

Do remote workers spend more time in urban green spaces?

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1. Abstract

This paper examines whether, since the outbreak of Covid-19, remote workers are using urban green spaces differently in comparison to non-remote workers. This research specifically investigates weekly time spent in urban green spaces between the two groups, the relationship between perceived stress and time spent in urban green spaces between the two groups and lastly whether one of the two groups started to use urban green spaces more often since the outbreak of Covid-19. To do so, 71 full-time working people in the city of Groningen have been surveyed regarding their behaviour. Using Two-Sample T-tests, simple linear regression and multiple linear regression, these surveys have been analysed. The results show that remote workers do not use urban green spaces longer than non-remote workers. Also, it is possible that higher perceived levels of stress are associated with increased use of urban green space. And lastly, the mode of working does not explain why people started to use urban green spaces more often since Covid-19. These empirical insights in remote workers' behaviour contradict popular beliefs and are of relevance to urban planning debates regarding the provision of urban green spaces and the 'corona-proofing' of cities.

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3. Background & Research Problem

The way we work, in terms of whether the work environment is enabling of productivity, is important. Many will agree to this simple statement, though especially the last decade the way many people work has changed, regardless if they want it or not. Most academics agree that this switch to more flexible ways of working has a positive impact on workers' productivity, because the advantages outweigh the disadvantages (Hunter, 2019; Agostoni, 2020). Perhaps for this reason, in Western countries, the share of remote workers has risen to approximately 10%-25% of the labour force as several estimates suggest.¹ With remote workers, all people are meant who work outside a traditional working space like an office or a factory. Given the current Covid-19 pandemic and the public policy measures such as lockdowns that force people to work from home, many suggest that the phenomenon of working at home will likely

¹ The British Office for National Statistics documents that 13,9% of all employees in the United Kingdom recently spent at least half of their working time at home (ONS, 2014). Since the start of this measurement, this rate has never been higher. Similarly, in the United States, the percentage of workers doing some or all of their work from home grew from 19,6 per cent in 2003 to 24,1 per cent in 2015 (BLS, 2016). European Union-wide research by Eurofound (2010) showed that around 20 per cent of employees mainly work from outside the office or factory space.

accelerate substantially (LSE Business Review, 2020).² Increases in the rate of remote working, in turn, might lead people to spend their free time, or work breaks, differently. For instance, popular media reports suggest that people use urban green spaces way more often since many started to work from home (Beilock, 2020; Kuipers, 2020; Van Noort, 2020). Especially people without a balcony or a garden may step outside to get some fresh air and make a walk. Is this a reason to rethink the way urban planners provide urban outdoor space in many cities worldwide? Popular media draw parallels between the current situation and the situation after the Great Depression in the '30's. In The Netherlands, this crisis back then resulted in unprecedented investments in urban renewal (Van Noort, 2020).

The empirical evidence of increased use of urban green space by urban residents is limited. One recent study shows that in the city of Oslo, Norway there was a staggering 291% increase of outdoor recreational activity after the partial lockdown, relative to a 3-year baseline average (Venter et al., 2020). This fact makes one think about the importance of providing a sufficient amount of urban green space. Though, many other recreational activities in the city were not available because of the lockdown. When other facilities like gyms open up again, a decrease in urban green space usage can again be expected. Therefore this 291% increase in usage is not only due to the fact more people work from home. But it cannot be denied that this increase in urban green space use also occurs simultaneously with more people working from home. And like said before, working from home will remain common. Thus it might mean that remote workers will cause a permanent increased use of urban green space.

This research will touch upon this matter: to find out how the use of urban green space among remote workers on one side and non-remote workers on the other side is different from each other. This study will be a case study in the city of Groningen, The Netherlands. Groningen is chosen in order to get a first insight in urban green space usage by workers in a highly urbanised area during a semi-lockdown. This study involves a statistical analysis of remote and non-remote workers' behavioural patterns.

Firstly, it looks into the weekly time spent in urban green spaces by both groups. Is it indeed true that people working from home use urban green spaces more often than people not working from home? In order to find out, a Two-Sample T-Test will be performed between

² According to the CEO Outlook 2020 by KPMG which is a global survey held after the outbreak of Covid-19, 69% of the CEO's think they will downsize their office space. This comes next to the fact that most CEO's are planning on improving digital collaboration and saw an improvement of communication between employees. (KPMG CEO Outlook, 2020)

the two groups, to find out if remote workers indeed use urban green spaces more often. Then secondly, it examines the relationship between stress levels and time spent in urban green spaces. Urban green spaces are associated with many positive health effects. To summarise it briefly, according to Lee & Maheswaran (2011), urban green spaces result in both significant physical and mental health improvements, among which reducing stress. By performing a simple linear regression between weekly time spent in urban green space and perceived stress levels on a scale from 1-10, the relationship between these two became more clear. Third and last, it explores whether remote workers started to use urban green spaces more frequently since Covid-19 started. This question gives an insight in the behavioural change of remote and non-remote workers regarding urban green space use, since Covid-19. It is plausible that people use urban green spaces more often since Covid-19 because they work from home, but other factors can play a role as well. Therefore a binary logistic regression will be performed to get an insight why people started to use urban green spaces more often since Covid-19.

The results show that remote workers do not seem to be using urban green spaces more than non-remote workers. The relationship between urban green space use and perceived stress levels could not be established, although data provides a clue that increased levels of stress are accompanied by increased use of urban green spaces. Lastly, working remotely does not appear to be a good predictor for more frequent urban green space use since Covid-19.

4. Theoretical framework

Since Covid-19 after all is primarily a health-crisis, the attributed health impact of urban green space on people is worth mentioning first. Research has shown that urban green spaces can have a positive effect on both physical and mental health (Lee & Maheswaran, 2011). The built environment can both constrain or facilitate physical activity, and urban green spaces can facilitate people to be physically active. Being physically active of course has many physical and mental health benefits (Morris, 2003). Lee & Maheswaran (2011) also provide many more health benefits associated with urban green spaces based on a systematic literature research. For instance, the provision and access to green space positively effects reported stress and quality of life; a positive relationship was found between the quantity of urban green space and the perception of general health; green spaces can influence social capital by providing a meeting place for communities to enhance social ties within a neighbourhood; and the presence of green vegetation in combination with the formation of social ties contribute to

residents' sense of safety and adjustment. These findings of the relationship between urban green space and citizens' health can be considered as the most important ones that have been proven until now. Knowing that the use of urban green space reduces stress levels (Lee & Maheswaran, 2011), it can be expected that remote workers perceive less stress than non-remote workers. Next to this, it is worth mentioning that a relationship between age and urban green space use has not been proven (Lee & Maheswaran, 2011).³ What we also know is that the accessibility of urban green space is an important factor in whether people actually use the space. Therefore the closer people live to an urban green space, the easier people tend to use it (Kahn et al., 2002).

Next to knowing the factors that make people choose to use an urban green space, it is also useful to understand the deeper cause of people wanting to be physically active in the first place. For instance Bauman et al. (2012) suggest in their renowned study that different determining factors on being physically active relate to different stages in life, and build upon each other. Working from home instead of working from an office space relates to many of these factors. Like on the interpersonal level, where social support at work determines physical activity. Also on an environmental level, where 'seeing others active,' 'public transport,' 'parks and recreational facilities' and 'walking and cycling facilities' play a role. Also on the regional or national policy level and the global level, things have changed since working from home became the new-normal. Nevertheless, predicting *how* physical activity patterns of individuals changed since Covid-19 is hard. The lack of social support at work could demotivate people to be physically active, but the lack of other activities could also have a motivating effect on people's propensity to use urban green space.

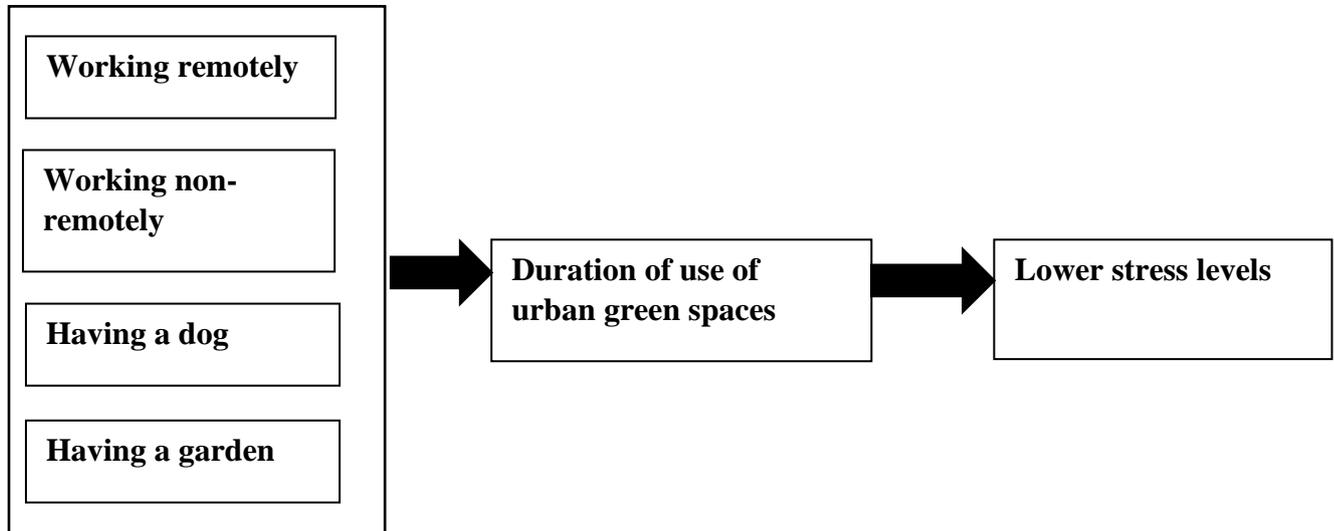
It is also possible that working from home itself is also a determining factor for people to step outside. Sijtsma et al. (2012) provide supporting evidence for this claim, namely that people living in very 'grey' urban areas tend to compensate the lack of nature by spending more nights away from home than people living in less 'grey' environments. If this is translated to people working from home, it could be argued that people who are stuck all day in their own

³ There are also many other user determinants of physical activity and green space use that Lee & Maheswaran (2011) described, but which are less relevant to this study. To summarise it briefly: the relationship between user age and urban green space use seems insignificant since multiple researches found opposing results. Males use urban green spaces twice as much for vigorously activities then women, while women often have a purpose when using an urban green space, rather than using it for exercise. People with high individual motivation and a positive attitude towards being physically active use urban green spaces more than people who don't have these characteristics

home might feel more urge to go outside than people who already use urban green space by commuting. Having a garden could also subdue this urge. Also regarding mental health, having a private garden can significantly improve the general sense of well-being during the Covid-19 pandemic (Pouso et al., 2020). Additionally, people owning a dog are known to be very frequent visitors of urban green spaces, for obvious reasons (Garrido-Cumbrera, 2020). Considering the above, the hypothesis of this research is that people working from home use urban green spaces more often than people who do not.

The group of remote workers is not homogenous. This group possibly has little in common in terms of personal characteristics, but for all of them their working space is outside the traditional working space and often at their home. In The Netherlands, 25% of all working people take the bike to work which is a physical activity in itself (Gedragmeting, 2016). Losing that physical activity on a daily basis will probably make them more active in different ways, such as taking a bike or going out for a walk to or through an urban green space (Bauman et al., 2012, Sijtsma et al., 2012). We know that psychological factors affect people's probability of using urban green spaces and being physically active (Lee & Maheswaran, 2011). What we don't seem to know is if people who are working from home in general are rather more or rather less eager to use urban green spaces than people who work in a traditional working place. But considering the 'missing' physical activity of actually getting to work in combination with many people's desire to be physically active could be a strong indicator that people working from home are using urban green spaces more often than people who work in a traditional working space.

FIGURE 1
CONCEPTUAL FRAMEWORK



Source: Author: Nathan van Dam.

5. Methodology

5.1 Empirical strategy

To what extent is there a difference between remote and non-remote workers regarding the duration of weekly use of urban green spaces in the city of Groningen?

The first research sub-question looks into the difference in weekly use of urban green spaces between these groups. The dependent variable is weekly duration of urban green space use, and the independent variables are then remote and non-remote workers. When comparing the equality of means of two independent groups with each other combined with a sample size larger than 30, it is necessary to perform a Two-Sample T-Test. By comparing the means of the two groups, it becomes possible to provide an answer whether or not remote workers use urban green spaces more often than non-remote workers. However, in order to be allowed to perform this test, first there needs to be found out if other variables influence the time spent in urban green space as well, as can be expected considering existing theory. The factors having a dog, having a garden, age and stress levels were therefore examined to see if they influence

the time spent in urban green space as well. Therefore a multivariable linear regression has been carried out, with formula: $Y_i = \beta_0 + \beta_1 * i_1 + \beta_2 * i_2 + \dots + \beta_p * i_p + \epsilon$. It shows that owning a dog is a significant contributor to time spent in urban green space. Having a garden is not significantly influencing urban green space use. Therefore, only dog owners are excluded from the sample analysis. This leads to a total research sample of 61. This allows us to perform a Two-Sample T-Test, since the data values are independent, a normal distribution can be assumed because $n=61$ and Levene's test for equal variances showed that the variances are equal.

To what extent is there a different relationship between duration of urban green space use and perceived stress-levels among remote workers and non-remote workers in the city of Groningen?

To identify a relationship between perceived stress levels during a working day, on a scale from 1-10 on one side, and the weekly duration of use of urban green spaces on the other side, a simple linear regression will be performed. Namely, it shows the relationship between minutes spent in urban green space and perceives stress levels, which is what needs to be known for this study. Identifying the dependent and independent variable in this one is hard, since the causal relationship is debatable. Does use of urban green spaces lower working stress or is working stress, in the specific situation of the pandemic, causing people to go outside? Since we know that, more generally, using urban green spaces lowers stress (Lee & Maheswaran, 2011), this is the hypothesis that is used in this research and not the other way around. Therefore, stress level of a working day is the dependent variable, and the duration of weekly use of urban green spaces is the independent variable. The formula for a simple linear regression is $Y_i = \beta_0 + \beta_1 * i_1 + \epsilon$. The regression coefficient will probably be different between the groups, which will be the answer to the research sub-question. It is also not necessary to exclude dog owners in this test. Namely, they still experience the same effects of being in an urban green space and therefore are as valuable as the rest of the sample for this analysis.

To what extent is there a difference in the frequency of use of urban green spaces in the city of Groningen before and after Covid-19 between remote and non-remote workers?

To investigate whether or not remote and non-remote workers have been starting to use urban green spaces in the city of Groningen rather more or rather less often since Covid-19, a statistical analysis is necessary. Every respondent stated whether or not he started to use urban green spaces more often since Covid-19 by stating yes or no, which is dichotomous data. Being a remote or a non-remote worker is the independent variable again, and using urban green spaces more often or less often is the dependent variable. The hypothesis is that remote workers have been starting to use urban green spaces more often since Covid-19 than non-remote workers. To test this, a binary logistic regression will be executed. In order to execute a binary logistic regression, several assumptions need to be made about the sample. First of all, the dependent variable needs to be dichotomous. This is the case since ‘Did you start using urban green spaces more often since Covid-19’ could only be answered by yes or no. The independent variable needs to be categorical or continuous then, and it is, namely remote workers or non-remote workers. These are categorical variables. To conclude, the observations are independent of each other. This altogether allows for a binary logistic regression.

5.2 Data collection

At this moment, there is no specific data available on remote workers versus non-remote workers and their use of urban green spaces in the city of Groningen. Therefore this research cannot be executed using secondary data only and as such requires primary data collection. The reason for this is that this research relies largely on individual behaviour of full-time working people and as such requires detailed information about respondents. This case study’s main data gathering method will be in the form of surveys. The main cause is that the research sample can be larger opposed to a qualitative research method, which facilitates generalization of findings. The current Covid-19 pandemic reduces the possibilities of researching ‘on the street’. Therefore the survey will be made online with the use of Qualtrics.⁴ In compliance with Dutch public policy to minimize face-to-face contact, surveys

⁴ Qualtrics is the only survey tool licensed by the University of Groningen. Therefore all its options are free to use and in addition the survey is designed in the University of Groningen style, increasing the credibility of the survey. Processing the data is also possible using Qualtrics and there is the possibility to export the dataset to SPSS.

are distributed using convenience sampling within my personal Facebook network and by posting the survey in the Facebook group ‘Oproepjes voor Groningers.’⁵ The goal is to reach as many full-time working people in the city of Groningen as possible.⁶ The target population is people working full time, remotely and non-remotely, living in the city of Groningen.

In investigating whether differences exist between remote and non-remote workers regarding their use of urban green spaces, identifying remote workers and non-remote workers is important. In the survey, respondents could choose between 4 answers to the question ‘*how often do you work from home?*’ Namely always, mostly, sometimes and never. Those who responded always and mostly are labelled remote workers, and those responding sometimes and never are this research’s non-remote workers.

This research does not touch upon politically sensitive topics but does include very personal respondent information about both working conditions and leisure activities. It has been made clear to the respondents that their participation is anonymous and no more information is gathered than necessary. Next to that, the respondents’ answers are not retraceable in the sense that the individual can be identified.

To give a general overview of the participating respondents of this study, table 1 provides descriptive statistics and figure 2 shows the living locations of the respondents.

⁵ This Facebook group is targeted at inhabitants of the city of Groningen and has 20,500 members. It is used for general questions, requests and messages for people living in Groningen. As such, it provides a large mix of people by design.

⁶ Using Facebook as a sampling strategy has its drawbacks, such as the impossibility to reach certain groups (people without Facebook) and a limited control who is filling in the survey. Though, given the current situation, it seems the most suitable method of providing the survey.

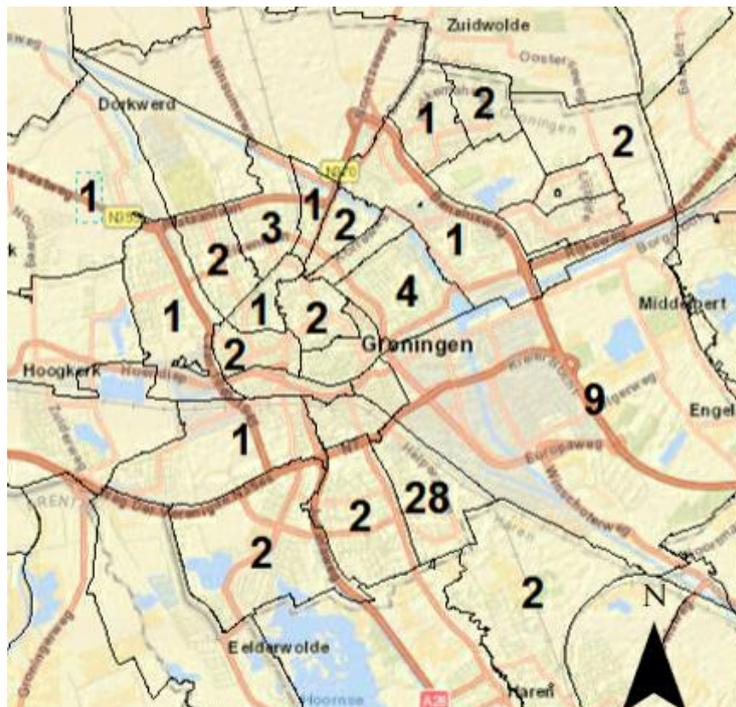
TABLE 1
DESCRIPTIVE STATISTICS OF THE SAMPLE

| Variable | Duration (minutes) ^a | Perceived stress levels ^b |
|-------------------------------------|---------------------------------|--------------------------------------|
| Mean | 215.8 | 4.4 |
| St. Dev. | 198.8 | 2.3 |
| Remote workers mean (n=39) | 224.6 | 4.4 |
| Non-remote workers mean (n=32) | 204.8 | 4.5 |
| People with a garden mean (n=50) | 215.4 | 4.5 |
| People without a garden mean (n=21) | 227.1 | 4.5 |
| People with a dog mean (n=10) | 408.5 | 5.4 |
| People without a dog mean | 187.8 | 4.3 |

a. The weekly amount of time spent in urban green spaces

b. The perceived stress levels on a scale from 1-10

FIGURE 2
MAP OF LIVING LOCATIONS OF SAMPLE RESPONDENTS



Source: Author: Nathan van Dam.

6. Results

6.1 Duration of use of urban green space

To investigate whether either remote workers or non-remote workers use urban green space more than the other, a Two-Sample T-Test is executed. In order to execute a valid analysis using a Two-Sample T-Test, other measured factors influencing urban green space use different than being a remote or a non-remote worker need to be filtered out of the sample. Therefore, a multivariable linear regression has been executed, as can be seen in Table 2.

TABLE 2^a
RESULTS OF MULTIPLE LINEAR REGRESSION

| Independent explanatory variable | Unit of measurement | Unstandardized Coefficient | | Standardized Coefficient | T | Sig. |
|----------------------------------|---------------------|----------------------------|------------|--------------------------|---------|-------|
| | | B | Std. Error | Beta | | |
| Constant | | 143.952 | 70.407 | | 2.045 | 0.045 |
| Working from home | Yes or no | -9.387 | 45.080 | -.023 | -.208 | .836 |
| Visiting UGS more frequently | Yes or no | 86.105 | 45.494 | .212 | 1.893 | .063 |
| Garden | Yes or no | -59.755 | 51.321 | -.134 | -1.1164 | .249 |
| Dog | Yes or no | 241.863 | 66.881 | .427 | 3.616 | .001 |
| Perceived stress levels | Scale 0-10 | 8.511 | 10.104 | .095 | .842 | .403 |

a. Dependent variable: Time (in minutes) weekly spent in urban green space

As table 2 shows, only having a dog as opposed to not having a dog contributes significantly to the dependent variable. This means that dog owners have been removed from the sample used for the Two-Sample T-Test. To examine to what extent there is a difference between remote workers and non-remote workers regarding the duration of urban green space use, we then turn to table 3 which shows the results of the Two-Sample T-Test. It shows that there is no significant difference between remote and non-remote workers in the city of Groningen regarding their weekly duration of urban green space use. Namely, a test statistic of -0.217 was found with a significance level of 0.829. This means that the difference found cannot be said to be significant. The difference between remote workers' and non-remote workers' duration of weekly use of urban green spaces is remarkably small.

TABLE 3
RESULTS OF TWO SAMPLE T-TEST

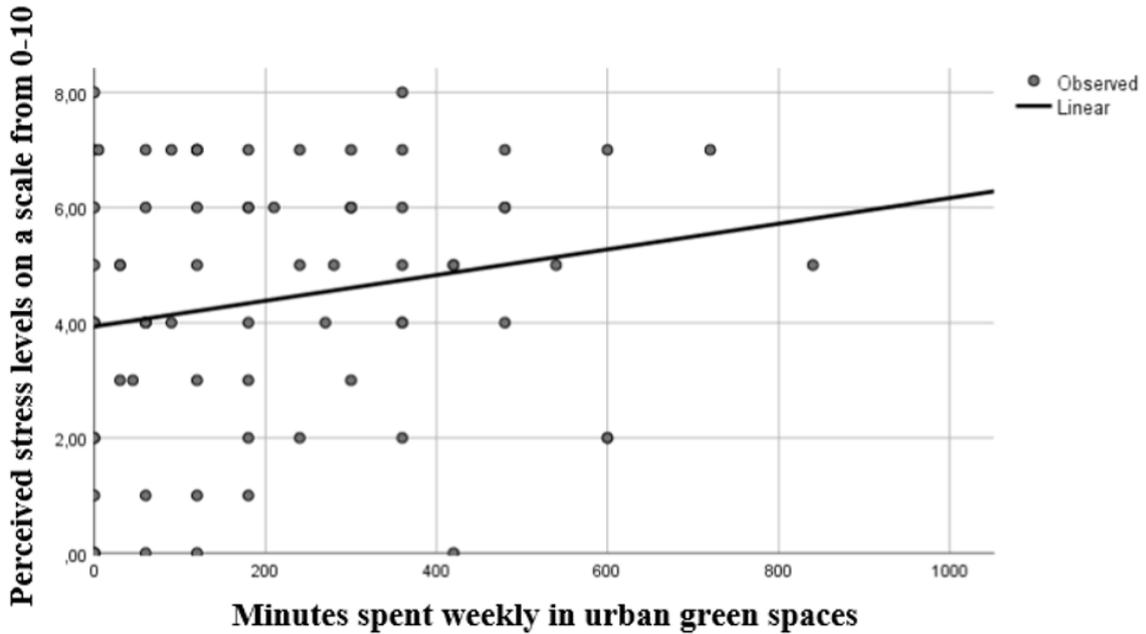
| Working method | N | Mean | St. Dev | T | Df | Sig. |
|-----------------------|----------|-------------|----------------|----------|-----------|-------------|
| Remotely | 32 | 183.28 | 172.578 | -.217 | 59 | .829 |
| Non-remotely | 29 | 192.76 | 168.457 | | | |

6.2 Relation between stress levels and urban green space use

To investigate whether a relationship exists between perceived stress levels and time spent in urban green space, a simple linear regression was carried out. The scatterplot shown in figure 3 below shows that there is a positive linear relationship between the two. Thus, this suggests that the higher stress levels are (Y-axis), the more time is spent in urban green space (X-axis).

FIGURE 3

SCATTERPLOT OF RELATIONSHIP PERCEIVED STRESS LEVELS-WEEKLY USE OF URBAN GREEN SPACE



Source: Author: Nathan van Dam

TABLE 4

RESULTS SIMPLE LINEAR REGRESSION WHOLE SAMPLE ^a

| Independent explanatory variable | Unit of measurement | Unstandardized Coefficient | | Standardized Coefficient | T | Sig. |
|----------------------------------|---------------------|----------------------------|------------|--------------------------|--------|-------|
| | | B | Std. Error | Beta | | |
| Constant | | 3.936 | .394 | | 10.000 | 0.000 |
| Time spent in urban green space | Minutes | .002 | .001 | .194 | 1.657 | .102 |

a. Dependent variable: Perceived stress levels on a scale from 0-10

TABLE 5

MODEL SUMMARY SIMPLE LINEAR REGRESSION^a

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------------------|----------|-------------------|----------------------------|
| 1 | .194 ^a | .038 | .024 | 2.25375 |

a. Predictors: (Constant), Time spent in urban green space (minutes).

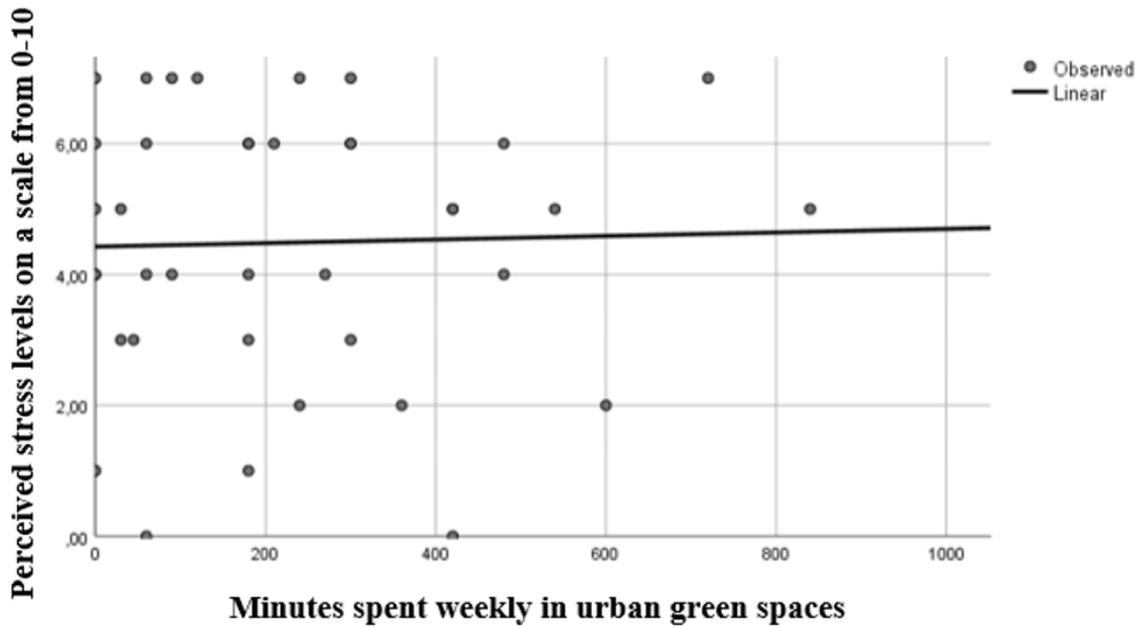
This positive linear relationship is confirmed by a Pearson's correlation coefficient of 0.194. Though, simple linear regression showed no significant relationship between weekly use of urban green spaces and perceived stress levels. The slope coefficient for weekly use of urban green spaces is 0.002 so for each more minute spent in urban green spaces, stress levels rise 0.002 on a scale from 0-10.⁷ The other way around, this means for each higher level of stress, 16.928 more minutes are spent in urban green spaces. The R² value is 0.038, so 3.8% of the variation in weekly urban green space use can be explained by the model containing only perceived stress levels.

Next to the simple linear regression of the whole sample (n=71), also two separate simple linear regressions have been executed. Namely, one with only the remote workers in figure 4 (n=39) and one with only the non-remote workers in figure 5 (n=31).

⁷ The scatterplot of standardised predicted values versus standardised residuals, showed that the data met the assumptions of homogeneity of variance and linearity and the residuals were approximately normally distributed.

FIGURE 4

SCATTERPLOT OF REMOTE WORKERS' RELATIONSHIP BETWEEN WEEKLY USE OF URBAN GREEN SPACE AND PERCEIVED STRESS LEVELS



Source: Author: Nathan van Dam

The results for simple linear regression to investigate the relationship between weekly use of urban green space (in minutes) and perceived stress levels (scale from 0-10) among remote workers, show that there is no significant relationship between the two, as can be seen in table 6 as well.⁸

⁸ The scatterplot of standardised predicted values versus standardised residuals, showed that the data met the assumptions of homogeneity of variance and linearity and the residuals were approximately normally distributed.

TABLE 6
RESULTS SIMPLE LINEAR REGRESSION REMOTE WORKERS^a

| Independent explanatory variable | Unit of measurement | Unstandardized Coefficient | | Standardized Coefficient | T | Sig. |
|----------------------------------|---------------------|----------------------------|------------|--------------------------|-------|-------|
| | | B | Std. Error | Beta | | |
| Constant | | 4.425 | .490 | | 9.031 | 0.000 |
| Time spent in urban green space | Minutes | .000 | .002 | .028 | .172 | .864 |

a. Dependent variable: Perceived stress levels on a scale from 0-10

TABLE 7
MODEL SUMMARY SIMPLE LINEAR REGRESSION^a

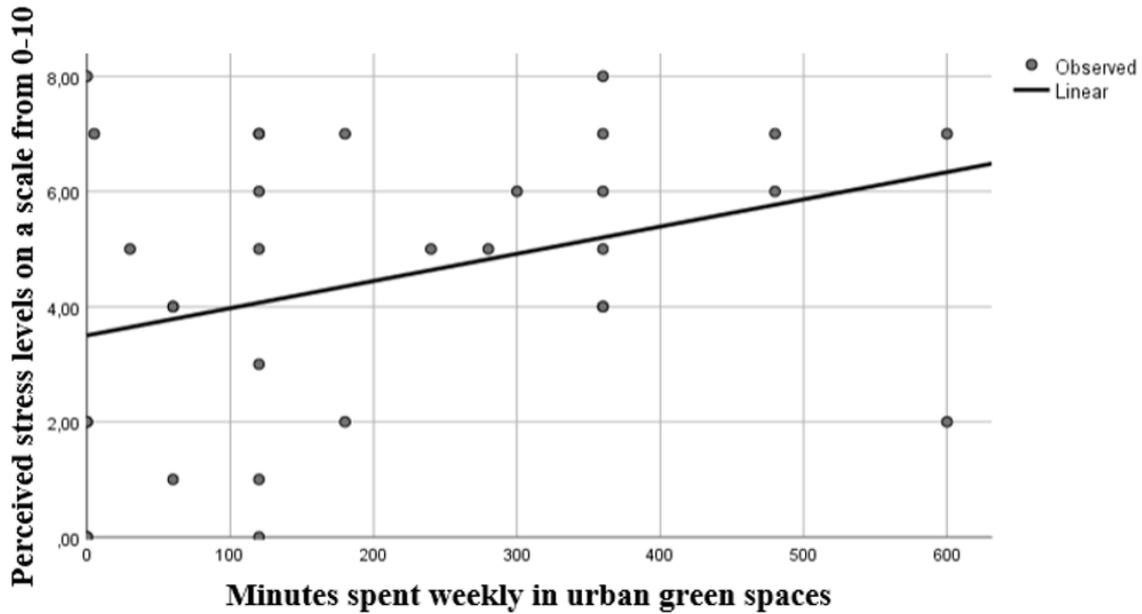
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------------------|----------|-------------------|----------------------------|
| 1 | .028 ^a | .001 | -.026 | 2.06396 |

a. Predictors: (Constant), Time spent in urban green space (minutes).

Though, the scatterplot in Figure 4 shows that there is a very weak positive linear relationship between the two, which is confirmed with a Pearson's correlation coefficient of 0.028. The slope coefficient is .000, so for each more minute spent in urban green space, stress levels rise 0.0. The R² value is 0.001, so 0.1% of the variation in weekly urban green space use can be explained by the model containing only perceived stress levels.

FIGURE 5

SCATTERPLOT OF NON-REMOTE WORKERS' RELATIONSHIP BETWEEN WEEKLY USE OF URBAN GREEN SPACES AND PERCEIVED STRESS LEVELS



Source: Author: Nathan van Dam

Another simple linear regression is carried out to investigate the relationship between weekly use of urban green spaces (minutes) and perceived stress levels (scale 0-10) among non-remote workers.⁹ The scatterplot shows that there is a positive linear relationship between the two, this positive linear relationship is confirmed with a Pearson's correlation coefficient of 0.344, as can be seen in table 8.

⁹ The scatterplot of standardised predicted values versus standardised residuals, showed that the data met the assumptions of homogeneity of variance and linearity and the residuals were approximately normally distributed.

TABLE 8
RESULTS SIMPLE LINEAR REGRESSION REMOTE WORKERS^a

| Independent explanatory variable | Unit of measurement | Unstandardized Coefficient | | Standardized Coefficient | T | Sig. |
|----------------------------------|---------------------|----------------------------|------------|--------------------------|-------|------|
| | | B | Std. Error | Beta | | |
| Constant | | 3.501 | .639 | | 5.477 | .000 |
| Time spent in urban green space | Minutes | .005 | .002 | .344 | 2.007 | .054 |

a. Dependent variable: Perceived stress levels on a scale from 0-10

TABLE 9
MODEL SUMMARY SIMPLE LINEAR REGRESSION^a

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------------------|----------|-------------------|----------------------------|
| 1 | .344 ^a | .118 | .089 | 2.37516 |

a. Predictors: (Constant), Time spent in urban green space (minutes).

Nevertheless, the simple linear regression shows no significant relationship between weekly use of urban green spaces and perceived stress levels among non-remote workers, although it almost does (P-value = ,054). The slope coefficient for weekly use of urban green spaces is .005, so for each more minute spent in urban green space, stress levels rise with 0.005 on a scale from 0-10. The R² value is 0,118, so 11,8% of the variation in weekly urban green space use can be explained by the model containing only perceived stress levels.

6.3 More frequent use of urban green space

To investigate whether either remote or non-remote workers have been starting to use urban green space more frequently since Covid-19, a logistic regression is performed. It ascertains the effects of mode of working (remote or non-remote), having a garden, having a dog and age on the likelihood of increased use of urban green spaces since Covid-19. The logistic regression model is not statistically significant, as can be seen in table 10. The model explains 2,8% (Nagelkerke R2) of the variance in increased urban green space use since Covid-19 and correctly classifies 52,9% of cases. Nevertheless, in total 60% of the sample respondents stated that they have started to use urban green spaces more often since Covid-19.

TABLE 10

BINARY LOGISTIC REGRESSION RESULTS ^a

| Variable | B | S.E. | Wald T | Nagelkerke R-square | Sig. |
|------------------------------------|----------|-------------|---------------|--------------------------------|-------------|
| Model | | | | .028 | |
| Garden | -.016 | ,602 | .001 | | .979 |
| Working from home | -.366 | .521 | .493 | | .483 |
| Age | -.003 | .023 | .022 | | .883 |
| Perceived stress levels | .080 | .114 | .495 | | .482 |
| Dog | ,580 | .735 | .624 | | .430 |
| Constant | -,171 | 1,454 | .014 | | .982 |

a. Dependent variable: More frequently visiting urban green space since Covid-19

7. Discussion and conclusions

7.1 Discussion

Understanding appropriately whether or not working remotely contributes significantly to an increased use of urban green space since Covid-19 is a complex affair. This study measured the time spent in urban green spaces by both remote and non-remote workers, and showed that the difference in time spent in urban green space between those two groups seems negligible. But this doesn't mean that urban green space in Groningen has been used less since Covid-19. Namely, approximately 60% of the respondents answered that they have been starting to use urban green space more often since Covid-19 started. Thus, this suggests that both remote and non-remote workers are using urban green space more often. This might even be a more radical outcome than was expected, namely that merely remote workers would use urban green spaces more often. Further research should explore whether this increased pressure on urban green space is permanent, but given the public health benefits that are attributed to urban green space, it is now the time to start rethinking the role urban green space has in society at this moment. It is one of the scarce activities people can still undertake during this pandemic and as such is important. But the distribution of urban green space is not equally spread over urban environments. In fact, access to urban green space is unequal and depending on social and economic status of the neighbourhood (Haase et al., 2017). Thus, in this current pandemic situation the worst effects are already for the lower socio-economic classes and additionally they also have the worst access to urban green spaces. The importance of urban green spaces has also been argued within the framework of the Sustainable Development Goals, namely number 3 & 11: good health and well-being; and sustainable and resilient cities. Also without a pandemic, urban green spaces will be increasingly important for cities to function properly. They should not be regarded as merely Sunday afternoon leisure for the rich, but as a common insurance for all living beings within an urban environment.

Building on top of that comes the issue of stress. The statement that urban green spaces tend to reduce stress has not been a controversial standpoint for long time already. In fact, researches find over and over again the negative relationship between the use of urban green spaces and the level of stress perceived (Lee & Maheswaran, 2011; Morris, 2003). Next to

that, many other benefits are attributed to the use of urban green spaces as well. Think about increased perceived health, the formation of social ties together with strengthening them and the motivation to get physically active. In line with earlier research, this research expected that there would be a negative relationship among the sample respondents between the weekly duration of urban green space use and perceived stress levels. Additionally, this relationship was researched among remote workers and non-remote workers separately. What was found is that this relationship could not be proven significantly in both groups. However, the scatter plot hinted at a positive relationship. The relationship between these variables was almost significant for the non-remote working group. But does this insignificant result mean that urban green spaces might not reduce perceived stress at all? No, that is too premature and is not backed by earlier research. Nevertheless, it might provide an insight in what is actually going on. Namely, if people use urban green spaces more, they tend to be more stressed as well. This is not because of the urban green spaces, but probably because they experience more stress already in the first place. So having stress might navigate people to use urban green spaces more often, to reduce this stress over the longer period. So urban green spaces might not only function as a preventive factor for stress, but also be counteracting stress itself. Considering the possibility of more worldwide crises in the future causing stress for urban residents, if urban green spaces indeed actively lowers stress levels, it could be one of the most valuable assets an urban environment can have. What not should be forgotten though is that crises hit lower socio-economic classes the hardest. Therefore, high quality urban green spaces should be evenly distributed over cities and not be located primarily in the richer parts.

7.2 Strengths and weaknesses

This research should be considered as a ‘dip in the water,’ since the massively working remotely experiment came all of the sudden. Previous research on behavioural differences between remote and non-remote workers is scarce. As such, this research has provided a strong hint that urban green spaces are not used more often by remote workers than non-remote workers, but equally often. Further research could dive into more specific preferences regarding urban green spaces that distinguish these two groups from each other. Nevertheless, all tests in this research were insignificant which could be considered as a weakness. This is probably primarily caused the sampled group was too small. Therefore, further research should include sufficient participants in order to draw more generic conclusions.

7.3 Conclusions

The expected difference in the duration of weekly urban green space use between remote workers and non-remote workers has not been proven. This means that on the basis of this research, it cannot be said whether or not remote workers use urban green spaces more often than non-remote workers. Though, it was found that the group of remote workers uses urban green spaces approximately 10% more than the group of non-remote workers. This is a strong hint that indeed, as this study beforehand expected, remote workers use urban green space more frequently than non-remote workers. Further research in different cities should make sure that a large amount of people, from all over the city, are included in the sample in order to make valid statements. But assuming the increased use of urban green spaces by remote workers and the increased share of remote workers in society compared to prior Covid-19, it can be expected that urban green spaces will be used more in the future.

The reasoning involving the expectation that an increased use of urban green spaces goes hand in hand with lower stress levels, so a negative relationship, has not been proven. But the regression analysis did provide a strong hint that there actually does exist a relationship between the two. Instead of working as a stress-preventor, urban green space seems to be used moreover as a stress-reducer. This suggests that urban citizens are well-aware of the positive impact of urban green spaces on health and therefore visit them. During the pandemic, many other stress reducing activities are not possible anymore, so this stresses the importance of urban green spaces in times of a pandemic even more.

All though a binary logistic regression could not find significant predicting factors to increased urban green space use since Covid-19, the more interesting is the discovery that around 60% of the respondents started to use urban green spaces more often. Furthermore, this binary logistic regression showed that increased use of urban green space is not merely a result of a single factor, but probably is influenced by many tiny factors that are difficult to catch in a model. Therefore in the future, qualitative research instead of quantitative research looking into people's motivations to visit urban green spaces can be valuable. This might provide more answers to the question why exactly the pandemic triggered people to use urban green spaces more often.

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Appendix 1. Survey questions

Welkom bij dit onderzoek over stedelijk groengebruik door thuiswerkers en niet-thuiswerkers in de stad Groningen!

Momenteel doe ik onderzoek naar het gebruik van parken, natuur en andere groene plekken door inwoners van de stad Groningen die een fulltime baan hebben, in het kader van mijn bachelor scriptie voor mijn studie *Human Geography & Planning* aan de Rijksuniversiteit Groningen. Hierbij wordt ook gekeken naar de hoeveelheid stress die u op een werkdag ervaart. Het enige wat u hoeft te doen is de acht vragen van de vragenlijst invullen. Dit kost u ongeveer 2-3 minuten. Voordat u verdergaat, attendeer ik u op het volgende:

Hierbij verzoekt de onderzoeker u tot toestemming om mee te doen aan dit onderzoek. U begrijpt dat u meedoet aan een onderzoek naar de verschillende manieren van groengebruik door fulltime thuiswerkers en niet-thuiswerkers in de stad Groningen. U begrijpt dat uw deelname volledig vrijwillig is. U begrijpt dat uw antwoorden strikt vertrouwelijk en anoniem worden bewaard. U heeft te allen tijde de optie om u terug te trekken uit het onderzoek en u heeft het recht om te verzoeken tot het verwijderen van uw antwoorden. De onderzoeker is verantwoordelijk voor een veilige verwerking van uw data.

Door mee te doen aan het onderzoek begrijpt u dat:

- U alleen mee kan doen als u momenteel zowel een fulltime baan heeft als in de stad Groningen woont.
- Het doel van deze studie is om de relatie tussen respectievelijk fulltime thuiswerkers en niet-thuiswerkers en hun gebruik van *urban green spaces* in de stad Groningen te onderzoeken. Het gaat hier dus om parken, natuur en groene plekken in het algemeen.
- Het onderzoek ongeveer 1-2 minuten duurt.
- Uw antwoorden vertrouwelijk en anoniem behandeld zullen worden. Uw antwoorden kunnen dus niet naar u herleid worden.

- De onderzoeker al uw vragen zal beantwoorden wat betreft deelname aan dit onderzoek.

Heeft u nog vragen? Dan kunt u mailen naar n.r.van.dam.2@student.rug.nl.

Alvast bedankt voor uw deelname!

Nathan van Dam

1. Wat is uw postcode?

2. Hoe vaak werkt u thuis?

- Altijd
- Meestal
- Soms
- Nooit

3. Bent u sinds de coronacrisis meer gebruik gaan maken van 'stedelijk groen' in de stad Groningen ten opzichte van daarvoor? Alle tijd in het groen telt mee, dus bijvoorbeeld ook uw fietstocht door het Noorderplantsoen naar sport/werk of het wandelen in de lunchpauze door het Pioenpark.

- Ja
- Nee
- Weet ik niet

4. Hoeveel tijd per week besteedt u gemiddeld in 'stedelijk groen' sinds de coronacrisis? Denk aan parken, natuur en groene gebieden in de stad Groningen. Alle tijd in het groen telt mee, dus bijvoorbeeld ook uw fietstocht door het Noorderplantsoen naar sport/werk of het wandelen in de lunchpauze door het Pioenpark.

- Ratio variabele

5. Op een schaal van 1-10, hoeveel stress ervaart u op een gemiddelde werkdag?

- Slide bar 1-10

6. Heeft u een tuin?

- Ja

- Nee

7. Heeft u een hond?

- Ja

- Nee

8. Wat is uw leeftijd?

- Interval variabele