friends that want to meet, children that require playing or a dog that needs to go outside function as facilitators of LTPA.

> "[…] Otherwise the dog is not happy and then I have no rest at home, so I have to." (male, 53 years old)

Fig. 6 The diagram illustrates the relative number the buttons on 'Box1: Not moving' were pressed. Buttons that were pressed most frequently are highlighted in yellow. In total Box 1 was pressed 50 times and Box 2 was pressed 34 times

3.4 Results Experience Sampling Method

The ESM demonstrated which factors influenced the PA behavior of the participants the most. Four of the six workers participated in the ESM study. Three participants pressed multiple buttons each day. One participant used the boxes less frequently, but did press at least one button each day.

Most selected reasons for being inactive were 'I moved at work' and 'I want to relax' (Fig. 6). 'I have chores' and 'I want to go outside' were most frequently indicated reasons for being active (Fig. 7).

4 Discussion

We explored contextual factors influencing PA behavior of people with a physically demanding job, and opportunities for lifestyle interventions. We identified contextual factors of each behavioral component of the COM-B model—capability, motivation, and opportunity, and found that workers mainly do not move because they believe they move enough at work and feel the need to rest. This inadequate risk perception of workers with a physical demanding job was also demonstrated by van den Berge et al. 2020. We also showed that PA could help workers to relax their minds but that they feel too exhausted to get started. This is in line with Bláfoss et al. (2019) who showed that the duration of LTPA gradually decreases with increased work-related fatigue in workers with physically demanding jobs. Facilitators for PA were

Fig. 7 The diagram illustrates the relative number the buttons on 'Box2: Not moving' were pressed Buttons that were pressed most frequently are highlighted in yellow. In total Box 2 was pressed 34 times

household chores and social or recreational activities. Although workers did not consider household chores as PA, it does elevate energy expenditure. However, the energy expenditure involved in housework is less than that involved in brisk walking or physical exercise (Lawlow et al. 2002). Recreational facilities like nature and social activities (e.g., meeting friends or going to the playground) were important motivators for PA. These findings align with Bauman et al.'s results (2012), which suggest that LTPA is consistently related to the availability and the proximity of recreation facilities and that a pleasant green environment can stimulate people to move. Future interventions should make use of these facilitators to enhance PA behavior.

Our results can be used for interventions for people with a physical demanding job using a holistic approach, including both the home and work environment. We propose an intervention focusing on creating awareness and facilitating change using e.g. an informational campaign and a digital buddy (Beckmann 2022).

The participatory and human-centered method applied in this study increased the depth of our exploration. Combining qualitative and quantitative data on how people experience PA behavior enriched our results and provided clear directions for future interventions. However, our research was performed with a small group of participants, limiting the generalizability of our results. Variety of nationalities of our participants limited clear communication. However, this is a pressing barrier for research projects with people with physical demanding jobs.

5 Conclusions

We showed that leisure-time PA behavior of people with a physically demanding job is limited by inadequate risk perception of the health benefits of occupational PA, and over-exhaustion. Interventions should apply a holistic approach and include home and working environment to promote PA behavior. Our findings are relevant for researchers and practitioners who aim to design preventive interventions to improve PA behavior of people with a physically demanding job.

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