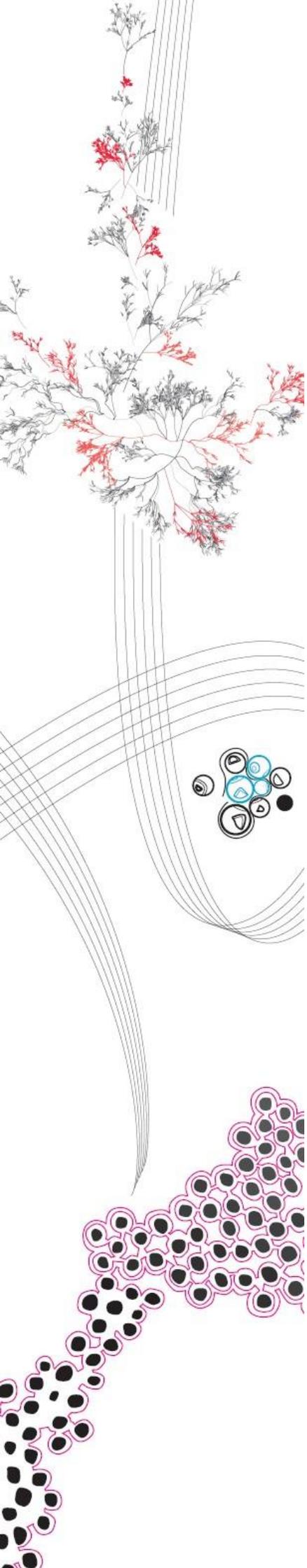


UNIVERSITY OF TWENTE.



Occupational sitting in forced home office  
during Covid-19 pandemic:  
A qualitative study among UT employees

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Date: 22/01/2021

## Abstract

**Purpose:** Sedentary behaviour is associated with premature mortality, cancer, and chronic illnesses. The existing literature focuses on the occupational sitting behaviour of office employees in traditional offices. However, it lacks a thorough investigation on forced home office conditions, as imposed during the Covid-19 pandemic. The aim of this study was to investigate the perspectives of the employees on occupational sitting time in forced home office under Covid-19 regulations, analysing the participants' responses related to behaviour, cognitions, emotions, and negative health effects components as well as barriers and facilitators to reducing occupational sitting time.

**Method:** This online cross-sectional study was completed by 96 employees from the University of Twente. Seven open questions were used for the analysis and focused on experiences of employees when working from home during Covid-19 regulations, occupational sitting in general, experiences of employees with sitting while working from home and experienced barriers and enablers to reduce occupational sitting time while working from home. Inductive and deductive coding was used to analyse the employees' answers. Through five phases the development of the final coding scheme was developed.

**Results:** Employees expressed both negative and positive aspects of occupational sitting time while working from home during Covid-19. The majority pointed out that they tried to find activities to stand up in order to reduce the total occupational sitting time. Participants also described possible ways to reduce occupational sitting time and activities they engage in to reduce occupational sitting time or ways they imagine might be helpful for them. Barriers (e.g., lack of adequate office equipment) and facilitators (e.g., reminders, outside activities) were stated by the participants as well.

**Conclusion:** This study showed that employees experienced many changes in their daily work routines when working from home as compared to working at the UT, reporting that they do not prefer working at home. The main reason for this was due to occupational sitting, which tends to increase during the Covid-19 regulations. Future research is essential to identify potential strategies for reducing occupational sitting behaviour at home and providing information about the effects of prolonged sitting time along with interventions.

**Keywords:** occupational sedentary behaviour, occupational sitting time, working from home, Covid-19 regulations, experiences, perspectives, office workers.

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## Introduction

With technological developments and shifting economic demands, the energy expenditure for many workplaces has been decreased and a vast majority of employees engage in sedentary behaviours (Hadgraft, Brakenridge, et al., 2016). Demands for physical activity of moderate or vigorous intensity have reduced which led to high levels of sedentary behaviour (Hadgraft, Brakenridge, et al., 2016; Owen, Healy, Matthews, & Dunstan, 2010). The same applies with the beginning of the Covid-19 situation, as more and more employees have changed their work environment being forced to work as much as possible from home. Hence, research is needed to examine whether this condition leads to even more sedentary behaviour. Sedentary behaviour (SB) can be defined as any waking activity characterized by little physical movement and energy expenditure of  $\leq 1.5$  metabolic equivalents (METs) or basal metabolic rate while in a sitting or reclining position (Barnes et al., 2012; de Rezende, Rey-López, Matsudo, & do Carmo Luiz, 2014; Mameli, Fabiano, & Zuccotti, 2014). Typical sedentary activities are television viewing, video game playing, transportation, computer use, and lying down or sitting to read or work at a desk (de Rezende et al., 2014; Tremblay et al., 2017). Additionally, sedentary behaviour is a distinct perspective from too little exercise or the absence of physical activity (Lubans et al., 2011; Owen et al., 2010). This means that adults can be sufficiently physically active while still engaging in prolonged periods of sitting time, for example, during work time (Cole, Tully, & Cupples, 2015; Owen et al., 2010; Tremblay et al., 2017).

### *Occupational Sitting and Health Effects*

Over the past decade, excessive sitting has emerged as a risk factor for an individual's health (Hadgraft, Healy, et al., 2016; Mameli et al., 2014). Most adult individuals spend most of their waking days working, meaning that their occupational sedentary behaviour levels have increased (Dewitt et al., 2019). Effects of Covid-19 regulations may cause an increased occupational sitting time (OST). However, no research has been performed to support this viewpoint. According to the literature, office employees spend more than two-thirds of their working time in seated tasks, with more than 30 minutes to prolonged periods along with little physical activity (Hadgraft, Healy, et al., 2016; Mansfield et al., 2018; Parry & Straker, 2013).

In both adults and elderly, high levels of sedentary behaviour are positively associated with a risk of all-cause premature mortality, cancer, chronic illnesses such as metabolic syndrome, type 2 diabetes, and cardiovascular disease (de Rezende et al., 2014), as well as accidental falls and low back pain disability and intensity (Alzahrani, Alshehri, Al Attar, &

Alzhrani, 2019; de Rezende et al., 2014; Hussain et al., 2016). Other relevant health risks include the case of becoming overweight or obese, as the more you engage in prolonged sedentary activities the higher the individual's body mass index (BMI) (de Rezende et al., 2014; Owen et al., 2010). When sitting, the waist circumference is also influenced in both sexes, indicating high numbers for waist-to-hip ratio (de Rezende et al., 2014; Heinonen et al., 2013). The aforementioned health effects have been identified independent from a person's physical activity, with more sedentary behaviour (greater than 6-8 hours per day) being strongly associated with an increased risk of mortality (Patterson et al., 2018). However, recent research presented that high volumes of moderate to vigorous physical activity can mitigate the deleterious health effects of sedentary behaviour (Biddle et al., 2019).

### *Barriers and Enablers Related to Employees' Sedentary Behaviour*

Recent research has established experienced barriers and facilitators that affect the employees' sedentary behaviour within their work-office environment. On the one hand, the nature of the work that requires sitting at a computer is considered as a barrier to reduce a sedentary activity (Cole et al., 2015; Hadgraft, Brakenridge, et al., 2016; Mackenzie, Such, Norman, & Goyder, 2019). Also, standing while working can cause discomfort to most of the workers, influencing their work performance (Cole et al., 2015; Nooijen et al., 2018). The employee's sitting time, in total, reflects the executed amount of work regardless of the level of an individual's physical activity (Cole et al., 2015). Thus, sitting at a computer and just work is a habit that many employees have formed over the years of their job career (Mackenzie et al., 2019; Nooijen et al., 2018). The experienced individual's pressure of getting the job done and finishing the amount of work which they have to deliver has also been found as a barrier (Cole et al., 2015; Hadgraft, Brakenridge, et al., 2016). Any interruption of leaving their desk throughout their work might cause the breakup of the work's flow. When working from home, the lack of facilities such as treadmills to encourage the employees to move from their desks and occupy themselves with something else, negatively influence the individuals to reduce their total sitting time (Cole et al., 2015; Mackenzie et al., 2019). Working at home leads to the fact that employees cannot work undisturbed and without distractions and they are forced to work longer hours to get the daily work done (Crosbie & Moore, 2004). Hence, distractions at the home-office environment influence the employees' sitting time and have been found as the main barrier to reduce sedentary sitting time.

On the other hand, a purpose and a definite reason of employees to get away from

their desks and engage in physical activity is one of the facilitators for reducing sedentary behaviours (Cole et al., 2015). Due to prolonged sitting, many workers experience physical as well as mental issues which can be relieved by getting up from their desks and taking short breaks. Hence, relief from these symptoms is another enabler to reduce sitting whilst working (Cole et al., 2015). Office environments do not operate as restrictive factors from taking breaks, by contrast, there is much space for flexibility. Therefore, peer support to stand up and take some time to meet with a colleague and talk about general areas of work or office is considered a facilitator to relieve long periods of sitting (Cole et al., 2015). When employees are aware of how other colleagues work and how much time they spend in their office, they can easily promote social interaction and peer support in any daily situation (Cole et al., 2015). Standing or walking through meetings and reminders for breaks through the usage of an application or activity watch can facilitate the employees to reduce their sitting time (Nooijen et al., 2018). Furthermore, the responsibilities of homeworkers are increased and the care of spouses, older children and relatives or children as well as household tasks can be included to the frequent enablers to help the employees reduce their sedentary time. Hence, when employees have to wash and clean the house or the garden, and go for shopping or pay the bills, they tend to take long breaks and consequently reduce their sitting time while working at home (Crosbie & Moore, 2004). Finally, while working at home, workers tend to play more with their children, although they work longer hours. Their need to spend more time with their kids and try to make fun altogether makes them take more frequent breaks and reduce their sitting time (Crosbie & Moore, 2004).

Nevertheless, few previous studies have examined the facilitators and barriers of reducing the sedentary time in the workplace of a home office. Of particular concern is to assure that the evidence of the above-mentioned experienced barriers and enablers correspond to worktime sitting from home during Covid-19. So far, very little attention has been paid to that topic; more research is needed to reduce sedentary behaviour in any working environment and provide possible employees' benefits of less sitting worktime without losing their productivity.

#### *Possible Solutions for Reduction of Occupational Sitting*

Considering the current situation whereby many employees spend most of their working time at home, the working environment seems to be a crucial factor for activity patterns and aspects of work. Studies have shown that employees can spend four-fifths of their working hours sitting in offices, which results in high levels of sedentary behaviour,

without being fully physically active (Hadgraft, Healy, et al., 2016; Ryan, Dall, Granat, & Grant, 2011). Therefore, there is a need for solutions to reduce occupational sitting (OS) and help the employees to improve their physical activity while working.

In a working environment, making small breaks during sedentary time seems to have positive and beneficial associations with metabolic biomarkers (Owen et al., 2010). Taking several short breaks from looking at the screen throughout the day in order to take a lunch or drink some water or have a walk around the space seems to enable a high-performance capacity and to increase the employee's well-being (Afanuh & Johnson, 2017; Fritz, Ellis, Demsky, Lin, & Guros, 2013). If an employee is struggling to remember to take a break, he/she can set a reminder on his/her phone or leave a note at an obvious screen spot. Standing instead of sitting while working is recommended as an effective way to incorporate any movement into employees' workday (Afanuh & Johnson, 2017; Shrestha et al., 2018). For instance, standing while talking on the phone or standing and moving around every 30 minutes or holding walking meetings can help to boost the worker's productivity (Afanuh & Johnson, 2017; Hadgraft, Brakenridge, et al., 2016; Shrestha et al., 2018). Furthermore, the provision of sit-stand desks or active workstations such as treadmill desks can result in reductions in sitting while working (Afanuh & Johnson, 2017; Hadgraft, Brakenridge, et al., 2016; Shrestha et al., 2018). Trying to stand for a few minutes while responding to or sending emails or editing a work's document can be a helpful solution to reduce occupational sitting.

### *Experiences with Occupational Sitting*

The focus of this research was to study the occupational sedentary behaviour from the employees' perspective to discover how University of Twente employees find themselves affected by working from home during Covid-19 through the expression of their experiences and feelings. Thereby, this qualitative approach discovered trends in thoughts and opinions of participants and developed a comprehensive overview of the current situation along with the analysis of the standardized questionnaire.

Previous studies have described the experiences of employees with occupational sitting, stating how they feel with such a situation, how it has affected their work progress and strategies to cope with possible difficulties. Based on research, office employees associate prolonged periods of occupational sitting with poor health in terms of fatigue, lack of motivation and musculoskeletal issues such as back pain, as well as joints, bones, and muscles pain (Gilson, Burton, van Uffelen, & Brown, 2011). Employees stated that as they sit a lot while working, they try to find ways and strategies to reduce the work time sitting (Hadgraft,

Brakenridge, et al., 2016). For instance, individuals mentioned that in order to interrupt and reduce occupational sitting time, they try to integrate strategies into their everyday work life (Gilson et al., 2011; Hadgraft, Brakenridge, et al., 2016). To achieve less occupational sitting, employees made a workload planning, they tried to change the position of a furniture in their office environment such as positioning the printer away from the desk or they perform work tasks while moving (Gilson et al., 2011). In this way, employees pointed out that they can be more productive during work hours and get the work done more easily. In contrast, other workers argue that they prefer to stand and move more with the use of sit-stand desks rather than adapting their job and change the office design (Gilson, Straker, & Parry, 2012). In particular, an employee stated that *“Having the stand-up desk definitely helps me ... It helps me to think. I’m much more productive with a stand up desk. I’m clear-minded, I’m focused, I’m standing, I’m getting oxygen in me.”* (Hadgraft et al., 2017). Hence, employees reported that they try to find a balance between sitting and standing time to increase awareness of their activity-sitting behaviour as well as work performance and productivity (Gilson et al., 2012; Hadgraft et al., 2017). For example, one employee mentioned that *“It has changed my whole mindset, even at home, not just at work. I am constantly now aware of sitting for more than 30 minutes at a time. I never was aware of that before.”* (Hadgraft et al., 2017).

Overall, based on the results published so far, workers discussed occupational sitting and any sedentary behaviour which is related to long-term health effects. Sedentary behaviours are associated with a variety of health issues including chronic illnesses, low back pains and obesity. Especially, sitting more than 6 hours is associated with a greater risk for negative health effects. Additionally, employees expressed their points of view regarding possible barriers and enablers in their work-office environment. For instance, the nature of the work which requires to sit in front of a computer, the pressure to finish the work on time, interruptions, or distractions of leaving the desk which influence the work’s flow as well as office facilities are some of the main experienced barriers. However, a purpose or a specific reason to stand up, relief from symptoms such as back pains, peer support, reminders for break purposes, standing-walking meetings and responsibilities at home were described by many workers as enablers to reduce their sedentary behaviours. Along with the experienced enablers, employees mentioned similar possible solutions for reduction of their occupational sitting. They stated that regular short breaks, standing instead of sitting to do several tasks such as while talking on the phone or sending an email, reminders and the provision of sit-stand desks might be helpful solutions to reduce occupational sitting. Finally, employees described their experiences with occupational sitting in general, expressing the way they feel

with sitting while working and stating strategies to deal with possible difficulties. Workers associated the prolonged occupational sitting with motivational issues, fatigue, and muscles pain. Thus, they tried to find ways to reduce their sitting by making a work plan or changing the position of office furniture. Other employees mentioned that they changed the office design, buying sit-stand desks in order to stand and move more often. To conclude, exploring the people's perspectives is an added value to gain, with appropriate interpretation, unique in-depth insights and understanding of the way employees think, experience, understand and behave in the situation of Covid-19 regulations in order to provide possible solutions.

### *The Current Study*

With the beginning of Covid-19 regulations, many aspects of life have changed, incorporating those related to work. As discussed before, no studies of the experiences of employees about working from home during Covid-19 crisis have been performed. Moreover, as of yet, there are no data and information available regarding the experiences of sitting while working from home such as circumstances compared to working at an organization's office or barriers and enablers that many employees experience while working at home. The primary objective of this study was to elucidate how working from home due to Covid-19 pandemic affects worktime prolonged sitting. The focus of qualitative research was to gain employees' responses on what they think about the Covid-19 situation and to point out their experiences, attitude, and opinions on that topic. In this way, a comprehensive understanding of the working at the home condition and an explicit rendering of worktime sitting at home will be examined. The aim of this report was to examine and analyse the participants' experiences that cover the situation of working from home during Covid-19 regulations. Therefore, the meaning of sedentary behaviour was analysed, occupational sitting and health effects were examined, barriers and enablers to reduce sitting time as well as solutions and employees' experiences with occupational sitting were identified. Consequently, the main research questions of this analysis were:

1. What are the perceptions of employees about occupational sitting at home during Covid-19 pandemic related to behaviour, cognitions, emotions, negative health effects & wellbeing components?
2. In what ways, at the moment, do the employees try to reduce occupational sitting time at home and what are the barriers and facilitators to successfully improve it?

## **Method**

### ***Recruitment***

This study uses a qualitative methodological approach to investigate the research problem. The data collection was achieved through a questionnaire which was distributed via the Qualtrics online survey tool and it was open from end-June to mid-August 2020. This study was executed in the context of the master thesis of Gerko Schaap (Schaap, 2020). The open questions allowed for a greater variety of the participants' responses regarding their working at-home experiences. The secondary data have already been collected by the Master student in the field of Health Psychology & Technology at the University of Twente who made them available to be used for the purpose of this analysis. The study was conducted online, and the participants were able to leave the study at any time for any reason without any consequences. The participation in this study was entirely voluntary, completing the questionnaire anonymously. The survey lasted approximately twenty minutes and all participants signed the online informed consent before commencing with the questionnaire (see Appendix A). The survey consisted of qualitative questions discussed below and additional closed questions for an accompanying quantitative study. The study was approved by the Ethics Committee of the University of Twente (request number 200843).

### ***Participants***

Participants of this study were employees of a Dutch University (University of Twente) who were recruited via convenience sampling by receiving an invitation to the questionnaire via faculties' HR managers and health, safety, and environment coordinators, via secretariats of departments, and via a related news media. For pragmatic reasons, snowball sampling was also used; employees were directly approached to participate and asked to spread the news of this study. For screening, the following inclusion criteria were used: having traditionally sedentary work (i.e. excluding e.g. janitorial staff and security; being part of academic staff (including PhD candidature) or supporting or management staff); at that time working from home; being 18 years or older; and being capable of understanding the English language. After adjusting and leaving out the cases with insufficient information (i.e., participants not reporting on the main study outcomes), the sample consisted of 96 valid cases, of which 66 were females and 25 males, with the majority of the respondents being part of the academic staff. The participants' demographic characteristics are summarized in Table 1. From the valid cases, 68 participants responded to the main questions concerning the experiences,

barriers, and facilitators regarding occupational sitting at home during Covid-19 pandemic, while the remaining 28 participants responded to all open questions.

**Table 1**

*Participants' demographic characteristics*

Characteristics	<i>n</i>
Gender	
Female	66
Male	25
Other/prefer not to say	5
Employment classification	
Academic staff	51
PhD students	12
Support and management staff	33
Valid N	96

*Note:* Participants' age range from 22 to 65 years with a mean 40.98

### ***Instruments***

In the first part of the survey, participants received information about the general purpose and procedure of the study and were informed regarding the researcher and the questionnaire's details such as the duration of the survey, confidentiality, and the anonymous responses. Next, the participants were presented with an informed consent, assuring that they approved to participate in acknowledging the nature, method and aim of this study. After giving their consent, the participants were presented with the next block; screening, in order to respond whether they work from home and appointed a number of working hours per week.

In the following block of the questionnaire, basic demographics were gathered. These included age, gender, and highest completed level of educational attainment. Furthermore, work-related demographic items related to employment classification (PhD students, academic staff, or support and management staff), office type at the university (private, shared, or other), and how often the employees worked from home before the Covid-19 regulations. In the final part, participants were also asked if they are able, physically, to stand for at least 15 uninterrupted minutes.

Additionally, participants were asked about experiences with working from home during Covid-19 regulations. Questions about sitting time while working in general, sitting while working from home as well as experienced barriers and enablers to reduce sitting time while working at home were also included. For a detailed overview see Schaap (2020). Seven open questions were presented to the participants in order to give answers about what they

think of such a situation and point out their opinions, attitudes, and experiences of working from home (see Table 2). In particular, the first open question was about the experiences of employees while working from home during the Covid-19 regulations. In this question, participants could explain what they think of such a new situation and how they experience the work routine at home. The second open question referred to the occupational sitting in general. In this question, employees could mention whether they sit a lot while working or whether they experience any health issue as a result of their total sitting time at work. The third open question was about, in addition to what they answered already, the experiences of employees with sitting whilst working from home. Hence, participants could highlight possible changes compared to working at the University of Twente such as differences in total sitting time or breaks between meetings or different office equipment. The fourth and fifth open questions concerned the experienced barriers and enablers in the current situation while working from home. In the case of barriers, participants could state whether they have tried to reduce sitting time in order to identify which obstacles they experienced to do so. In the case of facilitators or enablers, employees could indicate which factors or circumstances helped them to reduce occupational sitting at home. The sixth open question asked the participants whether they had additional thoughts they would like to share related to sitting in the current home office situation. This question was more general compared to the previous ones and the employees could share their thoughts as well as feelings about the current condition of working from home. The final open question was about further general remarks of the people who participated in this study. Therefore, in this question, they could point out whether they experienced any difficulty answering the aforementioned questions, whether they would like to include other questions in this questionnaire or how they felt after the completion of the study. The survey containing the screening and demographic block as well as the seven open questions can be found in Appendix B.

**Table 2**  
Overview of the seven open questions

	Open questions
Open question 1	In addition to what you answered already, what are your experiences with working from home during the COVID-19 regulations in your situation?
Open question 2	What are your experiences with sitting time while working in general?

Open question 3	In addition to what you answered already, what are your experiences (e.g., changes compared to working at the UT) with sitting whilst working from home?
Open question 4	In case you tried to reduce sitting time, which barriers did you experience in the current situation whilst working from home?
Open question 5	In case you tried to reduce sitting time, what for you are current enablers to reduce sitting time whilst working from home?
Open question 6	Do you have additional thoughts you would like to share related to sitting in the current home office situation?
Open question 7	Do you have further general remarks you want to share?

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### ***Data Analysis***

The qualitative anonymised data from the seven open questions were analysed through inductive and deductive coding in different phases. First of all, the participants' responses were transferred into a Microsoft word document to be studied and analysed. In this first stage, the familiarisation of the data was achieved through a repeated and active reading of the participants' responses in order to search for meaning and behaviour patterns of the employees' data (Braun & Clarke, 2006). Keywords and the most important responses of the employees, based on the formulated research questions, were highlighted. Participants' responses were examined sequentially and in detail. After that, an initial list of ideas, about what is interesting from the responses and how it is related to the research questions, was generated (Braun & Clarke, 2006). Initial codes from the data were produced for as many potential patterns and themes. In order to observe what might be interesting for the next step, themes were created to categorize data, and these were linked to quotes from the employees' responses. During the third phase, the data analysis was refocused at a broader level of themes, sorting the different codes into themes, and comparing all the relevant coded data extracts within the themes. Coding schemes (Appendix C) were developed for the concepts of behaviour, cognition, and emotions, negative health effects & wellbeing of employees (research question 1) and the concepts of ways to reduce occupational sitting time, barriers, and facilitators to successfully achieve it (research question 2) through the identification of themes arising from the data. The themes were reviewed and refined as well as merged and

changed as the coding process went on. In the final phase of the coding scheme, the themes were defined and named. The meaning of each theme was identified, and all the relevant aspects of each theme were determined. Once codes and themes were final and completed, these were checked by the supervisors of the study. Main themes with detailed descriptions, their corresponding codes and the related quotes from the participants' responses can be found in Appendix C.

Research question 1 will be answered by the information on open question 1 about the experiences with working from home during the Covid-19 regulations, and open question 3 about the experiences (such as changes compared to working at the UT) with sitting whilst working from home. Research question 2 will be answered by the information on open answers to questions 1 and 2 which were about the experiences with sitting time while working in general, 3, 4 and 5 regarding the experienced barriers and enablers as well as question 6 which was about additional personal thoughts related to the home office situation.

## **Results**

In the following part of the report, detailed analysis and explanation of the results from the participants' responses will be given. The focus will be on the employees' responses regarding occupational sitting time during Covid-19 regulations. In particular, employees from the UT reported both positive and negative sides of working from home during Covid-19 pandemic. However, in some cases, participants focused on working from the home situation and not to occupational sitting time. In this results section, only the responses for the employees' occupational sitting time during Covid-19 will be examined.

### **Research Question 1: What are the perceptions of employees about occupational sitting at home during Covid-19 pandemic related to behaviour, cognitions, emotions, negative health effects & wellbeing components?**

#### **Behaviour Related to Occupational Sitting**

Behaviour themes arising from the participants' responses in the questionnaire related to "Prolonged sitting", "Activities for break purposes", "Compensatory activities for previous physical activity", "No breaks", "Sitting postures" and "Distractions". The corresponding codes can be found in Figure 1 with relevant details and explanations and are all described in this results section.

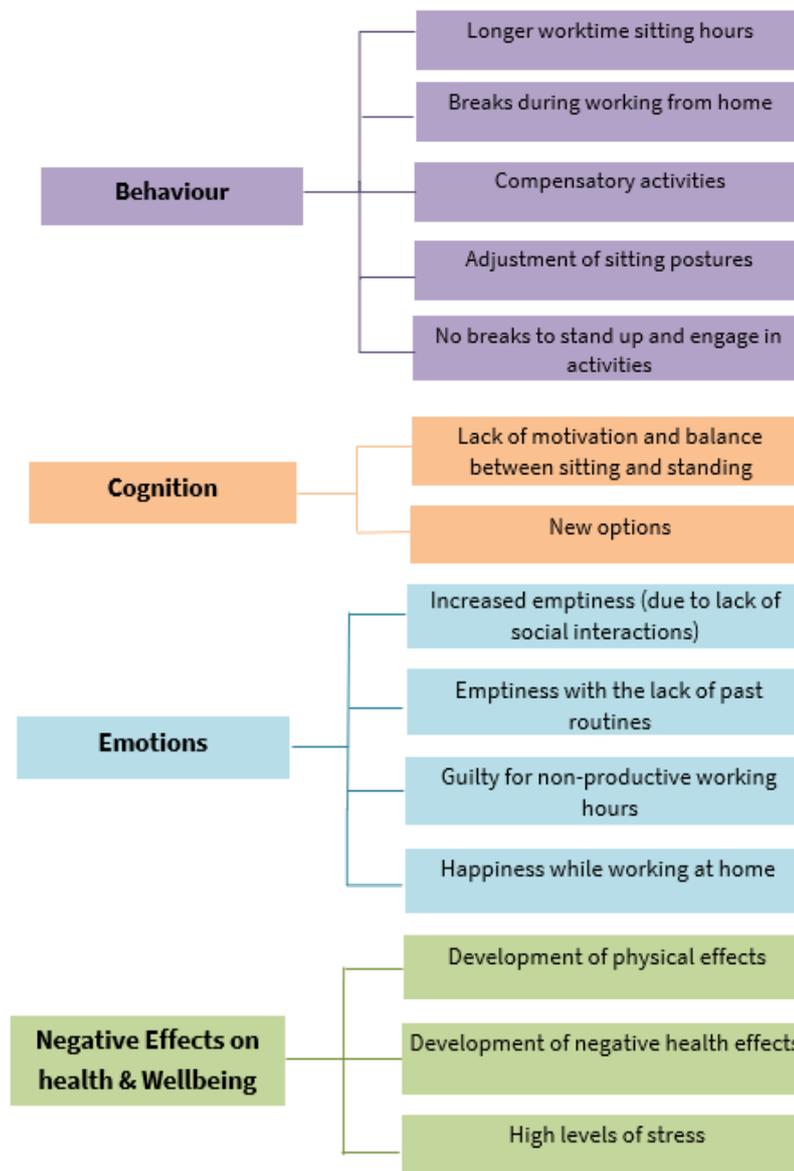


Figure 1. Coding scheme of the first research question. From top to bottom: behaviour, cognition, emotions, and negative effects on health & wellbeing with their corresponding codes.

### **Prolonged sitting**

Most of the participants said that they sit more when working from home in order to get the work done. They all mentioned that they start earlier and stop later because they have more emails to answer and as a result, they sit more than they actually want. Furthermore, they stated that all meetings are online, so they always need their computer to do a task, adding one more reason for sitting more hours. Many participants described the same pattern of sitting behaviour; sitting behind their desk for most part of the day. The following

participants briefly described their occupational sitting pattern at home during Covid-19 pandemic as follows:

“I sit more than I actually want because I barely have any tasks for which I do not need a computer.”

Female, age 25, participant 8.

“...Unfortunately, all those meetings are online now, and I spend the whole day sitting behind my desk.”

Male, age unknown, participant 59.

“...So, my experience is that I sit much more than what is good for me...”

Female, age 64, participant 64.

### **Activities for break purposes**

Participants stated that they engage in different activities throughout the day for break purposes. These activities include cycling, walking with a friend/boyfriend /girlfriend, or walking the dog in order to reduce sitting time or try not to sit too much when working at home. Hence, the following participants described:

“...I always try to take a long walking break during lunch to make sure that I reach at least 6000 steps a day and try to exercise in the evening...”

Female, age 30, participant 47.

“I have more energy since I've started working from home. I'm forced to take breaks because I have to walk the dog. I walk way more than I normally do during a work day at the UT...”

Female, age 27, participant 40.

“I try to take small breaks regularly (getting tea, going outside for a moment, going to the bathroom etc.) and I try to take a longer break by going for a walk...”

Female, age 27, participant 124.

### **Compensatory activities for previous physical activity**

A few participants mentioned that they try to find some activities in order to compensate for their daily routine regarding physical activity. Trying to behave like they work at the UT, employees said that they engage in different activities to compensate for

missing bike rides and walks at the campus and the following participant mentioned:

“As soon as you realize it is semi-permanent, you should take measures to get the circumstances right. Apart from that, I started the days from the beginning with activities to compensate for missing bike rides and campus walks.”

Male, age 52, participant 18.

### **Sitting postures**

Furthermore, many employees said that they adjust and try out other sitting postures than their normal ones by adjusting their office desks and chairs. They all used traditional sitting desks, and some mentioned that they adjusted their chairs for themselves. As the employees recognize that they sit quite a lot during a working day, switching their posture helped them to feel better and they described it as follows:

“Since the default workplace is not there, you try out other positions and stick to some.”

Male, age 52, participant 18.

“I did adjust my desk and chair in such a way that I sit correctly (so with knees at 90 degrees, elbows at desk height, etc), so I do feel I am a bit aware of working healthy, but I did not think of the option of alternating between sitting/standing...”

Female, age 24, participant 62.

### **No breaks**

However, on the other hand, some participants said that they do not take breaks due to the fact that they rarely stand up to engage in different activities. Therefore, when they work from home, they are physically less active. These facts were described by the participants as follows:

“...Rarely standing up or taking breaks is both a result of not being able to work efficiently at home (not deserving a break), and having no other (social, professional) activities that would cause me to stand up and change my posture as a side effect...”

Male, age 32, participant 74.

“I take less breaks and the toilet or kitchen for coffee or lunch is nearby within 3 meters...As a result I experience being physically less active during the day...”

Male, age 46, participant 44.

“At home you take less breaks and sit down much longer”

Female, age 48, participant 27.

### **Cognitions about Occupational Sitting**

In the cognition subcategory, participants responded to the open questions about two aspects. The first one was about the concept of working from home and the second one was about the concept of occupational sitting while working from home. In the results section, the focus will be on the employees' responses regarding occupational sitting time during Covid-19 regulations. Thus, cognition themes arising from the participants' responses in the questionnaire related to “Motivation issues”, “Balance between sitting and standing” and “Options to control occupational sitting time”. The corresponding codes can also be found in Figure 1.

### **Motivation issues**

Many participants in the study mentioned that they find it very boring as their sitting time is highly increased compared to when working at the University of Twente. Hence, there is a lack of motivation to just work efficiently and get the work done. One of the employees described that:

“The lack of motivation I experience when working from home also causes me to feel less accomplished. Rarely standing up or taking breaks is both a result of not being able to work efficiently at home (not deserving a break), and having no other (social, professional) activities that would cause me to stand up and change my posture as a side effect...”

Male, age 32, participant 74.

Next to that, other participants pointed out that they have a lack of motivation to stand up while working at their home. An example of that:

“...The problem is that I do not have the motivation to stand up and walk through my apartment because I am too much focused on my work...”

Female, age 64, participant 64.

However, other participants expressed the positive side of sitting while working from home during Covid-19 regulations, indicating that they can find a balance between occupational sitting time and standing time while working at home. Based on that, an employee said that:

“I’m trying to find a good balance between sitting and standing”

Female, age 51, participant 2.

### **Options to control occupational sitting time**

Additionally, a few participants stated that there is a better control on occupational sitting time when they work from home during Covid-19 regulations because there are more options that they can follow in their daily routine. The following participant described that as follows:

“At home there are more options to regulate the sitting time”

Female, age 42, participant 113.

### **Emotions of Employees about Occupational Sitting**

Finally, themes arising for the subcategory of emotions related to “Miss colleagues”, “Miss past daily routines”, “Guiltiness” and “Happiness”. The corresponding codes can be found in Figure 1 with relevant details and explanations and are all described in this results section.

### **Miss colleagues**

All of the participants said that they miss their colleagues as well as students from the UT. This lack of social interactions in the working environment make them feel an increased emptiness and less connected with the university and the staff. All of the employees described that the fact of missing the informal contact with other individuals at the office, influences them as they do not feel part of group or team. Examples of the participants’ responses that explain the above-mentioned situation:

“On the one hand side...On the other hand side, I miss interactions with colleagues and not being able to have regular meetings reduces effectiveness.”

Male, age unknown, participant 59.

“I miss the informal contact with colleagues. That is what makes working fun. The longer it takes to work from home, the worse the lack.”

Female, age 52, participant 69.

“I’ve gotten more used to it as time goes on, but my need for social interaction has risen. I miss the feeling of being in a group, smiling to people for no reason. I do however appreciate a bit calmer around me every now and then.”

Female, age 32, participant 77.

### **Miss past daily routines**

Next to the aforementioned theme, participants also mentioned that they miss their regular bikes rides from and to their work, the University of Twente. As the daily programme of everyone has changed, employees said that they miss all the activities they used to engage before the spread of the Corona situation. Therefore, they referred that they cannot go, for example, to the sports centre of the UT or do something to spend their free time productively. A participant described the situation as follows:

“...I miss my regular bike rides to and from work and the cardio fitness lessons at the sports center...”

Female, age 64, participant 64.

### **Guilt**

Furthermore, employees pointed out their feelings of guilt when they cannot work and for all the non-productive working hours. In a case, a participant said:

“I feel guilty for every non-productive minute I have”

Female, age 33, participant 38.

Also, a participant mentioned that they feel guilty when they go for a walk, either short or long, as they feel less efficient to finish their work.

“Sometimes I feel guilty for going on a longer walk because I feel like it's taking too much work-time and I feel like I should have started earlier so that I could go on a walk.”

Female, age 27, participant 124.

### **Happiness**

Employees also expressed their emotions of happiness while working from home during Covid-19 situation, as they feel the freedom to organize themselves their work and personal time as well as their everyday program. Examples from the participants’ responses

that describe these cases are:

“I am happy, much less stressful meetings that last hours”

Other/prefer not to say the gender, age 51, participant 32.

“A better balance in work and private life. I can bring my kids to school now, instead of leaving the house while they are still sleeping and coming home when it is almost their bedtime. That makes me very happy...”

Female, age 35, participant 106.

“I really like the freedom to organize my time”

Female, age 62, participant 88.

### **Negative Health Effects of Occupational Sitting & Wellbeing of Employees**

The themes arising for the subcategory of negative effects on health & wellbeing related to “Physical effects”, “Health effects” and “Stress”. Again, the codes of this category can be found in Figure 1.

#### **Physical effects**

Some employees described that sitting a lot while working from home makes them feel very tired. They expressed that as the workload has doubled, they are forced to sit more to get their work done.

“My workload has doubled in the last few months. That in combination with Teams-meetings (or calls) all day long, I'm tired all the time...”

Other/prefer not to say the gender, age 33, participant 19.

“...I do think the COVID-19 regulations and the decrease of social interaction have been challenging for my mental health. Physically, I feel more tired at the moment...”

Female, age 27, participant 124.

#### **Health effects**

The majority of the participants described negative health effects they experienced due to total sitting time while working from home during Covid-19 pandemic. In particular, employees said:

“I experience neck aches from sitting a lot, maybe because I find it hard to

get the right setup and do not have a great office chair...”

Female, age 26, participant 68.

“...but apparently something's not right because of the muscle pain in the shoulders and neck.”

Female, age 52, participant 69.

“Continuously working on a computer may have additional health effects besides sitting: neck and shoulder problems, concentration etc.”

Male, age 56, participant 86.

Moreover, a participant mentioned that this situation influences his general mental health as well, indicating specific pain and issues to his body.

“Increasing back problems that force me to lay down at night and therefore hinder me from participating in social activities. As a result, it influences my mental health as well”

Female, age 51, participant 16.

## **Stress**

Finally, many participants said that they experienced a lot of stress when they have to do everything online and are forced to sit for prolonged period of time. Hence, their levels of energy were decreased and any task or work they had to complete made them feel very stressed. Examples that illustrate the stressful cases of employees are given below:

“Stressful as doing everything online, more time and more energy”

Female, age 53, participant 60.

“I have been sitting a lot more and I've been noticing it in how my back and knees crack sometimes. I try to take breaks and create reasons to take breaks, but I had to make up for time lost in the first corona month, so there was more stress than usual”

Female, age 32, participant 77.

“I like working from home, but due to the enormous amount of extra work, the working hours are longer, and I experience a lot of physical stress (RSI)”

Female, age 60, participant 41.

There were also responses in which participants explained the fact that combining the work at home with having children at home was quite stressful for them as well. A participant gave the response as follows:

“quite stressful, especially when day care/school was closed and we have to take care of the kids (and although the university offers good regulations for this, it did not reduce workload).”

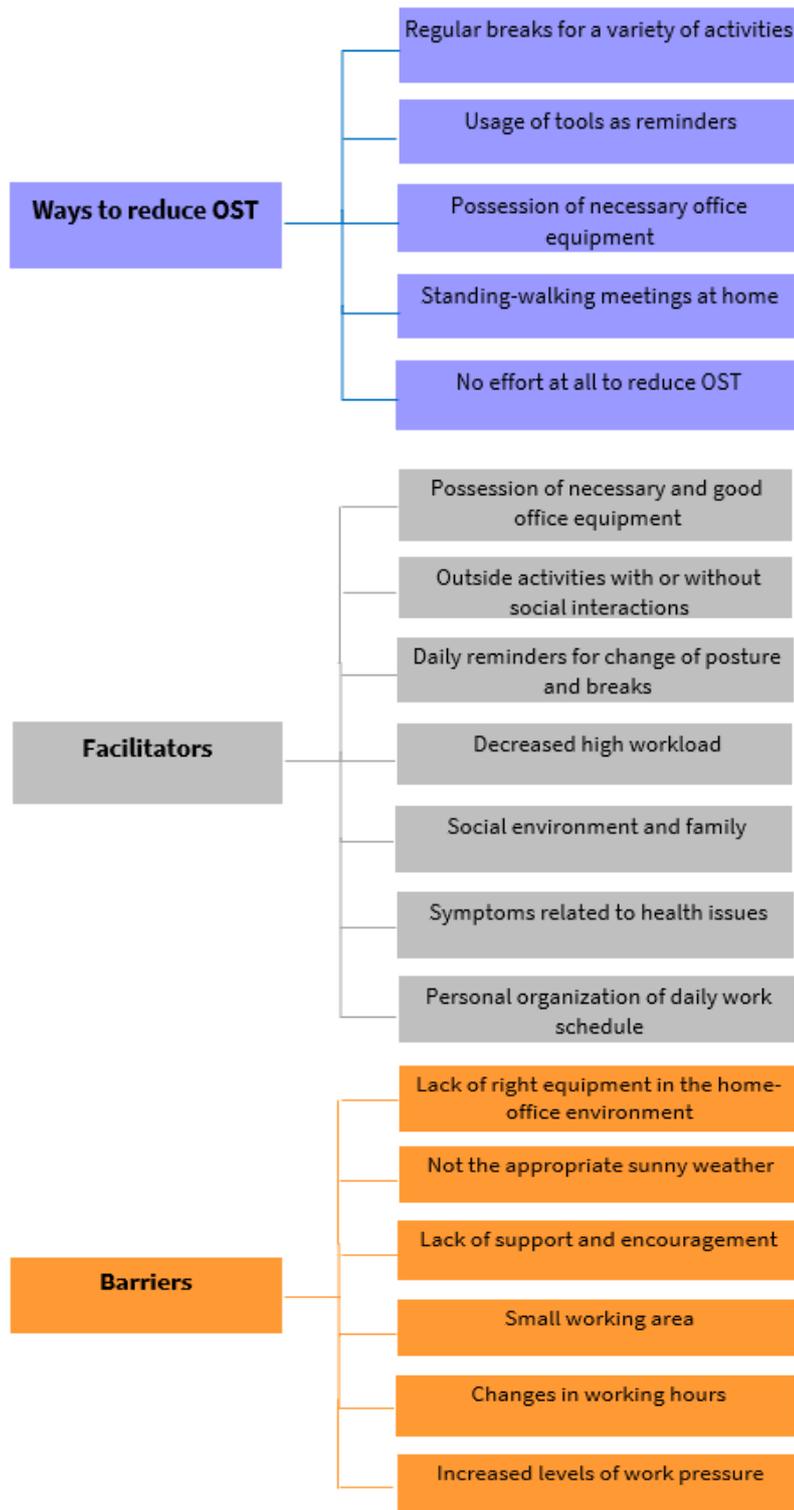
Female, age 36, participant 120.

In summary, participants expressed both negative and positive sides when asked about their experiences of occupational sitting time while working from home during Covid-19. The majority of the employees mentioned that they engage in prolonged sitting (they sit more while working from home) compared to working at the UT, but they try to find different activities in order to stand up and occupy themselves with a task rather than work. Participants stated that they find it very boring to work from home, and they miss their colleagues as well as the past activities at the UT. However, other employees pointed out the positive view of occupational sitting, enjoying working from home as they have more freedom to organize their personal schedule and find more free time to do something else rather than sitting in front of the computer. Another important theme that employees mentioned was about the physical and health effects and stress that they have experienced by prolonged occupational sitting. The general point of view from the participants' responses in RQ1, is that the majority of the participants expressed their negative experiences, cognitions and emotions while working from home during Covid-19. This situation indicates that most employees are not influenced positively from Covid-19 changes and that they try to find opportunities to reduce occupational sitting time.

**Research question 2: In what ways, at the moment, do the employees try to reduce occupational sitting time at home and what are the barriers and facilitators to successfully improve it?**

### **Ways to Reduce OST**

The main themes regarding the possible ways to reduce occupational sitting time were: “Breaks for different activities”, “Reminders”, “Right office equipment”, “Options for online meetings” and “No effort”, see Figure 2. This part can be combined with the part of facilitators as the employees expressed the same themes of “Office equipment”, “Outside activities”, and “Reminders” in both categories. For the corresponding codes see Figure 2.



*Figure 2.* Coding scheme of the second research question. From top to bottom: ways to reduce occupational sitting time, barriers, and facilitators to successfully achieve it while working at home during Covid-19 with their corresponding codes.

### **Breaks for different activities**

Almost all of the participants described the most frequent way to reduce occupational sitting time while working from home during Covid-19 crisis as well as a facilitator. First, most of the employees mentioned that they try or are forced by themselves to take regular breaks during working hours. For instance, one participant said that a good opportunity to stand up and do something was to go to the toilet or the coffee machine. The response was as follows:

“Getting up for coffee, water or toilet and having to take the stairs”

Female, age 27, participant 63.

“...and finding a good time to take sedentary breaks”

Male, age 28, participant 98.

Next to that, other activities inside the house to stand up from the desk were also mentioned by some employees. Taking breaks to get up for food, for preparation of snacks or meals, talk to a housemate or just go downstairs to do small household chores were provided as follows:

“More consciously doing small household chores in between...”

Female, age 63, participant 109.

“Getting up for food and drinks, talking to housemate in the break, going for a walk.”

Female, age 30, participant 121.

Other participants pointed out additional activities, more active ones, that engage to them for a better physical health. These outside activities with or without social connections include walking, running, cycling, walking with the dog and other sportive things either alone or with someone else such as girlfriend, boyfriend, or partner. Examples of participants' responses:

“I regularly try to cycle for half an hour to 45 minutes during the 'lunch break', weather permitting. And sometimes just a walk with the dog...”

Female, age 63, participant 109.

“social connection: e.g., meeting my girlfriend for a long walk in the park for an afternoon coffee”

Male, age 50, participant 78.

“...My partner also asks me on walks when he notices that I am thinking too hard. I have been meeting with colleagues for walks twice now, which has been great, but takes up a lot of time, so I cannot do that too often.”

Female, age 32, participant 77.

Other participants expressed that walks with the dog or go to the supermarket for shopping were helpful for them as well to reduce the occupational sitting time. Examples are given below:

“I have a puppy, so he had to go on short walks fairly regularly”

Female, age 43, participant 31.

“Shopping needs definitely help as a goal”

Male, age 38, participant 43.

“...or do some shopping in between, usually that works...”

Female, age 54, participant 5.

## **Reminders**

The usage of tools such as smart watches or pc reminders to stand up, take a break and make some steps around the area was also mentioned by some participants as a possible way to reduce the occupational sitting time and an ideal facilitator. Cases that employees use several tools as reminders are presented below:

“my apple watch that sometimes gives me a reminder to stand”

Female, age 48, participant 52.

“I have a smart watch which reminds me to get up every hour. This helps to some extent. I introduced "calling while walking" with friends. We did this more often in the evenings.”

Female, age 27, participant 76.

## **Adequate office equipment**

The possession of appropriate office equipment was also mostly mentioned as a way of reducing occupational sitting time as well as a facilitator. Participants emphasised the sit-stand desk and adjustable chair as relevant means for changing sitting postures for a better body position. Specifically, the following participants described:

“I used to sit a lot while working at home, so I bought a sit-stand desk last week. But it still has to become a habit to use it standing, which I often forget while working...”

Female, age 22, participant 13.

“...I bought a professional office chair after one week, and this was a great improvement...”

Male, age 44, participant 56.

“I am able to change sitting into standing because I have a high-low desk... So, I am more active in changing my sitting position”

Female, age 64, participant 64.

### **Options for online meetings**

Lastly, new options to participate in online meetings at home were discussed by some participants. In particular, they mentioned that for certain meetings, as a way to reduce occupational sitting time, they can move or stand while walking. Standing while participating in a Skype meeting for example, can reduce the total sitting time of individuals and it can work without sticking to a laptop video. Examples provided by the participants for standing or walking meetings:

“Stimulate walking meetings no stick at the laptop video...”

Male, age 52, participant 18.

“...For certain meetings that take place with just one other person moving or standing could be an option (depending on the nature of the meeting) in non-corona times.”

Female, age 36, participant 80.

### **No effort**

However, a few participants mentioned that they did not try to reduce occupational sitting time at all without making any effort to achieve reduction in sitting time at home. The employees that responded in this way, also did not mention details for the reasons why they did not want to try. Therefore, relevant cases were provided as follows:

“Never tried. I walk at least 10 km daily”

Other/prefer not to say the gender, age 51, participant 32.

“I did not try, but it’s easy to take a laptop somewhere, so it should not be too hard”

Female, age 27, participant 40.

“Did not try, but compensated by going for walks every evening...”

Male, age 59, participant 112.

### **Facilitators to Reduce OST**

The main themes regarding the subcategory of already experienced facilitators that can reduce occupational sitting time were: “Office equipment”, “Outside activities”, “Reminders”, which described above in the subcategory of possible ways to reduce occupational sitting time, and “Decreased workload”, “Social environment”, “Symptoms” and “Personal organization”.

#### **Decreased workload**

Some participants highlighted that a possible enabler to help them reduce their total occupational sitting time was to decrease workload. So, for example, when they had to work less it would be easier for them to stand up and engage in something else rather than the work.

“Less work probably”

Female, age 53, participant 60.

“Reduction of workload and being stimulated by UT”

Female, age 41, participant 58.

#### **Social environment**

Furthermore, other participants said that colleagues and the general social environment or family helped them and motivated them while working at home to reduce occupational sitting time. Regular phone calls and video calls throughout the day to discuss about the work or discuss a different topic without sticking to the computer screen but walking around the office is also described by the participants.

“Instead of one-on-one video calling, I’ve switched to just calling with the telephone, as it allows me to take the phone, put it in my pocket and walk about in my office.”

Female, age 31, participant 17.

“Supportive family.”

Female, age 36, participants 89.

“I have been meeting with colleagues for walks twice now, which has been great, but takes up a lot of time, so I can't do that too often...”

Female, age 32, participant 77.

### **Symptoms**

There were also some employees that started to experience health problems due to the increased occupational sitting time at home. Hence, these symptoms related to health issues made them to reduce sitting time and try to stand up more. A participant said that:

“Neck pain -- so I want to change position. Sometimes because I realise it is healthier.”

Female, age 26, participant 68.

### **Personal organization**

Finally, organizing the working hours alone as well as the personal daily schedule, participants mentioned that it was easier for them to find some time for a break during working hours. An employee described it as follows:

“Organizing the working-hours myself and spreading them out more gives me the opportunity to walk more in between and possibly do household chores or work in the garden.”

Male, age 42, participant 87.

### **Barriers to Reduce OST**

Themes arising from the participants' responses regarding the barriers for reducing occupational sitting time were: “Office facilities”, “Weather”, “Close social environment”, “Working area”, “Working hours” and “Work pressure”. The corresponding codes can also be found in Figure 2.

#### **Office facilities**

Most of the participants expressed their experiences with the office facilities that they already have in their homes. Specifically, they mentioned that there is a lack of appropriate equipment in their homes and no funding from the UT to buy the right facilities in order to work efficiently. The lack of a sit-stand desk as well as a adjustable chair are some of the most important stuff in a home-office environment that participants described:

“No funding from the UT to buy a standing desk or desk bicycle or something else to reduce sitting”

Female, age 25, participant 8.

“I find it hard to do anything else than working when I am working from home. My office does not allow me to do my work standing. Even telephone calls are now done via the laptop.”

Female, age 33, participant 38.

“working from the living room, not having my own office space, not having good quality desk, chair and computer equipment, ... and less walking/standing time during work.”

Female, age 32, participant 35.

### **Weather**

The bad weather in the Netherlands was also mentioned by the participants as a barrier to reduce occupational sitting time. In particular, employees stated that when there is not sunny weather, they cannot go for a walk alone or with a friend or do something else outside such as an exercise or activities. Relevant participants' responses as follows:

“...rain outside...”

Female, age 30, participant 47.

“...bad weather during lunchtime.”

Female, age 28, participant 57.

### **Close social environment**

Another relevant barrier to reduce occupational sitting time was the lack of support and encouragement from the close social environment of the employees. For example, a participant indicated that she needed someone to remind him to stand and there was not any family member or friend to do that. This participant expressed it as follows:

“Lack of support. I need someone / something to remind me to stand”

Female, age 48, participant 52.

Next to that, another participant stated that there was not any support from colleagues from the UT when working from home to engage in a small talk or walk and thus reduce the sitting time.

“No encouragement from colleagues around you”

Female, age 32, participant 48.

### **Working area**

A small working and home office area was one of the most frequent employees' responses regarding the barriers to reduce occupational sitting time. Specifically, participants mentioned that the distance from the workplace (at home) to the needed facilities, such as the printer or the coffee machine, was very close and it did not help them to stand up and occupy themselves with something else. Examples where the inappropriate working area was considered as a barrier as follows:

“The distance from the workplace to the coffee is negligible and a printer is on the table next to me. The meetings are now also digital, and I no longer walk to the various buildings at the UT”

Female, age 62, participant 88.

“Video calls, and small room”

Male, age 26, participant 7.

“limited living space. UT offered a high table, but I have no possibility put it in my living space.”

Female, age 51, participant 16.

### **Working hours**

A few participants pointed out that the schedules regarding their working hours have changed. Working until late every workday as well as on weekends is a frequent change that participants described as a relevant barrier to reduce occupational sitting. In particular, a participant said:

“All in all, I take enough breaks. But given the amount of work, that means that I am working all day until late and also often on weekends”

Female, age 54, participant 5.

As a result, the changes in working hours, made the employees experience less energy to work or engage in something during a break while working at home.

### **Work pressure**

Lastly, participants talked about the increased levels of work pressure to get the daily task done as a barrier to reduce occupational sitting time. Most of them referred to the fact that due to Covid-19 situation, they have much more work at home as the expectations from the UT are high. Two participants described how they experienced the work pressure:

“Time pressures; there is so much more work around the house with cleaning etc if everyone is at home all the time...”

Female, age 36, participant 37.

“Mostly the pressure I felt to finish as much work as possible in the time I had, so being as efficiently as possible with my work time”

Female, age 43, participant 31.

As a consequence, no free time (relaxing time) was discussed by some employees. One talked about a full personal agenda and schedule with lot of meetings all day (also during lunch time) which resulted to a high workload. Hence, high demands and pressure of daily meetings and workload compared to working at the UT made the employees explain the barriers in such a way as follows:

“I mostly cannot reduce sitting time, due to an overfull agenda. I have meetings the whole day (mostly), so I have to sit”

Female, age 53, participant 60.

“I feel like they want me to be available at all times, and when I'm not at my place and I get a call, they think I'm not at work. That's why I make sure I stay as close to my laptop as possible”

Female, age 26, participant 115.

“No time between Teams meetings, so no time to get coffee (and normally you will walk to new appointment)”

Female, age 36, participant 120.

In conclusion, participants described possible ways to reduce occupational sitting time. They mentioned either ways or activities they engage and helped them to reduce occupational sitting time or ways they imagine they will be helpful for them. Additionally, employees described enablers that already use to reduce the total occupational sitting time as well as future possible facilitators. Activities, reminders, and adequate office equipment were

mentioned by the employees in both categories, ways to reduce OST and facilitators. Finally, they stated barriers that they have experienced so far during the Covid-19 situation. For example, employees possess office facilities in their homes which do not satisfy them to work efficiently and reduce their occupational sitting time. Also, when there is no sunny weather they do not prefer to stand up from their chair and go for a walk.

## **Discussion**

The purpose of this study was to provide insights into the perspectives of the employees on occupational sitting time in forced home office during Covid-19 pandemic. The Covid situation shaped a new working condition and forced the employees to engage and work from home offices. As far as we know, this study was the first to measure occupational sitting time while employees worked from home under Covid-19 regulations, and the first to observe and assess the experiences, and perspectives of employees in the homeworking environment. The main results indicated that the majority of the employees experienced the occupational sitting time at home during Covid-19 pandemic negatively. The results of this study are compared with studies from different contexts (e.g., voluntary home offices) due to lack of similar studies such as occupational sitting experiences of employees in forced home offices under Covid-19 regulations as well as with the results of the quantitative study of Gerko Schaap (Schaap, 2020).

### **Reported Barriers, Facilitators & Ways to Reduce OST**

The results showed that online meetings, tasks using a computer and a high number of emails were prime contexts for prolonged sitting and therefore, highly sedentary workdays.

Meanwhile, activities for break purposes, reminders and adequate office equipment seemed potentially favourable for reducing occupational sitting time at home during Covid-19 pandemic.

The vast majority of employees in our study reported in a positive sense possible ways and facilitators towards reducing occupational sitting behaviour. Due to the reported ways in the theoretical approaches for the topic of occupational sitting in general, multiple ways from the employees' view were expected. For instance, short breaks for tasks inside the house, peer support to engage in activities and outside activities such as running or walking were the main expected ways for reduction of occupational sitting (Afanuh & Johnson, 2017; Cole, Tully, & Cupples, 2015; Crosbie & Moore, 2004). When our participants were asked about their experiences with working from home during Covid-19 regulations and sitting time while

working from home or in general, they indicated ways that they currently use in order to reduce OST. First, participants reported that they engage in short breaks such as drinking some water or coffee, making the lunch, or just walking around the home office space. These activities inside the house, imply that employees tried to increase their wellbeing and productivity in order to develop a high-performance capacity during workhours. The aforementioned ways for reduction of the occupational sitting time are in the same direction with the findings of another study (Afanuh & Johnson, 2017). Second, most of our participants reported outside activities either alone or with someone else as facilitators which helped them to reduce OST. A possible explanation for this might be that support from the family or social environment to stand up and meet a friend or colleague can detach an individual from long periods of sitting. These results seem to be consistent with other studies which found that peer support to go out and meet a colleague or to engage in activities such as shopping, can result to long breaks and reduced occupational sitting (Cole et al., 2015; Crosbie & Moore, 2004). However, this explanation is contrary to that of Schaap (2020) who found no support from colleagues on reducing occupational sitting behaviour either by standing from the desk or engaging in other activities.

Additionally, participants in our study believed ideal and adequate office equipment at home to be a significant factor for reducing occupational sitting, which is consistent with findings from previous studies (Afanuh & Johnson, 2017; Shrestha et al., 2018). Based on the literature, sit-stand desks, adjustable chairs, and active workstations such as treadmill desks are associated with the reduction of occupational sitting and seem to be useful constructs to enable reduced sitting time while working at home as well (Afanuh & Johnson, 2017; Shrestha et al., 2018). An explanation for the results of our study might be that professional office equipment is an essential tool for an employee as it boosts their efficiency and productivity in any workplace.

Our results also showed that the most important barrier from the participants' view was the experienced pressure of getting the job done and finishing the amount of work on time. The association between high workload at home, high expectations from the organization and work pressure found in this study, was mirrored previous studies (Cole et al., 2015; Hadgraft et al., 2016). These results are in accord with the quantitative study which reported that employees experienced an increase in work pressure, that is, working more hours along with a higher workload (Schaap, 2020). The majority of participants expressed the lack of ideal office equipment at home. This result may be explained by the fact that there was no funding from the UT to buy the right facilities to work productively and efficiently for

all the employees at the time of the data collection. However, evidence from the quantitative study showed that the majority of the participants were somewhat satisfied with their desk and seat, which contradicts the results of this qualitative research (Schaap, 2020). Employees also reported not being able to move from their desks and computers in order to reduce their sitting time. This result reflects those of Cole et al. (2015) and Mackenzie et al. (2019) who found that the lack of facilities does not encourage the workers to stand up and move from their desk in order to reduce their total sitting period. Finally, most of the participants stated the weather to be a frequent barrier for reducing occupational sitting time. As the weather in the Netherlands is rainy, the participants do not have the chance to go for a walk or engage in outside physical activities and thus, this result was expected. However, this result has not previously been described in another study.

### **Reported Behaviours, Cognitions & Emotions While Working From Home**

Furthermore, almost all of the employees in this study reported that they experienced longer occupational sitting time since from home. This was also reported by the quantitative study of Gerko Schaap who found that participants sit more and stand or move less while working at home compared to working at the University of Twente (Schaap, 2020). This finding indicates that employees were highly sedentary during workhours, experiencing an increase in their occupational sitting time (Schaap, 2020). The main participants' behaviour in this situation was to engage in activities for break purposes such as walking the dog or cycling. The specific behaviour may be explained by the fact that participants try to force and motivate themselves to increase their physical activity throughout the day to achieve a reduced sitting time. This finding broadly supports the work of other studies which showed that employees indeed sit a lot while working and thus, they try to integrate activities and strategies into their everyday life to reduce occupational sitting (Gilson et al., 2011; Hadgraft et al., 2016).

The results showed that the participants of our study consider working from home as boring owing to the increased sitting time. Consequently, they experienced a lack of motivation to work efficiently and concentrated to get the task done. A possible explanation for this might be that, as they do not have many choices due to the restrictions of Covid-19, they are too focused on their work to complete their task or they are bored to work from home. Another possible explanation for this is that the distractions at home, especially when an individual does not live alone, distract the attention of the employees and then they feel demotivated to work. In accordance with this result, a previous study has demonstrated that

prolonged occupational sitting resulted in the lack of motivation of employees (Gilson et al., 2011). Specifically, participants from the study of Gilson et al. (2011), due to motivational issues, they talked about feelings of exhaustion and sluggishness which led to poor work performance, low productivity, and disengagement with daily work tasks (Gilson et al., 2011).

Lack of social interaction in the working environment was expressed by the participants through the emotion of emptiness. Most of the employees described that they miss their colleagues and the past routines at the UT. This result may be explained by the fact that the employees at the UT interact with each other a lot, by taking the lunch break together or taking a break for a coffee to discuss multiple topics. Hence, the close relationships between the UT colleagues have been disappeared due to the Covid-19 regulations. Although the employees in this study reported emotions from their experience of working at home, no earlier findings have described specific feelings and emotions of workers so far to compare our findings to those of other studies.

One of the most important findings in this study is the experience of negative health effects as reported by the employees, including neck and low back pain after prolonged occupational sitting. A possible explanation for this result may be the lack of adequate office equipment such as a sit-stand desk and adjustable chairs which allow employees to maintain a balanced cycle between sitting and standing throughout a working day and a good body posture, respectively. These results are in agreement with the findings of Zemp et al. (2016) who suggested an increased risk of developing musculoskeletal disorders in the back and neck due to prolonged occupational sitting. The quantitative study also confirms that occupational sitting perceived to be unhealthy by the participants (Schaap, 2020). This result corroborates the experiences of our participants who reported negative health issues such as specific pain to their bodies and stress.

### **Strengths and Limitations of the Study**

A strength of the current study is that it is the first to give any insights into occupational sitting time of employees while working from home, as well as presenting the experiences, and thoughts of employees in the home office environment. As the Covid-19 situation has not finished yet, and employees are forced to work from home, insights into OST become significant for developing future suitable interventions. Participants provided their opinions, and thoughts, giving more detailed information and diversity to the data as they could express themselves freely on occupational sitting at home during Covid-19 pandemic. Therefore, the data from this analysis offered a more completed illustration on

what the employees think about the Covid-19 condition through their perceptions, and attitude on that topic in order to explain why participants think and behave in certain ways.

Additionally, this study combined and integrated into the questionnaire mixed methods design, that is, both qualitative and quantitative data within a single investigation. The quantitative data are explored in another study (Schaap, 2020).

However, this study was limited by the absence of pilot testing. Due to the time pressure, the questionnaire could not be tested before conducting the study in order to identify questions that may not make sense to participants and lead to biased answers. For instance, question 3 [“In addition to what you answered already, what are your experiences (e.g., changes compared to working at the UT”) with sitting whilst working from home?] was not very clear for the participants as they gave similar responses with the next following question about barriers and facilitators. They all focused on the fact about working from home and did not respond about occupational sitting time while working from home. We are not sure whether this lack of rich information regarding cognitions related to working from home influenced the results and the general conclusions we made from the data. Finally, the findings cannot be generalised to the study population. The non-random sampling method only at one organization, University of Twente, limits the generalisability of the findings. This means that the data from the specific participants may not generalisable to all office workers.

### **Looking into the Future**

The above-mentioned findings from the study can contribute to the development of future interventions in order to reduce occupational sitting time while working from home. For example, flexible rest breaks can be implemented without a resulting decrease in performance, as well as changes of sitting postures or reminders with the use of notes or applications. Hence, a future study could evaluate whether these interventions work and observe the experiences of office workers in specific strategies of reducing the total occupational sitting time. This study can be used by organizations to find new approaches and ways to reduce occupational sitting time. For instance, organizations can promote, through support and information, positive peer influences within the work environment, as well as offer flexibility to have standing-walking meetings and available sit-stand desks.

Further research should be carried out to establish more insights into occupational sitting time at home during Covid-19 pandemic. Specifically, a population-based study with different backgrounds is necessary to strengthen generalisability and to identify additional experiences from other participants other than workers from one organization. This study

found limited data for the first research question for the subcategory of cognition. This category would be completed if there would be more employees' data about occupational sitting time. A future study should assure whether the findings from this research are accurate and cover all the workers' cognitions. Thus, in the future, the open questions could be written in a different way in order to be clearer to the participants. For instance, the question about experienced changes compared to working at an organization with sitting while working from home could focus on specific areas of changes such as work, personal time, or health. In the question about thoughts related to sitting in the current home office situation, a possible improvement could be the addition of the concept of participants' emotions as well.

### **Conclusion**

The findings from this study and suggested recommendations may be useful and informative for organisations considering approaches and ways for reducing occupational sitting. Future studies should consider the aforementioned limitations summarized in this report to improve the current state of the art. It can be concluded that employees experienced and reported many changes since working from home compared to working at the UT. Due to occupational sitting, they do not prefer to work at home as there is an increase in sitting time. Additionally, sedentary behaviour and particularly occupational sitting can cause various health effects. So, a decrease of the worktime sitting, either by taking breaks or changing posture, can be considered as an opportunity to break up the total sitting time as it is an important aspect for public health.

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## Appendix A

### Opening statement and informed consent before commencing with the survey

#### Opening statement

You are invited to participate in a study titled **Working from home during the COVID-19 regulations**. The purpose of this research study is to find out how employees of [organisation] find themselves affected by working from home with regards to aspects of their work, as well as how physical active they are and how much time they spend sitting during the workday.

This study is performed by Gerko Schaap (UT student of Health Psychology & Technology), supervised by the University of Twente. If you would like to contact him, please e-mail [g.schaap@student.utwente.nl](mailto:g.schaap@student.utwente.nl). The anonymous questionnaire will take you approximately 20 minutes to complete. Your participation in this study is entirely voluntary and you can withdraw at any time. You are free to omit any question.

We believe there are no known risks associated with this research study; however, as with any online related activity the risk of a breach is always possible. To the best of our ability your answers in this study will remain confidential. We will minimise any risks by securing your answers safely and use the server of the [University of Twente] for storage of the data. Moreover, all collected data is anonymous, as no questions will ask you to answer with information which will make it able to identify you personally.

Before commencing with the questionnaire, we ask for your approval of participation in this study. **[page break]**

#### Informed consent

Principal researcher: Gerko Schaap, student University of Twente

([g.schaap@student.utwente.nl](mailto:g.schaap@student.utwente.nl))

Thesis supervisor: Dr. Christina Bode, Department of Psychology, Health & Technology, University of Twente

I acknowledge that I understand the method and aims of this study, and that I participate voluntarily. I am aware that the collected data and results are only anonymously published to others. I am aware that I may choose to withdraw from participation at any moment without any reason given.

Please give your consent by ticking the following box:

- I consent
- I do not consent [if this option was taken, participants were sent to end of survey]

## Appendix B

### Survey Working from home during COVID-19 regulations

#### Screening

Do you currently work from home (i.e. not at the campus/other (non-home) usual place of work)?

- Yes
- No [→ participants are forwarded to *end-of-survey message A*]

Please indicate by moving the slider how many hours a week are you appointed to work at [organisation]:

Not applicable, I do not work at [organisation]  
[→ participants are forwarded to *end-of-survey message A*]

0      8      16      24      32      40

Work hours/week ()



#### Demographics

What is your age?

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What is your gender?

- Male
- Female
- Other/prefer not to say

What is your highest education?

- Secondary school (*middelbaar onderwijs*)

- Intermediate vocational education (*middelbaar beroepsonderwijs*)
- Higher professional education (*hoger beroepsonderwijs*)
- Academic education (*wetenschappelijk onderwijs*)
- Advanced degree (e.g. PhD)
- Other, namely: \_\_\_\_\_

What is your employment classification?

- PhD student
- Academic staff
- Support and management staff

Are you physically able to stand for prolonged time ( $\geq 15$  minutes uninterrupted)?

- Yes
- No

What type of office do you have at [the organisation]?

- Shared
- Private
- Other, namely: \_\_\_\_\_

How often did you on average work from home before the COVID-19 regulations?

- Always
- Multiple days per week
- Once a week
- Once a month
- Almost never
- Never

### **Experiences**

In addition to what you answered already, what are your experiences with working from home during the COVID-19 regulations in your situation?

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What are your experiences with sitting time while working in general?

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In addition to what you answered already, what are your experiences (e.g. changes compared to working at [organisation] with sitting whilst working from home?)

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In case you tried to reduce sitting time, which barriers did you experience in the current situation whilst working from home?

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In case you tried reducing sitting time, what for you are current enablers to reduce sitting time whilst working from home?

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Do you have additional thoughts you would like to share related to sitting in the current home office situation?

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Do you have further general remarks you want to share?

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End of survey [*Participants are forwarded to end-of-survey message B*]

**End-of survey message A (not meeting the screening criteria)**

We are sorry, but you do not meet the qualifications for this survey. We thank you for your time and interest. You can close this tab now.

**End-of survey message B (completing the survey)**

Thank you very much for your participation in this study. You can close this tab now.

If you have any questions or remarks regarding the research or if you want a summary of the findings, you can contact the principal researcher via [g.schaap@student.utwente.nl](mailto:g.schaap@student.utwente.nl).

## Appendix C

### Coding Scheme with themes, codes, and the corresponding quotes

1. *Research question 1:* What are the perceptions of employees about occupational sitting at home during Covid-19 pandemic related to behaviour, cognitions, emotions, negative health effects & wellbeing components?

	Themes (description)	Codes	Quotes (from the data/responses)
<p><b>Behaviour</b> (an organism's activities in response to external or internal stimuli, including objectively observable activities, introspectively observable activities, and nonconscious processes)</p>	<p>-Participants indicated that they sit more in order to get the work done</p> <p>-Participants indicated that they engage in different activities for break purposes such as walking, cycling etc.</p> <p>-Participants indicated that they try to find some activities in order to compensate for their previous daily routine regarding physical activity</p>	<p>-Longer worktime sitting</p> <p>-Breaks during working from home</p> <p>-Compensatory activities</p>	<p>- "I sit more than I actually want"</p> <p>- "I just sit at my desk. No interesting breaks"</p> <p>- "I sit much more"</p> <p>- "whole day sitting behind my desk"</p> <p>- "work also in weekends and free days"</p> <p>- "I walk at least two hours a day"</p> <p>- "I'm forced to take breaks because I have to walk the dog. I walkway more than I normally do"</p> <p>- "try to take a long walking break during lunch, and try to exercise in the evening"</p> <p>- "I started the days from the beginning with activities to compensate for missing bike rides and campus walks"</p>

	<p>-Participants also indicated they do not take breaks due to the fact that they rarely stand up</p> <p>-Participants indicated that they try out other sitting postures by adjusting their office desks and chairs</p>	<p>-No breaks to stand up and engage in activities</p> <p>-Adjustment of sitting positions</p>	<p>- “I take less breaks, being physically less active”</p> <p>- “Rarely standing up or taking breaks is both a result of not being able to work efficiently at home”</p> <p>- “less lunch walks, being in the same environment”</p> <p>- “you try out other positions”</p> <p>- “I did adjust my desk and chair”</p>
<p>Cognition (all forms of knowing and awareness, such as perceiving, conceiving, remembering, reasoning, judging, imagining, and problem solving)</p>	<p>-Participants indicated that they find it boring as they sit much more compared when working at the UT</p> <p>-Participants indicated that they can find a good balance between sitting and standing while working from home</p> <p>-Participants indicate that at home they have more options to control occupation sitting time</p>	<p>-Lack of motivation (due to boring)</p> <p>-Balance between sitting and standing</p> <p>-New options</p>	<p>- “The lack of motivation I experience when working from home also causes me to feel less accomplished”</p> <p>- “I’m trying to find a good balance between sitting and standing”</p> <p>- “At home there are more options to regulate the sitting time”</p>
<p>Emotions (a complex reaction pattern, by which an individual attempts to deal with a personally significant matter or</p>	<p>-Participants indicated that they miss their colleagues and students</p>	<p>-increased emptiness, lack of social interactions, less connected with the UT and the staff</p>	<p>- “On the other hand, I miss interactions with colleagues and...”</p> <p>- “I miss the informal contact with colleagues. That's what makes working</p>

<p>event. For example, if the significance involves threat, fear is likely to be generated; if the significance involves disapproval from another, shame is likely to be generated.)</p>	<p>-Participants indicated that they miss the regular bike rides from and to work (UT)</p> <p>-Participants indicated that they feel guilty when they cannot work</p> <p>-Participants indicated that they feel happy with such a situation (when working from home)</p>	<p>-Emptiness with the lack of past routines</p> <p>-Guilty for non-productive working hours</p> <p>-Happiness while working at home; freedom for organization of personal time</p>	<p>fun”</p> <p>- “I miss the feeling of being in a group, smiling to people for no reason”</p> <p>- “I miss my regular bike rides to and from work and the cardio fitness lessons at the sports centre”</p> <p>- “I feel guilty for every non-productive minute I have”</p> <p>- “The lack of motivation I experience when working from home also causes me to feel less accomplished”</p> <p>- “I am happy, much less stressfully meetings that last hours”</p> <p>- “I really like the freedom to organize my time”</p>
<p>Negative effects on health &amp; wellbeing</p>	<p>-Participants indicated that they feel more tired as the workload has doubled</p> <p>-Participants indicated that they experience health problem due to sitting time while working at home</p>	<p>-Development of physical effects →tiredness</p> <p>-Development of negative health effects</p>	<p>- “...; I am tired all the time and I don’t feel relaxed”</p> <p>- “Increasing back problems that force me to lay down at night and therefore hinder me from participating in social activities”</p> <p>- “it influences my mental health”</p> <p>- “I experience neck</p>

	-Participants indicated that they feel stressed when they have to do everything online	-High levels of stress	<p>aches from sitting a lot”</p> <ul style="list-style-type: none"> <li>- “muscle pain in the shoulders and neck”</li> <li>- “have additional health effects besides sitting: neck and shoulder problems”</li> </ul> <ul style="list-style-type: none"> <li>- “work/educational environment results in stressful challenges”</li> <li>- “stressful as doing everything online, more time and more energy”</li> <li>- “quite stressful, long hours”</li> <li>- “...so, there was more stress than usual”</li> <li>- “...the working hours are longer, and I experience a lot of physical stress”</li> </ul>
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2. *Research question 2:* In what ways, at the moment, do the employees try to reduce occupational sitting time at home and what are the barriers and facilitators to successfully improve it?

	Themes (description)	Codes	Quotes (from the data/responses)
Ways to reduce OST	<p>-Participants indicated that in order to reduce occupational sitting time they try (are forced) to take regular breaks during working hours (e.g., to go the toilet, coffee machine)</p> <p>-Participants indicated the use of apple watches or pc</p>	<p>-regular breaks for a variety of activities</p> <p>-Usage of tools as reminders</p>	<p>- “...and finding a good time to take sedentary breaks”</p> <p>- “I forget to stand. Sometimes my apple watch reminds me of</p>

	<p>reminders to stand up and make some steps around the area</p> <p>-Participants indicated that buying official office equipment they can reduce OST by changing postures and feeling more active in changing sitting position</p> <p>-Participants indicated that for certain meetings, as a way to reduce sitting time, they can move or stand while walking</p>	<p>-possession of office equipment</p> <p>-Standing-walking meetings</p>	<p>that. I think a tool on my pc would work”</p> <p>- “my apple watch that sometimes gives me a reminder to stand”</p> <p>- “I used to sit a lot while working at home, so I bought a sit-stand desk last week”</p> <p>- “I bought a professional office chair after one week, and this was a great improvement”</p> <p>- “I am able to change sitting into standing because I have a high-low desk... So, I am more active in changing my sitting position”</p> <p>- “Stimulate walking meetings no stick at the laptop video”</p> <p>- “For certain meetings that take place with just one other person moving or standing could be an option (depending on the nature of the meeting) in non-corona times”</p>
<p>Barriers for reducing OST</p>	<p>-Participants indicated some daily changes as they work all day until late and on weekends</p> <p>-Participants indicated no funding (from the</p>	<p>-changes in working hours</p> <p>-lack of right equipment (sit-stand</p>	<p>“All in all, I take enough breaks. But given the amount of work, that means that I am working all day until late and also often on weekends”</p> <p>- “No funding from the UT to buy a</p>

	<p>Ut) to buy equipment and lack of facilities in their home</p> <p>-Participants indicated that due to the weather (in the Netherlands) could not go for a walk or do something else outside (such as exercise or activities)</p> <p>-Participants indicated less energy and no motivation during working hours at home and more pressure to get the task done. Participants indicated full personal agenda/schedule with lot of meetings all day (and specifically during lunch time) which results to high workload</p>	<p>desk, chair) and facilities in the home-office environment</p> <p>-not the appropriate sunny weather</p> <p>-Increased (high) levels of pressure to finish their daily work. No free time (relax time) due to high demands of daily meetings and increased workload compared to working at the UT</p>	<p>standing desk or desk bicycle or something else to reduce sitting”</p> <ul style="list-style-type: none"> <li>- “not the right equipment”</li> <li>- “My office does not allow me to do my work standing. Even telephone calls are now done via the laptop”</li> <li>- “working from the living room, not having my own office space, not having good quality desk, chair and computer equipment”</li> <li>- “bad weather”</li> <li>- “rain outside”</li> <li>- “bad weather during lunchtime”</li> <li>- “time pressures; there is so much more work around the house with cleaning etc if everyone is at home all the time”</li> <li>- “Mostly the pressure I felt to finish as much work as possible in the time I had, so being as efficiently as possible with my work time”</li> <li>- “I mostly cannot reduce sitting time, due to an overfull agenda. I have meetings the whole day (mostly), so I have to sit”</li> </ul>
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	<p>-Participants indicated that they had no encouragement from their close environment to reduce sitting time</p> <p>-Participants indicated that the distance from the workplace to the needed facilities (such as printer, coffee machine) is very close</p>	<p>-Lack of support and encouragement</p> <p>-Small working area (or office area)</p>	<p>- “Lack of support. I need someone / something to remind me to stand”</p> <p>- “No encouragement from colleagues around you”</p> <p>- “The distance from the workplace to the coffee is negligible and a printer is on the table next to me. The meetings are now also digital, and I no longer walk to the various buildings at the UT”</p> <p>- “video calls, and small room”</p>
Enablers/Facilitators	<p>-Participants indicated the possession of sit-stand desk at home, a good chair (with changeable height) and wireless headsets</p> <p>-Participants indicated that in order to reduce sitting time they go for a walk alone or with someone else (such as girlfriend/boyfriend, partner) or a walk with the dog or go to shopping</p>	<p>-Possession of good office equipment, Necessary office equipment</p> <p>-Outside activities with or without social connections</p>	<p>- “Sit-stand desks and setting reminders on my phone to move every hour”</p> <p>- “The availability of a high table, use of a Bluetooth headset”</p> <p>- “To have a walk and chat with your colleagues”</p> <p>- “I have a puppy, so he had to go on short walks fairly regularly”</p> <p>- “My dog is a brilliant enabler! I walk her in the morning, during lunch and at the end of the workday. My partner also asks me on walks when he notices that I am thinking too hard. I have been meeting with colleagues for walks twice now,</p>

	<p>-Participants indicated that they use their watch to set reminders to stand up and take a break</p> <p>-Participants indicated that when they had to work less (less workload) could find it easier to reduce the total sitting time</p> <p>-Participants indicated that colleagues and family helped (motivated) them to reduce sitting time while working at home through calls, video calls</p>	<p>-Daily reminders for change of posture and breaks</p> <p>-Decreased high workload</p> <p>-Social environment and family</p>	<p>which has been great, but takes up a lot of time, so I cannot do that too often”</p> <p>- “social connection: e.g. meeting my girlfriend for a long walk in the park for an afternoon coffee”</p> <p>- “I have a smart watch which reminds me to get up every hours. This helps to some extent”</p> <p>- “my apple watch that sometimes gives me a reminder to stand”</p> <p>- “Less work”</p> <p>- “reduction of workload and being stimulated by UT”</p> <p>- “Instead of one-on-one video calling, I've switched to just calling with the telephone, as it allows me to take the phone, put it in my pocket and walk about in my office”</p> <p>- “Supportive family”</p> <p>- “I have been meeting with colleagues for walks twice now, which has been great, but takes up a lot of time, so I can't do that too often”</p> <p>- “I introduced "calling while walking" with friends”</p> <p>- “...and chat with</p>
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	<p>-Participants indicated that he/she experienced health problems when sitting while working at home. This effect made him/her to reduce sitting time</p> <p>-Participants indicated that when organized their working hours alone they could find it easier to find some time for a break</p>	<p>-Symptoms related to health issues</p> <p>-Personal organization of daily work schedule</p>	<p>your colleagues”</p> <p>- “Neck pain →so I want to change position. Sometimes because I realise it is healthier”</p> <p>- “Organizing the working-hours myself and spreading them out more gives me the opportunity”</p>
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