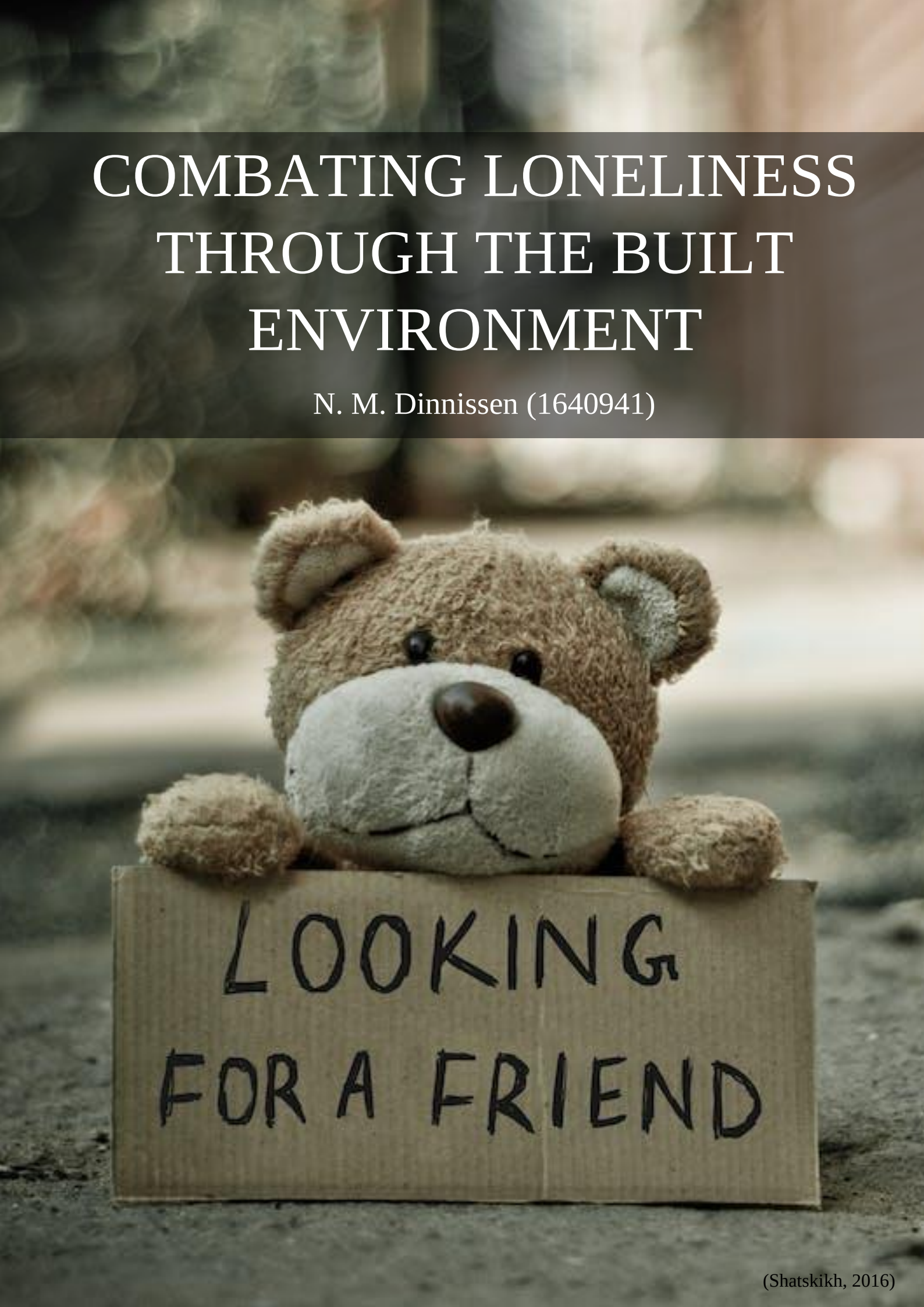
Combating loneliness through the built environment

Dinnissen, Noor M.

Award date:
2023

COMBATING LONELINESS THROUGH THE BUILT ENVIRONMENT

N. M. Dinnissen (1640941)



(Shatskikh, 2016)

Colophon

Combating loneliness through the built environment

Eindhoven, August 21, 2023

Author

N. M. Dinnissen

1640941

noordinnissen@hotmail.com

Graduation Supervision Committee

Dr. ir. A.D.A.M. Kemperman

Dr. ir. P.E.W. van den Berg

Prof. dr. T.A. Arentze

Course: Graduation project - 7Z45M0

Program: Architecture, Building and Planning, track Urban systems and Real Estate at Eindhoven University of Technology

This thesis is publicly available and has been carried out in accordance with the rules of the TU/e Code of scientific Integrity.

Preface

In front of you lays the result of my graduation thesis to complete my Master Urban systems and Real Estate at Eindhoven University of Technology. Because of my interest in the social domain and healthy urban environments, the choice for the topic loneliness in the built environment was quickly made. I carried this research out with great curiosity.

I have learned a lot by conducting this research, and even though I was sometimes struggling, I always got motivated again because of the people involved in my research. I conducted Part I in collaboration with Bregje Schulten. Thanks to our good cooperation and many talks, Part I became a comprehensive and clear piece of work. I would also like to thank my supervisors from the university, Astrid Kemperman and Pauline van den Berg, for the many meetings, careful feedback, help with the data analyses and of course responding to emails so quickly. Your involvement stimulated my curiosity and enthusiasm. In addition, I chose Theo Arentze as my third supervisor because of this knowledge of data analyses. You strengthened my report through your critical feedback, so thank you. I would also like to thank the experts from Planterra for your contribution to my thesis. Thanks to you, I have been able to think critically over and over again about why I am taking certain steps. The colleagues at the Municipality of Rotterdam helped me with part II of this research. Thanks to the provision of available data and experts, part II became a reality. In addition, they brought my thesis to a higher level by providing feedback and thinking along.

I would also like to mention the support of my friends and family. You always believed in me and helped me stay motivated, thank you for that! In addition, you helped make my thesis better through your interest. In particular, I would like to thank my mother who in the last weeks, even when she was on holiday, asked how I was doing. And of course, I want to thank my partner Bram for supporting me through thick and thin.

I hope that reading my thesis arouses the same curiosity in you as it did in me. Hopefully we will see a decrease in loneliness in the future.

Eindhoven, August 2023

Noor Dinnissen

Summary

Loneliness is, especially since the pandemic, increasing rapidly. Worldwide, 33% of adults experienced feelings of loneliness. Loneliness is described as a negative situation where someone's actual social contacts do not meet up with their expectations or desires. The increase in loneliness is a problem since loneliness has severe consequences for mental and physical health but also for society. For instance, people who experience feelings of loneliness have a higher chance of cardiovascular disease, stroke and even death. Consequently, it is important to reduce loneliness. Loneliness can possibly be reduced by interventions and measures in the built environment. However, there is limited research about the relationship between built environment factors and loneliness and so, interventions and measures are unknown. Hence, the objective of the study is to understand how objective and subjective built environment factors are related to feelings of loneliness and to determine which interventions and measures within the built environment can reduce feelings of loneliness. This research is divided into two parts, whereas part I focuses on the literature while part II examines the research gaps found in part I by conducting data analyses.

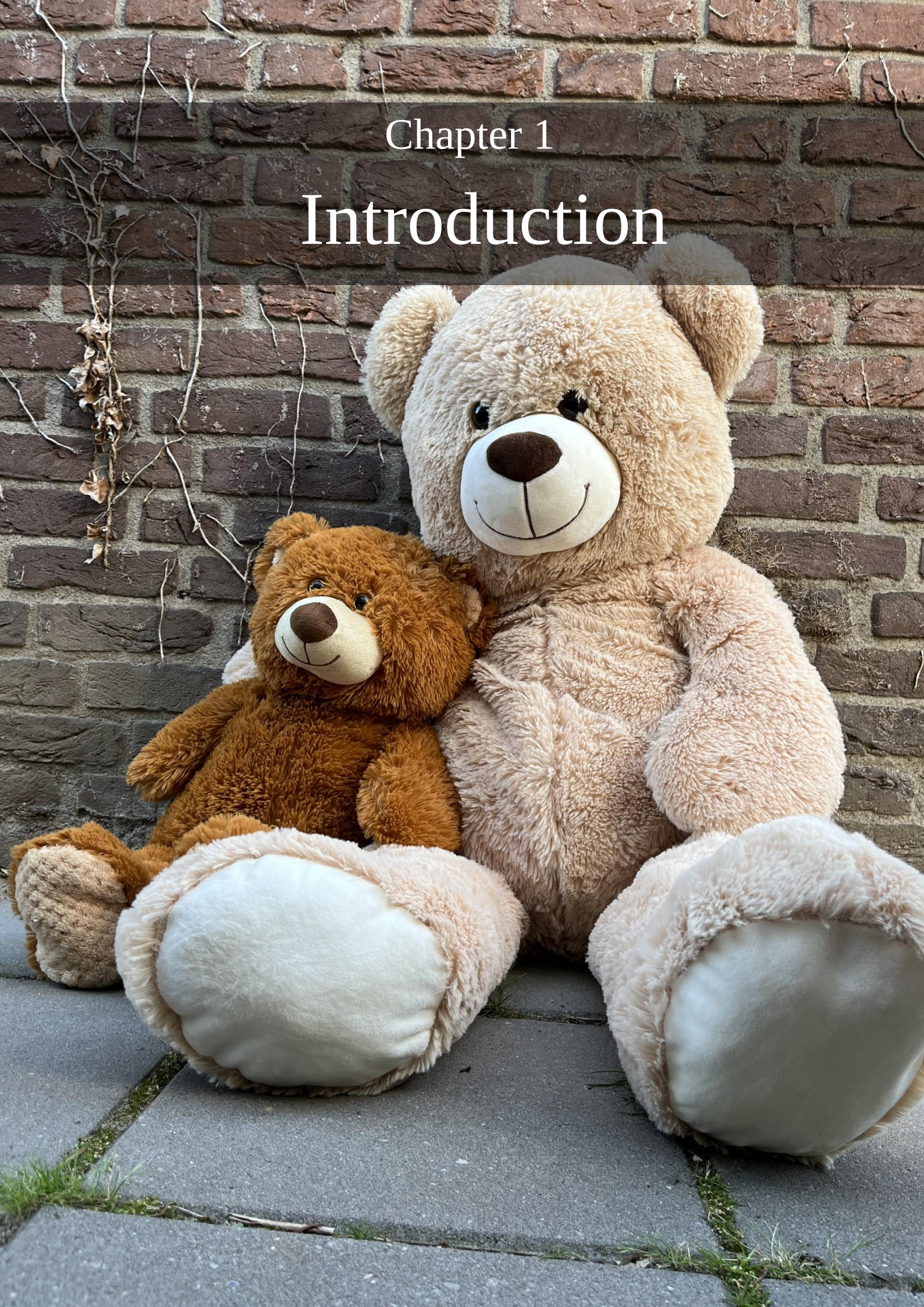
Part I revealed significant relationships between several factors, such as social network and health, and loneliness. Furthermore, a systematic literature review was conducted to understand the relationships between the built environment and loneliness. After establishing a query, 27 articles were included in the review. From this review, it became clear that nearly all studies found relationships between the social environment and social safety and loneliness. Additionally, the dwelling, the quality of the neighborhood, amenities, mobility and greenery seem to have a relationship with loneliness but there are some conflicting results, indicating the need for more research. Furthermore, limited evidence is found for relationships between neighborhood composition and socio-economic status. Lastly, objective variables within the topic general quality and subjective variables within the topic green are not examined in any of the studies. These variables should be examined and relationships that are unclear should be examined as well to strengthen the evidence. The most important research gap that is found, is that there is limited research at the neighborhood level while this is needed because interventions are not tailored to individuals. Additionally, it is not known which measure is most useful in reducing feelings of loneliness. Hence, the main predictors of loneliness should be determined. Moreover, indirect relationships between the built environment and loneliness remain unknown, while this could be related to each other.

In part II, several data analyses are conducted in order to find answers to the unclear aspects found in part I. Data at the neighborhood level that is collected in the municipality of Rotterdam is used for these analyses. Bivariate analyses are conducted to find the relationships between built environment factors and loneliness. Relationships between the topics dwelling, general quality, amenities, mobility, green, neighborhood composition, SES, social safety, social environment, social network, activities and health and loneliness are found. No relationships between variables within the topics density and life events are found. Moreover, the dependent variables have strong correlations among them, indicating the importance of examining the indirect relationships. Secondly, a regression analysis is performed to identify main predictors of loneliness. Social cohesion and participation and the percentage of residents who have a physical health condition are found to be the main predictors of loneliness. Therefore, improving these variables contribute to reducing feelings of loneliness. Lastly, a Bayesian belief network (BBN) is constructed to find indirect relationships. In this model, social cohesion and participation and active lifestyle have a direct relationship with loneliness. Furthermore, neighborhood satisfaction and educational level have relationships with a lot of independent variables. SES variables are connected to each other and therefore it is useful to implement measures and interventions in neighborhoods with a low SES first. These results indicate the need for a tailored approach for each neighborhood. The BBN can be used for this to examine which interventions are most useful in certain situations. Overall, a relationship between the built environment and loneliness is found and implementing these results can contribute to a reduction in feelings of loneliness.

List of figures

List of tables

Table of content



Chapter 1
Introduction

1. Introduction

In this chapter, the reason for conducting this research is outlined, along with the associated issues. Subsequently, a research objective is formulated. Based on this objective, a research question is developed with sub-questions. Furthermore, the relevance of the study is described together with the methods that are employed.

1.1 Background

Increasingly, distressing news reports emerge regarding an increase in loneliness and its risks and individuals who are undiscovered for years, lying dead in their homes, as shown in a selection of headlines in Figure 1.1. This raises the question: How is it possible that the absence of individuals goes unnoticed for such extended periods? In the Netherlands, a man was discovered deceased in his residence after a considerable duration (NOS Nieuws, 2023). Following this incident, the local police responded by posting a message on Facebook, emphasizing the vital importance of neighbors keeping an eye on each other because of the importance of social monitoring (Politie Den Bosch, 2023). These individuals must have had limited contact and social support, as otherwise, they would likely have been discovered sooner. But contacts are crucial, not only for avoiding unnoticed deaths but also for leading a fulfilling life. People who maintain regular social interactions tend to experience more happiness compared to others (Van Beuningen & Moonen, 2014). Furthermore, social contacts play a vital role in combating loneliness. Therefore, an increase in loneliness may also cause an increase in undiscovered deaths. Loneliness is a negative situation created by a person experiencing lack and disappointment in existing relationships as it is weighed down by expectations or desires of relationships. This is a personal subjective experience (Van Tilburg & De Jong-Gierveld, 2007), meaning that individuals who lack sufficient social connections compared to their expectations are likely to experience feelings of loneliness.

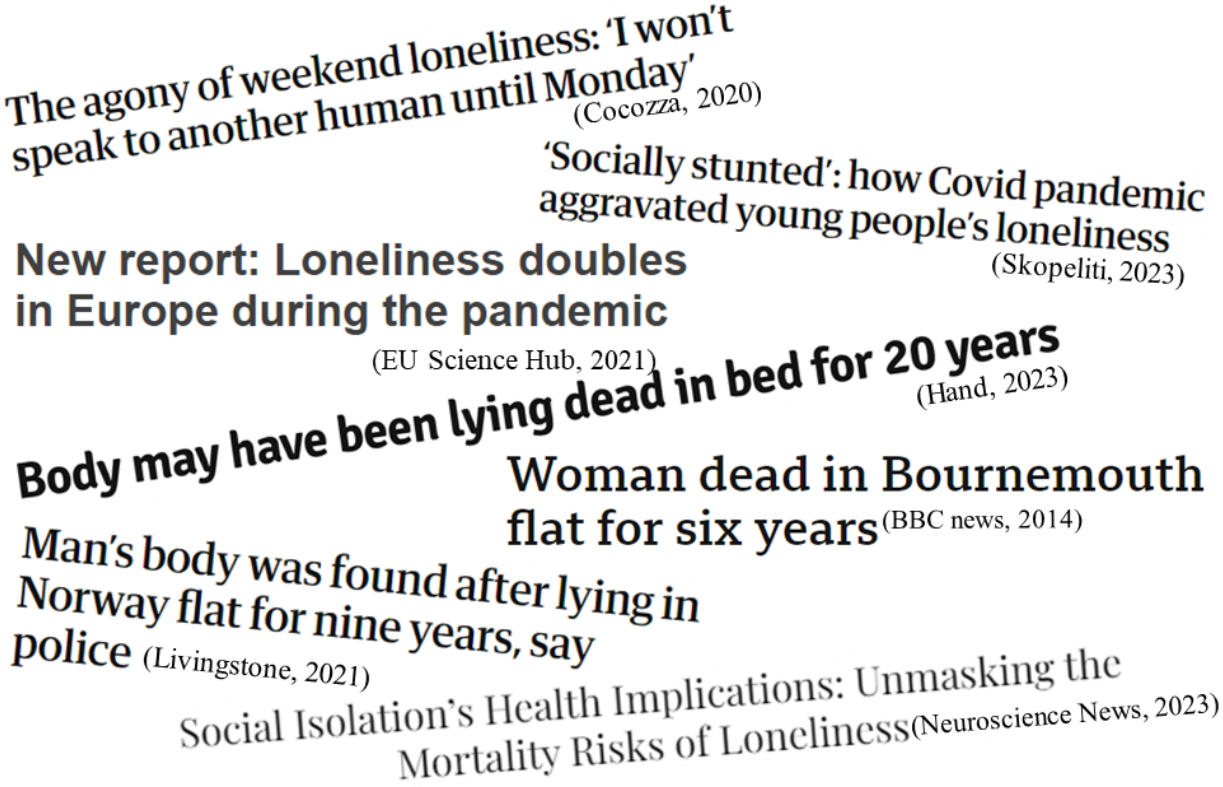


Figure 1.1 - Disturbing headlines of newspapers (BBC news, 2014; Cocozza, 2020; EU Science Hub, 2021; Hand, 2023; Livingstone, 2021; Neuroscience News, 2023; Skopeliti, 2023)

Loneliness is increasing and it has severe consequences. The pandemic seems to partly explain the higher numbers of loneliness (Ernst et al., 2022). Beaver (2021) found an increase in loneliness since the pandemic in several countries like Turkey, Brazil, Belgium, Canada and Great Britain. Statista (2021). took a survey around the world about loneliness. The outcome was that 33% of adults experienced feelings of loneliness. The highest number of loneliness was found in Brazil, namely 50%. This was however closely followed by other countries such as Turkey with 46% and India and Saudi Arabia with 43%.

In the Netherlands, 27.4% felt more often lonely during the pandemic than before and only 1.9% felt less lonely (Stewart, 2021). Van der A et al. (2023) found an increase of people experiencing feelings of loneliness of almost 10% during the last ten years. In 2020, 47% of Dutch inhabitants felt lonely. In 2022, the number of Dutch inhabitants feeling lonely increased to 49%. Before the pandemic, in 2016, 43% of the Dutch inhabitants felt lonely. So, an increase in loneliness is observed. Furthermore, people experiencing severe feelings of loneliness have increased as well. In the last ten years, an increase of 6% has been observed. In 2022, over 14% of the Dutch inhabitants experienced severe feelings of loneliness. The increase in feelings of loneliness in the Netherlands is shown in Figure 1.2 (van der A et al., 2023).

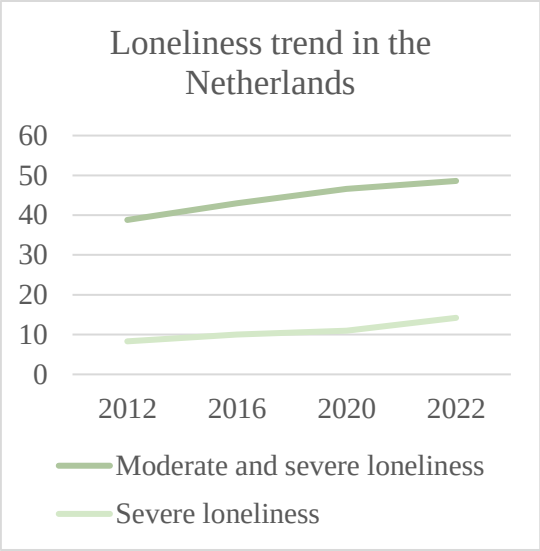


Figure 1.2 - Loneliness trend in the Netherlands (Van der A et al., 2023)

The increase in loneliness is a problem since loneliness has a lot of consequences. According to Smith et al. (2015) and Holt-Lunstad et al. (2015) people that experience feelings of loneliness have a 26% increased likelihood to die. Other studies also found that people who feel lonely have a higher chance of death (Longitudinal Aging Study Amsterdam, 2022; Rico-Uribe et al., 2018). Feelings of loneliness have a negative influence on mental and physical well-being (Holwerda, 2017; Park et al., 2020). On the physical side, loneliness increases the chance of cardiovascular disease and stroke (Heinrich & Gullone, 2006; Paul et al., 2021; van Amelsvoort, 2020; Xia & Li, 2018). Besides these diseases, loneliness causes stress, elevated cortisol and sleep problems. There are also behavioral problems like bad selfcare, excessive eating and drinking, smoking and not going to the doctor (Cherry, 2022; Malcolm et al., 2019). In addition, loneliness has a negative influence on the mental wellbeing (Doorakkers & Bos, 2019; Park et al., 2020; Heinrich & Gullone, 2006; Cherry, 2022). Problems such as depression, anxiety and suicidal behavior can occur (Dahlberg et al., 2022; Heinrich & Gullone, 2006). It is evident that loneliness contributes significantly to a number of health issues. As a result, the impact of loneliness is comparable to the impact of obesity, smoking and physical inactivity (Paul et al., 2021; Smith et al., 2015; van Amelsvoort, 2020). Because of all the health issues that are related to loneliness, loneliness is a burden for the health care system and the healthcare costs are higher for people who are lonely (van Amelsvoort, 2020). So, loneliness has a negative effect on society.

It is evident that loneliness is increasing worldwide and that it carries severe consequences. However, feelings of loneliness can be overcome, or it can cause a negative spiral. People can feel encouraged to make new contacts and by doing so, feelings of loneliness do usually not last (Movisie, 2020; Nikitin & Freund, 2017). Nonetheless, by not succeeding in making new contacts, loneliness can cause a negative spiral, making it exceedingly challenging to overcome feelings of loneliness (Cacioppo & Cacioppo, 2018; Movisie, 2020). When people find themselves in this negative spiral, it leads to withdrawal, negative thoughts, increased stress levels and reduced self-esteem (Movisie, 2020). For these individuals, finding a solution that contributes to reducing feelings of loneliness is important.

Research has been conducted on the relationship between loneliness and various factors. Fokkema & Van Tilburg (2007) identified three categories of causes. The first category relates to factors within one's personal life, such as a lack of social skills or health problems. The second category involves individual interactions with other people, including the loss of a partner or friend, or other impactful events. The last category includes societal causes, such as changes in the population composition within a neighborhood. This illustrates that feelings of loneliness can occur from diverse factors.

These factors have been examined by several researchers and relationships have been found between socio-demographics and loneliness. Beutel et al. (2017) discovered that individuals with lower socioeconomic status are more likely to experience loneliness. Conkova & Lindenberg (2018) found that migrants tend to experience higher levels of loneliness than non-migrants. Additionally, the loss of social connections, health characteristics, and expectations of social interactions contribute to the emergence of loneliness (Nikitin & Freund, 2017). Consequently, loneliness arises from a combination of risk factors. Built environment factors also appear to fall within these risk factors. For example, Fokkema & Dykstra (2009) state that facilitating social interactions in public space would help reduce loneliness. Within this context, two scoping reviews and one systematic literature review were found about loneliness in relationship to the built environment, from which two articles were published in 2022 and one article was published in 2017 which shows the recent interest in the topic.

Lyu & Forsyth (2022) wrote a scoping review, which is used for broader questions, and focused on elderly within the topic loneliness. They found that a supportive built environment can reduce loneliness. According to Lyu & Forsyth (2022) the planning and design of the built environment should be improved to reduce loneliness. Specifically, they found that neighborhoods with access to green space, high perceived walkability, high quality, good resources or destinations and convenient and affordable public transportation facilities can reduce feelings of loneliness. There was no difference found in feelings of loneliness for residents living in rural and urban areas (Lyu & Forsyth, 2022).

Hsueh et al. (2022) performed a systematic review and included loneliness and mental health as the topic. They only found seven articles on this topic. This is mainly due to the screening process, where 45 articles were excluded because of ineligible interventions, 11 articles because of an ineligible study design and 9 articles because of ineligible outcomes. They found that local community facilities are associated with improved mental health and social connectedness, but they did not find evidence that local community facilities reduce the quality of life and feelings of loneliness. There was also no evidence found about the relationship between active engagement in local green spaces and loneliness (Hsueh et al., 2022).

The last review from Syed et al. (2017) is a scoping review which is focused on Chinese older adults. Their query has an extra keyword which is the location of the research, they only focused on Chinese research. Therefore, a limited number of articles was found, namely 19. They found a relationship between having access to positive social support and loneliness. This means that having access to social support reduces loneliness. No evidence was found about the relationship between availability or affordable or appropriate housing and loneliness. Lastly, living alone can be a risk factor in some instances for feeling lonely (Syed et al., 2017).

Two of the three review articles only included elderly in their study. The review that included all ages had a very limited number of articles in their review, which makes it less comprehensive, and they only focused on the effectiveness of place-based interventions. Therefore, it can be concluded that there is limited evidence which can be used to reduce loneliness. A new and updated literature review about all built environment factors influencing loneliness can provide evidence. This is important because the built environment may hold the potential as a success factor for reducing feelings of loneliness.

1.2 Problem outline and statement

There is limited research on how the objective and subjective built environment can influence feelings of loneliness. As a result, the relationships between built environment factors and loneliness are unclear. In addition, limited research on the relationship between neighborhood characteristics and loneliness of residents has been conducted. Therefore, it is uncertain which built environment measures and interventions contribute to reducing feelings of loneliness.

1.3 Research objective and questions

The objective of this research is to synthesize and understand how objective and subjective built environmental factors are associated with feelings of loneliness, and to provide information to urban planners and designers on how to reduce loneliness of residents. This led to the following research question:

How are objective and subjective physical and social built environmental factors associated with feelings of loneliness of residents and which built environment measures and interventions are effective to reduce feelings of loneliness?

This research is divided into two parts to address the research question to a full extent. Part I will be executed first, after which part II is examined. The following sub-questions for the first part have been formulated:

- How can loneliness be defined?
- How is loneliness measured?
- What factors influence feelings of loneliness?
- What is the relationship between objective and subjective social and physical built environmental factors and feelings of loneliness?

Part II focusses on the research gaps found in Part I. Specifically, limited research has explored the effect of neighborhood characteristics on feelings of loneliness of residents. Therefore, the following sub-questions for Part II are formulated:

- What are the bivariate relationships between built environment factors at the neighborhood level and loneliness?
- Which built environment factors at the neighborhood level are most important predictors of loneliness?
- What are the direct and indirect relationships between the built environment factors related to loneliness at the neighborhood level?
- What advice can be given to urban planners and designers on how to reduce feelings of loneliness among residents?

1.4 Relevance

This research holds significance from various perspectives. It is important for the field of science. A comprehensive systematic literature review has not been conducted yet. This study identifies relationships between the built environment and loneliness. Additionally, by identifying missing factors in the literature, new areas of investigation can be explored and by conducting part II, these new areas will be examined. Therefore, this is giving answer to at least one research gap. Furthermore, there is limited research at the neighborhood level, so this research provides new insights within this matter. By conducting analyses to find indirect relationships, the relationships as a whole will become clear. Limited research has done this before, while this does provide a better understanding of the topic and it offers a new perspective on the topic. By identifying all those relationships, interventions and measures can be made. Currently, the built environment is not designed with the aim of reducing loneliness. Urban planners and designers, policymakers and project developers lack knowledge regarding measures and interventions they can take to reduce feelings of loneliness among residents. It is therefore vital to

provide concrete measures based on the research findings, so that individuals in these roles understand what they can do and recognize the impact of their actions.

Lastly, this research has societal relevance. The results of this research can be used as guidelines within urban planning, management and design. Ultimately, this could lead to a reduction in feelings of loneliness among residents and therefore healthier, both physical and mental, residents and less healthcare costs.

1.5 Research design

This research uses multiple methods. The research consists of two parts. In Part I, a literature review is conducted to explore the concept of loneliness and to identify factors that have influential effects. Subsequently, a systematic literature review is performed to examine the existing research on built environment factors and loneliness and to draw conclusions from it.

In part II, the effect of neighborhood characteristics on loneliness of residents is examined. A data analysis can provide more insight into this matter. Therefore, a data analysis at the neighborhood level will be performed. To choose variables that should be included in the dataset, a brainstorm session is conducted with experts in the field of healthy and livable environments. After that, several analyses are conducted to answer the sub-questions for part II. The specific analyses are determined in Chapter 4. Lastly, a brainstorm session is conducted with experts from a municipality to formulate an advice for urban planners and designers on how to reduce feelings of loneliness.

1.6 Reading guide

This research consists of nine chapters. The first chapter provides an introduction to the problem and establishes the research questions. The research questions of part I are discussed in Chapter 2 and 3. Chapter 2 presents a literature review on factors influencing loneliness. In Chapter 3 a systematic literature review on the relationship between built environment factors and loneliness will be conducted. Chapter 4 describes the methodology for part II. This is followed by the data preparation with includes descriptive statistics and factor analysis in Chapter 5. In Chapter 6, correlation analyses are performed to examine the relationships between built environment factors and loneliness. The main predictors of loneliness and the indirect relationships are determined in Chapter 7 by conducting several analyses. Chapter 8 offers specific interventions and measures for the planning, management, and design of the built environment. Finally, in the last chapter, Chapter 9, the conclusions, discussion, and recommendations are presented. A visual presentation of the chapters in this study and the questions that will be answered is shown in Figure 1.3.

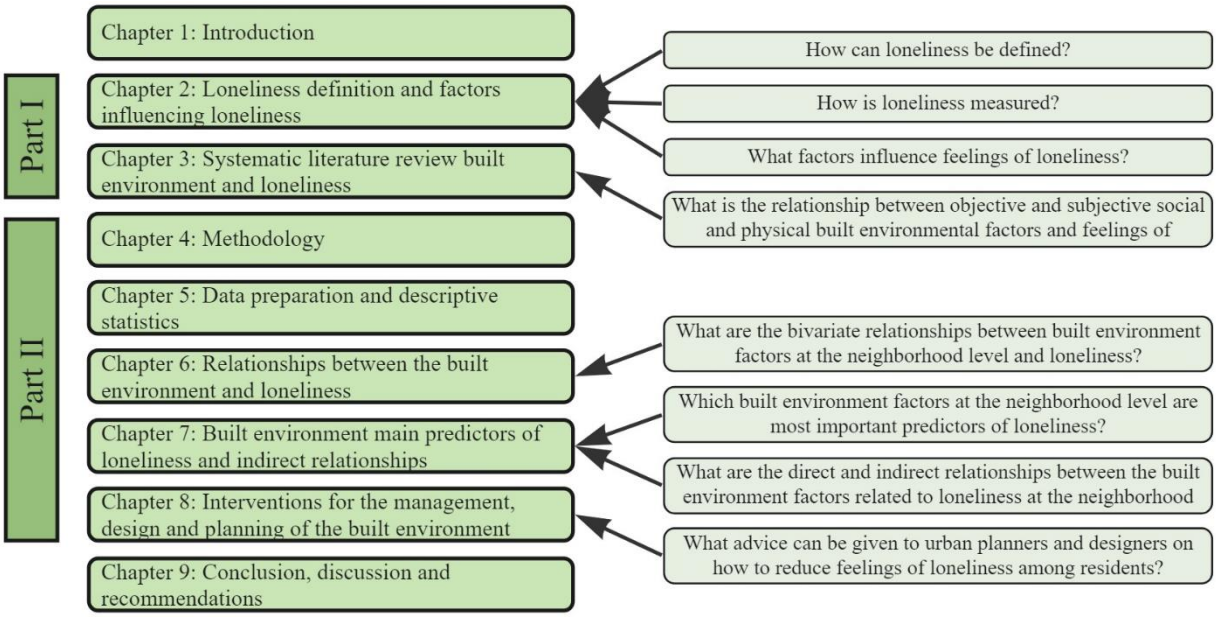


Figure 1.3 – Visualization reading guide

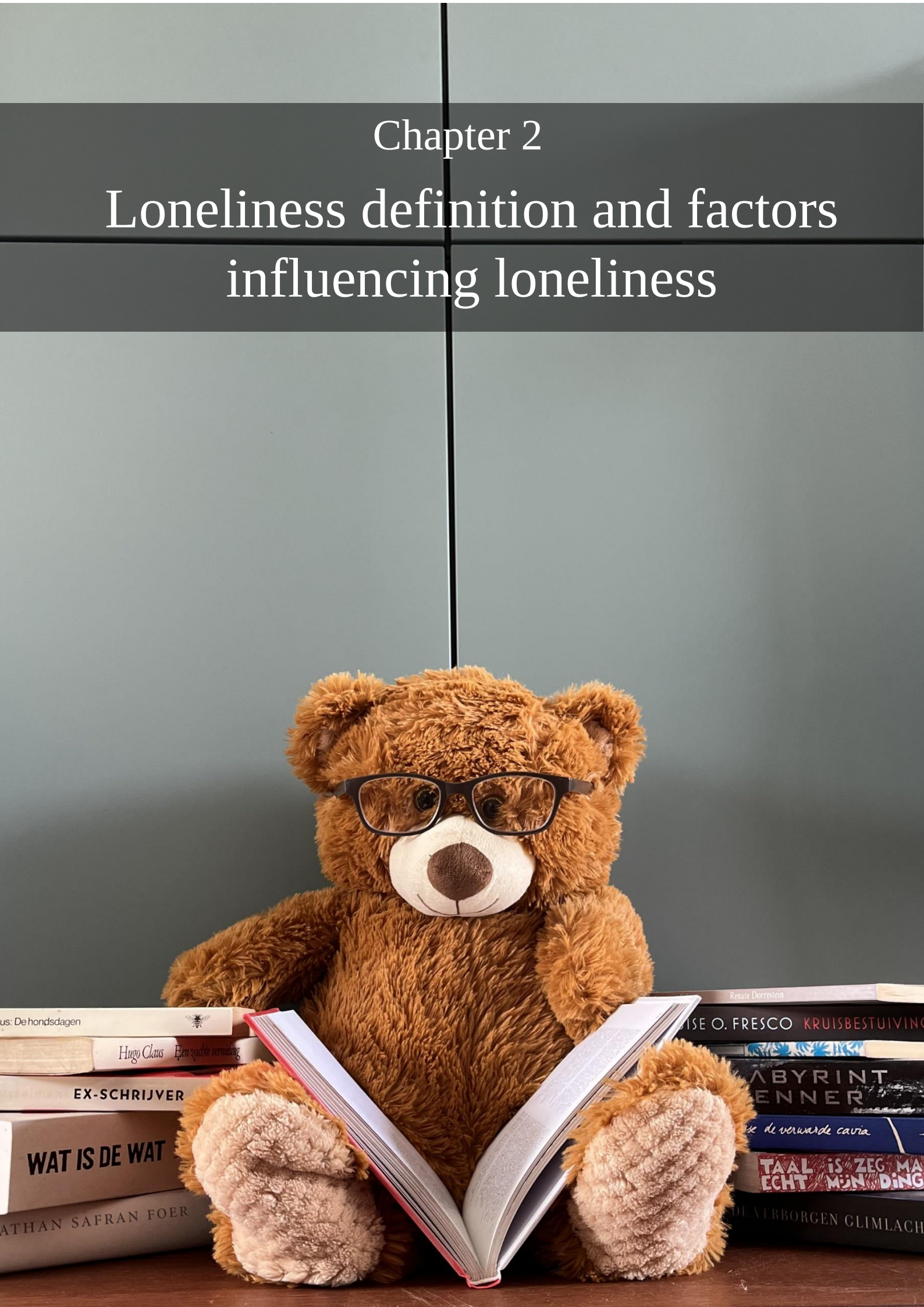
Part I: A literature review about loneliness

In Part I, loneliness is defined and measurement methods are identified. Moreover, a literature review is carried out to create an overview of factors related to loneliness. By doing so, a conceptual model is made that can be used throughout this study. Furthermore, a systematic literature review is conducted. This is important as it helps to understand how built environment factors and loneliness are related. A comprehensive overview of existing research is made by conducting this review. Additionally, research gaps can clearly be identified, which will be used in part II.

(Elliott, 2020)

Chapter 2

Loneliness definition and factors influencing loneliness



2. Loneliness definition and factors influencing loneliness

In this chapter, the concept of loneliness will be further explained and the way it can be measured is determined. Additionally, by conducting a literature review, factors that have a relation with loneliness will be determined. This is important because it provides a framework for the research.

2.1 Loneliness definition and measurement method

In this section, a definition of loneliness is formulated, and the way of measuring feelings of loneliness is examined. Both of these topics are important to frame the research and to get relevant results regarding the measurement.

2.1.1 Definition of loneliness

As indicated in the introduction, Van Tilburg & De Jong-Gierveld (2007) and Wenger & Burholt (2004) describe loneliness as a negative situation which is characterized by absence and disappointment of social relationships. This is a subjective, personal experience so it varies from person to person. A person weighs their existing relationships against wishes or expectations regarding relationships. Because this varies from person to person, one person will quickly experience feelings of loneliness in the absence of certain relationships while another person experiences no feelings of loneliness (Rook, 1984b). In short, loneliness is the result of shortage of social relationships compared to expectations (Andersson, 1998; de Jong-Gierveld, 1987). Something similar to loneliness is subjective social isolation. However, objective social isolation is not the same as loneliness. This is observable while loneliness is a subjective experience that can only be described by a person themselves. Feelings of loneliness are caused by feeling alone which is not the same as being alone (De Jong-Gierveld, 1984; Wenger & Burholt, 2004). Weiss (1973) says: “Loneliness is caused not by being alone, but by being without some definite needed relationship or set of relationships.” Therefore, the central question for loneliness is: To what extent does this person feel isolated and disconnected from other people? Arguably, loneliness is mostly related to the absence of meaningful relationships with a partner, family, friends and colleagues (Van Tilburg & De Jong-Gierveld, 2007). The three main characteristics of loneliness are: 1) a result of shortage of social relationships, 2) a negative experience and 3) a subjective experience (Mullins et al., 1987; Peplau & Perlman, 1982).

Loneliness can be distinguished based on three duration-related categories, namely 1) momentary loneliness, also known as state loneliness, 2) situational loneliness, and 3) chronic loneliness (de Jong-Gierveld & Raadschelders, 1982; Young, 1982). In this context, state loneliness are brief moments of loneliness that quickly pass, such as feeling lonely while traveling. Situational loneliness occurs for a longer duration. This arises from specific life events, such as the loss of a partner or moving to another city. However, this feeling will pass after someone grieves. On the other hand, chronic loneliness lasts for an extended period (Victor et al., 2000). It is important to note that situational loneliness can change into chronic loneliness when individuals struggle to adapt to their new circumstances (Young, 1982).

Weiss (1973) distinguished loneliness into emotional and social loneliness. Emotional loneliness is defined as the lack of an intimate relationship with a partner or a close friend. In this case, an emotionally close connection is being missed. In theory, this can only be overcome by entering into an intimate close relationship. Social loneliness is defined by Weiss (1973) as the lack of meaningful relationships with a broader social network such as friends, colleagues, neighbors, people to pursue a hobby with and people with the same interests. An example of a situation where feelings of social loneliness can occur is after moving to another area (Van Tilburg & De Jong-Gierveld, 2007). Thus, social loneliness cannot be resolved by the presence of an intimate partner and emotional loneliness is not necessarily resolved by having a broad network. Simply put, in the case of feelings of social loneliness, a person desires more social contacts while in the case of feelings of emotional loneliness, a close bond is missed (Centraal Bureau voor de Statistiek, 2020). Heylen (2011) visualized this in a conceptual model, which can be seen in Figure 2.1. The loneliness threshold is exceeded when a person finds that their current social

relationships and/or an intimate relationship do not meet their desires and expectations (Heylen, 2011). Within the scope of this study, it is likely that only social loneliness can be reduced by built environment factors, but this should be examined.

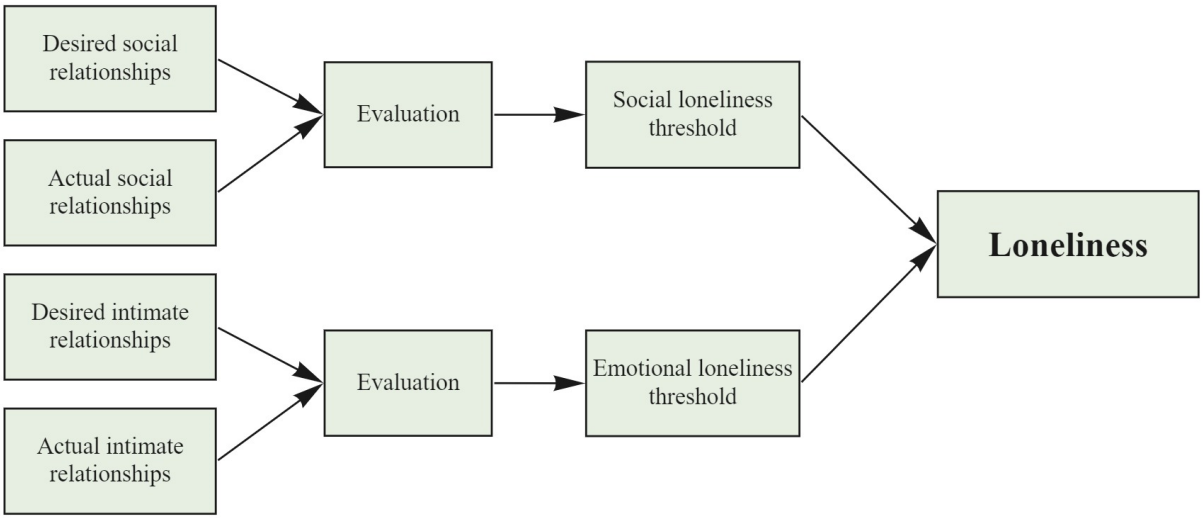


Figure 2.1 - Conceptual model of loneliness (Heylen, 2011)

A lot of research has already been conducted on loneliness interventions, which can be categorized into three approaches (Andersson, 1998; Rook, 1984a). The first approach is about reducing loneliness. This can be done by lowering standards and expectations, learning to cope with feelings of loneliness, and through network development (Fokkema & Tilburg, 2005). The second approach aims to prevent loneliness from resulting in problems, such as mental health issues. The final approach focuses on the prevention of loneliness itself (Andersson, 1998; Rook, 1984a). This research primarily addresses the reduction of feelings of loneliness, but also considers the prevention of loneliness, as it can indirectly contribute to the overall goal. The prevention of problems occurring from loneliness is not addressed in this research.

2.1.2 Loneliness scales

There are many different ways to measure loneliness such as using a single question or by using a loneliness scale. By using a single question to determine whether someone feels lonely, it can create a negative and embarrassing feeling. Therefore, people are less likely to answer the question with yes. For this reason, several researchers have developed loneliness scales. In these scales, different questions are asked which make it possible to measure whether someone feels lonely and to what extent (Perlman & Peplau, 1981). The most well-known loneliness scales are the De Jong Gierveld scale and the UCLA scale. The De Jong Gierveld scale consists of eleven questions, five of which are positively formulated and six of which are negatively formulated (Van Tilburg & De Leeuw, 1991). The UCLA scale, on the other hand, contains twenty negatively formulated questions (Russel et al., 1978). Shortened versions of both scales have also been created so that fewer questions need to be answered to measure feelings of loneliness. Both scales are regularly used in research, and it is therefore recommended that one of these two scales is also used in this research for measuring loneliness.

2.2 Loneliness trends

In this section, the trends regarding loneliness will be discussed. A recent study examined the percentage of people aged above 50 feeling lonely in different countries. As can be seen in Figure 2.2, there is less loneliness for elderly living in Northern Europe compared to southern and eastern Europe (van der Wilk, 2023). According to Fokkema & Dykstra (2009), this is attributed to the stronger family ties in Southern Europe compared to Northern Europe. Consequently, individuals in Southern Europe may have higher expectations, increasing the likelihood of disappointment in their family relationships.

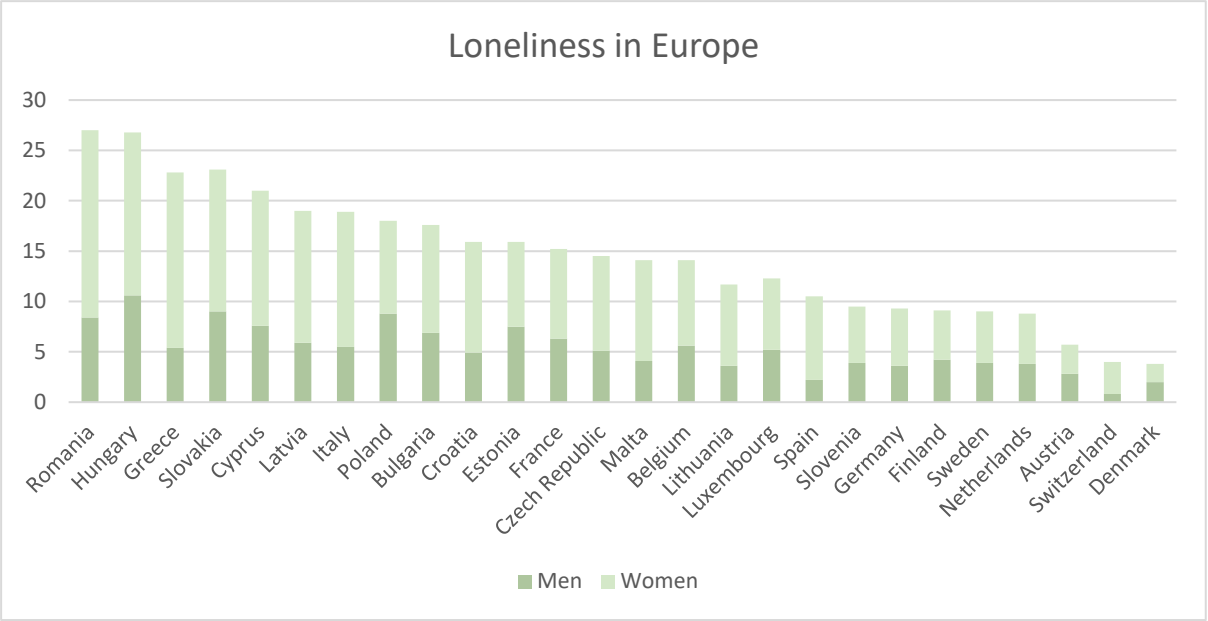


Figure 2.2 - Loneliness in Europe (van der Wilk, 2023)

When comparing these findings with the Dutch data, a significant difference can be seen. Van der A et al. (2023) found that 46.6 percent of the population of 18 years or older feels lonely in 2020 and Centraal bureau voor de Statistiek (2022) found a similar percentage. This might be due to the fact that the study of van der Wilk (2023) only took elderly into account while these studies included all Dutch adults and that there was a different study population. In Figure 2.3, it can be seen that loneliness increased between 2019 and 2021 in the Netherlands. In 2019, 65.6% of inhabitants aged 15 years or older did not feel lonely while in 2021 this was only 57.5%. As a result, there has been an increase in somewhat lonely, 25.7% in 2019 and 31.5% in 2021 and in strong lonely, this was 8.7% in 2019 and has increased up to 11% (Centraal bureau voor de statistiek, 2022).

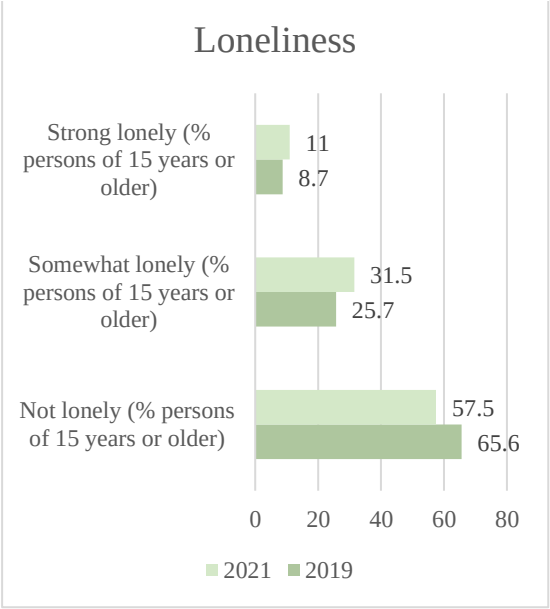


Figure 2.3 - Loneliness trend in the Netherlands (Centraal bureau voor de statistiek, 2022)

Earlier, a difference in feelings of loneliness between countries was seen. This is most likely caused by cultural differences. However, in the Netherlands, loneliness is seen more in some places than in other. When looking at the distribution of loneliness in the Netherlands, as can be seen in Figure 2.4, it can be seen that the highest percentage of loneliness is in the municipality of Rotterdam and The Hague. The other places that have a higher percentage of loneliness are close to the border or are big cities. A reason for this has not been found yet but possibly this is caused by socio-demographics. For example, migrants are usually living in the big cities and their social contacts may be limited (Deuning & Giesbers, 2023). Furthermore, in the big cities and places close to the border there are more residents located with a low income. On average, the big cities in the Netherlands have a lower average income than the average income of the Netherlands (Van Der A. et al., 2023).

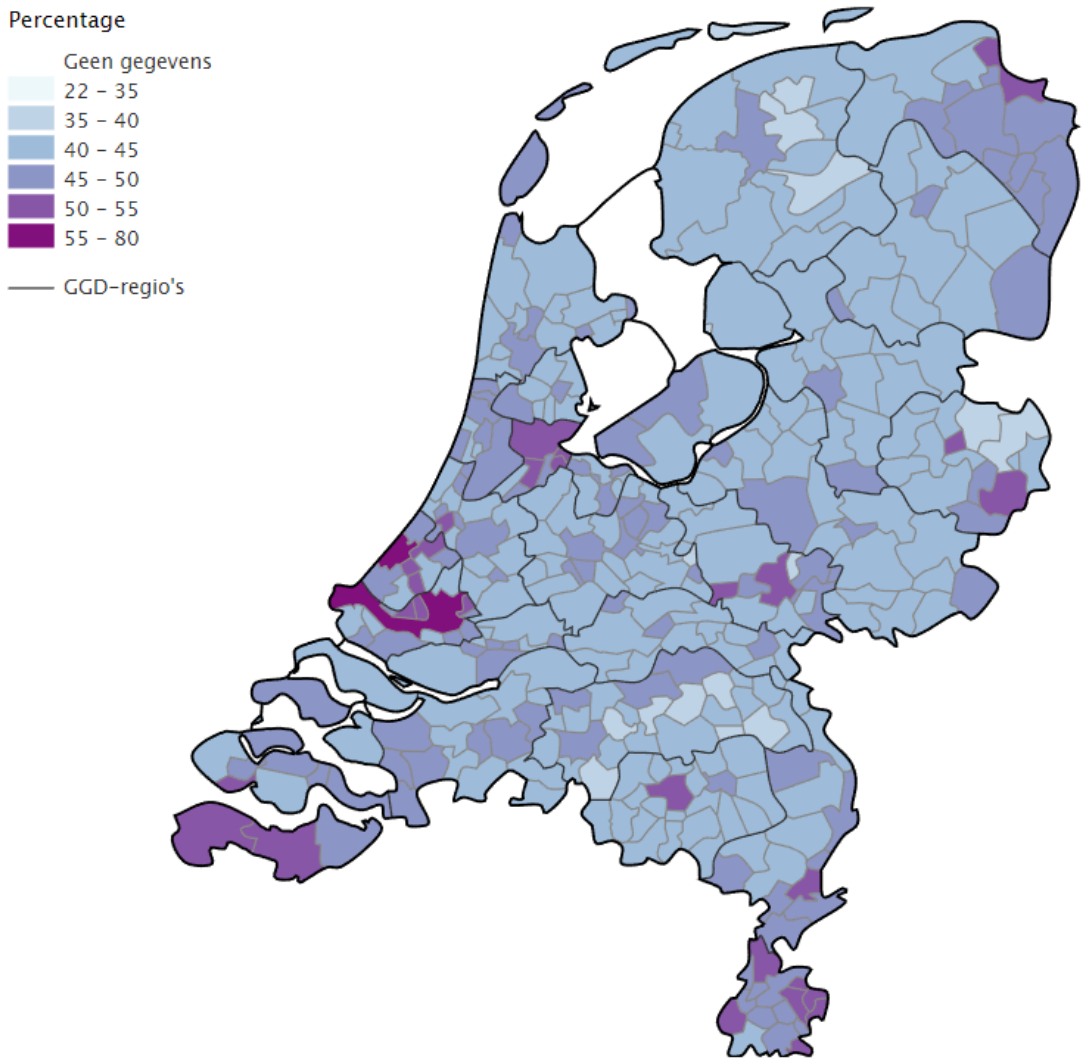


Figure 2.4 - Loneliness distribution in the Netherlands (Rijksinstituut voor Volksgezondheid en Milieu, 2020)

2.3 Aspects influencing loneliness

It could already be seen that loneliness differs according to the country and place of residence. However, there are more factors that influence feelings of loneliness. These factors are for example related to someone's social network, health status or socio-demographics (Demakakos et al., 2006; Fokkema & Dykstra, 2009). Weiss (1973) says that people have social needs which can be distinguished in different relationship types. Those types are related to social networks but also to socio-demographics so they will be discussed separately. In this section, the factors that have a relationship with loneliness will be determined.

2.3.1 Social network

There is already a great amount of research on the relationship between social contacts and loneliness. This is obviously related because it is closely related to actual and desired social relationships as shown in the conceptual model of loneliness in Figure 2.1.

It has been proven that the size of one's social network has a relationship with loneliness (Demakakos et al., 2006; Hawkley et al., 2008; van den Berg et al., 2016). In this regard, people with a larger social network tend to have fewer feelings of loneliness. Hyland et al. (2019) say that having four relationships is sufficient to prevent feelings of loneliness from occurring. However, when an individual has more than four relationships, the rate at which loneliness decreases becomes less rapid (Klok & van Tilburg, 2018), meaning that having four relationships is sufficient to prevent loneliness but having more gives less added value. Demakakos et al. (2006) found that the main predictor of loneliness is a relationship

with friends. Specifically, it indicates that people without friends are the loneliest. Anderson (2010) also found this relationship and extends this by saying that people with a shrinking network of friends are lonelier. No relationship was found between the frequency of interactions and loneliness (Demakakos et al., 2006; Hawkley et al., 2008). Pinquart & Sorensen (2001) and Cuyvers & Valerie (2009) examined the relationship between the quality and the quantity of contact and loneliness. They found that a lower quality of interaction was more related to loneliness than a low amount of interaction. Fardghassemi & Joffe (2022) also found a relationship between the quality of interactions and loneliness. But what is a qualitative interaction? According to Farooqi (2014), a qualitative relationship is characterized by affection, care, understanding, intimacy, and forgiveness. A qualitative relation might also be related to the need for emotional support, as this also has a relationship with loneliness according to Pinquart & Sorensen (2001). Anderson (2010) found a similar relationship between the presence of supportive people in someone's life and loneliness. The study of Weiss (1973) found that someone needs a trustworthy connection to fulfill one of the social needs. This is mostly provided by close family relationships which are also related to emotional support and supportive people. This is making the need for close relationships clear. Besides family relationships, it is important to have a diverse social network. Meaning that there should be a variety in types of relationships, which can for example be established by having contact with family, friends, neighbors and colleagues (Klok & van Tilburg, 2018; Pinquart & Sorensen, 2001). Furthermore, social integration, which is one of the social needs, is found to be an important relationship type. This can be achieved by having a network with likeminded people (Weiss, 1973).

Hawkley et al. (2008) examined the relationship between chronic stressors and loneliness. It was found that when social life and recreation are perceived as chronic stressors, people experience more feelings of loneliness. Lastly, a relationship between having contact by the phone or seeing friends in real life and loneliness was found. They are more likely to experience feelings of loneliness than those who do have contact (Anderson, 2010). All of these factors can be directly linked to actual social relationships. Regarding desired social relationships, network satisfaction was found to be related to loneliness. Low network satisfaction in this case leads to more feelings of loneliness (Hawkley et al., 2008).

2.3.2 Activities

Besides the quantity and quality of the social network, social participation was found to be very important in reducing feelings of loneliness (Niedzwiedz et al., 2016). Participation is described as an individual's engagement in activities that facilitate social interaction within a community or society (Fudge Schormans, 2014). Previously, it has been noted that interacting with neighbors can help in establishing a diverse network, but it is also strongly associated with participation. For example, participation helps to bring neighbors into contact with each other, but neighbor contact can also make people participate more. Participation can also be achieved by doing volunteer work within the community. Van den Berg et al. (2016) and Anderson (2010) found that volunteers are less lonely so this might be related to participation. Furthermore, research indicates that participating in a sport is associated with loneliness. Individuals who engage in sports experience significantly lower levels of loneliness compared to those who do not participate in sports (Wirtz et al., 2012). So, it is important that people participate in society and have an active lifestyle to prevent feelings of loneliness from occurring.

2.3.3 Socio-demographics

Much research has been done on the relationship between socio demographics and loneliness and in doing so, many relationships have been found.

First of all, the relationship between gender and loneliness has been studied. In Figure 2.5, it can be seen that slightly more men feel lonely than women. The percentage of very severely lonely is in turn slightly higher among women. That in general men in the Netherlands feel lonelier than women at the time of measurement is remarkable because several studies have found that relatively more women than men are lonely (Buecker et al., 2021; Bustamante et al., 2022; de Jong Gierveld & van Tilburg, 2010; Demakakos et al., 2006; van der Wilk, 2023). Because a lot of research found a significant relationship between gender and loneliness, specifically women being more at risk of being loneliness, it is assumed that women are more likely to experience feelings of loneliness than men.

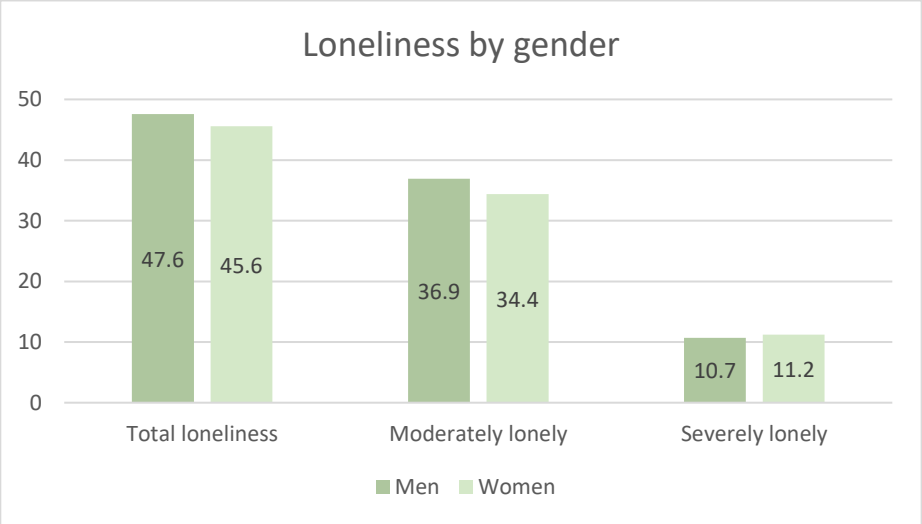


Figure 2.5 - Loneliness by gender (van der A et al., 2021)

Besides the relationship between gender and loneliness, there is also a difference in feelings of loneliness between age groups. 33% of older adults, defined as people ≥75 years old, feels lonely while this is about 25% for the people in the other age groups in The Netherlands. So, the elderly feel more often lonely than the other age groups (Centraal Bureau voor de Statistiek, 2020). The other age group that has a higher percentage of feelings of loneliness is the group between 15 and 25 years old. Within this age group, a slightly higher percentage for strong loneliness was found (Centraal Bureau voor de Statistiek, 2020). Looking at the data from van der A et al. (2021), which is shown in Figure 2.6, it was found that around 65% of the elderly feel lonely and around 13% feel (very) severely lonely. Both of those percentages are significantly higher than the percentages for other age groups. People aged 75-84 years also feel lonelier than the other age groups. Centraal Bureau voor de Statistiek (2020) took the age group 75+ as one group while van der A et al. (2021) divided this into two groups. As a result, the data in Figure 2.6 shows that people aged 85+ are even more likely to feel lonely. This is in line with the literature, as much research has shown that older people are more likely to experience feelings of loneliness (Dahlberg, McKee, Lennartsson, et al., 2022; de Jong Gierveld & van Tilburg, 2010; van den Berg et al., 2016; Wenger & Burholt, 2004). Demakakos et al. (2006) found that people aged above 80 are the most vulnerable to feelings of loneliness. This has probably something to do with certain life events, but this will be discussed later.

A difference is also seen between age groups when it comes to emotional and social loneliness. Figure 2.7 shows that young people between the ages of 15 and 25 feel the most emotionally lonely of all age groups. A possible reason for this could be that young people have fewer intimate relationships where they develop a really close connection with someone, whereas older people know they can rely on someone. Furthermore, Figure 2.7 shows that people in the 45-55 age group experience the most feelings of social loneliness. Young people experience this significantly less than emotional loneliness.

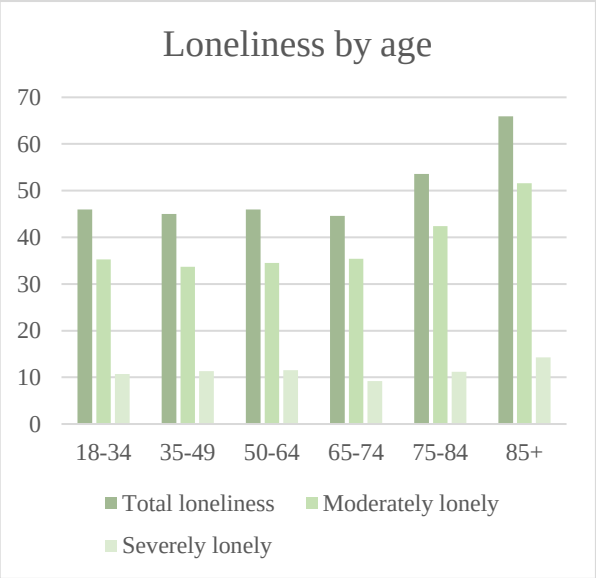


Figure 2.6 - Loneliness by age (van der A et al., 2021)

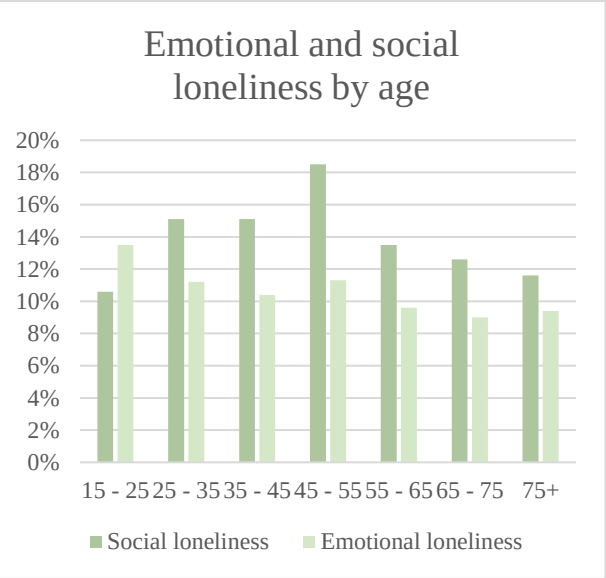


Figure 2.7 - Social and emotional loneliness by age (Centraal bureau voor de statistiek, 2022)

Two other socio-demographic factors influencing loneliness are household composition and marital status. People who are married and living together experience less feelings of loneliness according to van der A et al. (2022). People who never have been married or who are separated are on the other hand more likely to experience feelings of loneliness (Andersson, 2010). Much research has found that people in a relationship are less loneliness than singles (Buecker et al., 2021; Dahlberg, McKee, Frank, et al., 2022; de Jong Gierveld & van Tilburg, 2010; Klok & van Tilburg, 2018). In Figure 2.8, this is clearly visible as well (Centraal Bureau voor de Statistiek, 2020). People who live with a partner, with or without children, often experience less feelings of loneliness. Demakakos et al. (2006) add that it's all about the closeness of that relationship and therefore this also contributes greatly to the presence of feelings of loneliness. This is similar to the results that Hawkley et al. (2008) found, having a relationship can prevent loneliness but when it turns into a chronic stressor because it is a stress factor, feelings of loneliness will likely increase.

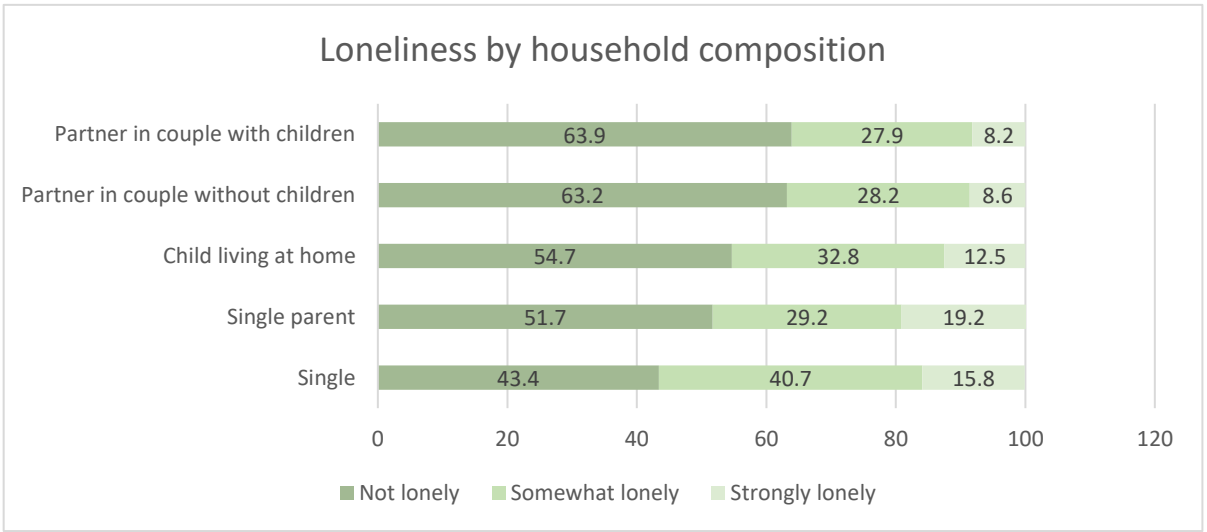


Figure 2.8 - Loneliness by household composition (Centraal bureau voor de statistiek, 2022)

Moreover, relationships between educational level and income and loneliness are found. Hawkley et al. (2008), van den Berg et al. (2016), Demakakos et al. (2006) and Pinquart & Sorensen (2001) all found that people with a low education level are more likely to experience feelings of loneliness. In Figure 2.9, it can be seen that this is also applicable for Dutch inhabitants as the percentage of people who experience feelings of loneliness for the people with a low education level is higher. Highly educated people experience less feelings of loneliness according to Figure 2.9. This is applicable to all ages and also to men and women separately. But besides education level, a relationship between income and loneliness is often found (Beutel et al., 2017; Demakakos et al., 2006; Hawkley et al., 2008; Niedzwiedz et al., 2016; Pinquart & Sorensen, 2001; Shovestul et al., 2020). Meaning that a higher income decreases the likelihood of experiencing feelings of loneliness. Having a job appears to have both advantages and disadvantages. An advantage is that a diverse network can be established by having social interactions with colleagues. Furthermore, another advantage is that it allows for the formation of a relationship type, as formulated by Weiss (1974). A social need, such as self-esteem, is often fulfilled when colleagues acknowledge an employee's competencies so this can be accomplished by having a job. Lastly, having an income can help people participate in social activities. Niedzwiedz et al. (2016) found that people among the poorest are less active in social participation which is often caused by a lack of financial resources. This problem can be tackled by having a job as well. However, there is also a downside to consider. A job can potentially leed to chronic stress, which in turn can contribute to increased feelings of loneliness (Hawkley et al., 2008).

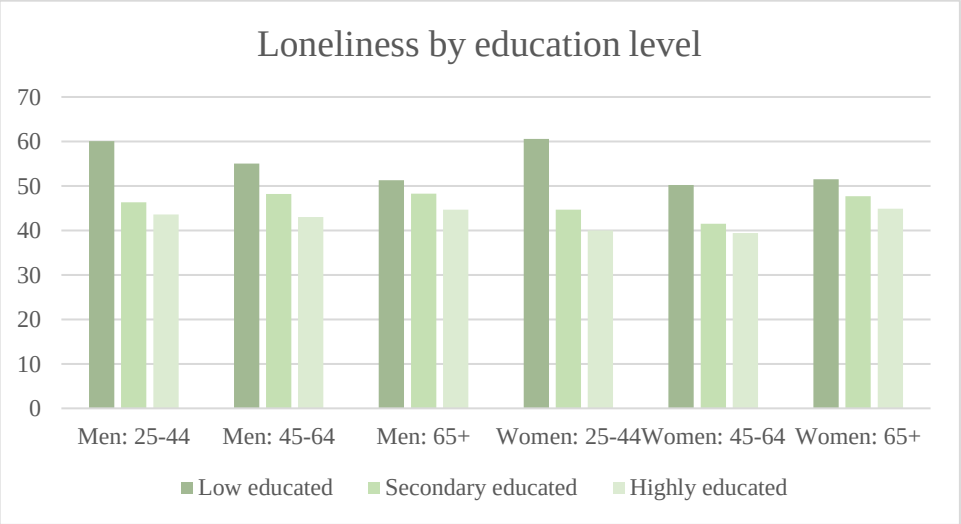


Figure 2.9 - Loneliness by education level (Zomer et al., 2022)

Lastly, variations in feelings of loneliness can be observed between ethnic backgrounds. Hawkley et al. (2008) investigated the relationship between race and loneliness and discovered that Hispanic individuals tend to experience higher levels of loneliness compared to white individuals. van Tilburg & Fokkema (2018) and Conkova & Lindenberg (2018) focused on a specific ethnic background and revealed that migrants from non-European countries are more prone to experiencing loneliness. Moreover, their research indicated that individuals of Turkish descent among migrants are most likely to experience feelings of loneliness.

2.3.4 Health

Another topic that has been found to have a relationship with loneliness is the topic health. This can be divided into physical and mental health and lifestyle factors.

In terms of physical health, several studies have found relationships between individuals with health problems and loneliness. This relationship is explained due to the limitations they face in engaging in activities that others can do (Pinquart & Sorensen, 2001; Van Beuningen & Moonen, 2014). A relationship has also been found between this variable and the sense of control over one's own life, and

both variables reinforce feelings of loneliness (Klok & van Tilburg, 2018). Additionally, a relationship has been established between certain diseases, such as cardiovascular and respiratory diseases, and loneliness. Due to the unpredictable course of these diseases, people in the social network are unaware of the patient's needs, leaving them vulnerable and lonely (Penninx et al., 1999). Furthermore, several studies have demonstrated a relationship between subjective health and loneliness (Anderson, 2010; de Jong Gierveld & van Tilburg, 2010; Klok & van Tilburg, 2018). This means that individuals who perceive their health as poor are more likely to experience feelings of loneliness.

When examining lifestyle factors, a relationship is observed between smoking, drug use, and loneliness. Individuals engaged in either of these behaviors tend to experience higher levels of loneliness (Anderson, 2010; Hämmig, 2019). Furthermore, relationships between exercise, diet and sleep and loneliness were found (Schrempft et al., 2019). Relationships have also been discovered between mental health and loneliness. Cherry (2022) suggests that loneliness may contribute to depression. However, this appears to be a bidirectional relationship. One can become depressed due to limited social contacts, but depression can also hinder one's ability to maintain social connections (Beutel et al., 2017; Cherry, 2022; Dahlberg, McKee, Frank, et al., 2022).

Moreover, specific groups are more prone to experience feelings of loneliness. A relationship has been established between individuals with physical or intellectual disabilities and loneliness (Emerson et al., 2021). Baart (2021) found that psychiatric patients often experience intense loneliness and feel neglected by society, as government plans and initiatives tend to focus primarily on the elderly and youth, overlooking other target groups that also require attention. Overall, it can be seen that there is a relationship between health factors and loneliness.

2.3.5 Life events

The final topic that has been found to have a relationship with loneliness is the topic life events. This includes specific experiences that individuals go through. For example, someone is more likely to experience feelings of loneliness after recently relocating to a new area. Being unfamiliar with the surroundings and not knowing anyone can result in feelings of isolation (Anderson, 2010; Sbarra, 2015). Additionally, the loss of a partner can lead to feelings of loneliness, as a significant social relationship is suddenly absent. However, this does not immediately lead to chronic loneliness but passing loneliness following such an event can potentially develop into chronic loneliness over time (Guiaux, 2010; Sbarra, 2015).

2.4 Conceptual model

Extensive research has been conducted to explore the general factors associated with loneliness. It has been revealed that socio-demographics, social networks, health status, life events, and one's activities all play significant roles in reducing loneliness. Furthermore, previous studies have found a relationship between built environment factors and loneliness. These findings have been incorporated into a conceptual model, as shown in Figure 2.10. As mentioned earlier, loneliness is not determined by a single factor but is usually the result of a combination of factors. Therefore, relationships between the factors are indicated in the model. For example, an individual who has experienced a major life event may not feel lonely if they engage in sufficient daily activities. Thus, all these factors are related, ultimately leading to feelings of loneliness. This conceptual model serves as the framework for the current research study.

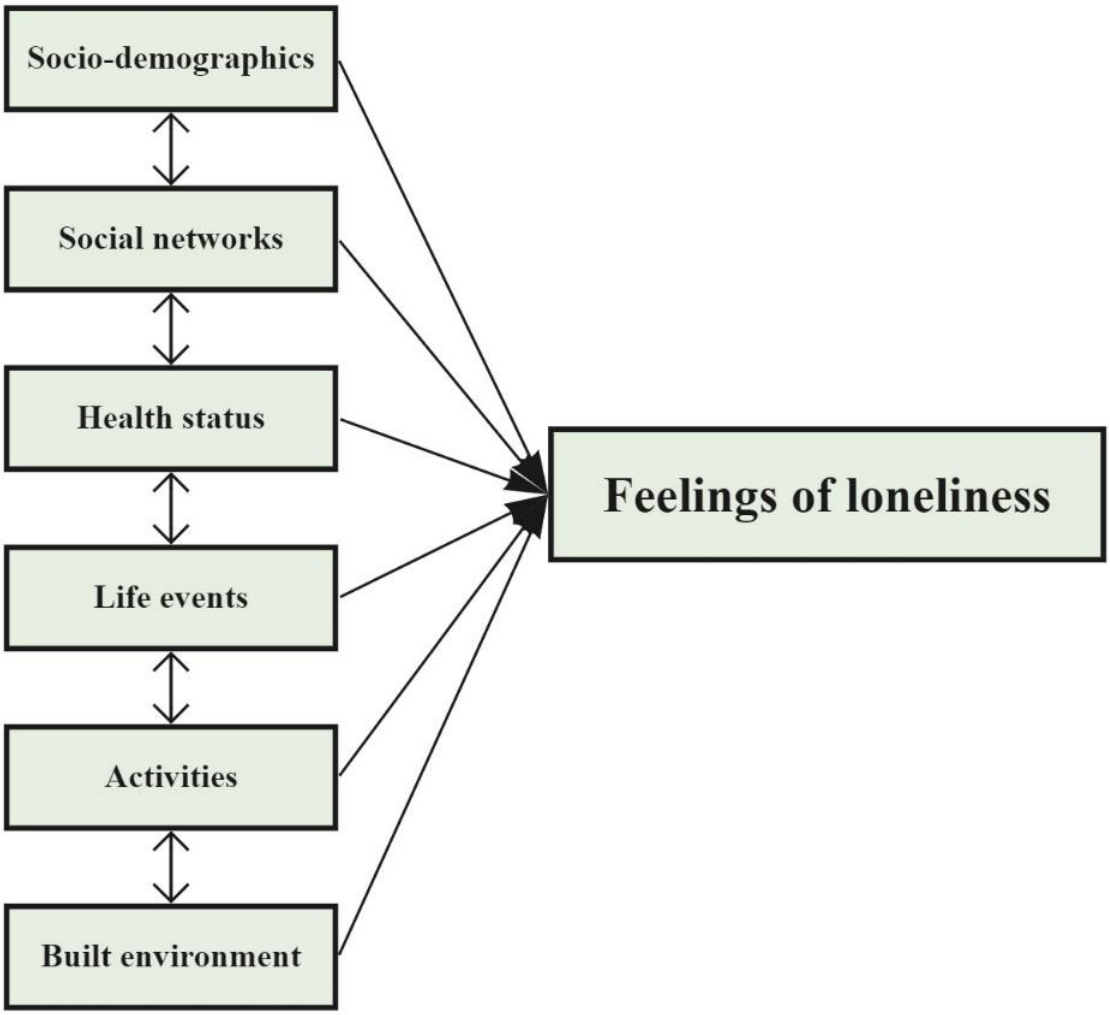


Figure 2.10 - Conceptual model

2.5 Conclusion

In this chapter, three sub questions were answered. The first question that was answered was: '*How can loneliness be defined?*'. Loneliness is defined as a negative situation where someone's existing relationships do not meet up to the expectations or desires of their relationships. The second sub-question that was answered is: '*How is loneliness measured?*'. Different loneliness scales, such as the De Jong-Gierveld scale or the UCLA scale, have been developed to measure feelings of loneliness. The use of one of those scales is the most accurate way to measure loneliness and is therefore recommended. The last question that is answered in this chapter is: '*What factors influence feelings of loneliness?*'. The factors were divided into six topics, namely socio-demographics, social networks, health, activities, life events and lastly built environment, which will be discussed in the next chapter. A lot of relationships were found within those topics. This information is useful because these factors need to be taken into consideration as a control variable when focusing on part II of this study. But these factors can also be relevant at the neighborhood level, as some neighborhoods will for example have a low average income which might be related to higher levels of loneliness.

Chapter 3

Systematic literature review built environment and loneliness

3. Systematic literature review built environment and loneliness

In this chapter, a systematic literature review is conducted about the relationship between loneliness and the built environment. This is done because this will give a reliable analysis and overview (Weber, 2011). A systematic literature review was chosen instead of a scoping review because the sub-question '*What is the relationship between objective and subjective social and physical built environmental factors and feelings of loneliness?*' is specific so this fits best with a systematic literature review. A scoping review is mostly used to answer broad research questions and for new complex topics (Meijers & Bolt, 2021). With a systematic literature review, international evidence about the topic can be uncovered and future research and conflicting results can be identified (Munn et al., 2018).

It was determined to use the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (hereafter PRISMA) method. This method is used because it helps to improve the quality of the report of the systematic literature review (Page et al., 2021). In this process, the PRISMA checklist and flow diagram were used as a guideline for this review.

In this chapter, first, a query should be made first to select the articles used for the review. This is done in section 3.1. After that, all abstracts and titles will be read to make a selection of relevant articles for this study. The articles that are relevant for the study are all read after the selection and an analysis is made to create an overview of the articles. This is done in section 3.2. Next, from all the articles, the variables that were used were identified and divided under different topics. Within these topics, the conclusions for the variables were examined. This can be read in section 3.3. Besides that, an overview table is given in section 3.3. Lastly, a conclusion is written about which variables have a relationship with loneliness and for which variables there is still much uncertainty, which can be seen in section 3.4.

3.1 Query

For the systematic literature review, a query is made to have all possible articles needed for the review. The selection criterion will be formulated in this section and a query will be made. Three categories for the query were identified. The article should have loneliness as keyword as this is the most important topic of this research. Besides that, the article should have a built environment word in the title, abstract or keywords because this makes sure the article is about the built environment. Lastly, the article should have a built environment factor in the title, abstract or keywords because this is the information that is particularly needed for this research. It has been tried to include all possible words in this list but of course it is always possible that words have been forgotten. To avoid this, a number of articles have been reviewed and it has been looked at which words occur in the articles, based on this the list of words has been made together with own ideas. These categories led to the following search words which can be seen in Table 3.1.

Besides the words, there will be filtered on only articles and reviews, the language should be English, and the articles should be written less than 20 years ago, which means articles since 2002 can be used. Research methods are not considered in the selection criteria because all methods could be useful for this research. These criteria let to the following query:

(KEY (lonel*) AND TITLE-ABS-KEY ("urban planning" OR "built environment*" OR "spatial factor*" OR "spatial planning" OR neighb?rhood* OR "living environment*") AND TITLE-ABS-KEY (green* OR "open space*" OR garden* OR nature OR housing OR building* OR facilit* OR utilit* OR amenit* OR "local recource*" OR accessib* OR transport* OR mobility OR safety OR "environment* quality" OR "neighb?rhood attachment" OR walkab* OR recreational OR "residen* characteristics")) AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "re")) AND (LIMIT-TO (LANGUAGE , "English") OR LIMIT-TO (LANGUAGE , "Dutch")) AND (EXCLUDE (PUBYEAR , 1990))

The database that will be used is Scopus. This is a database with peer-reviewed literature. Books, scientific journals and conference proceedings are included in Scopus. This makes the database suitable for this literature review.

Table 3.1 - Query categories

Loneliness	*Built environment*	*Built environment factors*
Lonel*	Urban planning	Green*
	Built environment	Open space*
	Spatial factor*	Garden*
	Neighb?rhood	Nature
	Living environment*	Housing
	Spatial planning	Building*
		Facilit*
		Utilit*
		Amenit*
		Local recource*
		Accessib*
		Transport*
		Mobility
		Safety
		Environment* quality
		Neighb?rhood attachment
		Walkab*
		Recreational
		Residen* characteristics

With this query, 102 documents were found in November 2022. These documents were manually filtered by reading the title and abstract. The inclusion criterion is that articles should make a connection between the built environment and loneliness and loneliness should be the dependent or a mediating variable. So, articles that are only about health, focus on technology or are about the interior of buildings are excluded in the research because those articles are not relevant for this research. 69 articles got excluded as a result from the manual filtering. All articles were retrieved so at the end of the screening process, 33 articles remained in this systematic literature review. After reading all the 33 articles, some articles were not relevant after all. For three of the articles, it appeared that there was no measurable link between the built environment and loneliness which should be included for this review, which is reason 1 of exclusion. For example, one article was about the relationship between loneliness and violence but after reading the article, the violence did not have a relationship with the built environment. Besides that, reason 2 is that three reviews were included and those were already used in section 2.1 to show the relevance of this systematic literature review. The manual filtering process is shown in Figure 3.1.

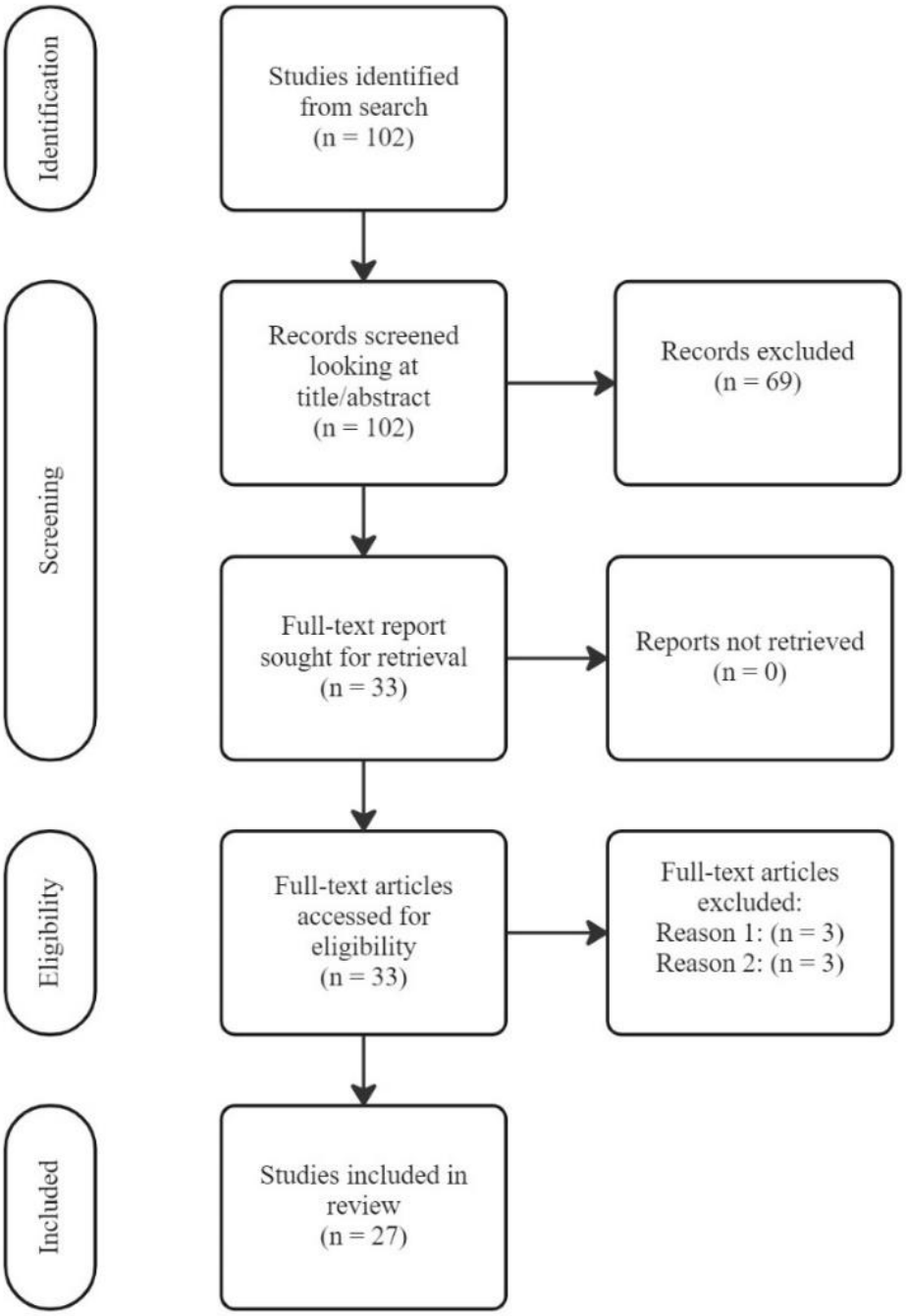


Figure 3.1 – Flow diagram based on PRIMSA (Page et al., 2021)

3.2 General information of the articles

After reading and analyzing all the articles, Table 3.2 was made to make an overview of all the articles, which is shown in the pages below. Besides that, all articles were analyzed, and the general information and data collection is compared with each other.

Table 3.2 - General information about the articles

General information				***Data collection, variables and descriptives***		
Nr.	Title	Authors (publication year)	Country/Setting	Data collection	Target group (nr. respondents)	Loneliness measurement
1	Environmental Influences on Life Satisfaction and Depressive Symptoms Among Older Adults With Multimorbidity: Path Analysis Through Loneliness in the Canadian Longitudinal Study on Aging	Gan, D.R.Y., Wister, A.V., Best, J.R. (2022)	Canada	Quantitative	People aged above 65 with at least 2 chronic diseases (14301)	3-item UCLA loneliness scale
2	Mental health and well-being in times of COVID-19: A mixed-methods study of the role of neighborhood parks, outdoor spaces, and nature among US older adults	Bustamante, G., Guzman, V., Kobayashi, L.C., Finlay, J. (2022)	United States, Columbia, and Puerto Rico	Quantitative & qualitative	People aged above 55 (6551)	3-item UCLA loneliness scale
3	A social exclusion perspective on loneliness in older adults in the Nordic countries	Dahlberg, L., McKee, K.J., Lennartsson, C., Rehnberg, J. (2022)	Sweden, Denmark, Finland and Norway	Qualitative	People aged above 60 (7755)	'how much of the time during the past week have you felt lonely'
4	Loneliness in urbanising China	Chen, J., Gong, L. (2022)	China	Quantitative	People aged 18-75 years (3229)	six-item De Jong Gierveld Loneliness Scale
5	Built Environment and Loneliness Among Older Adults in South East Queensland, Australia	Lam, J., Wang, S. (2022)	Australia	Quantitative	People aged 60 and older (298)	Respondents agree with the statement "I often feel very lonely"
6	Perceptions of neighborhood environment and loneliness among older Chinese adults: the mediator role of cognitive and structural social capital	Mao, S., Lou, V.W.Q., Lu, N. (2021)	China	Qualitative	people aged 60 years and older (472)	Six item De Jong Gierveld scale
7	Loneliness mediates the relationships between perceived neighborhood characteristics and cognition in middle-aged and older adults	Yu, X., Yang, J., Yin, Z., Jiang, W., Zhang, D. (2021)	United States	Quantitative	People aged above 50 (15142)	R-UCLA Loneliness Scale

8	Calculating a national Anomie Density Ratio: Measuring the patterns of loneliness and social isolation across the UK's residential density gradient using results from the UK Biobank study	Lai, K.Y., Sarkar, C., Kumari, S., (...), Gallacher, J., Webster, C. (2021)	United Kingdom	Quantitative	People aged 37 - 73 (390169)	Through two questions: "Do you often feel lonely?" And "How often are you able to confide in someone close to you?"
9	Social and physical neighbourhood characteristics and loneliness among older adults: Results from the MINDMAP project	Timmermans, E., Motoc, I., Noordzij, J.M., (...), Van Lenthe, F.J., Huisman, M. (2021)	The Netherlands	Quantitative	People aged 63 and older (1959)	11-item and six-item the De Jong Gierveld Loneliness Scale
10	In a Lonely Place: Investigating Regional Differences in Loneliness	Buecker, S., Ebert, T., Götz, F.M., Entringer, T.M., Luhmann, M. (2021)	Germany	Quantitative	All age groups (17602)	3-item UCLA
11	'Trapped', 'anxious' and 'traumatised': COVID-19 intensified the impact of housing inequality on Australians' mental health	Bower, M., Buckle, C., Rugel, E., (...), Phibbs, P., Teesson, M. (2021)	Australia	Quantitative	People above 18 (2065)	Six-item De Jong Gierveld Loneliness Scale
12	Examine the associations between perceived neighborhood conditions, physical activity, and mental health during the COVID-19 pandemic	Yang, Y., Xiang, X. (2021)	United States	Quantitative	All age groups (2667)	Three-item loneliness scale (three questions from R-UCLA scale)
13	The association between perceived social and physical environment and mental health among older adults: mediating effects of loneliness	Domènech-Abella, J., Switsers, L., Mundó, J., (...), Dury, S., De Donder, L. (2021)	Belgium	Qualitative	People aged 60 and older (869)	Six-item De Jong Gierveld scale
14	Lonely places or lonely people? Investigating the relationship between loneliness and place of residence	Victor, C.R., Pikhartova, J. (2020)	England	Quantitative	aged 50 years and older (4663)	UCLA scale and asked participants to evaluate how often they felt lonely in their area of residence

15	Loneliness and depression among older European adults: The role of perceived neighborhood built environment	Domènech-Abella, J., Mundó, J., Leonardi, M., (...), Haro, J.M., Olaya, B. (2020)	Finland, Poland and Spain	Qualitative	Older European adults (5912)	Three-item UCLA Loneliness Scale
16	Sense of community, loneliness, and satisfaction in five elder cohousing neighborhoods	Glass, A.P. (2020)	United States	Quantitative	People aged over 55 years living in a cohousing community (86)	Three-item Revised UCLA Loneliness Scale
17	Risk factors for loneliness: The high relative importance of age versus other factors	Shovestul, B., Han, J., Germine, L., Dodell-Feder, D. (2020)	United States	Quantitative	People aged 10–97 years (4536)	three-item UCLA Loneliness Scale
18	Loneliness and life satisfaction explained by public-space use and mobility patterns	Bergefurt, L., Kemperman, A., van den Berg, P., (...), Oosterhuis, G., Hommel, M. (2019)	The Netherlands	Quantitative	People aged above 18 years (200)	Three-item loneliness scale
19	Loneliness and Neighborhood Characteristics: A Multi-Informant, Nationally Representative Study of Young Adults	Matthews, T., Odgers, C.L., Danese, A., (...), Moffitt, T.E., Arseneault, L. (2019)	England and Wales	Qualitative	Twins born in 1994 and 1995 (2232)	four items from UCLA loneliness scale and three items from children's depression inventory (CDI)
20	Loneliness amongst low-socioeconomic status elderly singaporeans and its association with perceptions of the neighbourhood environment	En Wee, L., Tsang, T.Y.Y., Yi, H., (...), Oen, K., Koh, G.C.H. (2019)	Singapore	Quantitative	Residents aged 60 years and older (528)	UCLA Loneliness Scale
21	Loneliness of older adults: Social network and the living environment	Kemperman, A., Van Den Berg, P., Weijs-Perrée, M., Uijtdewillegen, K. (2019)	The Netherlands	Quantitative	65+ aged inhabitants of west Brabant region (182)	6-item De Jong Gierveld loneliness scale
22	Social isolation and loneliness in later life: A parallel convergent mixed-methods case study of older adults and their residential	Finlay, J.M., Kobayashi, L.C. (2018)	United States	Qualitative	People aged above 55 (124)	Through the question: "Do you feel lonely?"

	contexts in the Minneapolis metropolitan area, USA					
23	Associations between perceived neighborhood walkability and walking time, wellbeing, and loneliness in community-dwelling older Chinese people in Hong Kong	Yu, R., Cheung, O., Lau, K., Woo, J. (2017)	China	Quantitative	People aged above 60 living in community-dwelling (181)	Six-item De Jong Gierveld Loneliness Scale
24	Ageing and loneliness: The role of mobility and the built environment	van den Berg, P., Kemperman, A., de Kleijn, B., Borgers, A. (2016)	The Netherlands	Quantitative	People aged between 35 and 75+ (344)	‘‘to what extent do you agree with the statement: I experience social isolation/loneliness?’’
25	Factors influencing social satisfaction and loneliness: A path analysis	Weijs-Perrée, M., Van den Berg, P., Arentze, T., Kemperman, A. (2015)	The Netherlands	Quantitative	People aged above 40 years (177)	Six-items UCLA loneliness scale
26	Social contacts as a possible mechanism behind the relation between green space and health	Maas, J., van Dillen, S.M.E., Verheij, R.A., Groenewegen, P.P. (2009)	The Netherlands	Quantitative	People aged above 12 years (10089)	Six-items based on the UCLA Loneliness Scale
27	Objective and perceived neighborhood environment, individual SES and psychosocial factors, and self-rated health: An analysis of older adults in Cook County, Illinois	Wen, M., Hawkley, L.C., Cacioppo, J.T. (2006)	United States	Quantitative	People aged between 50 to 67 years (214)	R-UCLA scale (20-items)

For all the articles shown in Table 3.2, the general information and data collection is compared. In Figure 3.2, the distribution of the publication year can be seen. Looking at the publication year, eight articles were published in 2021, which is 29% of all the articles. Because of this, it can be concluded that loneliness and especially the relationship between the built environment and loneliness is a relevant topic that gets more attention these days. In 2022, 2020 and 2019 there were also more publications than the years before. In Figure 3.3, the location of the studies is shown. Most of the studies, namely fifteen, were done in Europe, from which six were performed in the Netherlands. From the other nine studies performed in Europe, 3 were conducted in the UK, 2 in Nordic countries and in Belgium, Spain, Poland and Belgium one research is conducted. The most articles written in one country were found in the United States, seven studies were performed here.

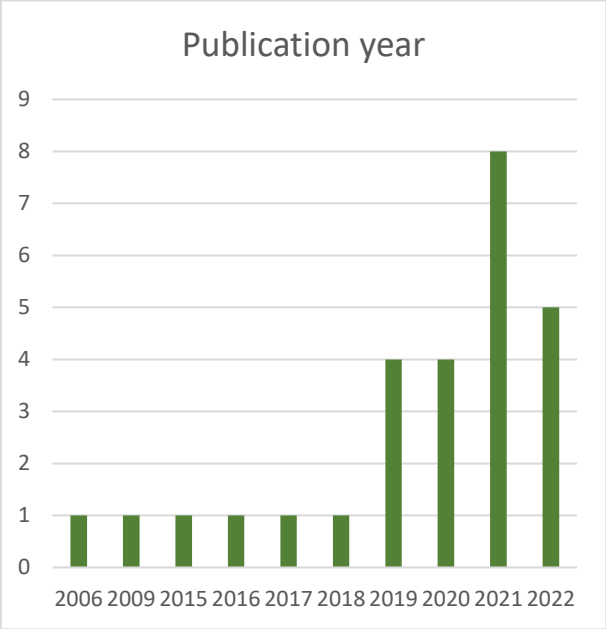


Figure 3.2 - Publication year of the articles

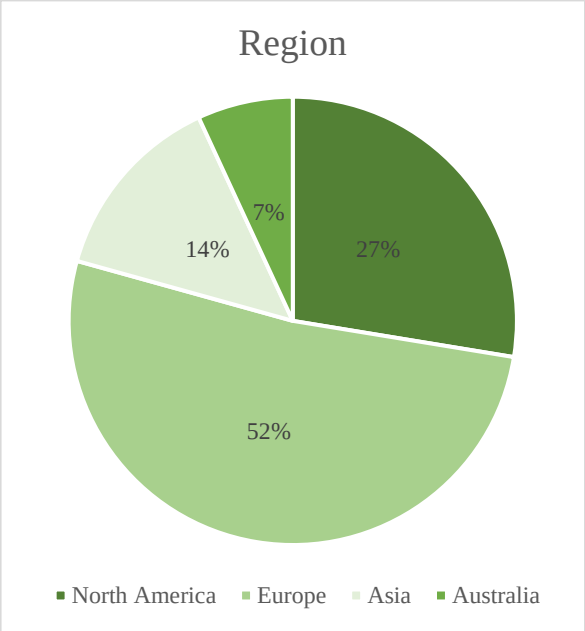


Figure 3.3 - Region of research from the articles

When looking at age, it was found that a lot of the articles only take people aged above 50 into account as can been seen in Figure 3.4. Only two articles examined loneliness of children (aged above 12) in their research. This could be the case because lonely people are often assumed to be elderly while it is seen that the younger generations also feel lonely (Centraal Bureau voor de Statistiek, 2022; van der A et al., 2021). More research is needed into the other age groups and their relationship with loneliness. In Figure 3.5, it can be seen that 75% of the studies are quantitative studies and 25% are qualitative studies.

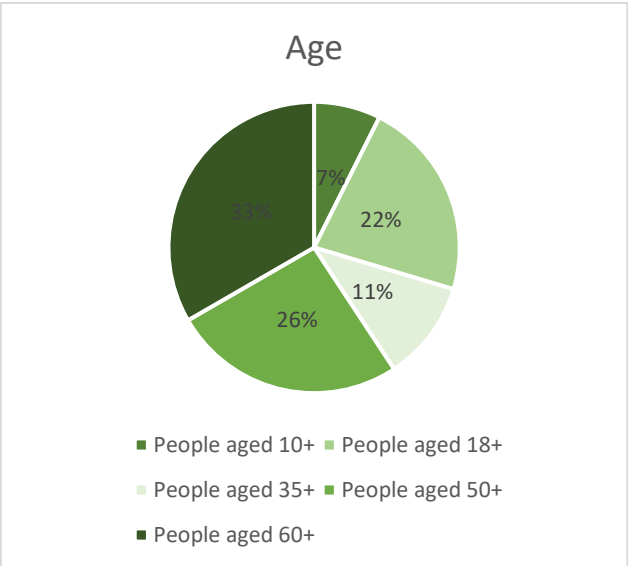


Figure 3.4 - Age target group from the articles

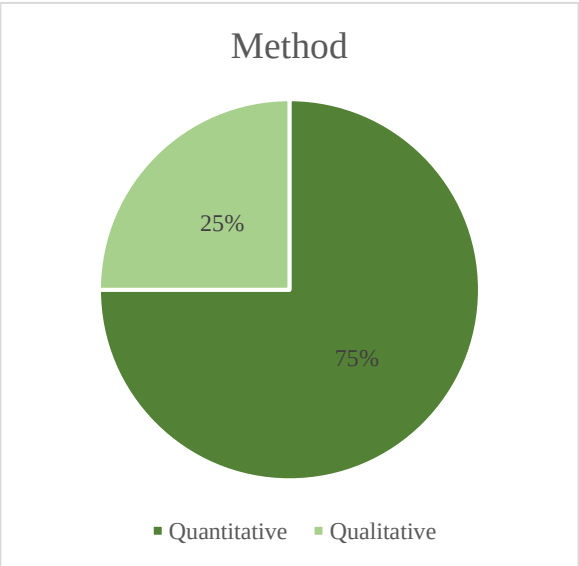


Figure 3.5 - Research method of the articles

Lastly, the loneliness scale used in the research is shown in Figure 3.6. 56% of the articles used one of the UCLA loneliness scales. Within this 52%, 8 articles used the 3-item UCLA scale, four articles used the full UCLA scale, two articles used the 6-item UCLA scale and 1 article used a 4-item UCLA loneliness scale. 26% of the articles used the De Jong Gierveld loneliness scale. All of the articles used the 6-item De Jong Gierveld scale. 19% did not use one of the two loneliness scales but used other question(s). Four articles used a single question to measure loneliness and one article used multiple questions to measure loneliness.

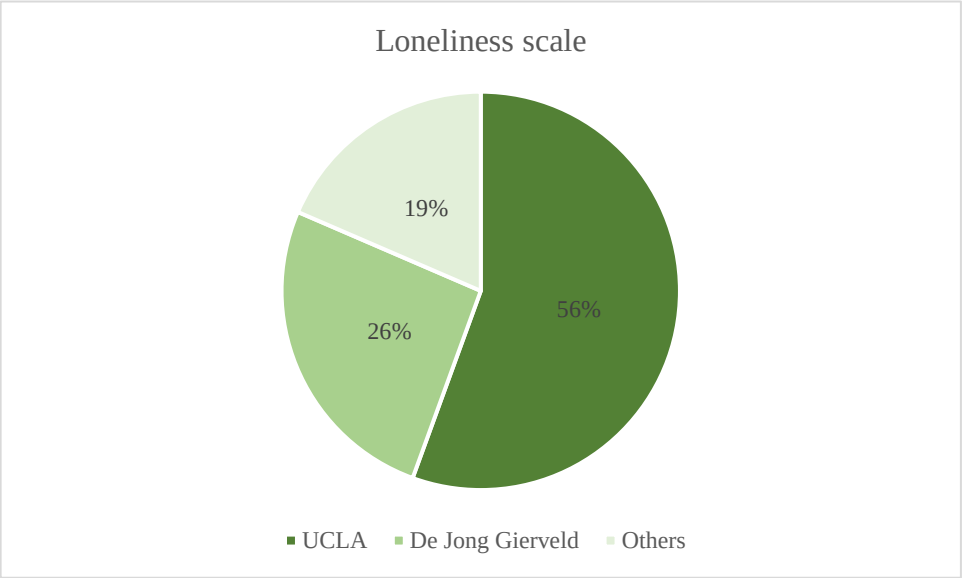


Figure 3.6 - Loneliness scales of the articles

3.3 Built environment variables

After reading the articles, the variables used in each study were collected to get a clear overview of results. Several built environment variables have been identified and these are categorized into different categories. The different categories can be seen in the left column in Table 3.3. In the right columns, the variables that belong to the category are shown. Each article is analyzed and the variables that were examined in the articles are linked to a category, which is also shown in Table 3.3. This is divided into objective and subjective variables. Some of the categories are only objectively or subjectively measured. For example, the neighborhood quality is only measured subjectively, which means respondents indicated what they thought about the quality of the neighborhood and a researcher did not examine the quality by oneself. Whereas objective variables are variables that are a fact, for instance the number of shops in a neighborhood or the residential density.

Table 3.3 – Built environment categories and variables

	Objective	*Subjective*
Dwelling	Housing type (4, 5, 11, 24); outside space (11); Owner-occupied (4, 25); Rental (11, 20); Major structural/physical problem (11); Natural light in dwelling (11)	Perceived dwelling affordability (11); Housing quality (1); frequency bothered by noise (11)
	Neighborhood	
General quality		Neighborhood quality (27); aesthetics (12, 23); perceptions of neighborhood physical environment (20); Neighborhood satisfaction (23)
Amenities	Land use mix access (9); Accessibility (10, 13, 21, 24)	BE usability/land use mix-access (15, 23); Satisfaction with facilities/recreational services (6, 21, 24); Satisfaction with community health care (6)
Urban density	Neighborhood type/density (4, 8, 10, 12, 14, 17, 21, 22, 24, 25, 26); Unoccupied dwellings (9); Population and household income density (17)	
Mobility/infra	Street type (22); Sidewalks (22); Distance to public transport (10)	Mobility (13); Public transportation convenience (6); Traffic density (12, 13); Traffic safety (23); Street connectivity (23); Walkability (15, 18, 23); Barrier for walking (12, 23); Sidewalks (12)
Green	Percentage of green/distance to green (2, 10, 21, 24, 26)	
Neighborhood composition	Neighborhood composition (5); Percentage of non-Western ethnic minorities (25); age density (17); sex density (17); race density (17); ethnic density (17); percentage of low educated residents (9)	
SES	Neighborhood SES (27); deprivation (14); neighborhood poverty (12); average income (9, 17); percentage of social security beneficiaries (9)	Neighborhood disorder (20)
Social safety	Number of criminal offences (9)	Safety (3, 6, 7, 13, 21); crime (12); neighborhood disadvantage (7)
Social environment		Social cohesion (1, 7, 12, 13, 18, 25); neighborhood belonging (11); neighborhood attachment (18, 21, 25); advantages to living in a community (16); relation to neighbors (10); Social capital (6); Satisfaction to living in a community (16)

In the following sections, the results of each category are discussed.

3.3.1 Dwelling

Seven articles researched one or multiple variables about the effects of dwelling characteristics on loneliness. Bower et al. (2021) and van den Berg et al. (2016) examined the effects of living in an apartment on loneliness. Bower et al. (2021) found that living in an apartment does not affect loneliness. Van den Berg et al. (2016) did find a significant relationship between loneliness and living in an apartment. They found that living in an apartment positively influences loneliness, which means that people living in an apartment feel lonelier than people who live in a house. Lam & Wang (2022) took the percentage of separated houses in a neighborhood into account in their research. The percentages of separated houses in a neighborhood did not have a significant effect on loneliness (Lam & Wang, 2022). Chen & Gong (2021) did very extensive research about the effects of housing on loneliness. In this study, self-built-, commercial-, public-, resettlement-, and temporary housing were examined. For all those variables, an insignificant result was found which means no relationship between loneliness and those housing types was found. Because of that, it seems that the housing type has no relationship to loneliness.

Four of the articles took housing tenure into account in their research. Chen & Gong (2021) and Weijs-Perrée et al. (2015) found no significant relationship between being a homeowner and feelings of loneliness. Bower et al. (2021) and En Wee et al. (2019) examined the relationship between loneliness and living in a rental house. Bower et al. (2021) did not find a relationship between those variables. En Wee et al. (2019) did find a significant relationship, which was a positive relationship. This means living in a rental house increases feelings of loneliness. This difference in results could be explained by the fact that En Wee et al. (2019) only examined elderly with a low socio-economic status and this target group is already more likely to feel lonely. Therefore, it can be concluded that there is no relationship between housing tenure and loneliness.

Besides the housing type and homeownership, Bower et al. (2021) examined if the presence of an outside space, a major structural problem and natural light in the dwelling has an influence on feelings of loneliness. No relationship was found for the presence of outside space and loneliness. A major structural or physical problem to the dwelling gives a significant positive result. A dwelling with structural or physical problems increases the likelihood of feelings of loneliness. Natural light in the dwelling is also significant and is negatively associated with loneliness. This means that people who live in a dwelling with natural light are less likely to feel lonely (Bower et al., 2021). But because only one article examined these variables, it is hard to draw a proper conclusion so more research is advised.

Only two articles examined subjective dwelling characteristics, namely the perceived dwelling affordability which was included in the study of Bower et al. (2021), the perceived housing quality which Gan et al. (2022) examined and the frequency of bothered by noise, which is examined by Bower et al. (2021). For both variables, a non-significant result was obtained. Bower et al. (2021) did find a significant result for the frequency of bothered by noise in a neighborhood. A positive result was found, which means if people feel like they are very often bothered by noise, they are more likely to feel lonely. For the subjective variables within the topic Dwelling, it is not possible to draw a proper conclusion because only two of the 27 articles examined this. Therefore, this subject should be examined in further research.

Neighborhood

3.3.2 General quality

There are several general neighborhood characteristics examined, namely neighborhood quality, satisfaction, aesthetics and physical environment, which are all perceived variables. The perceived neighborhood quality was examined by Wen et al. (2006) and they found a significant negative result. This means that people living in a neighborhood that has a high perceived quality are less lonely. The perceptions of neighborhood physical environment are examined by En Wee et al. (2019) and a negative relationship was found. If the perceptions of the neighborhood physical environment are improved,

people are less likely to feel lonely. Yang & Xiang (2021) and Yu et al. (2017) examined the perceived aesthetics of the neighborhood. Yu et al. (2017) did not find a significant result for this variable. In the article of Yang & Xiang (2021) a significant relationship was found. They examined the effects of an increased perceived neighborhood aesthetics and found a significant positive result. So, if a neighborhood's aesthetics are improved, people can feel lonelier. This is in contrast with the initial expectations. This may be due to the fact that the study was only conducted during the pandemic, so it was not known how lonely people were before the pandemic and what influence this had on the appreciation of the neighborhood.

It can be concluded that the perceptions of the neighborhood physical environment have a relationship with loneliness. This variable is closely related to the perceived neighborhood quality, so it is assumed that this variable also has a relationship with loneliness. The relationship between neighborhood aesthetics and loneliness should be examined more in future research.

Van den Berg et al. (2016) examined the effect of neighborhood satisfaction on loneliness. They found a significant negative relationship. This implies that people who are very satisfied with their neighborhood are less likely to feel lonely. According to van den Berg et al. (2016), a high satisfaction might imply that residents are more integrated in the neighborhood and have a greater number of social contacts there. This is in line with the previously examined variables. Therefore, it seems that there is a relationship between neighborhood satisfaction and loneliness.

3.3.3 Amenities

Several studies were done about the effect of amenities on loneliness. Six articles looked at objective amenities and three articles took subjective amenities into account in their research. The subjective amenities are, for example, the usability of the built environment and the satisfaction with the facilities. Timmermans et al. (2021) examined the effect of land use mix access on loneliness. Land use mix access is the availability and accessibility of different facilities in the neighborhood. In the article, no relationship was found. For accessibility of the neighborhood, several distances to amenities were considered. For the distance to shops and the availability of basic services, Domènech-Abella et al. (2021), Kemperman et al. (2019) and van den Berg et al. (2016) all found no relationship. Buecker et al. (2021) examined the effect of distance to the nearest city center on loneliness, which could be similar to the distance of shops, and also found no relationship. Buecker et al. (2021) did find a significant positive relationship between the distance to sport and leisure facilities and feelings of loneliness. This means that people who live far away from sports and leisure facilities are more likely to feel lonely. The last variable in the category accessibility is distance to a highway. Van den Berg et al. (2016) examined this and found a significant positive relationship. People who live far away from a highway are more likely to feel lonely.

For the objective variables within the topic Amenities, it can be concluded that there is no relationship between the distance to shops and loneliness. There seems to be no relationship between the land use mix and loneliness, but further research is needed within this topic. For the distance to sport and leisure facilities and the distance to a highway it is hard to draw a proper conclusion as only one article took the variable into account in their research. It seems that there is a positive relationship between de variables and loneliness, but further research can provide stronger conclusions about this.

The subjective variables are built environment usability, satisfaction with recreational services and facilities and satisfaction with community health care in the neighborhood. Domènech-Abella et al. (2020) and Yu et al. (2017) examined the effect of perceived land use mix and built environment usability. The built environment usability is defined with several items, namely: useful and interesting places to go, transit stops close to living place, the ease of use and entrance of public transport and seating areas in the neighborhood. The perceived land use mix access is only measured with two items which are many places to go within walking distance from home and it is difficult to walk in my

neighborhood because the streets are hilly. Yu et al. (2017) did not find a relationship between the perceived land use mix access. However, Domènech-Abella et al. (2020) did find a significant negative relationship between the perceived built environment usability and loneliness. This means that if people feel like their neighborhood is very usable, they are less likely to experience feelings of loneliness. Three of the studies examined the effect of satisfaction with facilities and recreational services on loneliness. Mao et al. (2022) found a significant negative relationship between the satisfaction with recreational services in the neighborhood and loneliness. Van den Berg et al. (2016) examined the influence of satisfaction with facilities on loneliness and found a significant negative influence. This means that if people are very satisfied with the facilities and recreational services in their neighborhood, they are less likely to feel lonely. Kemperman et al. (2019) found an indirect negative link where satisfaction with the social network was the mediating variable. Lastly, the satisfaction with community health care was examined by Mao et al. (2022). An indirect negative relationship was found. The mediating variable in this case is cognitive social capital. This means that if the satisfaction with community health care is higher, people have more cognitive social capital and feel less lonely because of that (Mao et al., 2022).

For the subjective variables within this category, it can be concluded that the satisfaction with facilities in the neighborhood is related to feelings of loneliness. A contradictory result was found for the perceived land use mix and usability. This could be the case because both articles took other variables into account. This would mean that transit stops close to living place, the ease of use and entrance of public transport and seating areas in the neighborhood have a relationship with loneliness. This is, however, hard to conclude with only one article examining this. Therefore, the perceived usability of the neighborhood should be examined in future research. Lastly, only one article examined the relationship between community health care and loneliness. It seems that there is a relationship and future research can strengthen this link.

3.3.4 Urban density

A lot of research has been conducted about the effects on loneliness of living in a dense area. Yang & Xiang (2021), Victor & Pikhartova (2020), Kemperman et al. (2019), Finlay & Kobayashi (2018) and Weijs-Perrée et al. (2015) examined the relationship between urban density and loneliness. The variable urban density is in most articles explained as urban, suburban and rural areas. Maas et al. (2009) examined the relationship between the number of households per km^2 and loneliness and van den Berg et al. (2016) examined the number of addresses per km^2. Chen & Gong (2022), Buecker et al. (2021) and Shovestul et al. (2020) examined the relationship between population density and loneliness, which is closely related to the other density types given above. Chen & Gong (2022), Victor & Pikhartova (2020) and Finlay & Kobayashi (2018) found a positive relationship between density and loneliness. This means that living in a high-density area increases the chances of feeling lonely. However, Buecker et al. (2021), Yang & Xiang (2021), Shovestul et al. (2020), Kemperman et al. (2019), van den Berg et al. (2016), Weijs-Perrée et al. (2015) and Maas et al. (2009) did not find a relationship between urban density and loneliness. Therefore, there is no strong evidence for a relationship between density and loneliness because seven articles found no relationship and only three did find a relationship. However, more research can provide stronger evidence about this variable in relationship to loneliness. Finlay & Kobayashi (2018) examined the effect of residential density on loneliness and Lai et al. (2021) examined the relationship between neighborhood density, where population, lot, housing, green and road density was included, and loneliness. Both articles found a positive relationship with loneliness. This means that people living in a neighborhood with a high residential density are more likely to feel lonely. Because two articles both found a positive relationship, it can be concluded that the residential density has a relationship with loneliness.

Timmermans et al. (2021) examined the relationship between the percentage of unoccupied dwellings and loneliness. No relationship was found. Lastly, Shovestul et al. (2020) took the population and household income density into account as one variable. Shovestul et al. (2020) found a positive

relationship between the variable and loneliness. This means that people living in a neighborhood with a high population and household income density are more likely to feel lonely. Because for both variables only one article examined this, it is hard to draw a proper conclusion. Therefore, more research about those categories is recommended.

3.3.5 Mobility

For the subject mobility, both objective and subjective variables were examined. Finlay & Kobayashi (2018) looked at the effects of different street types on loneliness. Main roads were used as baseline and avenues and residential roads were. A significant relationship between avenues and residential roads and loneliness was found, which was negative. The presence of avenues and residential roads in the neighborhood reduces feelings of loneliness. Besides these roads, Finlay & Kobayashi (2018) examined the influence of having sidewalks in the neighborhood on loneliness. A significant negative relationship was found for this variable. This means that the presence of sidewalks in a neighborhood decreases feelings of loneliness. The last objective variable is the distance to public transport. Buecker et al. (2021) did not find a relationship between the distance to public transport and loneliness. It seems that there are some relationships between objective variables within this category and loneliness but there was not enough research about this to draw proper conclusion. Therefore, more research into this is recommended.

In the subjective variables, public transportation convenience was examined, which has similarities with distance to public transport. Mao et al. (2022) found a significant negative relationship between public transportation convenience and loneliness. This means that if people have the feeling that the public transport in their neighborhood is very convenient, they are less likely to feel lonely. This is in contrast with the study of Buecker et al. (2021) who did not find a relationship between the distance to public transport and loneliness. Domènech-Abella et al. (2020) found a relationship between perceived usability, which belonged to the topic Amenities, and loneliness. Within this variable, public transport was taken into account. Because of that, it seems that there is a relationship between public transportation convenience and loneliness. Future research can provide more evidence about this relationship.

Domènech-Abella et al. (2021) examined the effect of perceived mobility on loneliness. A significant negative result was found for this variable. Thus, by increasing the perceived mobility in a neighborhood, loneliness can be reduced. The perceived traffic density in the neighborhood was examined by Yang & Xiang (2021) and Domènech-Abella et al. (2021). Domènech-Abella et al. (2021) found no relationship while Yang & Xiang (2021) found a significant negative relationship, which is in contrast with each other. Yang & Xiang (2021) examined the relationship between changes in the traffic density during the COVID-19 pandemic and loneliness and say that decreased traffic density increases feelings of loneliness, but this could also be linked to feelings of loneliness because of the pandemic. Yu et al. (2017) examined the effect of perceived traffic safety on loneliness, but no relationship was found. Besides the perceived traffic safety, Yu et al. (2017) examined the relationship between street connectivity and loneliness, but they did not find a relationship. It seems that there is no relationship between the traffic density and loneliness and between street connectivity and loneliness. There does seem to be a relationship between perceived mobility and loneliness. However, not a lot of research has been done about these variables so they could be included in future research.

Four articles examined variables related to walking. Domènech-Abella et al. (2020), Bergefurt et al. (2019) and Yu et al. (2017) examined the perceived walkability in a neighborhood. Domènech-Abella et al. (2020) and Yu et al. (2017) found a significant negative relationship between perceived neighborhood walkability and loneliness. This means that people who live in a neighborhood with a high perceived walkability feel less lonely. However, Bergefurt et al. (2019) did not find a relationship which is in contrast with the other two articles. This could be due to the fact that Domènech-Abella et al. (2020) and Yu et al. (2017) only included elderly in their research and Bergefurt et al. (2019) included

all people above 18 years who may notice a low perceived walkability less or are less bothered by it. Yang & Xiang (2021) asked their respondents if there were sidewalks in their neighborhoods. No relationship was found between the perceived presence of sidewalks and loneliness (Yang & Xiang, 2021). Lastly, two articles examined the effect of perceived crime and violence in the neighborhood which was perceived as a barrier of walking on loneliness. Yu et al. (2017) did not find a relationship, but Yang & Xiang (2021) did find a relationship. According to Yang & Xiang (2021) if crime and violence in the neighborhood feels like a barrier for walking, people are more likely to experience feelings of loneliness. This could be explained by the difference in location of both studies. Yang & Xiang (2021) did their research in the United States while Yu et al. (2017) examined residents of Hong Kong. It could be that people in general feel safer in China.

To conclude, a relationship between the perceived walkability of elderly and loneliness was found. This is probably not the case for younger generations. It seems that there is no relationship between the perceived presence of sidewalks and loneliness but only one article examined this so future research can be done about this variable. Lastly, it is not possible to draw a proper conclusion about the relationship between the crime and violence in a neighborhood as a barrier of walking and loneliness, but it seems that this is location dependent as one study was performed in China and one in the United States.

3.3.6 Green

Only five of the twenty-six articles took objective green spaces into account. Bustamante et al. (2022), Kemperman et al. (2019) and van den Berg et al. (2016) did not find a relationship between the amount of green or the distance to green and loneliness. Buecker et al. (2021) and Maas et al. (2009) found that the amount of green is negatively related to loneliness. In the case of the article of Buecker et al. (2021), the bigger the distance to a park, the lonelier people feel. The article of Maas et al. (2009) took the average percentage of green space in a 1 km radius and in a 3 km radius. They found that with both the 1 km radius and the 3 km radius there is a significant relationship to loneliness. This means that people who live in neighborhoods with more green space are likely to feel less lonely. With only two articles finding a relationship between the distance and amount of green in a neighborhood and loneliness and three articles not finding a relationship and no articles looking at subjective variables, more research about this category is needed.

3.3.7 Neighborhood composition

Four articles took objective neighborhood composition variables into account. Lam & Wang (2022) examined the effects of the neighborhood composition on loneliness. Within this variable, Lam & Wang (2022) looked at minority, cultural diversity and if people speak good English. Weijs-Perrée et al. (2015) only took the percentage of non-Western ethnic minorities into account and Shovestul et al. (2020) examined the relationship between ethnic density and loneliness and between race density and loneliness. None of the articles found a relationship between the examined variable and loneliness. Because of that, it seems that the ethnic background in neighborhoods does not have an effect on loneliness.

Shovestul et al. (2020) also examined the relationship between age- and sex density and loneliness. No relationship was found for both variables. Because only one article examined the effects of age- and sex density on loneliness, it is not possible to draw a proper conclusion. Therefore, it is recommended to take the variables into account in future research. Overall, it can be seen that for all the variables in the topic Neighborhood composition, no relationship with feelings of loneliness was found so there seems to be no relationship between the neighborhood composition and feelings of loneliness.

3.3.8 SES

SES is the socioeconomic status of the neighborhood. Five articles included objective variables of SES in their research and one article included a subjective variable of SES. Wen et al. (2006) included neighborhood SES in their research and examined the relationship between SES and self-rated health with loneliness as a mediating variable. No relationship was found in their research.

Victor & Pikhartova (2020) examined the relationship between deprivation and loneliness. Deprivation is measured by income, employment, education, health, crime, barriers to housing and services and the living environment (Ministry of Housing Communities & Local Government, 2019). No relationship was found between deprivation and loneliness (Victor & Pikhartova, 2020).

Yang & Xiang (2021) included the percentage of families living below the poverty threshold within a zip-code, Timmermans et al. (2021) included the average income of the neighborhood and the percentage of social security beneficiaries and Shovestul et al. (2020) included the median household income in their study. Yang & Xiang (2021) and Timmermans et al. (2021) did not find a relationship between income levels in the neighborhood and loneliness. The percentage of social security beneficiaries was measured as the percentage of residents that received general social assistance. No relationship was found between this variable and loneliness. However, Shovestul et al. (2020) did find a negative relationship between median household income and loneliness. This means that people who live in a neighborhood with a higher median household income are less likely to feel lonely.

Timmermans et al. (2021) also included the percentage of low-educated residents in their research but did not find a relationship between the variable and feelings of loneliness. This is probably closely related to the average income. To conclude, there seems to be no relationship between the socioeconomic status of the neighborhood and loneliness as four articles do not find a relationship. Only one article found a relationship between the median household income and loneliness. This could be examined in future research but for now there does not seem to be a relationship.

En Wee et al. (2019) examined the relationship between perceived neighborhood disadvantage, which is the only subjective variable within this category, and loneliness. In the article of En Wee et al. (2019) the perceived neighborhood disadvantage was measured with a 4-point Likert scale. En Wee et al. (2019) found a significant positive relationship between neighborhood disadvantage and loneliness. This means that people living in a more disadvantaged neighborhood are more likely to feel lonely. However, because only one article examined this, it is not possible to draw a firm conclusion. Therefore, future research is needed within this category.

3.3.9 Social safety

For the subject social safety, one article that took an objective variable into account and seven articles that took subjective variables into account were found. Timmermans et al. (2021) examined the effect of number of criminal offences per 1000 residents in a neighborhood on loneliness. No relationship was found for this variable. Yang & Xiang (2021) included perceived crime in their study but did not find a relationship with loneliness. Since only two articles have examined this, more research is needed on this category, but it seems that there is no relationship between (perceived) crime and loneliness.

Five articles examined the effect of perceived neighborhood safety on loneliness. Dahlberg et al. (2022) and Kemperman et al. (2019) included the perceived safety at night in their study, which is assumed to be a time when people feel less safe. Dahlberg et al. (2022), Mao et al. (2022), Yu et al. (2021) and Domènech-Abella et al. (2021) examined the direct relationship between perceived safety and loneliness and found a negative relationship. Mao et al. (2022) also examined the relationship between safety, cognitive social capital and loneliness and found a relationship here as well. Kemperman et al. (2019) found a significant relationship between neighborhood safety, neighborhood satisfaction and loneliness and with neighborhood safety, neighborhood attachment and loneliness. With all this evidence, it can be concluded that perceived safety in a neighborhood has a negative effect on loneliness. This means that people who feel that they live in a safe neighborhood are less likely to feel lonely.

Yu et al. (2021) examined the effect of neighborhood disorder on loneliness. Mao et al. (2022) included neighborhood disorder in neighborhood safety but did not use two separate variables. Yu et al. (2021) asked five questions to measure the perceived physical disorder and measured whether graffiti, vacant buildings and houses, trash, abandoned cars and unmaintained yards formed an issue in the

neighborhood. Yu et al. (2021) found a significant positive relationship between neighborhood disorder and loneliness. This means that people living in neighborhoods with more disorder are more likely to feel lonely. However, as only one article included this variable in their research, more research is needed about this category.

It can be concluded that safety variables in a neighborhood affect loneliness. Residents should feel safe in their neighborhood. Neighborhood disorder should be controlled because there seems to be a relationship, but future research is recommended. The number of crimes in a neighborhood does not seem to have a relationship with loneliness but this should be examined in future research because only two articles included this.

3.3.10 Social environment

For the subject social environment, all perceived variables including social variables in a neighborhood are included namely social capital, social cohesion, sense of community, neighborhood belonging, neighborhood attachment and relation to neighbors. All the articles included subjective variables.

Mao et al. (2022) measured the effect of cognitive and structural social capital on loneliness. To examine cognitive social capital, residents' trust in others, reciprocity and sense of belonging were examined. For structural social capital the social network and social participation were examined. This is not an actual built environment variable, but because it was asked whether people do something for the local community, it was included in this study. For both variables, a significant negative relationship was found (Mao et al., 2022). This means that good social capital can reduce loneliness. However, since only one article included these variables, it is not possible to provide a firm conclusion so more research is needed.

Glass (2020) examined something similar, namely the satisfaction with the sense of community. This was measured with several questions about group membership, the fulfillment the neighborhood offers, the influence and the emotional connection. Glass (2020) found a significant negative relationship between satisfaction with the sense of community and loneliness. So, if people are very satisfied with the sense of community, they are less likely to feel lonely. To conclude, it seems that satisfaction with the sense of community has a relationship with loneliness, but more research can strengthen this conclusion. Glass (2020) also examined the relationship between satisfaction to living in a community and loneliness and did not find a relationship.

To continue in this category, Gan et al. (2022), Yu et al. (2021), Yang & Xiang (2021), Domènech-Abella et al. (2021), Bergefurt et al. (2019) and Weijs-Perrée et al. (2015) included social cohesion in the research. Weijs-Perrée et al. (2015) did not find a relationship between social cohesion and loneliness while all other articles did find a significant negative relationship between social cohesion and loneliness (Bergefurt et al., 2019; Domènech-Abella et al., 2021; Gan et al., 2022; Yang & Xiang, 2021; Yu et al., 2021). Because of that, it can be concluded that people living in neighborhoods with a high level of social cohesion are less likely to feel lonely.

Bower et al. (2021) examined the effect of neighborhood belonging on loneliness. A significant negative result was found, which implies that people having a high sense of neighborhood belonging are less likely to feel lonely. This is in line with the previously seen variables, which are all very similar.

Bergefurt et al. (2019), Kemperman et al. (2019) and Weijs-Perrée et al. (2015) also included the neighborhood attachment as a variable. Kemperman et al. (2019) and Weijs-Perrée et al. (2015) found a significant negative relationship while Bergefurt et al. (2019) did not find a relationship between the variable and loneliness. This is closely related to neighborhood belonging, cognitive social capital and maybe even with neighborhood satisfaction. Because of that, it is concluded that people who feel more attached to their neighborhood are less likely to feel lonely. Lastly, Buecker et al. (2021) examined the effect of the relationship with neighbors on loneliness and found a significant negative relationship. This

implies that people who have a good relationship with their neighbors are less likely to feel lonely. This is in line with the other conclusion made on this topic.

Overall, it can be concluded that the social environment has an influence on loneliness. The environment should be designed to support social interaction and actions could be performed to increase the feeling of belonging in a neighborhood and increase social cohesion.

3.3.11 Overview of results

All the variables from the different articles are included in Table 3.4. This is divided into objective and subjective variables. A difference is made in significant positive and negative relationships. A positive relationship means that loneliness gets worse, and a negative relationship means that loneliness decreases. All these variables are included in the topics above.

3.4 Conclusion

The aim of this chapter was to answer the question: *'What is the relationship between objective and subjective social and physical built environmental factors and feelings of loneliness?'*. For this purpose, a systematic literature review has been conducted. The reason for this is that literature can be compared and therefore proper conclusions can be drawn. After formulating the query and filtering the articles, 27 articles were included in the systematic literature review. All relevant information from those articles has been presented in a table in order to compare the articles easily. It was quickly noted that most articles were published recently, indicating recent interest in the topic.

An overview of the variables included within several topics was created. The objective and subjective variables were divided into two categories. After analyzing all the articles, it became clear that a lot of variables have been examined. However, from the overview it was clear that within some topics no objective or subjective variables were examined. Within the topic General quality, no objective variable was included. However, these variables are available, for example, quality measurements from organizations like CROW in the Netherlands. Furthermore, subjective variables within the topic Green were not examined either. This is surprising because subjective green variables are relatively easy to measure. The question arises whether it is the quantity of greenery or the way it is experienced in the neighborhood that matters. For both topics it is important to include these variables in future research as it might give important insights.

After the comparison at a higher level, the findings of the studies were analyzed per topic. Consistent results were found within some of the topics. Nearly all studies found relationships between social safety and social environment and loneliness. Because of that, it is advisable to improve the social environment and the social safety of neighborhoods to contribute to reducing feelings of loneliness. Furthermore, none of the studies found a relationship between neighborhood composition and loneliness. Only a few associations between the socioeconomic status (SES) and loneliness were found. Considering that neighborhood composition and SES do not seem to have a relationship with loneliness, no recommendations are necessary. However, this conclusion remains challenging as only a limited number of studies examined variables within those topics. Therefore, it is advisable to include these variables in future research. This can confirm their lack of association with loneliness. Furthermore, it is often seen that variables have only been examined by a limited number of studies. This is making it difficult to draw firm conclusions. Some variables are only included in one or two studies or have contradicting results. Hence, it is recommended that those variables are examined again in future research to examine the relationships.

By conducting a systematic literature review, it has become evident that this approach was valuable. It was valuable because of the variation in results from different studies. By reading only a few articles, those differences in results would not have been found. By applying this approach, a reliable and comprehensive list has been created which can be used by various stakeholders involved in the management, design and planning of the built environment.

Table 3.4 – Results of systematic literature review

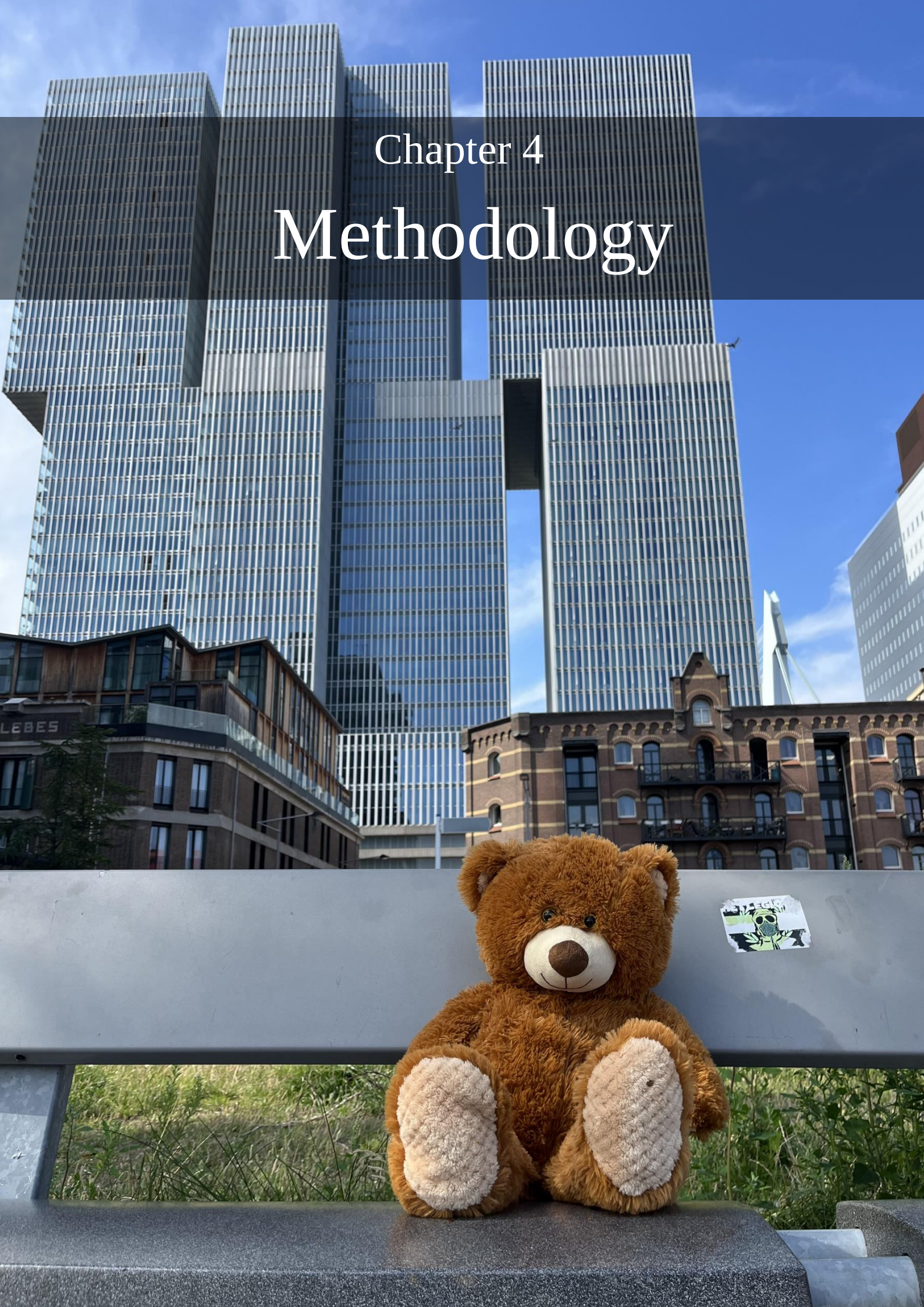
Variables		**Objective**			**Subjective**		
		Increases Loneliness		*Decreases loneliness*	*Increases Loneliness*		*Decreases loneliness*
		+	0	-	+	0	-
3.1 Dwelling							
Housing type	Apartment	24	11				
	House		5				
	Commercial housing		4				
	Public housing		4				
	Resettlement housing		4				
	Temporary housing		4				
	Other		11				
Outside space			11				
Owner-occupied			4, 25				
Rental		20	11				
Major structural/ physical problem		11					
Natural light in dwelling				11			
Perceived dwelling affordability							11
Housing quality							1
Frequency bothered by noise					11		
Neighborhood							
3.2 General quality							
Neighborhood satisfaction							23
Neighborhood quality							27
Aesthetics					12	23	
Perceptions of neighborhood physical environment						20	
3.3 Amenities							
Land use mix access			9				
Accessibility (distance to)	Shop (km) and basic services available		13, 21, 24				
	Nearest city center		10				

	Highway (km)	24				
	Sport/leisure facilities	10				
BE usability/land use mix-access					23	15
Satisfaction with facilities/ recreational services						6, 21, 24
Satisfaction with community health care						6
3.4 Urban density						
Density		4, 8, 14, 22	10, 12, 17, 24, 25, 26			
Percentage of unoccupied dwellings			9			
Population and household income density		17				
3.5 Mobility						
Street type	Main road			22		
	Avenue			22		
	Residential			22		
Sidewalks (yes)				22		
Distance to public transport			10			
Mobility						13
Public transportation convenience						6
Traffic density					13	12
Traffic safety					23	
Street connectivity					23	
Neighborhood walkability					18	15, 23
Sidewalks					12	
Crime and violence, infrastructure or traffic is a barrier of walking					23	12
3.6 Green						
Amount of green			2, 21, 24	10, 26		
3.7 Neighborhood composition						
Neighborhood composition (minority, cultural diversity and good English)			5			
Percentage of non-Western ethnic minorities			25			
Age density			17			

Sex density	17				
Race density	17				
Ethnic density	17				
3.8 SES					
Neighborhood SES	27				
Deprivation	14				
Percentage of low educated residents	9				
Neighborhood poverty	12				
Average income	9	17			
Percentage of social security beneficiaries	9				
Neighborhood disadvantage			20		
3.9 Social safety					
Number of criminal offences per 1000 residents	9				
Safety					3, 6, 7, 13, 21
Crime				12	
Neighborhood disorder			7		
3.10 Social environment					
Cognitive social capital (sub)					6
Structural social capital (sub)					6
Satisfaction with Sense of community					16
Satisfaction to living in a community				16	
Social cohesion				25	1, 7, 12, 13, 18
Neighborhood-belonging					11
Neighborhood attachment				18	21, 25
Relation to neighbors					10

Part II: A quantitative study about the relationship between the built environment and loneliness

From part I it became clear that there is limited research about the relationship between neighborhood characteristics and loneliness. This is a research gab which should be examined as it is important to know for urban planners and designers. In newly developed neighborhoods, it is important that such relationships are known so that they can be taken into account in the design process. The information is also important for public space management departments since a lot of the work on cities is performed by this department. Therefore, the aim of part II is to examine the relationships between built environments factors themselves and loneliness and its strength. Consequently, several data analyses will be conducted to provide a clear overview of relationships between the built environment at the neighborhood level and loneliness. This is a crucial to answer the research question.



Chapter 4

Methodology

4. Methodology

This chapter aims to determine the specific steps for part II of this study. This is done by focusing on the problem and then choosing an appropriate research design. After that, the datasets that are available will be analyzed and variables will be selected. Finally, specific analyses will be chosen to provide a complete answer to all sub-questions.

4.1 Introduction

From part I, it became clear that there is limited research about the relationship between neighborhood characteristics and loneliness. However, this information is crucial as designs and urban planning are not based on individuals but rather on neighborhoods. For instance, one neighborhood may need more trash cans due to the presence of loitering youths, while another may need speed bumps due to excessive speeding. Conducting research at neighborhood level could therefore provide insights for interventions in the built environment that support all residents of that neighborhood. Moreover, by conducting this research, interventions and measures are determined. These interventions and measures can be implemented in cities which are crucial to actively contribute to reducing feelings of loneliness. The municipality of Rotterdam has a particular need for such measures as the loneliness rates are the highest in the Netherlands, which was already shown in Figure 2.4. In Figure 4.1, the distribution of moderate to severe loneliness in Rotterdam can be seen. Residents in the southern part of Rotterdam experience loneliness more often than in other locations while residents living in the North-West of Rotterdam score below the average score of Rotterdam. This makes Rotterdam a very suitable municipality to use for this study because neighborhoods differ from one another. Additionally, this finding underscores the need for implementing interventions aimed at reducing loneliness within the municipality of Rotterdam. Much research has already been done on loneliness within the municipality of Rotterdam but not yet on the relationship between loneliness and built environment factors and not at the neighborhood level. Therefore, the municipality is interested in this research.

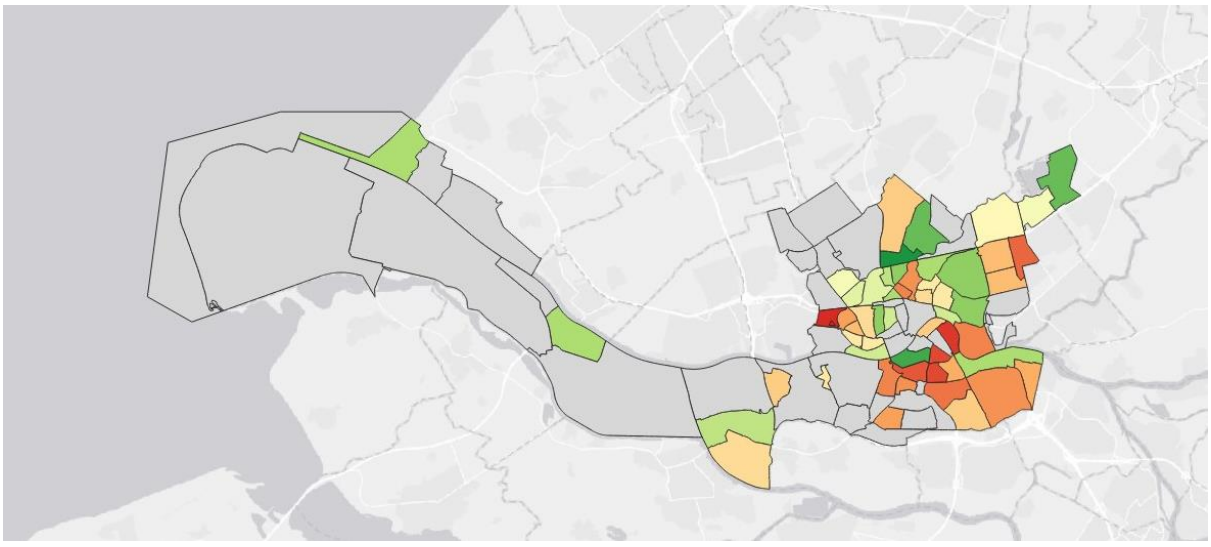


Figure 4.1 - Loneliness distribution in Rotterdam (Data from Gezondheidsmonitor Volwassenen en Ouderen (2023))

Moreover, measures that are most effective in reducing loneliness are needed. In the Netherlands, municipalities receive an annual budget for the maintenance of the public space, which is often low, resulting in the need to combine tasks wherever possible. For example, a street is outdated and has to be renewed, a plan is made to replace the street and because everything has to be replaced it is decided to transform half of the street into green space. Therefore, municipalities must make choices about what they can and cannot tackle in public space, making it essential to choose measures that have the most significant impact. Because of that, there is often a desire to manage based on values and effects. The asset management department of the municipality of Rotterdam has developed the Values Wheel for

this purpose which is based on several policies. This is a model which is used to choose interventions that have the biggest effect. By using the Values Wheel, management is based on broader values instead of only technical issues. It is about making smart choices and better trade-offs that create added value for the city of Rotterdam (Gemeente Rotterdam, 2022). By finding measures and interventions that fit with the values wheel, concrete actions can be taken. Additionally, by finding measures that are most effective, smart choices can be made within a municipality.

Hence, the aim of this further research is as follows: to determine the direct (bivariate) and indirect relationship between built environment factors and loneliness, and to determine the most effective measurements and interventions at a neighborhood level with specific focus on the city of Rotterdam. This led to the research questions shown in Chapter 1.

4.2 Research design

To address the research questions effectively, a research design needs to be specified. Given that the aim of this study, a quantitative research approach is deemed most suitable. The reason for this is that data analysis can be conducted to provide answers to the sub-questions. Additionally, the results of this study can be applied in other cities and locations. In future research, it would be highly valuable to conduct qualitative research in the city of Rotterdam, for example through a case study involving neighborhoods that differ a lot in terms of loneliness rates and other factors. However, due to the great extent of potential variables that can influence loneliness, it is crucial to first investigate them in order to establish a solid foundation for future research.

Data is required for quantitative research, and the municipality of Rotterdam has already gathered a significant amount of data through various means, including monitoring changes and conducting surveys. Therefore, an assessment was made to determine if sufficient data has been collected within the municipality to conduct this research. Several datasets, including the Health Monitor and the Neighborhood Profile, can be used for this research. Therefore, the conclusion is made that there is enough data for this study.

To select the variables within all the data gathered by the municipality of Rotterdam, the outcomes of part I are used and a small-scale qualitative study will be conducted. The aim of this qualitative study is to identify potential interesting variables in addition to the ones that are already known. This is a brainstorming session where experts within the built environment are asked what they think influences loneliness. By doing so, variables that might be forgotten are included in the study. This is important because the prior knowledge gained from the previous chapter offers a different perspective on potential variables. After doing this, variables are selected to be included in the analyses. With the dataset, several analyses should be conducted in order to answer all sub-questions. The specific analysis per question is determined after the variables are selected. After conducting all analyses, another small-scale quantitative study will be conducted. The reason for this is that interventions and measures within the management of the built environment are unknown. Another brainstorming session can provide a clear understanding of these measures. By applying these research types, complete answers to the sub-questions are formed.

Target group

The target population of this study are neighborhoods within the municipality of Rotterdam. This includes all residents of these neighborhoods and all types of loneliness. It is worth noting that previous research has predominantly focused on the elderly population, while recent years have revealed that loneliness is not exclusive to this age group. That is the reason to include all age groups above 18 years in this study. Furthermore, this study chooses to examine both social and emotional loneliness, which are reflected in the overall loneliness score.

4.3 Datasets Rotterdam

The municipality of Rotterdam collects several types of data that are useful for answering the research questions of this study. For this research, data from the Neighborhood Profile (Wijkprofiel), the Health Monitor (Gezondheidsmonitor), Research010 (Onderzoek010) and the Basic Information Department (Basisinformatie) are used. By using data from multiple departments, an integral approach is taken. By doing so, information is brought together that has not been brought together before. This allows as many factors as possible to be tested for their relationship with loneliness while highlighting different angles. This ultimately ensures that a complete picture arises to explain loneliness at a neighborhood level. The different data sets are discussed below.

4.3.1 Health monitor

A major data platform of the municipality of Rotterdam is the health monitor. This is a database covering many different topics. To ensure the accuracy and relevance of this database, a survey is conducted once every four years among the residents of Rotterdam. The survey that was used is shown in Appendix I in English. The data used for this survey was collected from September 2020 to October 2020, and as with the Neighborhood Profile survey, people were selected by random sampling to participate in the study. Everyone selected was contacted by letter to participate. People can participate in this survey either online or in writing. Additionally, the online survey is available in Dutch and English. To generate as much response as possible, an approach method was developed depending on the age group and the neighborhood where a person lives. The main difference is that people over 65 received the questionnaire earlier on paper and that elderly people of Turkish, Moroccan, Surinamese, Antillean or Aruban origin received an optional door-to-door motivation and could be questioned on the spot. Also, people aged above 65 received a slightly different survey than the younger age groups. Most people were approached 3 times to participate in the survey but in some cases were contacted 4 times. This was done when the response in a neighborhood was too low. However, in some neighborhoods still not enough response was received, for this reason some neighborhoods were combined so that collectively the neighborhoods could still get a score (Schouten & Koene-Smit, 2023).

As indicated earlier, the health monitor contains many different data on a variety of topics. Because some neighborhoods were merged, a combination grade was used here. The combination figure is determined by calculating the average of the merged neighborhoods. This is the case for subjective variables within the health monitor but not for the objective variables. Those variables can be seen per neighborhood. Nevertheless, this is a point of attention for the study.

4.3.2 Neighborhood profile

The Mayor of Rotterdam Ahmed Aboutaleb says: *"The Neighborhood Profile connects the hard figures with the perception of the inhabitants of Rotterdam)" (*OBI, 2022). The Neighborhood Profile is a dashboard that shows how neighborhoods score on certain indicators. These indicators are divided into three indexes, namely the safety index, the social index and the physical index, which are all relevant in this study. For this study, it is important to know how the data was collected. The municipality of Rotterdam conducted two large-scale surveys. To do so, the basic registration of persons (BRP) was used to draw two random samples. Two samples were selected because half of the inhabitants of Rotterdam had to answer questions on social and physical topics while the other half was faced with a questionnaire on safety. The survey was available in Dutch and English. The neighborhood survey is shown in Appendix II and the safety survey is shown in Appendix III. People could fill out the survey digitally but could also send in a written questionnaire or choose a telephone interview. The survey was spread over a long period, from March to the end of October 2019 to reduce the sensitivity to incidents. 30,000 residents of Rotterdam participated in the survey over the course of 2019 (OBI, 2020).

4.3.3 Basic Registration department

The basic registration of the Municipality of Rotterdam is also used as a source of data. This department keeps track of almost everything regarding the demographic data and the building aspects of the city of

Rotterdam. Different teams within the Basic Registration department were approached to provide potentially interesting variables based on the previous literature research and the brainstorm session. This department provided the following variables: the number of trees, benches, greenery, dog areas, and public toilets per neighborhood. This resulted in the presence of various objective variables that are not present in the neighborhood profile and health monitor datasets, making the total dataset more complete with this addition.

4.3.4 Research010

A final source of data was retrieved from Research010. This is a research department within the municipality of Rotterdam. They collect socio-demographic data of Rotterdam. Hence, the socio-demographic variables from 2020 that need to be included in this study are collected from Research010.

4.3.5 Differences in neighborhoods

Unfortunately, a thorough comparison revealed that the health monitor and the neighborhood profile use different neighborhoods. While many neighborhoods were measured consistently across both datasets, some neighborhoods were treated as a whole in one dataset, whereas the same neighborhood was divided into, for example, north and south in the other dataset. Several approaches were considered to address this discrepancy.

First, an attempt was made to merge neighborhoods by calculating their average scores. However, this method proved to be insufficient due to significant differences in area and characteristics for certain neighborhoods that were split into multiple parts. As a result, wrong outcomes would arise from such an approach. Consequently, the decision was made to remove the neighborhoods that did not align between the datasets from the analysis. As a result of this action, 53 neighborhoods remain in the dataset, which still provides a sufficient basis for the data analysis. However, it should be noted that this limits the number of possible outcomes for the regression analysis. Although the number of neighborhoods is smaller than initially anticipated, it is still possible to derive valuable insights from the available data.

4.4 Variables

In this section, the brainstorm session will be discussed from which selection criteria are determined. After that, the variables that are selected will be discussed.

4.4.1 Selection criteria

The datasets consist of a large number of variables, and not all variables are relevant for this study. Therefore, criteria have been established for selecting variables. Five criteria have been developed for this purpose. If a variable has a proven relationship with loneliness, it must be included in the study as it can be an explanatory variable. Additionally, variables with inconsistent results in the systematic literature review are included as much as possible because it is important to draw definitive conclusions for these variables. Within the theme of general quality, objective variables are missing, and within the theme of greenery, subjective variables are missing. Therefore, variables within these groups are included in the study. Variables should be relevant on the neighborhood level, for example, the availability of a swimming pool is less relevant at the neighborhood level as it is never present in all neighborhoods and people are willing to travel further for such facilities. Lastly, an inclusion criterion is to include variables that were identified during the brainstorming session with the experts from PLANTERRA, which will be explained in the following section. By applying these criteria, a comprehensive dataset is created, ensuring that potentially interesting variables are not accidentally overlooked. However, it should be noted that not all variables will be available. Therefore, these criteria apply only to the selection of variables, and beyond the four datasets, no further search will be conducted if variables are found to be missing.

4.4.2 Brainstorming session I

A brainstorming session is conducted in order to find variables that have not been examined yet. Hence, the aim is to identify potentially interesting variables in addition to the ones already known. This is

important because the prior knowledge gained from the previous chapter offers a different perspective on potential variables while others might identify other variables. The session was conducted with experts from the company PLANTERRA. This is an advisory firm specializing in innovative advice for managing public spaces and they are actively involved in integrating health aspects into neighborhoods to improve livability. Because of the background of the firm, experts from this firm are perfect for this brainstorming session because of their expertise.

The approached experts did not receive any information beforehand as this might influence their thoughts on possible variables. During the brainstorming session, a brief presentation was given about the research objectives and all the topics identified in part I. Following this, the experts were asked to write down on post-it notes what they thought influenced loneliness. They were then asked to place the post-it note under one of the identified topics.

The session generated a lot of variables that could have a relationship with loneliness according to the experts. Some of these variables are already examined, such as residential density, income and crime rates. However, there were also unexpected outcomes such as the maintenance of roads. According to the experts, good maintenance of roads encourages people to go out while unmaintained roads may cause people to feel unsafe and therefore stay in. The experts had the same reasoning for a clean neighborhood. All variables written down by the experts of PLANTERRA are shown in Appendix IV. These results are useful in the selection of variables as management variables are recognized. However, it should be noted that not all variables will be available within the datasets of the municipality of Rotterdam. Therefore, only variables that are available are used for this study.

4.4.3 Dependent variable

As the purpose of this study is to determine the relationship between built environment factors and loneliness, the dependent variable in this research is loneliness. Therefore, it is essential to understand how loneliness is measured and which type of loneliness is used.

The health monitor of the municipality of Rotterdam included loneliness in their dataset, using the De Jong-Gierveld scale as a measurement tool (de Jong Gierveld & van Tilburg, 2010; De Jong-Gierveld Scale, n.d.; de Jong-Gierveld & Kamphuls, 1985). This scale consists of 11 statements that assess both emotional and social loneliness using three response options: Yes, More or Less, and No. The resulting total score reflects the level of perceived loneliness, where higher scores indicate higher levels of loneliness. The eleven statements used to measure perceived loneliness in the De Jong-Gierveld scale can be seen in Table 4.1.

Tabel 4.1 - Questions of the De Jong-Gierveld loneliness scale (De Jong-Gierveld scale, n.d.)

Nr.	Statement	Subscale	Formulation
1	There is always someone that I can talk to about my day to day problems.	Social	+
2	I miss having a really close friend.	Emotional	-
3	I experience a general sense of emptiness.	Emotional	-
4	There are plenty of people that I can lean on in case of trouble.	Social	+
5	I miss the pleasure of the company of others.	Emotional	-
6	I feel my circle of friends and acquaintances is too limited.	Emotional	-
7	There are many people that I can count on completely.	Social	+
8	There are enough people that I feel close to.	Social	+
9	I miss having people around.	Emotional	-
10	Often, I feel rejected.	Emotional	-
11	I can call on my friends whenever I need them.	Social	+

In this regard, questions 1, 4, 7, 8 and 11 can be used to determine social loneliness and questions 2, 3, 5, 6, 9 and 10 are used to measure emotional loneliness (De Jongh & Erdem, 2017). It is important to note that the phrasing of each question, whether positively or negatively worded, can impact the scoring. In cases where a question is positively worded, a negative answer suggests loneliness, while in negatively worded questions, a negative answer indicates the absence of loneliness. That is why the last column in Table 4.2 shows whether the statement is formulated positively or negatively. To calculate social loneliness, all neutral and negative answers (no and more or less) to questions 1, 4, 7, 8, and 11 should be added up. The opposite applies to emotional loneliness, which is calculated by summing up all the neutral and positive answers (yes and more or less) to questions 2, 3, 5, 6, 9 and 10. By adding both scores together, the level of overall loneliness is measured (De Jong-Gierveld Scale, n.d.; De Jongh & Erdem, 2017). The loneliness score per neighborhood is determined by the number of respondents that score 3 points or more at the loneliness scale compared to the number of respondents in the neighborhood.

Some preliminary research has already been done to check the correlations between the loneliness variables. This indicated a strong correlation between social and emotional loneliness. Therefore, comparing these two types of loneliness would show almost identical results, so it makes little sense to compare both types. In addition to social and emotional loneliness, moderate to severe loneliness and severe loneliness are variables included in the dataset of the health monitor. The variable ‘moderate to severe loneliness’ includes all individuals experiencing feelings of loneliness, whereas the variable ‘severe loneliness’ focuses exclusively on individuals with severe feelings of loneliness. That is why the variable ‘moderate to severe loneliness’ was chosen for this study. The choice of using the "moderate to severe loneliness" variable is due to the study not being specific to only severely lonely individuals, as it aims to encompass all target groups. This is also the reason why the age range of 18 years and older is considered instead of a specific age group.

4.4.4 Independent variables

The majority of variables that are used in this study are measured at ratio level as they represent percentages of neighborhoods. All variables obtained from the four datasets are presented in Table 4.2. In Appendix V, an extended version with explanations of the variables and their sources is shown.

Table 4.2 - Variables in dataset

	Objective	*Subjective*
Loneliness		Moderately to severely lonely
Dwelling	% homes with over-occupancy, average property value per square meter of living space	% satisfaction with housing size, % satisfaction with housing type, % satisfaction with insulation from neighbors, % satisfaction with outside noise insulation, % satisfaction with size of outdoor space, % satisfied with maintenance of own home
General quality	Cleanliness, Intactness	% a lot of odor pollution from sewage systems outside, % often bothered by garbage next to the container, % often bothered by litter, % satisfied with maintenance of buildings in the neighborhood, A satisfactory rating (8 or higher) for the living environment, appreciation of neighborhood buildings, % (very) satisfied with the neighborhood
Amenities		% of residents who say that there are enough elderly facilities in the neighborhood, % satisfied with overall amenities, % sufficient presence of primary healthcare providers, % sufficient presence of public transportation, % sufficient presence of shops for daily groceries, % sufficient presence of sports fields, % sufficient presence of indoor sports facilities, % of residents who say that there are enough leisure facilities for young people in the neighborhood

Density	Residential density (inhabitants per km2), Urban density	
Mobility	% of homes within norm distance of bus stops, % of homes within norm distance of metro stations, % of homes within norm distance of tram stops	% satisfaction with bike path safety, % satisfaction with maintenance of bike paths, % satisfaction with maintenance of sidewalks, % satisfaction with sidewalk safety
Green	Benches per km2, Green per km2, Trees per km2, quality of greenary (average)	% satisfaction with attractiveness of canals, ditches, and ponds, % sufficient presence of green areas (lawns, trees), % sufficient presence of recreational green areas (picnics, sports, games), A satisfactory rating (8 or higher) for green spaces
Neighborhood composition	% 0 to 15 years, % 15 to 25 years, % 25 to 45 years, % 45 to 65 years, % 65 years or older, % divorced, % Households with children, % Households without children, % married, % men, % Residents with non-Western migration background, % Residents with Western migration background, % Single-parent families, % Single-person households, % unmarried, % widowed, % women	
SES	% Completed higher education (HBO or WO), Disposable household income	
Social safety		% often bothered by: crime types and nuisance (multiple variables)
Social environment	% likelihood of moving away from the neighborhood, % of residents who provide neighborly help, % of residents who have lived in the neighborhood for a long time, % residents who have been involved in making plans for the neighborhood or city.	% of residents who say that neighbors help each other, % of residents who say that neighbors know each other, % of residents who say that neighbors share opinions, % of residents who say that there are enough places in the neighborhood for joint resident activities, % of residents who say that young and old get along well in the neighborhood, % of residents who say they feel at home with neighbors, % of residents who say that neighbors interact frequently, % of residents who feel connected to the neighborhood, % of residents who feel responsible for the neighborhood
Social network		% of residents who report knowing enough people to talk to, % of residents who report having enough interest from close family members, % of residents who report having enough interest from others, % of residents who say they know enough people for help and advice
Life events	% residents (18 years and older) who have only recently moved to the Netherlands	
Activities	% that engages in volunteer work, 18 years and older, % of residents who visit a hobby club or association monthly, % of residents who participate in sports weekly	
Health	At least 1 mental health condition, Drugs (soft drugs/hard drugs), has overweight (moderate and severe), Mobility limitation, % that meets the physical activity guideline	Limited by one or more chronic conditions

4.5 Data analysis methods

The specific methods for analyzing the data have to be chosen. Now that all variables are known, this is possible. The first couple of steps are taken in order to prepare the data for the upcoming analyses. Firstly, descriptive statistics are examined to verify the data's characteristics. After that, correlation analysis is performed using the Pearson correlation. This is done as preparation for the next step. The following analysis is a factor analysis. This helps to reduce the number of variables by creating one

variable for all variables included in the analysis, but it also helps to reduce correlations between independent variables. By using a factor analysis, variables that are strongly correlated are grouped together, while variables that are not correlated are separated. The variables that do not have a relationship with loneliness are excluded from this analysis since otherwise it can look like they do have a relationship with loneliness. After doing this, descriptive statistics can be examined again to see the characteristics of the created factors. When this is examined, analyses to answer the sub-questions can be conducted.

A different analysis is needed for each sub-question. For sub-question 1, a correlational analysis is suitable. This analysis is conducted in order to examine whether variables have a relationship with loneliness or not and how strong this relationship is. This is conducted in SPSS using the Pearson's correlation. This test is applied when both the independent and dependent variables are measured on an interval or ratio scale, and it is suitable for more than two variables. Since all variables are represented at the neighborhood level, this test is suitable for this research. By doing this analysis, an answer to sub-question 1 can be provided.

Sub-question 2 is about measures that are most effective on reducing loneliness. In this context, a regression analysis will be performed. This can be used to predict how much influence variables have on loneliness, and it filters out underlying correlations from the result. Since multiple variables are used and the dependent variable is on interval level, the simple linear regression and logistic regression analyses are not suitable. Instead, this research uses multiple linear regression analysis. However, a multilinear regression analysis has specific requirements that the dataset must meet. These requirements are: Linear relationship between dependent and independent variables; Normally distributed error component; No multicollinearity or no instability of the regression coefficients; No heteroskedasticity, the variance of the residuals must be constant across the predicted values. Points 1, 2, and 4 are verified in the descriptive statistics, and a factor analysis is performed to prevent point 3 from occurring. However, one of the above points can occur and, in that case, a new analysis that matches the data best needs to be made.

The last question that needs to be answered through data analysis is sub-question 3. To find indirect and direct relationships, the results of the correlation analysis can be used. However, by doing so, the structure of the relationships is not clear. Therefore, a Bayesian belief network will be constructed. This is a data mining approach, and it estimates indirect but also direct relationships. It creates a model from which direct and indirect relationships can easily be seen and strengths of relationships are also included. Within the context of this sub-question, this is highly suitable.

4.6 Conclusion

In this chapter, an introduction is given and the research design for part II has been determined. By using the data that the municipality of Rotterdam already has collected, a robust analysis can be conducted as the data is considered reliable and valid. The variables have been explained and a detailed plan for the data analysis has been determined. This lays the foundation for a comprehensive data analysis in the next phase of this study. Furthermore, two small-scale quantitative studies can improve the results of this study. One brainstorming session is held as preparation of the quantitative study while another brainstorming session is conducted after the analyses in order to create interventions that are realistic. An overview of the steps that will be taken to answer the sub-questions is given in Figure 4.2. In this figure, the sub-question is shown and the analysis for each sub-question can be seen. Additionally, the objective of each analysis can be seen, making it clear why each analysis is chosen. Moreover, the brainstorming session is represented to indicate their objective. Overall, this figure gives a clear overview of the steps undertaken in this study.

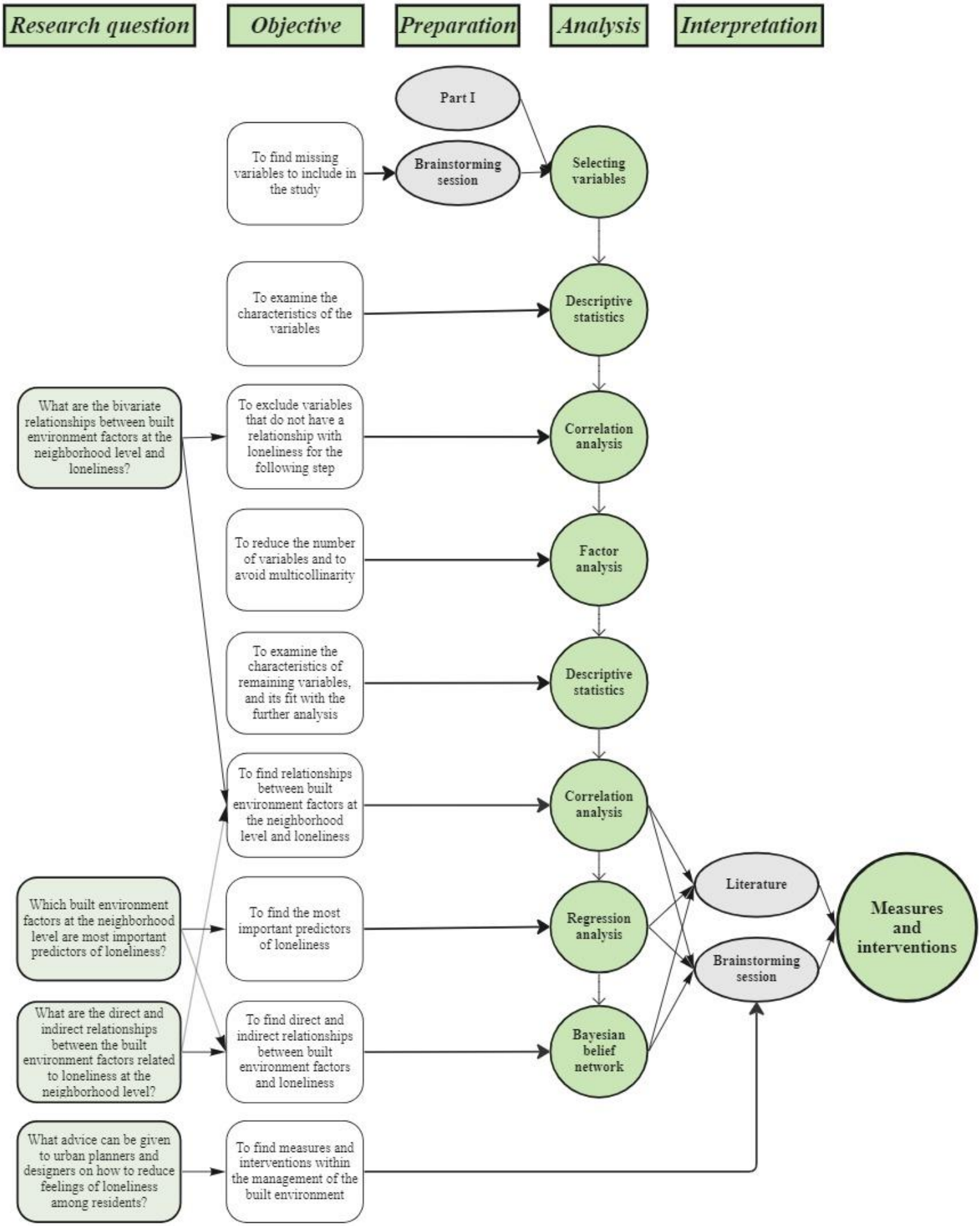


Figure 4.2 - Visual presentation of steps taken in part II

Chapter 5

Data preparation and descriptive statistics

5. Data preparation and descriptive statistics

In this chapter the data from the municipality of Rotterdam are prepared in order to be able to conduct proper analysis. A factor analysis is conducted in order to reduce the number of variables and descriptive statistics are shown for every topic.

5.1 Introduction

To initiate the data analysis, the data should be examined, and it should be ready for all analyses. Therefore, descriptive statistics are examined for all variables. This step is important as it helps to understand the nature of the data. The descriptive statistics of all variables used in this study can be seen in Appendix VII while in this section the descriptive statistics are performed for the factor analysis and all remaining variables. A factor analysis is conducted to reduce the number of variables and to avoid multicollinearity. Only the variables that have a significant relationship with loneliness need to be in a factor. Otherwise, variables that do not have a relationship with loneliness seem to have a relationship with loneliness because the factor has a relationship with loneliness. Therefore, bivariate analyses are conducted first, which is shown in Appendix VIII. These analyses revealed significant correlations between the independent variables. Since regression analysis is not possible with high correlations between the independent variables, the results indicate that a factor analysis is necessary. Additionally, as the number of variables is considerably high, factor analysis contributes to reducing the number of variables. The objective of the factor analysis is to reduce the number of variables and to decrease correlations between the independent variables.

In a factor analysis, variables that have the highest correlations are grouped together. This means that within factors, variables correlate as much as possible, while factors themselves correlate as little as possible. In this case, factors can be seen as hidden variables that explain multiple observed variables variable (Ellis, 2013; Hair et al., 2010). For example, satisfaction with housing type, maintenance and housing dimensions are observed variables and this can be explained by satisfaction with the dwelling, the hidden. A schematic representation of a factor analysis is shown in Figure 5.1. There are various approaches for conducting a factor analysis. The specific method used in this study will be discussed below, followed by the actual execution of the factor analyses together with the descriptive statistics of the remaining variables.

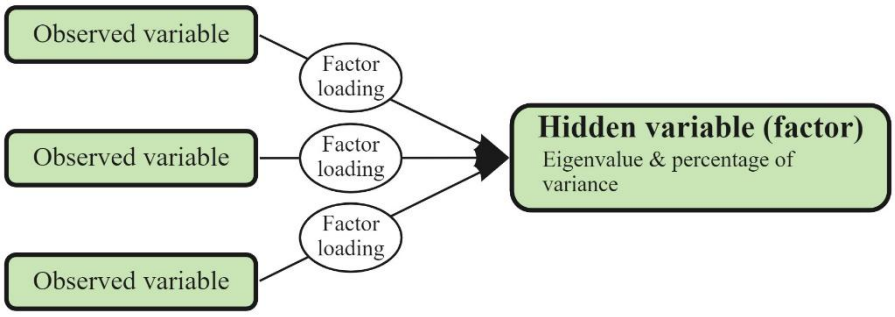


Figure 5.1 - Schematical representation of factor analysis

5.2 Determination of execution of factor analyses

There are various objectives and methods for conducting a factor analysis. The objective is to reduce the number of variables and to avoid multicollinearity. Including all variables in one factor analysis ensures low correlations between the factors but it can also create illogical factors. By doing separate factor analyses for each topic, multicollinearity can occur, but the factors would be logical. In this study, separate factor analyses for each topic have been chosen. The outcome of logical factors is considered more important than completely avoiding multicollinearity. This method ensures that variables are reduced, which is part of the objective. However, it does raise the question if correlations among variables decrease. To test multicollinearity, it is important to conduct bivariate analyses after the factor

analyses. By performing the factor analyses per topic, the results can be compared with the results from the systematic literature review. This is important as research often finds different results, which was shown in chapter 3.

Within each topic, a factor analysis will be conducted with all variables that have a relationship with loneliness, that have the same measurement level and that fit well together. Different measurement levels, such as euros and percentages, cannot be used together in a factor analysis. However, this does mean that some variables are not included in a factor. Additionally, there should be three variables within a factor analysis, meaning that in some topics, a factor analysis will not be possible (Hair et al., 2010). The factor analyses will be conducted using in SPSS using the principal components extraction, with varimax rotation and it will be based on an eigenvalue of 1. If one factor represents the hidden variable, the factor analysis is repeated with a fixed number of factors, namely one. In that case, rotation is not used. The factors are saved for further analyses in SPSS.

5.3 Key characteristics and descriptive statistics of loneliness

The first variable discussed is the dependent variable loneliness. First of all, it is important to examine if the results from the survey are the same as the loneliness numbers in the Netherlands. The loneliness data from the Rijksinstituut voor Volksgezondheid en Milieu (RIVM) (2020) is compared with the loneliness data from the Health Monitor (2020). From this comparison it is evident that the data aligns sufficiently, as shown in Figure 5.2. In Appendix VI, a figure is presented illustrating the distribution per neighborhood which is more detailed. The loneliness data from the Health Monitor is considered reliable because it aligns sufficiently.

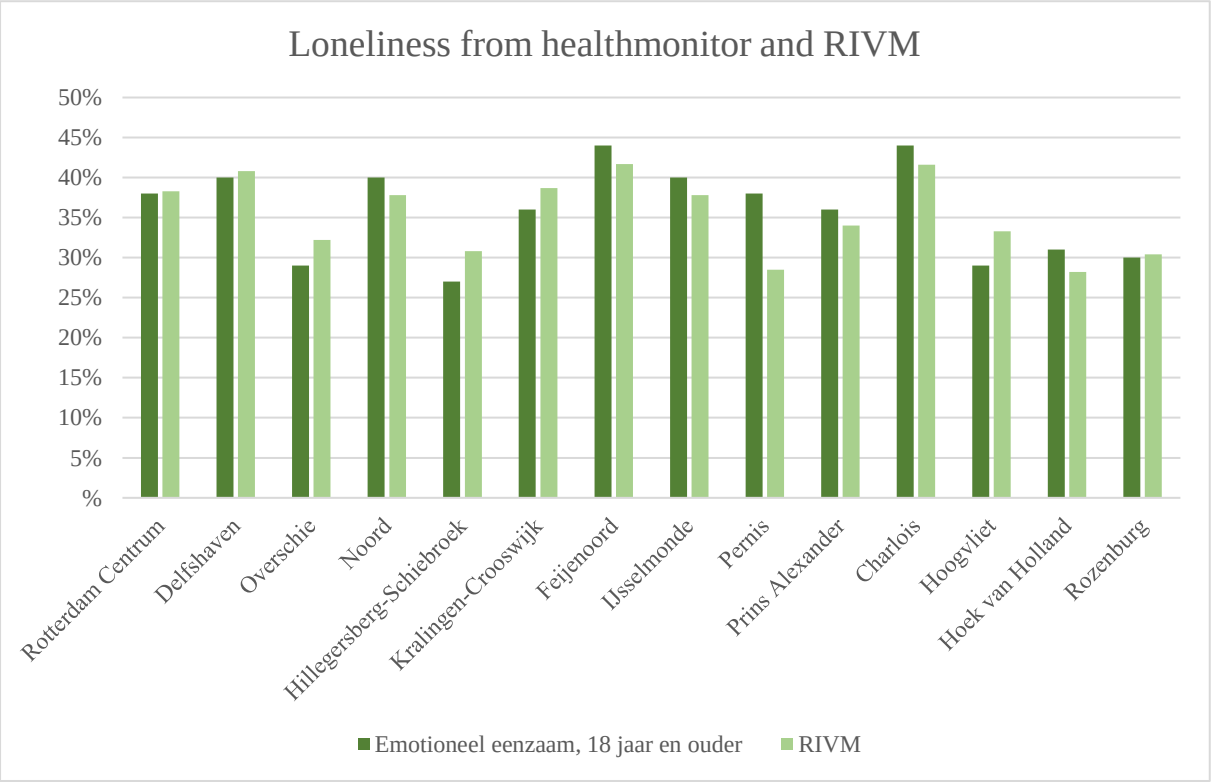


Figure 5.2 - Loneliness from RIVM and Health monitor (Gezondheidsmonitor Volwassenen en Ouderen, 2020; Rijksinstituut voor Volksgezondheid en Milieu, 2020)

The descriptive statistics of this variable can be seen in Table 5.1. The smallest value observed is 40%, while the largest value is 71%. This indicates that in at least one neighborhood, 71% of the inhabitants experience feelings of loneliness. This is noteworthy as it is considerably higher compared to the national average as well as the average of Rotterdam, which is 55.6%. The mean and the median are almost the same and there are not extremely high or low values, which is a positive indication. Additionally, the standard deviation is 7.49%, which shows the average deviation of each score from

the mean. This is a reasonable score. Lastly, the Shapiro-Wilk test was conducted to assess whether the variable has a normal distribution. The null hypothesis assumes normal distribution, meaning that if the significance value is above .05, the variable is normally distributed. In this case, the variable's significance value is well above .05, confirming that it has a normal distribution. Furthermore, the histogram in Figure 5.3 displays the distribution and demonstrates a clear normal distribution.

Table 5.1 - Descriptive statistics Loneliness

		Moderately to severely lonely
Mean		55.60%
Median		56.00%
Std. Deviation		7.49%
Minimum		40.00%
Maximum		71.00%
Shapiro-Wilk	Statistic	0.984
	df	53
	Sig.	0.709

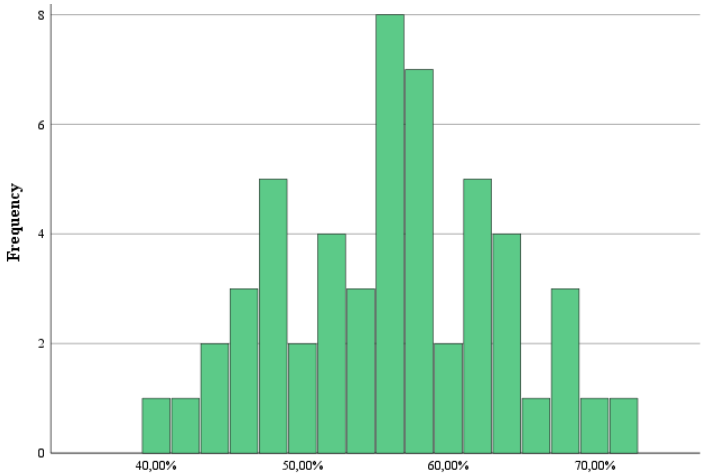


Figure 5.3 – Histogram feelings of loneliness per neighborhood

5.4 Descriptive statistics and factor analyses of built environment variables

In this section, the factor analysis for each topic where this analysis is needed and possible is conducted. Additionally, the descriptive statistics of every topic are discussed.

5.4.1 Dwelling

Within the topic Dwelling, there are eight variables. Of those variables, only one variable does not have a relationship with loneliness and is therefore not included in the factor analysis. The variable "average property value" is measured in euros, while all other variables are expressed in percentages. Consequently, this variable is not included in the factor analysis. Lastly, there is one variable that does not fit well with the other variables, which is ‘homes with over-occupancy’. This variable is not related to satisfaction while all other variables are. As a result, this variable is not included in the factor analysis. The other variables are all included in the factor analysis.

The results of the analysis can be seen in Figure 5.4. The factor loading can be seen in the circle in the middle of the figure. This value ranges from -1 to 1. In this case, values closer to -1 or 1 indicate a better fit. In this study, values below 0.400 are excluded from the factor because they do not fit with the factor. Within this factor analysis, the factor loadings are all very high, which indicates that there is a good fit between the variables and the factor. The eigenvalue and the percentage of variance are shown under the factor. The eigenvalue represents the amount of variance explained by the factor. The eigenvalue should be higher than one since this means that the factor is explaining more than the individual variables. In this factor analysis, the eigenvalue is bigger than one, so it meets the criterion. Furthermore, the percentage of variance should be as close to 100% as possible. The threshold for the percentage of variance is 60% or higher as the factor would otherwise not summarize the variables well enough according to Hair et al. (2010). This threshold will also be used in this study. However, the percentage of variance for this factor is well above 60%, namely 82.52%. This factor is therefore suitable for the following steps of the data analysis. The factor will be called dwelling satisfaction as all observed variables are related to this variable.

In Table 5.2, the descriptive statistics of the variables within the topic dwelling can be seen. The factor created from the factor analysis is presented in bolt together with the variables that are were not included in the factor analysis. It can be observed that the mean and median values are close to each other for all variables, which is a positive sign. There are some high standard deviations, but this should not be a

problem because the variables are normally distributed. Therefore, the variables within this topic are suitable for further analysis.

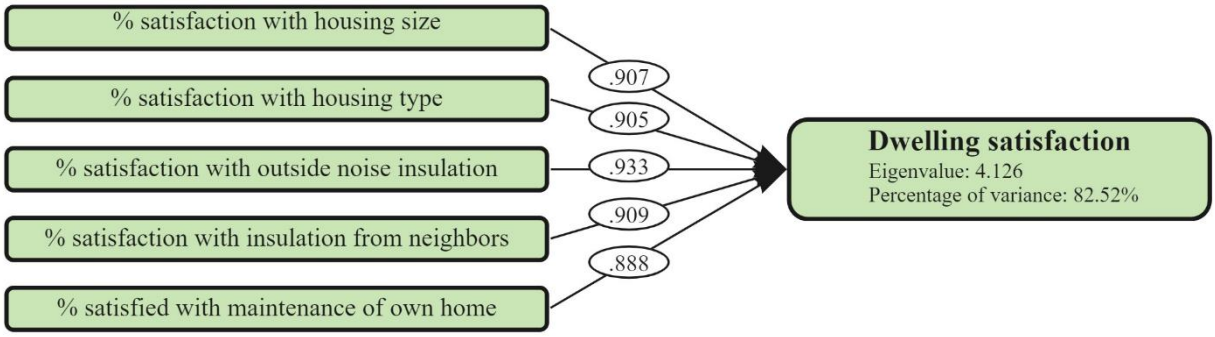


Figure 5.4 - Factor analysis dwelling satisfaction

Table 5.2 - Descriptive statistics dwelling

Dwelling					
	Mean	Median	Std. Deviation	Minimum	Maximum
% satisfaction with size of outdoor space	69.5%	69.5%	8.2%	53.3%	85.9%
average property value	2042.7	1935	455.45	1362.83	3253.41
% homes with over-occupancy	9.4%	8.5%	4.1%	3.2%	18.8%
Dwelling satisfaction	0.00	-0.10	1.00	-2.30	2.48

5.4.2 General quality

The factor analysis of the topic general quality can be seen in Figure 5.5. Not all variables were included in this factor analysis because they were not measured at the same level. The score for clean and intact is a scale between 0 to 5 while the other variables are percentages. It is noteworthy that there are positive and negative factor loadings within this analysis. This makes sense since some variables are positively formulated (e.g., satisfaction) while others are negatively formulated (e.g., nuisance). Moreover, the factor loadings are all high, indicating a good fit with the factor. The eigenvalue is 4.902, which is higher than the threshold of one. The percentage of variance is 61.27%, which is just above the threshold of 60%. All variables within this analysis are related to the satisfaction or dissatisfaction with the neighborhood and therefore this factor is called neighborhood satisfaction.

The descriptive statistics for the topic general quality are displayed in Table 5.3. The factor created in the factor analysis is shown in bolt letters. The mean and the median are all close to each other which is a positive indication. There are no high standard deviations and the minimum and maximums are an equal distance from the mean and median. Considerably, the variables are very suitable for further analysis.

Table 5.3 - Descriptive statistics general quality

General quality					
	Mean	Median	Std. Deviation	Minimum	Maximum
Score clean (average)	3.66	3.66	0.13	3.44	3.95
Score intact (average)	3.83	3.83	0.08	3.59	3.98
Neighborhood satisfaction	0.00	0.11	1.00	-2.01	1.83

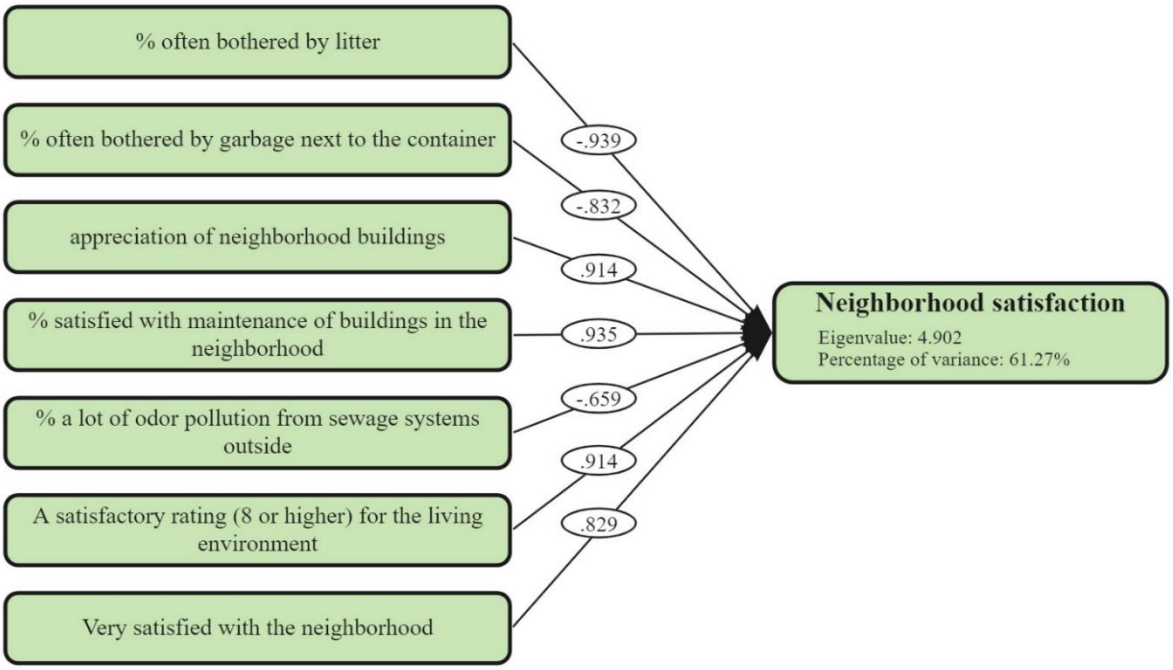


Figure 5.5 - Factor analysis neighborhood satisfaction

5.4.3 Amenities

The earlier conducted bivariate analysis for the topic amenities showed that many variables do not have a relationship with loneliness and are therefore excluded from the factor analysis. As a result, only one variable remained, namely the satisfaction with amenities. Consequently, a factor analysis is not needed for this topic. The descriptive statistics of the topic are shown in Table 5.4. The variables that do and do not have a relationship with loneliness are included in this table because the relationships will be discussed in the following stage of this study. From Table 5.4 it is immediately noticeable that the variable sufficient presence of shops for daily groceries has some remarkable values. The minimum and maximum value are very far from each other, which is almost a 100% difference. The minimum value differs more than 80% from the mean. The same observations can be seen for the variable sufficient presence of primary healthcare providers. Nonetheless, these variables will be included in the analysis, but this information should be kept in mind.

Table 5.4 - Descriptive statistics amenities

	Amenities				
	Mean	Median	Std. Deviation	Minimum	Maximum
% satisfied with overall amenities	50.4%	50.3%	11.1%	22.1%	75.4%
% sufficient presence of shops for daily groceries	82.3%	89.3%	19.0%	0.5%	98.9%
% sufficient presence of primary healthcare providers	85.8%	90.2%	14.6%	10.1%	97.7%
% sufficient presence of sports facilities	52.4%	52.9%	14.4%	24.6%	87.8%
% of residents who say that there are enough places in the neighborhood for joint resident activities	50.3%	49.3%	9.1%	24.6%	84.3%
% of residents who say that there are enough elderly facilities in the neighborhood	34.7%	34.1%	12.3%	13.8%	62.5%
% of residents who say that there are enough leisure facilities for young people in the neighborhood	37.5%	39.1%	11.6%	16.5%	74.4%

5.4.4 Density

Within the topic density, the two variables that are included are measured in a different way. The urban density is a score between 0 and 5 while the residential density is presented in inhabitants per square kilometer. Therefore, a factor analysis within this topic is not possible.

In Table 5.5, the descriptive statistics of the topic density are shown. It is notable that the mean and median are widely separated for the residential density. This can be caused by the inclusion of various types of areas. Specifically, a large area with a low population is included while other areas have a high residential density, such as the city center of Rotterdam. However, the variables will be included in further analysis.

Table 5.5 - Descriptive statistics density

Density					
	Mean	Median	Std. Deviation	Minimum	Maximum
Residential density (inhabitants per km2)	8403	6452.6	5888.93	35.23	20210.19
Urban density	1.38	1	0.882	1	5

5.4.5 Mobility

Within the topic mobility, three variables have a relationship with loneliness and are therefore included in a factor analysis. The results of the factor analysis are schematically represented in Figure 5.6. All factor loadings are remarkably high. Moreover, the eigenvalue is bigger than one and the percentage of variance is well above 60%, namely 74.69%. For this reason, it can be concluded that the factor explains the variables well and it is suitable for further analysis. The name for this factor is satisfaction with maintenance infrastructure.

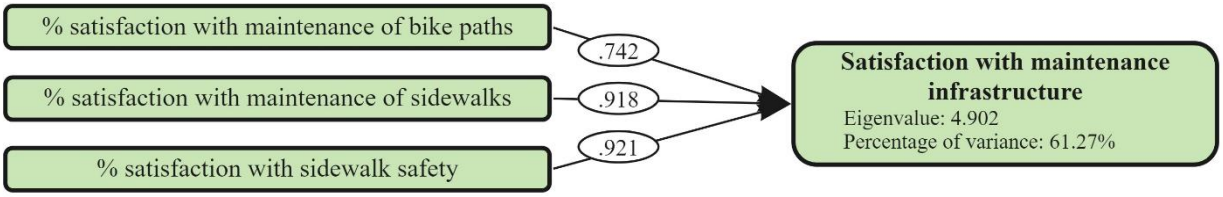


Figure 5.6 – Factor analysis satisfaction with maintenance intrastructure

In Table 5.6, the descriptive statistics of the topic Mobility are presented. The factor satisfaction with infrastructure is shown in bolt. It is noteworthy that some of the variables have a minimum value of 0% and a maximum value of 100%. In all those cases, the minimum value is far from the mean and medium. However, this is logical since many neighborhoods have public transport within acceptable distance, but a few neighborhoods do not meet this requirement, resulting in a 0% score.
Neighborhoods in and around the city center score very high on these matters while remote areas have lower scores. Nevertheless, these variables will be used for the following stages of this data analysis.

Table 5.6 - Descriptive statistics mobility

Mobility					
	Mean	Median	Std. Deviation	Minimum	Maximum
Satisfaction with infrastructure	0.00	-0.09	1.00	-2.42	3.34
% of homes within norm distance of bus stops	67.9%	76.0%	24.0%	0.3%	100.0%
% of homes within norm distance of metro stations	70.4%	96.6%	39.6%	0.0%	100.0%
% of homes within norm distance of tram stops	77.4%	100.0%	41.3%	0.0%	100.0%
% satisfaction with bike path safety	50.9%	51.5%	11.5%	29.3%	81.0%
% often parked on the sidewalk	35.8%	34.7%	10.8%	17.1%	61.1%
% sufficient presence of public transportation	89.2%	92.8%	10.5%	52.5%	99.7%

5.4.6 Green

Eight variables were included within the topic green, but only three remained after the first bivariate analysis because the other five did not have a relationship with loneliness. On the remaining three variables, a factor analysis is performed from which the results can be seen in Figure 5.7. The factor loadings are very high, indicating a good fit between the variables and the factor. The eigenvalue is bigger than one, meaning that the factor explains more variance than the individual variables alone. Besides that, the percentage of variance is above the threshold, namely 75.53%, meaning that the factor effectively summarizes the variables. All variables within the factor are subjective and related to natural elements. Hence, the factor is named satisfaction with natural elements.

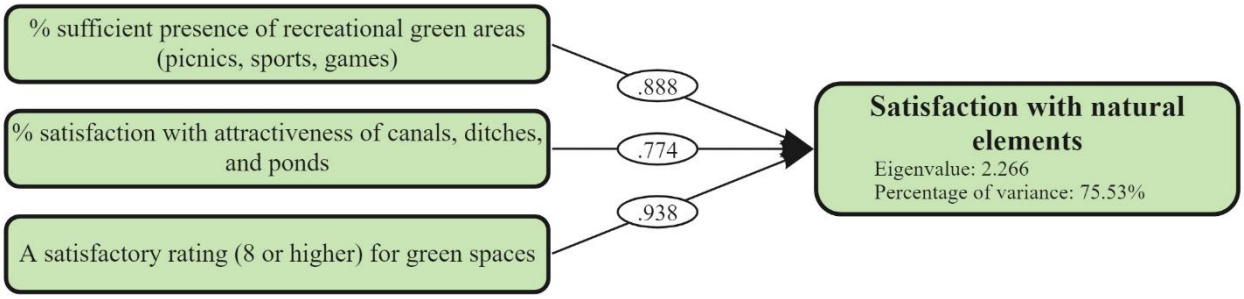


Figure 5.7 - Factor analysis satisfaction with natural elements

In Table 5.7, the descriptive statistics of the topic Green are shown. The factor, satisfaction with natural elements, is shown in bolt. There are some noteworthy differences among the variables that are measures per square kilometer. For instance, the neighborhood with the fewest trees per km2 only has 15.37 trees, while the neighborhood with the most trees has 2413.35. Due to this, there is a large standard deviation associated with these variables. The factor does not have extremely high or low values, indicating a better distribution. The variables will be used in this study, but the high standard deviation should be kept in mind.

Table 5.7 - Descriptive statistics green

Green					
	Mean	Median	Std. Deviation	Minimum	Maximum
Trees per km2	1436	1515	630.68	15.37	2413.35
Green per km2	17752	15080	10914.76	362.4	48741.39
Benches per km2	110.49	73.66	83.99	1,07	349.47
% sufficient presence of green areas (lawns, trees)	78.6%	81.9%	13.4%	50.2%	98.1%
CROW score green (average)	3.81	3.8	0.1	3.64	4,08
Satisfaction with natural elements	0,00	0,06	1,00	-1.73	2,09

5.4.7 Neighborhood composition

The next topic is neighborhood composition, from which the factor analysis can be seen in Figure 5.8. Among the factor loadings, there is one negative factor loadings. This is logical as the household with children has a negative effect on loneliness while the other variables have a positive effect, as could be seen in the bivariate analysis before. All factor loadings are high values, indicating a good fit between the factor and the variables. Additionally, the eigenvalue is bigger than 1 and the percentage of variance is high, namely 75.48%. Therefore, it can be concluded that this factor is suitable for further analysis. This factor will be named percentage of singles and migrants.

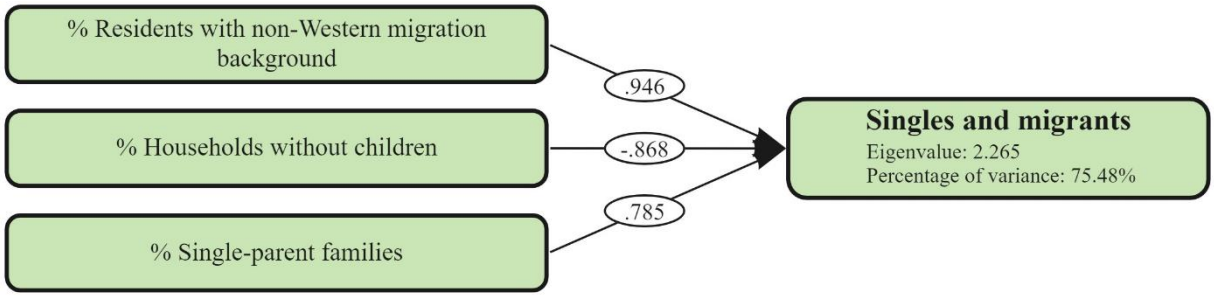


Figure 5.8 - Factor analysis singles and migrants

The descriptive statistics of this topic are shown in Table 5.8. The variables that are included in the factor are only shown as the factor, which is represented in bolt. For all variables, the mean and the median are close to each other, indicating a desirable distribution. Furthermore, most variables have a small standard deviation. These variables are thus appropriate for further analysis.

Table 5.8 - Descriptive statistics neighborhood composition

Neighborhood composition					
	Mean	Median	Std. Deviation	Minimum	Maximum
% Residents with Western migration background	13.6%	13.0%	4.7%	7.5%	32.0%
% Single-person households	49.4%	49.0%	9.2%	22.0%	75.0%
% Households with children	18.2%	18.0%	6.4%	4.0%	46.0%
% men	49.6%	49.7%	1.7%	46.4%	54.0%
% women	50.4%	50.3%	1.7%	46.0%	53.7%
% 0 to 15 years	15.7%	15.7%	4.0%	4.1%	26.0%
% 15 to 25 years	13.3%	12.7%	4.2%	7.7%	36.2%
% 25 to 45 years	31.9%	30.8%	7.1%	19.3%	54.6%
% 45 to 65 years	24.4%	24.1%	3.6%	13.8%	32.4%
% 65 years or older	14.8%	13.3%	5.8%	6.7%	30.8%
% unmarried	58.4%	59.0%	8.5%	42.9%	78.2%
% married	28.0%	27.7%	6.9%	13.6%	42.4%
% divorced	9.7%	9.9%	1.8%	5.6%	13.6%
% widowed	3.9%	3.1%	2.1%	1.6%	12.4%
Migration and household composition	0.00	0.10	1.00	-1.88	2.18

5.4.8 SES

Within the topic SES, two variables have been included in this study. The two variables that are included are measured at a different level, making it unsuitable for factor analysis. Additionally, a factor analysis is not possible with only two variables. Therefore, no factor analysis has been conducted within this topic. The descriptive statistics of the topic SES are presented in Table 5.9. It is noticeable that the maximum values deviate further from the median and mean compared to the minimum values. However, these values will be used for the other analysis, but this should be taken into account.

Table 5.9 - Descriptive statistics SES

SES					
	Mean	Median	Std. Deviation	Minimum	Maximum
Disposable household income	39.41	36.3	13.17	29.2	113
% Completed higher education (HBO or WO)	30.8%	28.0%	14.3%	13.0%	64.0%

5.4.9 Social safety

Within the topic social safety, there are numerous variables. A factor analysis was performed on all the variables that have a relationship with loneliness. Two variables do not fit within the factor because they have a factor loading below the threshold of .400. These are the variables 'Percentage of residents who have been victims of purse snatching with violence in the past year' and 'Vandalism of telephone booths, bus shelters, or tram shelters is often seen as a neighborhood problem'. Consequently, these variables are not included in the factor analysis and because there are enough variables within this topic, the variables will not be included in further analysis.

Another notable observation for the factor analysis within this topic is that there are some high but also some low factor loadings. For example, the variable 'home burglaries are often seen as a neighborhood problem' has a factor loading of .409. The percentage of variance is below the threshold of 60%, namely 59%. Therefore, the variable with the lowest factor loading, home burglaries are often seen as a neighborhood problem, is removed from the analysis. By doing so, the percentage of variance increases above the threshold. The final factor analysis for the topic social safety can be seen in Figure 5.9.

In the analysis, it is noteworthy that objective variables have lower factor loadings compared to the subjective variables, suggesting that the factor is more related to subjective social safety. Furthermore, the eigenvalue is high, namely 12.412. This indicates that the factor explains more variance than the individual variables alone. The percentage of variance is 61.28%, which is just above the threshold of 60%. The factor is not summarizing the variables perfectly, but it is sufficient enough to include the factor in the following steps of this research. Since all variables are negatively formulated but have a positive factor loading, the overarching name for this factor is neighborhood disorder. This is the only variable remaining within this topic.

Within the topic social safety, there are numerous variables for which descriptive statistics are presented in Table 5.10. The factor, neighborhood disorder, is also presented while the variables within this factor are not shown. The mean and median scores for the variables are relatively close to each other. The created factor has a higher maximum score than the minimum score compared to the mean. This indicates that there is at least one neighborhood that deals with a lot of neighborhood disorder while there is no neighborhood that scores very low on this variable. Besides that, there are no notable observations within this topic.

Table 5.10 - Descriptive statistics social safety

Social safety					
	Mean	Median	Std. Deviation	Minimum	Maximum
Bicycle theft in own neighborhood in the past year	13.50%	15,0%	7.70%	0,0%	29.50%
Bicycle theft is a common neighborhood problem	18.70%	18.80%	8.20%	1,0%	31.40%
Car theft in own neighborhood in the past year	1.50%	0.90%	1.40%	0,0%	5.60%
Neighborhood disorder	0.000	-0.113	1.000	-1.396	2.235
Percentage of residents who have been victims of assault in own neighborhood	1.10%	0.80%	1.10%	0,0%	4.10%
Percentage of residents who have been victims of other vandalism in own neighborhood	7.90%	7.20%	3.80%	0.90%	16.20%
Percentage of residents who have been victims of threats with violence in own neighborhood	3.40%	3.30%	2,0%	0.60%	8.60%
Theft from cars is a common neighborhood problem	8.30%	7.60%	3.90%	0.40%	22.30%

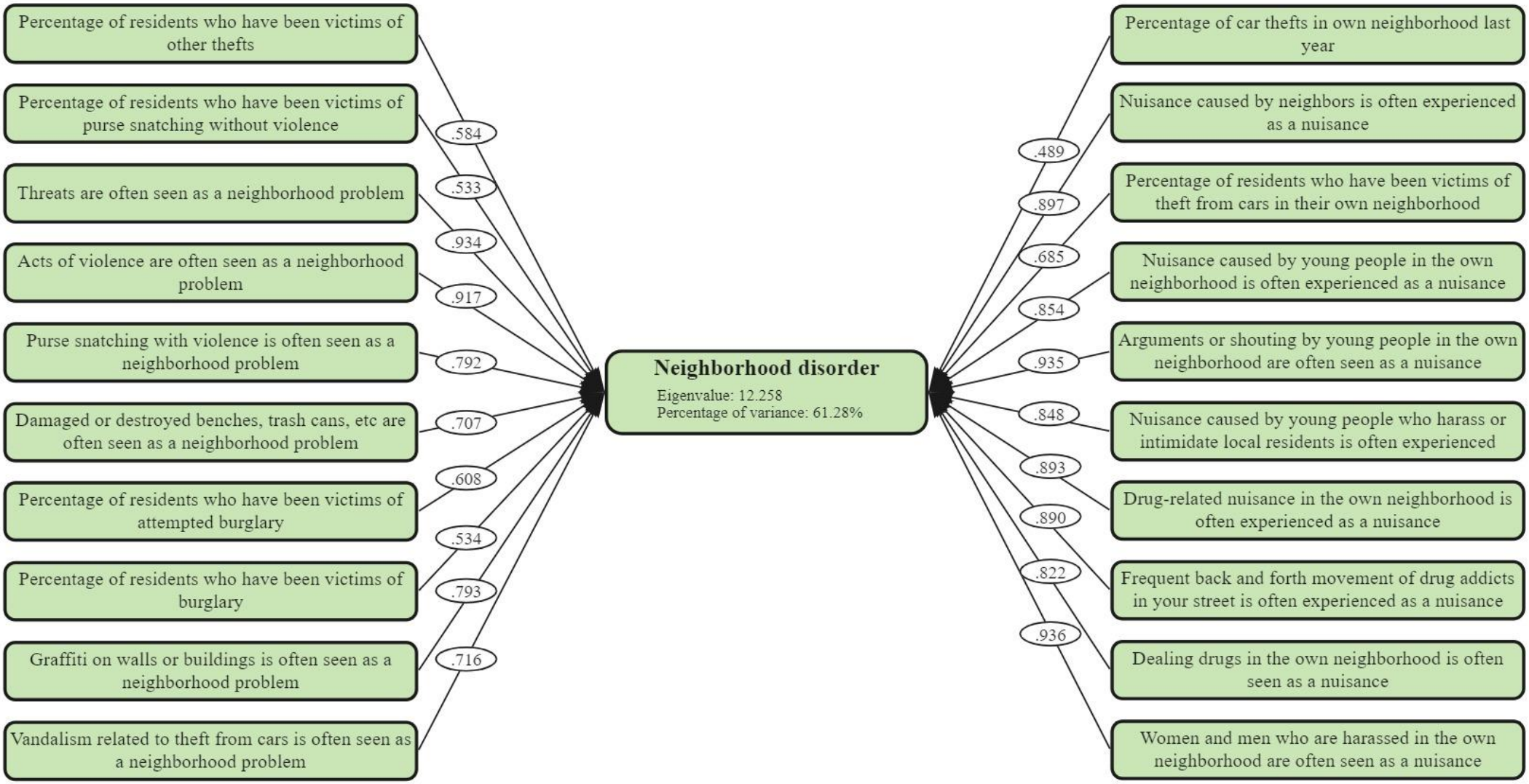


Figure 5.9 - Factor analysis neighborhood disorder

5.4.10 Social environment

A factor analysis was also conducted within the topic social environment, which is shown in Figure 5.10. All factor loadings exceed the threshold of .400, indicating a good association between the variables and the factor. Additionally, most variables have a high factor loading, which is even better. One variable has a negative factor loading which makes sense as this variable is negatively related to the social environment while all other variables are positively related to the social environment. The eigenvalue, measuring the amount of variance explained by the factor, is 7.205, which is higher than the value of 1. Furthermore, the percentage of variance is 65.50%, indicating a satisfactory level of variability explained. Consequently, the factor is suitable for this study. This factor is called social cohesion and participation since all variables are related to this. However, it is crucial to recognize that neighborhood belonging, and attachment also contribute partially to this factor. This is making it possible to compare the final results with these variables as well.

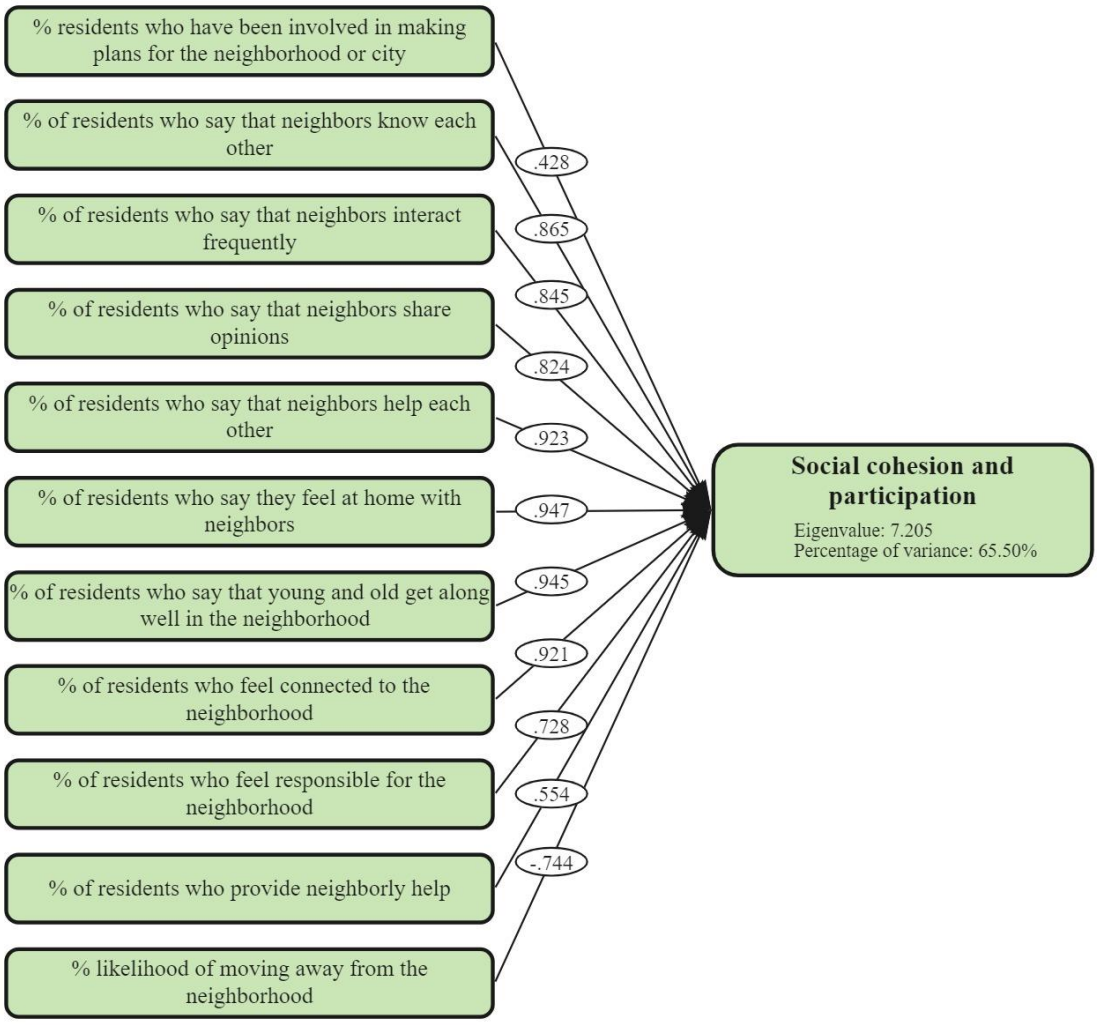


Figure 5.10 - Factor analysis social cohesion and participation

In Table 5.11, the descriptive statistics of the topic social environment are shown. The factor is shown in bolt letters and besides that, only one other variable is included. There are no striking results in the descriptive statistics. Consequently, these variables are suitable for further analysis.

Table 5.11 - Descriptive statistics social environment

Social environment					
	Mean	Median	Std. Deviation	Minimum	Maximum
Social cohesion and participation	0.00	-0.26	1.00	-1.97	2.35
% of residents who have lived in the neighborhood for a long time	42.9%	42.3%	7.2%	18.7%	55.9%

5.4.11 Social network

A topic closely related to the social environment is the topic social network. This topic focuses on individual contacts instead of neighborhood interactions. This topic contains four variables, which are included in a factor analysis. The factor analysis is schematically represented in Figure 5.11. The factor loadings are all very high, indicating a strong alignment between the variables and the factor. The eigenvalue is 3.452, which is exceeding the threshold of one. This indicates that the factor explains more than an individual variable. Additionally, the percentage of variance is 86.30%, which is also remarkably high. The overarching name for this factor is social network.

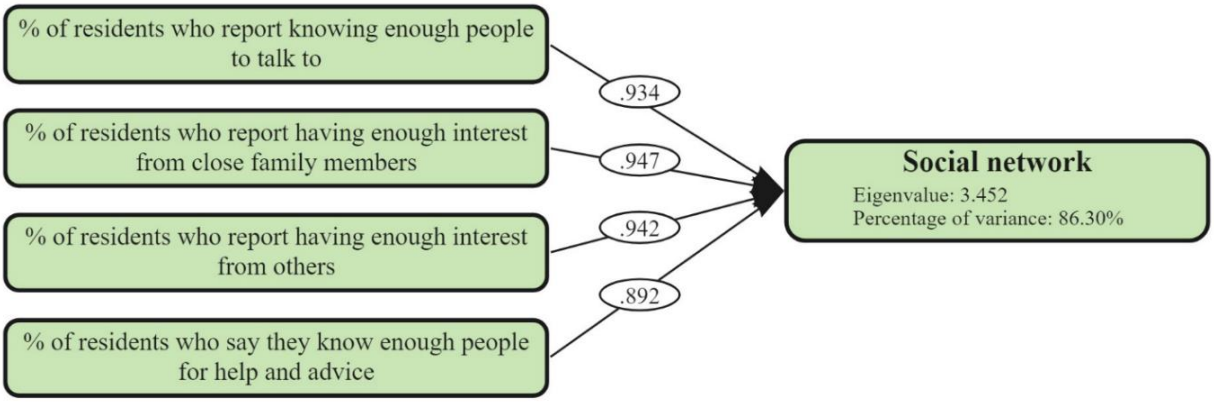


Figure 5.11 - Factor analysis social network

The descriptive statistics of the factor within the topic social network can be found in Table 5.12. In this table, no remarkable observations are seen. The mean and the median are close to each other, and the standard deviation is not remarkably high. Therefore, this topic contains proper data for further analysis.

Table 5.12 - Descriptive statistics social network

Social network					
	Mean	Median	Std. Deviation	Minimum	Maximum
Social network	0,00	-0,02	1,00	-2,03	2,03

5.4.12 Life events

Within the topic life events, only one variable will be examined. Therefore, a factor analysis is not necessary. The descriptive statistics of the variable are shown in Table 5.13. It is noteworthy that the maximum value is significantly far from the mean. This suggests that at least one neighborhood has a high proportion of individuals who have recently moved to the Netherlands. However, this data will be used in the further steps of this research.

Table 5.13 - Descriptive statistics life events

Life events					
	Mean	Median	Std. Deviation	Minimum	Maximum
% residents who have only recently moved to the Netherlands	4.4%	3.5%	3.9%	0.8%	26.3%

5.4.13 Activities

The next topic that is discussed is the topic activities. Four variables are included within this topic but only three have a relationship with loneliness, which was discovered during earlier bivariate analysis. The three variables that do have a relationship with loneliness are included in a factor analysis, from which the results can be seen in Figure 5.12. The factor loadings are all well above the threshold of .400. The eigenvalue is also above the threshold, namely 2.128. This indicates that the factor explains more variance than the individual variables themselves. Lastly, the percentage of variance is 70.91%, which is also above the threshold. This factor is therefore suitable for further analysis. All variables are about individuals' engagement in activities so the factor is labeled as active lifestyle.

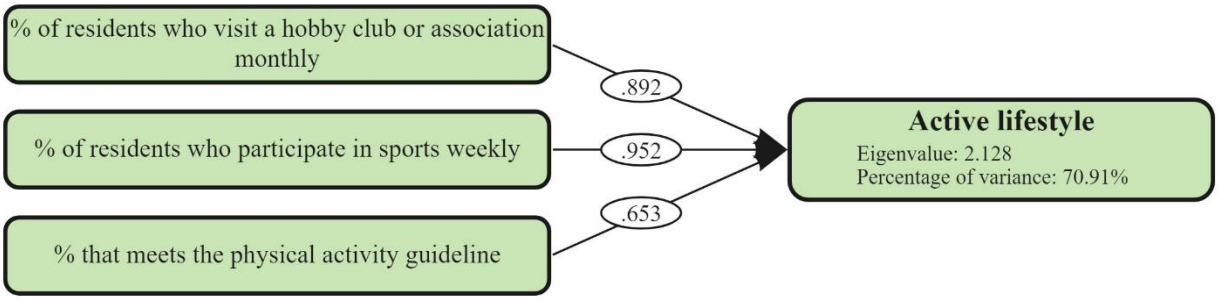


Figure 5.12 - Factor analysis active lifestyle

The descriptive statistics of this topic are presented in Table 5.14. The factor, active lifestyle, is shown in bolt. The mean and median are for both variables close to each other, which is a positive sign. Furthermore, there are not extremely high or low values, and the standard deviation is not high. This indicates that the data is suitable for further analysis.

Table 5.14 - Descriptive statistics activities

Activities					
	Mean	Median	Std. Deviation	Minimum	Maximum
% that engages in volunteer work, 18 years and older	18.5%	18,0%	4.6%	10,0%	29,0%
Active lifestyle	0,00	0,00	1,00	-2.18	2.67

5.4.14 Health

The last topic that is discussed is the topic health. Within this topic, six variables are included, and one does not show a relationship with loneliness. For that reason, the factor analysis is conducted with the remaining five variables. After conducting a first factor analysis, it became clear that the variables mental health conditions and smokes have a low factor loading compared to the other variables. Additionally, the percentage of variance in this analysis is low, namely 51.24%. This is below the threshold of 60%. Due to this, the two variables with the lowest factor loadings were removed. By doing so, the percentage of variance became significantly higher, namely 77.54%. The eigenvalue is still above 1 and the factor loadings are still high. Hence, it can be concluded that the second factor analysis is more suitable than the first one. The results of the second factor analysis can be seen in Figure 5.13. The factor will be labeled as physical health conditions since this is the overarching theme of the variables.

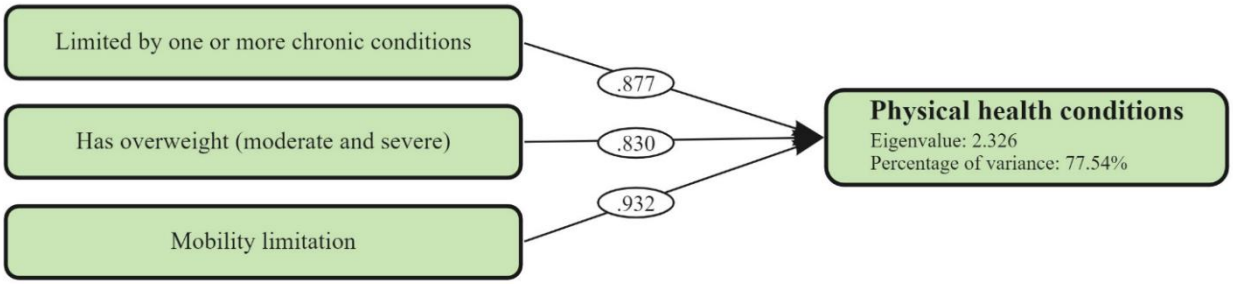


Figure 5.13 - Factor analysis physical health conditions

In Table 5.15, the descriptive statistics of the variables within the topic Health are represented. The factor physical health conditions is shown in bolt. Within this topic, the mean and median values are closely together for all variables. Additionally, there are no noteworthy minimum or maximum values and the standard deviation is not high. This data is therefore suitable for further analysis.

Table 5.15 - Descriptive statistics health

Health					
	Mean	Median	Std. Deviation	Minimum	Maximum
Physical health conditions	0.00	0.07	1.00	-1.99	2.26
At least 1 mental health condition	10.1%	10.0%	3.4%	3.0%	19.0%
Drugs (soft drugs/hard drugs) (in the past 4 weeks)	10.1%	9.0%	4.4%	4.0%	19.0%
Smokes	20.8%	20.0%	5.2%	13.0%	37.0%

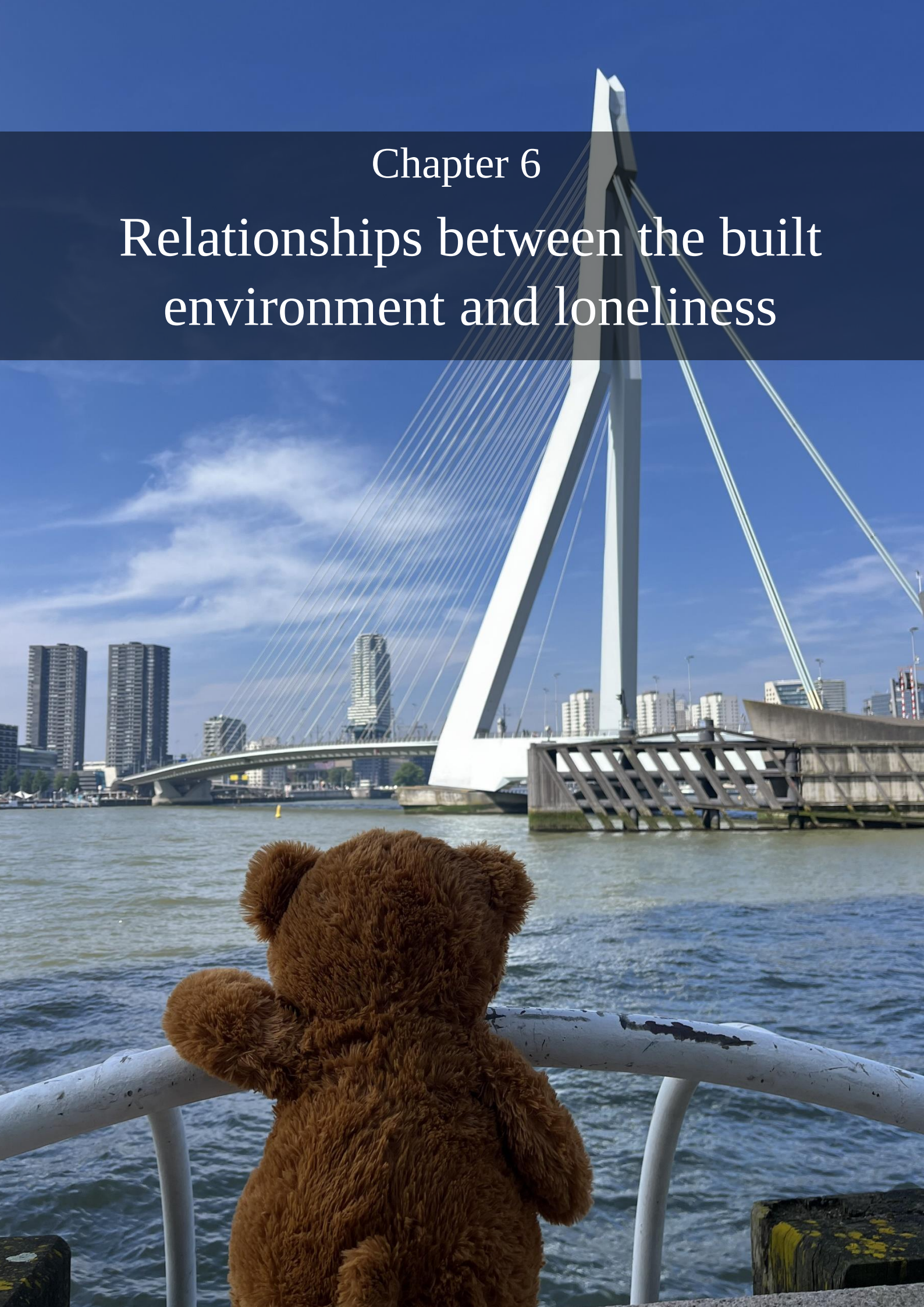
5.5 Conclusion

In this chapter, the data is prepared and examined for the data analyses. Factor analyses are performed for every topic if applicable. In some cases, this was not applicable as there were few variables or different measurement levels. In all other cases, a factor analysis was conducted. The number of variables has significantly been reduced. This section started with 120 variables. Now there are 10 factors that are replacing 62 of the variables while the information of the variables stays preserved. The factors created are dwelling satisfaction, neighborhood satisfaction, satisfaction with maintenance infrastructure, satisfaction with natural elements, singles and migrants, neighborhood disorder, social cohesion and participation, social network, active lifestyle and physical health conditions. Thus, it can be concluded that conducting factor analyses has been successful. However, correlations between the topics can still occur, this will be examined in the next chapter.

Besides the factor analyses, descriptive statistics are examined. The descriptive statistics for the dependent variable loneliness are excellent, indicating that it can be used in this study. Additionally, some noteworthy values were seen. For example, homes within norm distance of public transport stop, all those variables have a minimum of 0% while the maximum is 100%. The minimum is in those cases far from the mean and median. This is due to the fact that some neighborhoods are more industrial and so have less public transport stops while for instance in the city center there are a lot of stops. Therefore, it is debatable if this is measured the right way or if neighborhoods should be excluded. However, the presence of neighborhoods with different characteristics are preferable for this study as they can show the differences between neighborhoods where there is a lot of loneliness and neighborhoods where residents experiencing no loneliness. Therefore, these variables are used in the next stages of this study.

Chapter 6

Relationships between the built environment and loneliness



6. Relationships between the built environment and loneliness

The aim of this chapter is to answer the sub question '*What are the bivariate relationships between built environment factors at the neighborhood level and loneliness?*' The objective is to find relationships between built environment factors and loneliness and to check for multicollinearity. For that reason, correlation analyses are conducted. One correlation analysis including all variables from all topics is conducted to check for multicollinearity. To examine relationships between built environment factors and loneliness, correlation analyses for all individual topics are conducted. The correlation analyses are conducted using SPSS with the Pearson correlation. This is a suitable method in the context of this study. The results are discussed below.

6.1 Correlation analysis for indirect relationships

First of all, a bivariate analysis is conducted for all variables. The reason for this is that relationships between the topics cannot be seen in bivariate analysis per topic. This is important because the factor analyses were done per topic and thus correlations may still be present between topics. A compact version of the bivariate analysis using Pearson correlation is presented in Table 6.1.

It is immediately noticeable that there are still many correlations between the dependent variables. Because of that, it is important to look how highly correlated they are. To chart this clearly, correlations are colored in Table 6.1. In this case, the darker green the higher the correlation while variables that have no color are not correlated. It is noticeable that some variables still have a high correlation between them (colored dark green). For example, the variable neighborhood composition has a relationship of .750 or higher with five other variables. The average property value per m2 has a correlation higher than .750 with two other variables and the variable completed higher education has a correlation higher than .750 with four other variables. This variable has a high correlation with the average property value, which could mean that they measure the same thing. Neighborhoods with high housing prices will most likely not have many people with low levels of education living in them. The reason for this is that a low education is related to the income level. However, something stands out, disposable household income has a significant relationship with average property value of 0.679 and with completed higher education of .517. Thus, these correlate less with each other than the correlation between average property value and educational level. Nevertheless, these are still significant correlations. The variable "active lifestyle" also has a correlation above 0.750 with four variables. Here it is noticeable that there is a high relationship between active lifestyle and physical health conditions. This makes sense because, for example, someone with mobility conditions will exercise less often than perfectly healthy people.

Besides the correlations above 0.750, there are a lot of significant correlations between 0.50 and 0.75. For example, the factor migrants and household composition correlates at this level with ten other variables, which is a lot. Correlations with a Pearson correlation between 0.25 and 0.50 are also very common. For example, the variable "smokes" correlates with thirteen other variables at this level. Variables that have no significant relationship with each other are left white on the table. It is immediately noticeable that there are few white boxes so only a few variables have no significant relationship with each other. The variable 'mental health conditions' has no relationship with nine other variables. This is significantly higher compared to the correlations of other variables. In contrast, neighborhood satisfaction has a significant relationship with all variables. From this analysis, it becomes clear that the variables have a significant relationship with loneliness but also with each other.

Correlations

		Moderately to severely lonely	Average property value	Homes with over-occupancy	Satisfaction with dwelling	Intactness	Neighborhood satisfaction	Satisfied with amenities	Satisfaction with maintenance of infrastructure	Satisfaction with natural elements	Singles and migrants	Disposable household income	Completed higher education	Neighborhood disorder	Social cohesion and participation	Social network	Active lifestyle	At least 1 mental health condition	Physical health conditions
Moderately to severely lonely	Pearson Correlation	1	-,636**	,461**	-,564**	-,355**	-,682**	-,431**	-,471**	-,393**	,639**	-,554**	-,629**	,489**	-,679**	-,669**	-,649**	,390**	,606**
Average property value	Pearson Correlation	-,636**	1	-,513**	,366**	,371**	,658**	,605**	,509**	,509**	-,627**	,679**	,873**	-,413**	,554**	,744**	,864**	-0.250126	-,741**
Homes with over-occupancy	Pearson Correlation	,461**	-,513**	1	-,540**	-0.165561	-,751**	-,431**	-0.171741	-,652**	,844**	-,412**	-,413**	,622**	-,513**	-,589**	-,464**	,297*	,403**
Satisfaction with dwelling	Pearson Correlation	-,564**	,366**	-,540**	1	,315*	,829**	,316*	,427**	,435**	-,619**	,498**	0.1980383	-,700**	,732**	,467**	0.2579138	-,423**	-0.185957
Intactness	Pearson Correlation	-,355**	,371**	-0.165561	,315*	1	,385**	,333*	,334*	0.1713792	-0.262234	0.267305	,333*	-,360**	,302*	,376**	,381**	-0.111172	-,281*
Neighborhood satisfaction	Pearson Correlation	-,682**	,658**	-,751**	,829**	,385**	1	,589**	,440**	,684**	-,794**	,669**	,505**	-,788**	,832**	,679**	,576**	-,376**	-,400**
Satisfied with amenities	Pearson Correlation	-,431**	,605**	-,431**	,316*	,333*	,589**	1	,401**	,765**	-,487**	,470**	,493**	-,424**	,517**	,466**	,625**	-0.178056	-,361**
Satisfaction with maintenance of infrastructure	Pearson Correlation	-,471**	,509**	-0.171741	,427**	,334*	,440**	,401**	1	,298*	-,290*	,347*	,551**	-,271*	,402**	,511**	,563**	-0.152463	-,480**
Satisfaction with natural elements	Pearson Correlation	-,393**	,509**	-,652**	,435**	0.1713792	,684**	,765**	,298*	1	-,548**	,518**	,336*	-,566**	,477**	,434**	,481**	-,282*	-0.245546
Singles and migrants	Pearson Correlation	,639**	-,627**	,844**	-,619**	-0.262234	-,794**	-,487**	-,290*	-,548**	1	-,583**	-,560**	,645**	-,681**	-,711**	-,599**	,353**	,591**
Disposable household income	Pearson Correlation	-,554**	,679**	-,412**	,498**	0.267305	,669**	,470**	,347*	,518**	-,583**	1	,517**	-,412**	,651**	,608**	,624**	-,310*	-,474**
Completed higher education	Pearson Correlation	-,629**	,873**	-,413**	0.1980383	,333*	,505**	,493**	,551**	,336*	-,560**	,517**	1	-,321*	,436**	,776**	,870**	-0.124172	-,881**
Neighborhood disorder	Pearson Correlation	,489**	-,413**	,622**	-,700**	-,360**	-,788**	-,424**	-,271*	-,566**	,645**	-,412**	-,321*	1	-,659**	-,508**	-,379**	0.1637035	0.2151187
Social cohesion and participation	Pearson Correlation	-,679**	,554**	-,513**	,732**	,302*	,832**	,517**	,402**	,477**	-,681**	,651**	,436**	-,659**	1	,651**	,513**	-,295*	-,327*
Social network	Pearson Correlation	-,669**	,744**	-,589**	,467**	,376**	,679**	,466**	,511**	,434**	-,711**	,608**	,776**	-,508**	,651**	1	,798**	-,277*	-,733**
Active lifestyle	Pearson Correlation	-,649**	,864**	-,464**	0.2579138	,381**	,576**	,625**	,563**	,481**	-,599**	,624**	,870**	-,379**	,513**	,798**	1	-0.092431	-,781**
At least 1 mental health condition	Pearson Correlation	,390**	-0.250126	,297*	-,423**	-0.111172	-,376**	-0.178056	-0.152463	-,282*	,353**	-,310*	-0.124172	0.1637035	-,295*	-,277*	-0.092431	1	0.2512307
Physical health conditions	Pearson Correlation	,606**	-,741**	,403**	-0.185957	-,281*	-,400**	-,361**	-,480**	-0.245546	,591**	-,474**	-,881**	0.2151187	-,327*	-,733**	-,781**	0.2512307	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 6.1 - Correlation analysis with all variables related to loneliness

6.2 Correlation analyses per built environment topic

Besides the correlation analysis over all variables, a correlation analysis will be conducted for every topic. This is conducted separately because there are many variables and the variables that do not have a relationship with loneliness were not included earlier. In these analyses, all variables that were selected within the topic are included. This will be discussed below per topic.

6.2.1 Dwelling

In Table 6.2, the bivariate analysis of the topic dwelling is presented. It is notable that all variables that have a relationship with loneliness are significant at the 0.01 level. The average property value shows a high negative correlation with loneliness, suggesting that individuals residing in neighborhoods with more expensive homes tend to experience lower levels of loneliness. In Figure 6.1, the distribution of this variable is shown across the neighborhoods using the program GIS. When comparing this to the distribution with loneliness, which was shown in Figure 4.1, it is clearly visible that loneliness is higher in the southern part of Rotterdam and the average property values are low in this part as well. Consequently, the relationship between the variable and loneliness could be expected. It is worth noting that this specific relationship has not been explored in any of the articles reviewed in the systematic literature review. However, the perceived affordability of dwellings has been examined, revealing a positive relationship with loneliness (Bower et al., 2021). There is a distinction between an objective and subjective variable, but it can still be concluded that the average property value has a significant relationship with loneliness.

Table 6.2 - Correlation analysis dwelling

		Average property value	Homes with over-occupancy	Satisfaction with dwelling	Satisfaction with size of outdoor space
Moderately to severely lonely	**Pearson's r**	-,636**	,461**	-,564**	-0.232
	p-value	0.000	0.001	0.000	0.094

**. Correlation is significant at the 0.01 level (2-tailed).

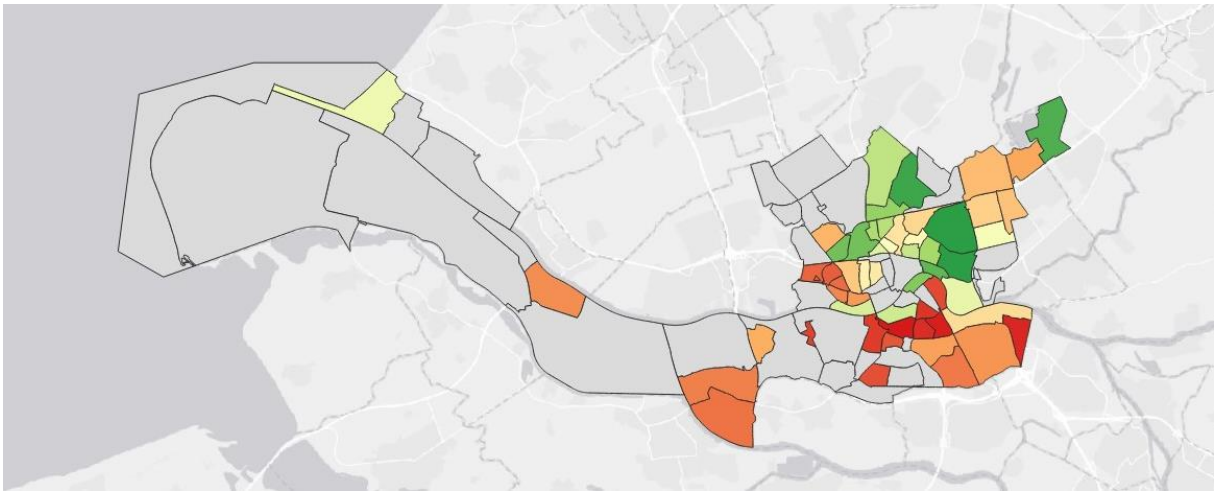


Figure 6.1 - Distribution of average property value

Furthermore, homes with over-occupancy show a significant positive correlation, indicating that individuals living in houses that are too small for their composition are more likely to experience feelings of loneliness. The distribution of this variable can be seen in Figure 6.2. In this figure, some parts in the south score below average and some parts score above average. However, the parts that have the lowest score also have the highest rates of loneliness. The correlation is slightly lower than the correlation with the other variables within this topic and loneliness. When looking at the distribution, this is logical. Furthermore, this finding is significantly associated with the average property value, suggesting that individuals residing in small and inexpensive houses might do so due to limited financial resources.

Figure 6.2 - Distribution of homes with over-occupancy

The variable satisfaction with size of outdoor space does not show a significant relationship with loneliness, leading to its exclusion from the factor analysis. However, it is important to discuss this finding because demonstrating the absence of a relationship is equally as important. This variable had not been examined before, although an objective variable related to outdoor space was investigated, which also did not show a relationship with loneliness (Bower et al., 2021). Therefore, it can be concluded that satisfaction with the size of outdoor space does not have a relationship with loneliness.

The last variable in this bivariate analysis is 'Dwelling Satisfaction'. This variable is created by performing a factor analysis. It includes five variables related to satisfaction with the dwelling. This factor has a significant negative relationship with loneliness. This implies that in neighborhoods where residents are more satisfied with their homes, loneliness is less prevalent. In Figure 6.3, the distribution of dwelling satisfaction in the city of Rotterdam can be seen. In this figure, it is clearly visible that dwelling satisfaction is lower in the areas where loneliness is higher than average. The neighborhood in the west is dark red, indicating a low dwelling satisfaction and the same neighborhood has high rates of loneliness. The other dark red colored neighborhoods in Figure 6.3 all have higher loneliness rates than average. Therefore, the strong relationship between the variables is logical.

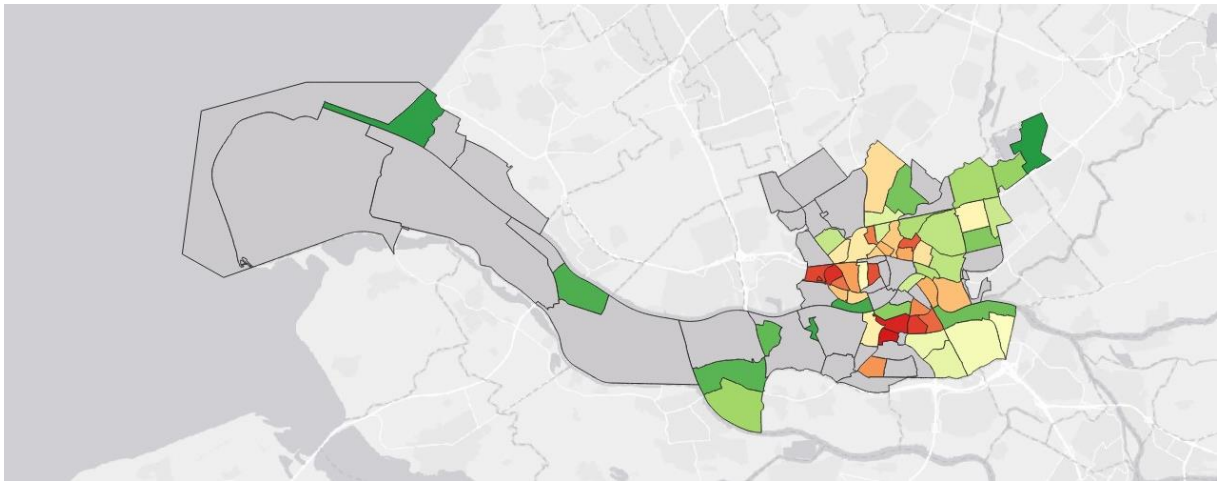


Figure 6.3 - Distribution of dwelling satisfaction

Previous studies included only three subjective variables within the topic of dwelling. Gan et al. (2022) found a relationship between housing quality and loneliness. Although this factor includes several more variables, one of them is % satisfied with maintenance of one's own home, which is related to housing quality. Additionally, Bower et al. (2021) found a relationship between frequency of being bothered by noise and loneliness. The factor includes variables related to noise insulation. Therefore, it can be concluded that the results of studies Bower et al. (2021) and Gan et al. (2022) align with the findings of

this research, confirming the relationship between dwelling satisfaction and loneliness. Significant relationships can also be observed between the factor and other variables within this topic. This indicates that individuals in more expensive homes are more likely to be satisfied with their dwelling, while those living in homes that are too small in relation to the number of occupants are more likely to be dissatisfied. The existence of this relationship was expected based on the initial bivariate analysis. Moreover, dwelling satisfaction is highly correlated with neighborhood satisfaction. This indicates that people who are satisfied with their dwelling are also more often satisfied with their neighborhood and vice versa. This is an important point to consider in the following steps of this research.

6.2.2 General quality

The bivariate analysis of the topic General Quality is presented in Table 6.3. The factor 'neighborhood satisfaction' has a strong relationship with loneliness. This factor includes various variables, including aspects of nuisance as well as satisfaction. The distribution of neighborhood satisfaction is presented in Figure 6.4. The distribution aligns very well with the distribution of loneliness. Again, neighborhoods in the south score below average which is the same for loneliness. Furthermore, there is a strong correlation between neighborhood satisfaction and dwelling satisfaction. When comparing those two distributions, it becomes very clear that the same neighborhoods score below and above average. Therefore, this correlation is not surprising. When comparing these findings with previous studies, Yu et al. (2017) found a significant negative relationship between neighborhood satisfaction and loneliness. Wen et al. (2006) found a relationship between neighborhood quality and loneliness. Therefore, it can be concluded that neighborhood satisfaction is negatively related to loneliness. This means that in neighborhoods where neighborhood satisfaction is high, there is less loneliness.

Table 6.3 - Correlation analysis general quality

		Intactness	Cleanliness	Neighborhood satisfaction
Moderately to severely lonely	**Pearson's r**	-,355**	-0.212	-,682**
	p-value	0.009	0.127	0.000

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

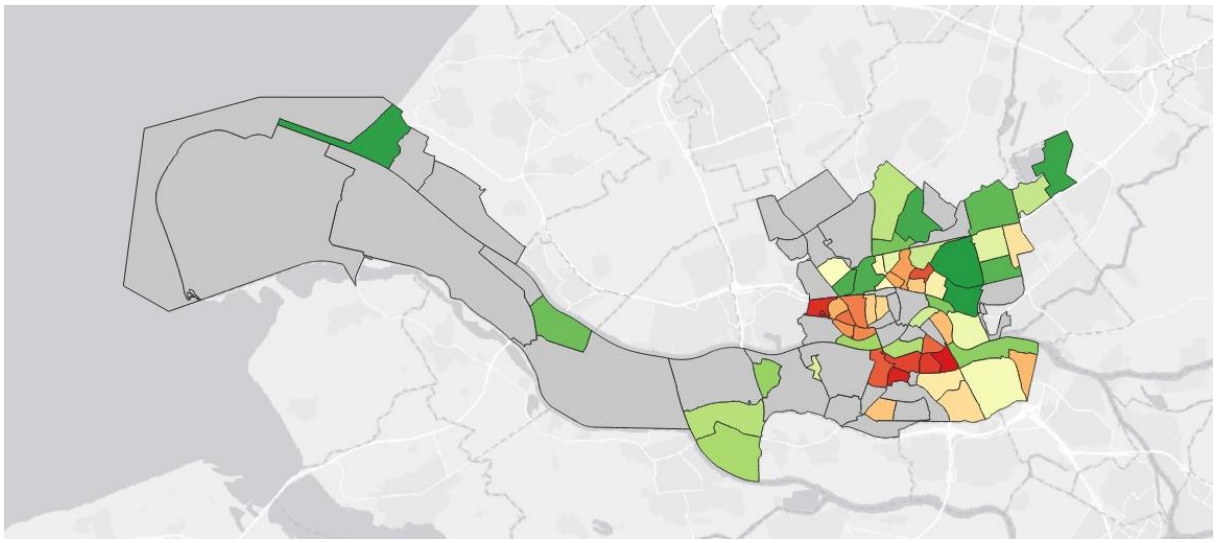


Figure 6.4 - Distribution of neighborhood satisfaction

In addition, two CROW scores have been included as variables. CROW is a Dutch company that creates methods to measure the quality of public space based on five states. This is an objective measurement. No relationship was found between the CROW score for cleanliness and loneliness. However, a

relationship was found between the CROW score for intactness and loneliness. This relationship is negative and significant at the 0.01 level. For this finding, it can be said that individuals residing in neighborhoods with a high CROW score for intactness, indicating better performance on elements related to the intactness scorecard, have a lower likelihood of experiencing feelings of loneliness. In Figure 6.5, the distribution of intactness in the city of Rotterdam can be seen. It is notable that the areas in the western part of Rotterdam have a low score while loneliness is not above average in those areas. Furthermore, the scores are divided throughout Rotterdam so there is not one part that scores particularly bad. However, it is notable that the neighborhoods in the south have a low score, and these are the areas where loneliness is above average. Therefore, this relationship could be expected. Previous studies did not include objective general quality variables. Hence, in this research, the relationship between objective variables and loneliness was examined. Unfortunately, the found relationship cannot be compared with other studies. Therefore, it is now concluded that an intact neighborhood can reduce feelings of loneliness. The CROW score for cleanliness does not show a relationship with loneliness and is not further discussed.

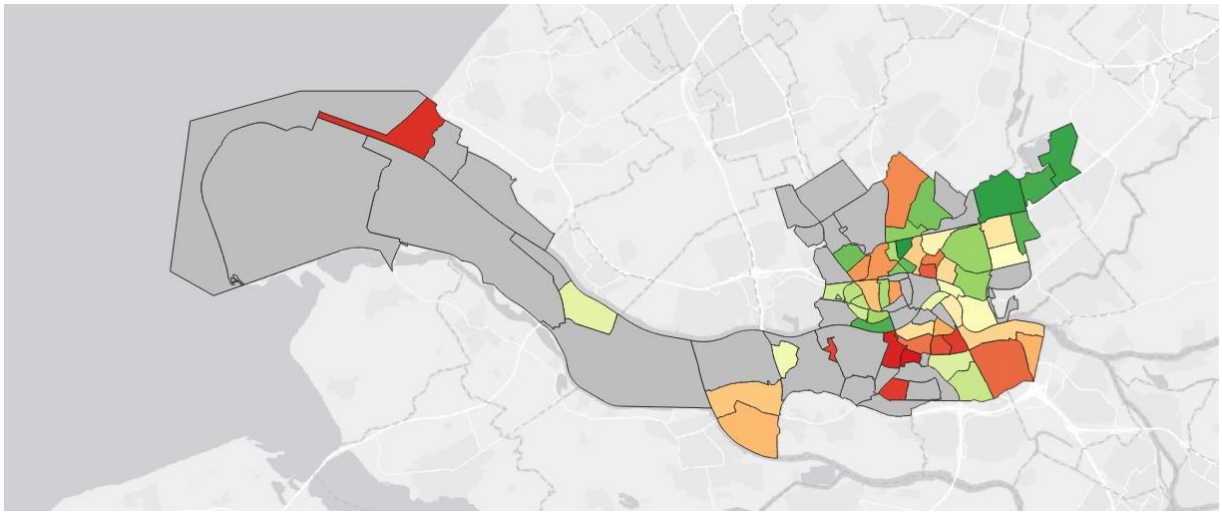


Figure 6.5 - Distribution of intactness

6.2.3 Amenities

The correlation analysis for the topic amenities can be seen in Table 6.4. Within the topic Amenities, numerous variables are included. However, there is only one variable that has a relationship with loneliness, which is satisfaction with overall amenities. A significant negative relationship was found at the 0.01 level, which indicates a strong association. In Figure 6.6, the distribution of satisfaction with amenities is presented. When looking at the distribution of this variable, it can be seen that some neighborhoods in the south score particularly below average on this variable. This is in line with loneliness rates. However, there are some neighborhoods in the south that have a score above average. This is making the strength of the relationship logical. The finding of a relationship aligns with previous studies that demonstrated a relationship between satisfaction with facilities or recreational services and loneliness (Kemperman et al., 2019; Mao et al., 2022; van den Berg et al., 2016). The same relationship is found in this study.

Table 6.4 - Correlation analysis amenities

		% satisfied with overall amenities	Sufficient presence of shops for daily groceries	Sufficient presence of primary healthcare providers	Sufficient presence of sports facilities
Moderately to severely lonely	**Pearson's r**	-,431**	0.154	0.038	-0.185
	p-value	0.001	0.270	0.785	0.186

		Enough places in the neighborhood for joint resident activities (subjective)	There are enough elderly facilities in the neighborhood (subjective)	Enough leisure facilities for young people in the neighborhood (subjective)
Moderately to severely lonely	**Pearson's r**	0.071	-0.083	0.241
	p-value	0.614	0.555	0.082

**. Correlation is significant at the 0.01 level (2-tailed).

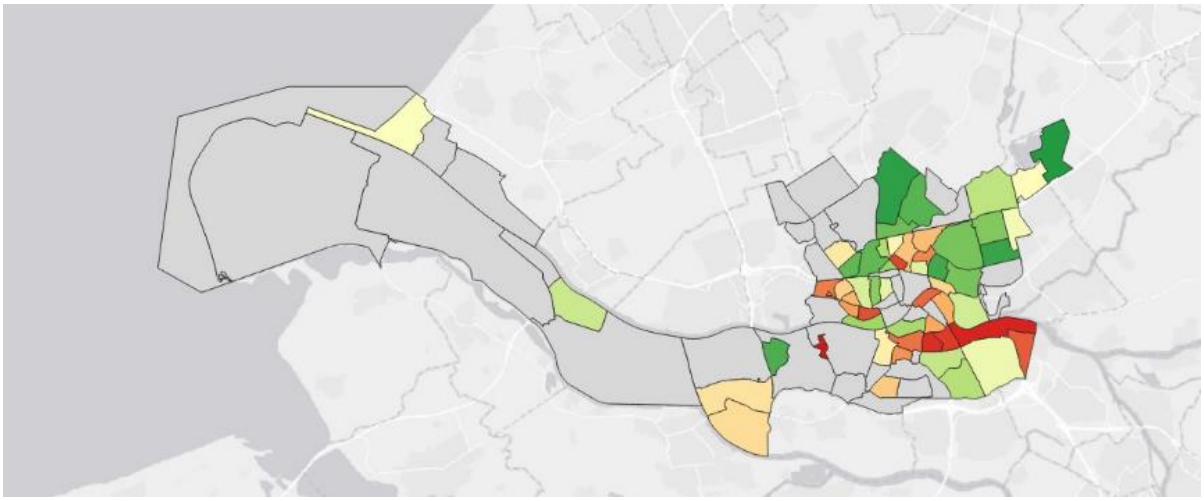


Figure 6.6 - Distribution of satisfaction with overall amenities

All other variables do not have a relationship with loneliness. The other variables are all related to whether residents feel there are enough amenities. Although this specific aspect has not been previously examined, no results were found regarding the distance to amenities (Buecker et al., 2021; Domènech-Abella et al., 2021; Kemperman et al., 2019; van den Berg et al., 2016). These are objective variables instead of the subjective variables used in this study. However, this outcome seems logical considering the nature of these variables.

6.2.4 Urban density

Within the topic urban density, a correlation analysis is performed to examine the relationships between loneliness and variables within this topic. This analysis is shown in Table 6.5. The results indicate that none of the variables have a significant relationship with loneliness. Both p-values exceed the significance threshold of 0.05. The majority of studies identified in the systematic literature did also not find a relationship between density and loneliness (Buecker et al., 2021; Maas et al., 2009; Shovestul et al., 2020; van den Berg et al., 2016; Weijs-Perrée et al., 2015; Yang & Xiang, 2021). The results of this analysis align with this. Hence, the results of this study confirm the lack of relationship between urban density and loneliness.

Table 6.5 - Correlation analysis density

		Residential density	Urban density
Moderately to severely lonely	**Pearson's r**	0.224	-0.233
	p-value	0.107	0.093

**. Correlation is significant at the 0.01 level (2-tailed).

6.2.5 Mobility

Table 6.6 presents the bivariate analysis of the topic mobility. Initially, eight variables were included in this topic, out of which three variables were grouped into a factor. The remaining five variables were found to have no relationship with loneliness in the initial bivariate analysis and were therefore excluded from the factor analysis. These excluded variables mainly pertained to public transportation. The lack of a relationship between objective variables related to public transportation and loneliness is consistent with the findings of Buecker et al. (2021), so it aligns with the existing literature. However, Mao et al. (2022) examined the relationship between public transportation convenience and loneliness and found a negative relationship. Although the variables might have been measured slightly differently in this study, the conclusion drawn is that there is no relationship between objective and subjective public transportation variables and loneliness.

Table 6.6 - Correlation analysis mobility

		Satisfaction with maintenance infrastructure	% of homes within norm distance of bus stops	% of homes within norm distance of metro stations	% of homes within norm distance of tram stops	% satisfaction on with bike path safety	% sufficient presence of public transportation
Moderately to severely lonely	**Pearson's r**	-,471**	0.037	0.100	0.140	-0.232	0.214
	p-value	0.000	0.791	0.476	0.316	0.095	0.125

**. Correlation is significant at the 0.01 level (2-tailed).

Furthermore, no significant relationship was found between satisfaction with bike path safety and loneliness. This finding is surprising, considering the relationship found between sidewalk safety and loneliness. One possible explanation for this discrepancy is that individuals are more inclined to engage in conversations while walking compared to cycling.

However, a significant relationship was discovered between satisfaction with maintenance for active travel modes (sidewalks and bike paths) and loneliness. This negative relationship is significant at the 0.01 level. This indicates that individuals who perceive good maintenance of sidewalks and bike paths and perceive good safety of sidewalks have a lower likelihood of experiencing feelings of loneliness. The distribution of this variable is shown in Figure 6.7. Again, the southern part of Rotterdam scored lower than average. However, it is notable that some neighborhoods in the north also score below average. This is in line with the loneliness rates, since there are also some neighborhoods in the north where loneliness is higher. These are exactly the same neighborhoods as in Figure 6.7 and therefore the correlation is clearly visible. Yu et al. (2017) examined the relationship between traffic safety and loneliness and did not find a relationship. However, it is important to note that the variable in this study focuses solely on sidewalks. No other studies have investigated similar variables. Given the high significance in this data analysis, it can be concluded that there is a relationship between satisfaction with maintenance of sidewalks and bike paths and the safety of sidewalks and loneliness.

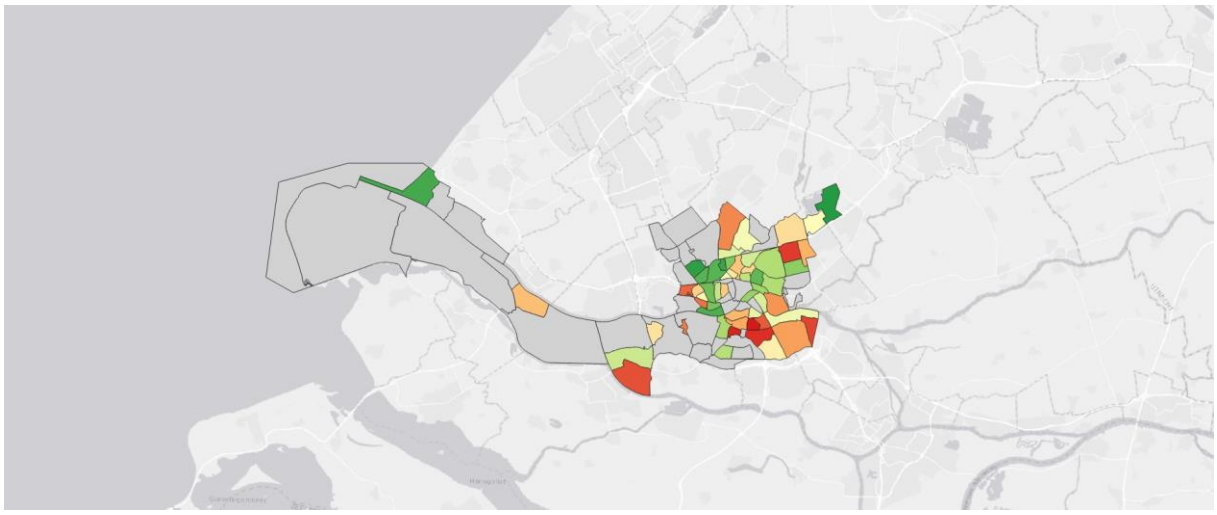


Figure 6.7 - Distribution of satisfaction with maintenance infrastructure

6.2.6 Green

Within the topic Green, a correlation analysis is conducted, as shown in Table 6.7. As a result of the earlier bivariate analysis, several variables did not have a relationship with loneliness and were therefore not included in the factor analysis. Therefore, it is not surprising that only one variable has a relationship with loneliness, which is the created factor. The factor 'Satisfaction with natural elements' consists of three variables: the presence of enough recreational green areas, attractiveness of canals, ditches, and ponds and a satisfactory rating for green spaces. A negative relationship is found between this factor and loneliness. This implies that neighborhoods where people are satisfied with the greenery experience lower levels of loneliness. The distribution of this variable is presented in Figure 6.8. The neighborhoods that score below average (colored orange and red) on the satisfaction with natural elements all have higher rates of loneliness. This is an interesting finding as it has not been previously examined. None of the studies included in the systematic literature review examined subjective green variables.

Table 6.7 - Correlation analysis green

		Satisfaction with natural elements	Trees per km2	Green per km2	Benches per km2	% sufficient presence of green areas (lawns, trees)	Quality of greenery
Moderately to severely lonely	**Pearson's r**	-,393**	0.230	0.060	0.184	-0.236	-0.215
	p-value	0.004	0.098	0.668	0.187	0.089	0.122

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 6.8 - Distribution of satisfaction with natural elements

As mentioned before, there are some variables that do not have a relationship with loneliness. A subjective variable that does not have a relationship with loneliness is the sufficient presence of green areas, which refers to whether there are enough trees and lawns present. Since no previous research has explored the relationship between subjective green variables and loneliness, this result cannot be compared. However, it can be somewhat explained by the finding of a relationship between sufficient recreational green space (places where people actually meet) and loneliness, as opposed to the number of trees and lawns, which may have fewer opportunities for social interactions. So, it can be concluded that there is no relationship between sufficient presence of green areas and loneliness.

Besides this finding, the results of this study indicate that objective green variables do not have a relationship with loneliness. All objective variables from this study were found to have no relationship with loneliness. The number of trees per km2 and green space per km2 are examined, but no relationship was found. This finding aligns with the results of the systematic literature review, as Bustamante et al. (2022), Kemperman et al. (2019) and van den Berg et al. (2016) did not find a relationship with distance to green spaces or the amount of greenery and loneliness. However, there was some uncertainty due to the fact that Buecker et al. (2021) and Maas et al. (2009) did find a negative relationship. Based on these results, it can be concluded that the amount of greenery in a neighborhood has no relationship with loneliness. Additionally, the relationship between the number of benches per square kilometer and loneliness was examined, but no relationship was found. This is noteworthy because benches are places where people can have conversations and meet. Furthermore, no relationship was found between the quality of greenery and loneliness. The quality of greenery is measured by the CROW score method which measures the condition of the greenery, such as the length of the grass. The lack of a relationship is not surprising as there may not be a significant difference in quality that residents would notice. Based on these analyses, it can be confidently concluded that objective green variables have no relationship with loneliness, while subjective variables often do.

6.2.7 Neighborhood composition

A correlation analysis is conducted within the topic composition, and the results are presented in Table 6.8. Many variables within this topic are found to have no relationship with loneliness. The variables included in this analysis were selected based on the systematic literature review and general factors known to influence loneliness, such as age and gender. However, in this study, neighborhood characteristics were used instead of individual respondent characteristics, which may explain the lack of relationship found between age, gender, marital status, and loneliness. This finding is consistent with the results of Shovestul et al. (2020), which also found no relationship between age density, sex density, and loneliness.

Table 6.8 - Correlation analysis composition

		Singles and migrants	% Residents with Western migration background	% women	% men	% Single-person households
Moderately to severely lonely	**Pearson's r**	,639**	0.075	-0.087	0.087	0.171
	p-value	0.000	0.594	0.534	0.534	0.220
		% Households with children	% unmarried	% married	% divorced	% widowed
Moderately to severely lonely	**Pearson's r**	-0.169	-0.082	0.011	0.245	0.087
	p-value	0.228	0.558	0.938	0.077	0.538
		% 0 to 15 years	% 15 to 25 years	%25 to 45 years	% 45 to 65 years	% 65 years or older
Moderately to severely lonely	**Pearson's r**	-0.108	-0.097	-0.087	,274*	0.079
	p-value	0.441	0.489	0.537	0.047	0.575

**. Correlation is significant at the 0.01 level (2-tailed).

Within the factor singles and migrants, three variables were included, namely non-Western migration background, households without children, and single-parent families. This factor has a strong relationship with loneliness, which is significant at the 0.01 level. This means that neighborhoods with a higher proportion of residents with a non-Western migration background and single-parent families have higher levels of loneliness. On the other hand, households without children had a negative factor loading within the neighborhood composition, indicating that neighborhoods with a higher proportion of households without children have lower levels of loneliness. When looking at the distribution of this factor, as can be seen in Figure 6.9, it is clearly visible that the neighborhoods in the south and in the middle have a higher score in this factor. A higher score indicates more singles and/or migrants and less households with children. The neighborhoods that score higher on the factor also score higher on loneliness, making the relationship between them clear.

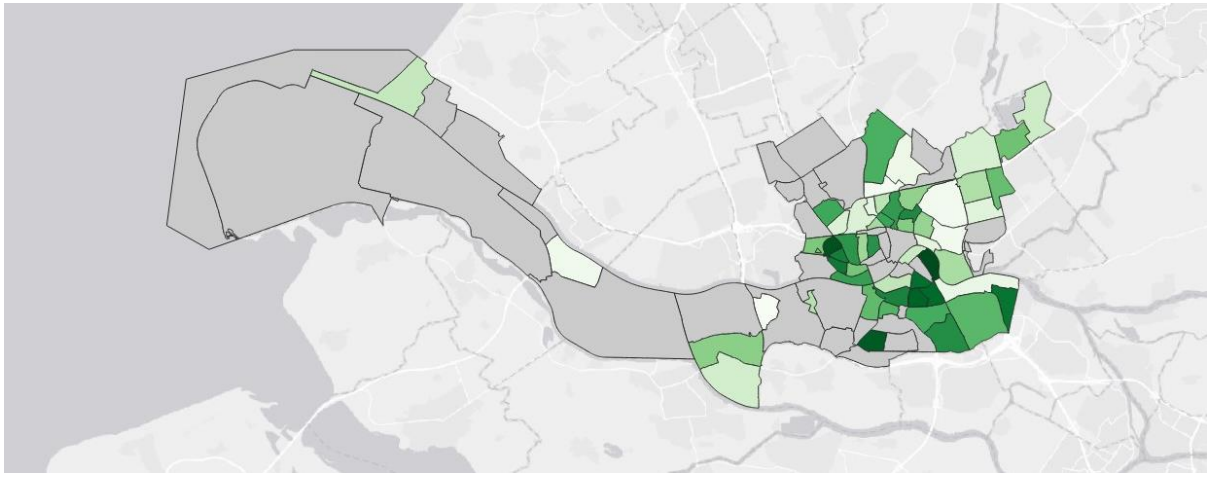


Figure 6.9 - Distribution of singles and migrants

When comparing these results with existing literature, there is a discrepancy. Wen et al. (2006) found no relationship between migration background and loneliness. However, on the individual level, relationship between migration background and loneliness is found (Conkova & Lindenberg, 2018; van Tilburg & Fokkema, 2018). Furthermore, previous research has demonstrated a relationship between singles and loneliness (Buecker et al., 2021; Dahlberg, McKee, Frank, et al., 2022; de Jong-Gierveld & van Tilburg, 2010; Klok & van Tilburg, 2018). This explains the relationship between single-parent families and loneliness. No existing literature was found specifically addressing the relationship between not having children and loneliness. Therefore, this study concludes that not having children is negatively related to loneliness. It is also concluded that certain neighborhood composition variables, namely migrants and singles, have a relationship with loneliness.

6.2.8 SES

Table 6.9 shows the correlation analysis of the topic SES. In this topic, a factor analysis was not conducted because the variables have different measurement levels. Both variables demonstrate a strong relationship with loneliness and are significant at the 0.01 level. This indicates that individuals with a higher household income or higher education level are less likely to experience loneliness.

Table 6.9 - Correlation analysis SES

		Disposable household income	Completed higher education
Moderately to severely lonely	**Pearson's r**	-,554**	-,629**
	p-value	0.000	0.000

**. Correlation is significant at the 0.01 level (2-tailed).

The distribution of the household income can be seen in Figure 6.10. In this figure it is clearly visible that the neighborhoods in the south have an income below the average income. The distribution of above and below the average is almost identical to the distribution of loneliness. Hence, this relationship is clearly visible when comparing both distributions. However, the results from the systematic literature review show different results, as Timmermans et al. (2021) found no relationship between income and loneliness, while Shovestul et al. (2020) did find a relationship. Based on the results of this analysis, it can be concluded that there is indeed a relationship between income and loneliness.

Figure 6.10 - Distribution of household income

The distribution of completed higher education can be seen in Figure 6.11. It is immediately visible that the southern neighborhoods score below average. When comparing this to the distribution of loneliness, a strong alignment can be seen. But also, by comparing the distribution of household income with the educational level, an alignment can be seen whereas neighborhoods in the south score below average and neighborhoods in the north score above average. However, in the western outskirts of Rotterdam, a score below average can be seen as well while this is not the case for loneliness. This is surprising as all other neighborhoods align very well. When comparing the result of this analysis with the results from part I there are some discrepancies. Timmermans et al. (2021) found no relationship between the percentage of low-educated residents and loneliness. However, this study reveals a significant relationship between highly educated residents and loneliness. This finding is likely because education is strongly associated with income, and individuals with higher education levels often have higher incomes compared to those without a starting certificate. Therefore, the results of this study are considered valid.

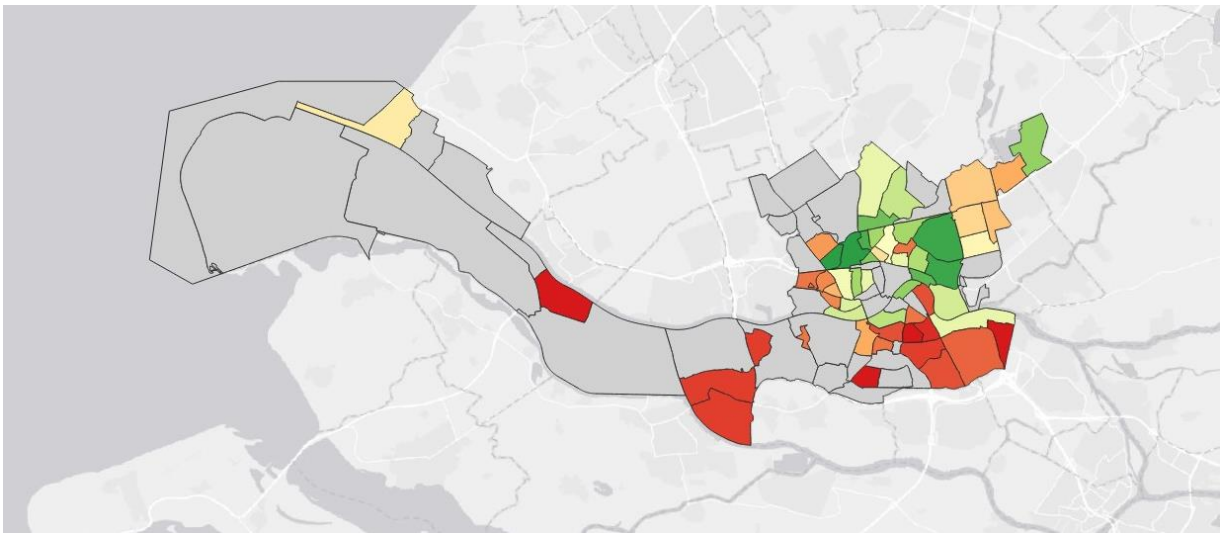


Figure 1 - Distribution of completed higher education

6.2.9 Social safety

Within the topic safety, numerous variables are examined but not all have a relationship with loneliness. The correlation analysis of this topic is presented in Table 6.10. The variables that do not have a relationship with loneliness are primarily about subjective measures of thefts. It is noteworthy that while most variables do have a relationship with loneliness, some do not. This makes it difficult to determine the reasons for these discrepancies.

Table 6.10 - Correlation analysis social safety

		Neighborhood disorder	Bicycle theft is a common neighborhood problem	Theft from cars is a common neighborhood problem	Auto theft in own neighborhood in the past year as a percentage of the total number of cars
Moderately to severely lonely	**Pearson's r**	,489**	0.164	0.222	0.139
	p-value	0.000	0.241	0.110	0.322
		Bicycle theft in own neighborhood in the past year as a percentage of the total number of bicycles	Percentage of residents who have been victims of threats with violence in the past year in their own neighborhood	Percentage of residents who have been victims of assault in the past year in their own neighborhood	Percentage of residents who have been victims of other vandalism in the past year in their own neighborhood
Moderately to severely lonely	**Pearson's r**	0.106	0.181	0.086	0.175
	p-value	0.449	0.194	0.542	0.210

**. Correlation is significant at the 0.01 level (2-tailed).

The factor analysis only included variables that have a relationship with loneliness. Moreover, the factor analysis revealed that not all variables aligned well with the factor, leading to the exclusion of some variables. Ultimately, the factor Neighborhood disorder consists of twenty variables. Neighborhood disorder demonstrated a significant relationship at the 0.01 significance level with loneliness. This implies that neighborhoods with higher levels of disorder are associated with increased loneliness, while safer neighborhoods experience less loneliness. The distribution of neighborhood disorder is presented in Figure 6.12. It is noteworthy that neighborhood disorder is differently distributed than most variables seen so far. There is neighborhood disorder in the south but some of those neighborhoods score exceptionally well. Furthermore, neighborhood disorder is below average in the city center of Rotterdam. The fact that there are some differences with the distribution of loneliness is not surprising as the correlation between neighborhood disorder and loneliness is not very high, namely .489. Previous studies have found a relationship between neighborhood safety and loneliness (Dahlberg, McKee, Lennartsson, et al., 2022; Domènech-Abella et al., 2021; Kemperman et al., 2019; Mao et al., 2022; X. Yu et al., 2021). Furthermore, Yu et al. (2021) explored the link between neighborhood disorder and loneliness. They measured similar variables and found a relationship. However, Yang & Xiang (2021) did not find an effect of perceived crime on loneliness. This study is the only one that did not find a relationship between a subjective safety variable and loneliness, while five other studies did find such a relationship.

Through this bivariate analysis, it is demonstrated that a relationship between perceived safety and loneliness is also found in this current study.

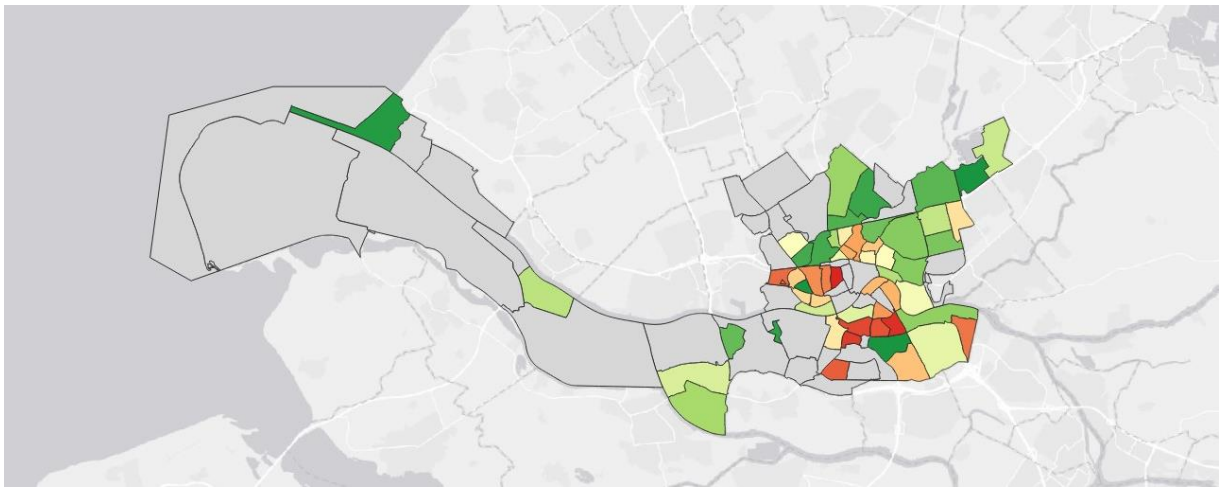


Figure 6.12 - Distribution of neighborhood disorder

6.2.10 Social environment

The next topic analyzed through a correlation analysis, as shown in Table 6.11, is the topic social environment. A factor analysis was conducted with all variables that already showed a relationship with loneliness. The only variable that does not have a relationship with loneliness is residents who have lived in the neighborhood for a long time. This finding is surprising considering its potential association with neighborhood belonging and attachment, which previous studies have found to be related to loneliness (Bower et al., 2021; Kemperman et al., 2019; Weijs-Perrée et al., 2015). It was expected that individuals who have resided in a neighborhood for a long period would have more social connections than those who have recently moved. However, it is worth considering that individuals may remain in a neighborhood for reasons unrelated to social connections, such as limited housing options in other neighborhoods.

Table 6.11 - Correlation analysis social environment

		Social cohesion and participation	Residents who have lived in the neighborhood for a long time
Moderately to severely lonely	**Pearson's r**	-,679**	0.125
	p-value	0.000	0.373

**. Correlation is significant at the 0.01 level (2-tailed).

A relationship is found between social cohesion and participation and loneliness which is statistically significant at the 0.01 level. The distribution of social cohesion and participation is shown in Figure 6.13. The distribution of social cohesion and participation aligns very well with the distribution of loneliness. However, there are some differences, such as a neighborhood in the south where loneliness is above average, indicating more loneliness, while the social cohesion and participation is above average, indicating more social cohesion and participation. But since all other neighborhoods align well, the relationship is logical. This result is consistent with previous research that consistently identified relationships within the same domain (Bergefurt et al., 2019; Bower et al., 2021; Domènech-Abella et al., 2021; Gan et al., 2022; Kemperman et al., 2019; Weijs-Perrée et al., 2015; Yang & Xiang, 2021; X. Yu et al., 2021). Therefore, it can be concluded that the relationship found in this correlation analysis is valid. Thus, it can be said that neighborhoods characterized by high social cohesion and active participation tend to have lower levels of loneliness.

Figure 6.13 - Distribution of social cohesion and participation

6.2.11 Social network

Within the topic social network, all variables were included in a factor analysis, resulting in the variable social network. A correlation analysis for this variable is conducted and is presented in Table 6.12. The created factor, social network, has a strong relationship with loneliness. This finding is not surprising as loneliness is measured by examining both the actual and expected number of relationships. The distribution of social networks across neighborhoods in the city of Rotterdam can be seen in Figure 6.14. It is clearly visible that neighborhoods that score badly on this variable, score badly on loneliness as well, as indicated by orange and red colored neighborhoods. Previous research has identified relationships between social network and loneliness as well (Cuyvers & Valerie, 2009; Demakakos et al., 2006; Hawkley et al., 2008; Klok & van Tilburg, 2018; Pinquart & Sorensen, 2001). The present study reinforces the clear association between social network and loneliness.

Table 6.12 - Correlation analysis social network

		Social network
Moderately to severely lonely	**Pearson's r**	-,669**
	p-value	0.000

**. Correlation is significant at the 0.01 level (2-tailed).

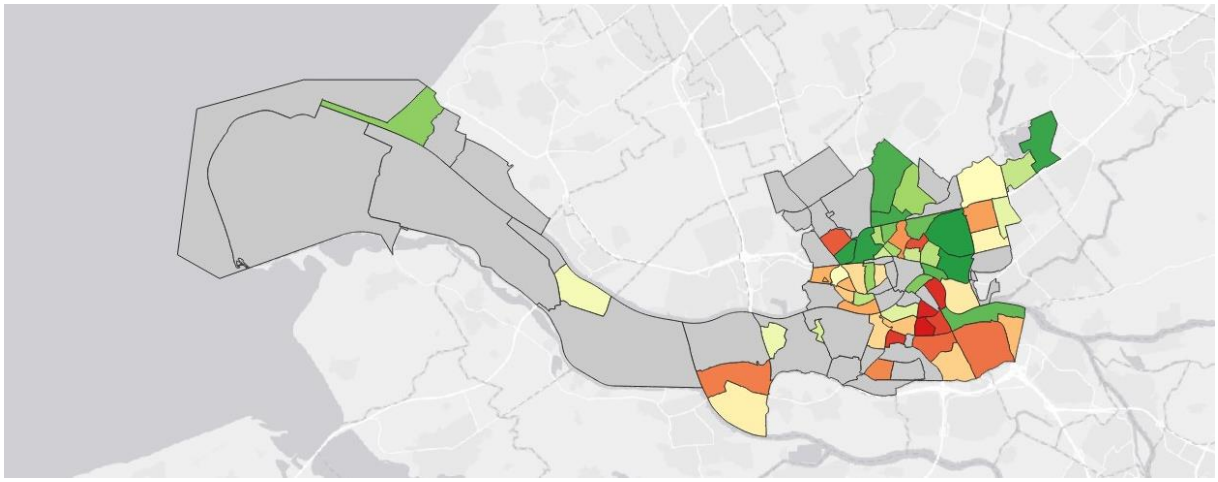


Figure 6.14 - Distribution of social network

6.2.12 Life events

The next topic under examination is the topic life events. Unfortunately, only one variable was available within this topic, which relates to residents who have recently moved to the Netherlands. In the systematic literature study, no relationship was found between English proficiency, cultural diversity, minority status, and loneliness (Lam & Wang, 2022). However, Anderson (2010) found a relationship between recently relocated individuals and loneliness. Therefore, this variable was included in this study. However, the analysis shows no significant relationship between this variable and loneliness, as can be seen in Table 6.13. It is possible that when people move within their own country, the dynamics differ because they still have their established social circles and may not actively seek to form new contacts or maintain regular contact with old ones. On the other hand, when immigrating to a different country, individuals are aware that they are starting fresh, prompting them to be proactive in meeting new people. This might be the reason for not finding a relationship between this variable and loneliness. Because no relationship was found, the variable will not be included in further analyses.

Table 6.13 - Correlation analysis life events

		% residents who have only recently moved to the Netherlands
Moderately to severely lonely	**Pearson's r**	0.082
	p-value	0.561

6.2.13 Activities

The correlation analysis for the topic activities is presented in Table 6.14. Four variables were included in this topic but only three were replaced by a factor. The last variable was not included in the factor analysis because it does not have a relationship with loneliness, which can be seen in the correlation analysis. This is the variable engages in volunteer work. This is in contrast with the findings of Anderson (2010), Niedzwiedz et al. (2016) and van den Berg et al. (2016). This difference could be explained by the fact that the current study analyzes data at the neighborhood level, whereas much research focused on the individual level.

Table 6.14 - Correlation analysis activities

		Active lifestyle	Engages in volunteer work
Moderately to severely lonely	**Pearson's r**	-,649**	-0.230
	p-value	0.000	0.097

**. Correlation is significant at the 0.01 level (2-tailed).

By conducting a factor analysis, the factor active lifestyle was created. This variable does show a significant negative relation with loneliness. This implies that individuals with an active lifestyle have a lower likelihood of experiencing feelings of loneliness. These associations can be linked to factors such as participation, as individuals engaged in hobby clubs are involved in social activities, and health, as individuals who engage in physical activities are more likely to be healthy. The distribution of active lifestyle is presented in Figure 6.15. Again, the southern part of Rotterdam scores below average while the northern part scores above average, which is in line with the distribution of loneliness. Therefore, this relationship is not surprising. Previous studies have established relationships between participation and loneliness (Niedzwiedz et al., 2016), as well as between poor health and loneliness (Anderson, 2010). The findings of this research further reinforce these relationships.

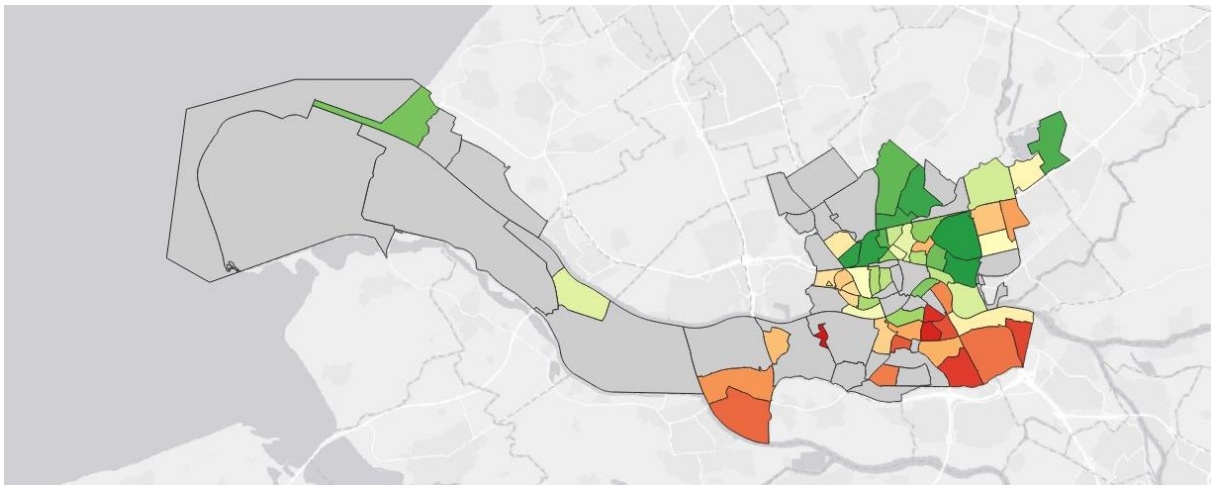


Figure 6.15 - Distribution of active lifestyle

6.2.14 Health

The final topic in these analyses is the topic health, for which the correlation analysis is presented in Table 6.15. Within this topic, there were five variables, one of which showed no relationship with loneliness. Specifically, no relationship was found between drug use and loneliness, which contradicts the findings of Anderson (2016). This discrepancy may be attributed to the current study's focus on the neighborhood level rather than the individual respondent level.

Table 6.15 - Correlation analysis health

		Physical health conditions	At least 1 mental health condition	Drugs (soft drugs/hard drugs)
Moderately to severely lonely	**Pearson's r**	,606**	,390**	-0.059
	p-value	0.000	0.004	0.673

From the remaining four variables, three were included in a factor analysis. By doing so, the factor physical health conditions was created. This variable has a significant positive relationship with loneliness. This indicates that individuals with more health conditions are more likely to experience loneliness. The distribution of physical health conditions is shown in Figure 6.16. It is noteworthy that the distribution from this variable and loneliness is almost identical. Therefore, the relationship is not surprising. Furthermore, this finding aligns with the existing literature, which also identifies a link between health and loneliness (Pinquart & Sorensen, 2001; Van Beuningen & Moonen, 2014; Anderson, 2010; de Jong Gierveld & van Tilburg, 2010; Klok & van Tilburg, 2018),

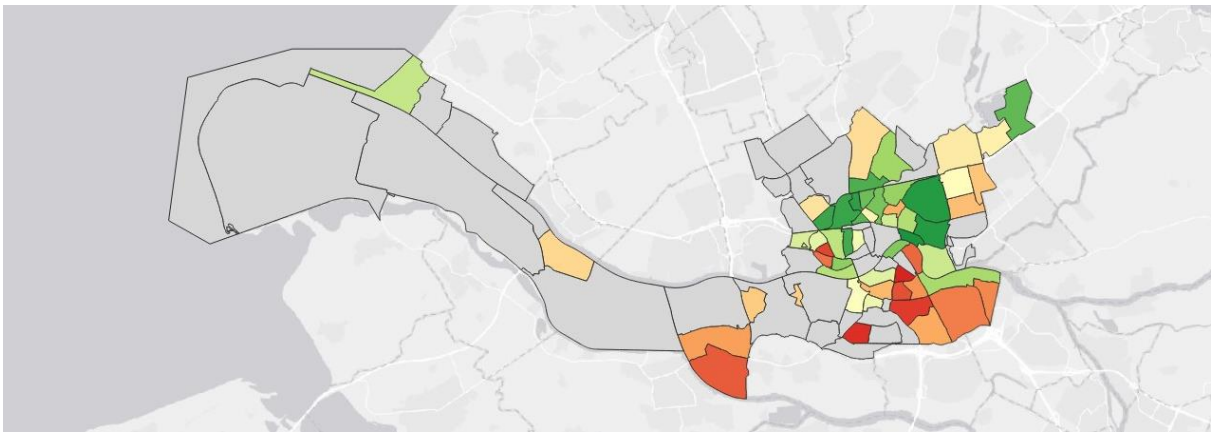


Figure 6.16 - Distribution of physical health conditions

In addition to physical health conditions, mental health conditions and its relationship with loneliness is examined. This revealed a significant positive relationship. This suggests that individuals with more mental health problems have a higher likelihood of experiencing loneliness. When looking at the distribution of this variable, as shown in Figure 6.17, it is notable that most neighborhoods score above average. Only a few neighborhoods are colored dark orange or red, indicating a score far below average. However, these neighborhoods are exactly the neighborhoods where loneliness is the highest above average. This indicates that there is a relationship between the two variables, but it is not a strong one, which is seen in the results from the correlation analysis as well. Cherry (2022) also found a relationship between mental health and loneliness.

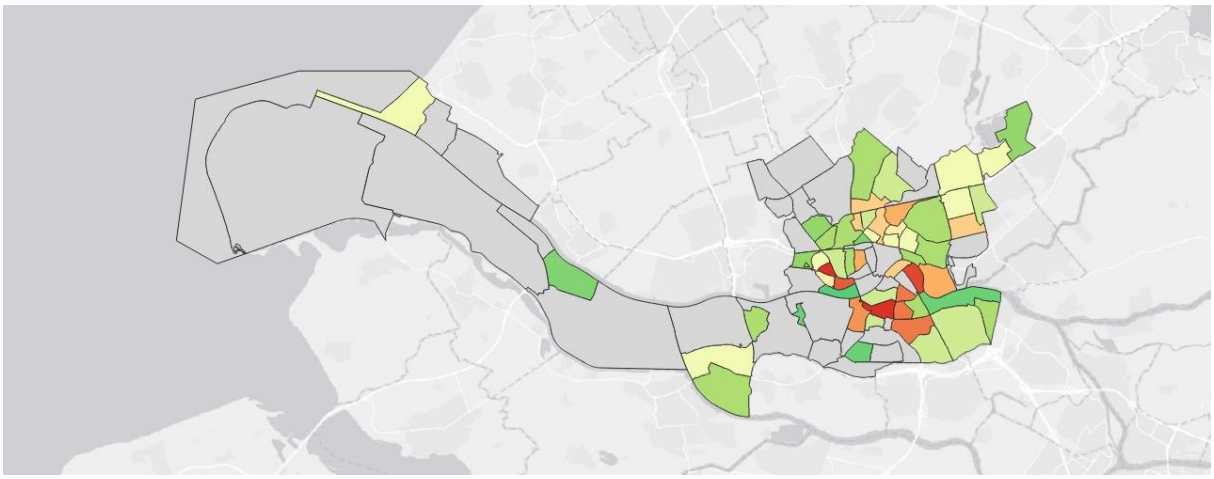


Figure 6.17 - Distribution of mental health conditions

6.3 Conclusion

In this chapter, the following sub question was answered: '*What are the bivariate relationships between built environment factors at the neighborhood level and loneliness?*' The bivariate analyses reveal strong relationships between the independent variables and loneliness. Relationships between the topics dwelling, general quality, amenities, mobility, green, neighborhood composition, SES, social safety, social environment, social network, activities and health and loneliness were found. Moreover, some variables that do not have a relationship with loneliness are identified. Within the topics urban density and life events, no relationship with loneliness was found. This is consistent with the literature and therefore not surprising. Figure 6.17 shows the relationships between built environment factors and loneliness. The original variables that were combined into factors and their factor loadings are included in the figure to clarify what was measured. Also, the Pearson correlation is shown in the figure from which the strength of the relationship with loneliness can be seen. Overall, it can be seen that there are a lot of strong relationships between independent variables and loneliness. This is an important finding of this study. Moreover, from this figure, it can be seen that the built environment factors are related to each other. The factor analyses have reduced correlations within the topics, but there is still a lot of correlation between the factors. By presenting the distributions of variables into figures this became clear as well. Almost all variables score below average in the southern part of the city of Rotterdam. Because of these correlations, it is important to examine whether a regression analysis is the most appropriate approach for the next phase of this research. Due to the correlations, it may not be feasible to conduct a reliable regression analysis. Moreover, the indirect relationships will become clearer by constructing a Bayesian belief network. These analyses will both be explored in the following chapter. Nonetheless, the results from the bivariate analyses are already valuable, as they indicate significant relationships between a lot of independent variables and loneliness. These findings can already be taken into consideration in practical applications.

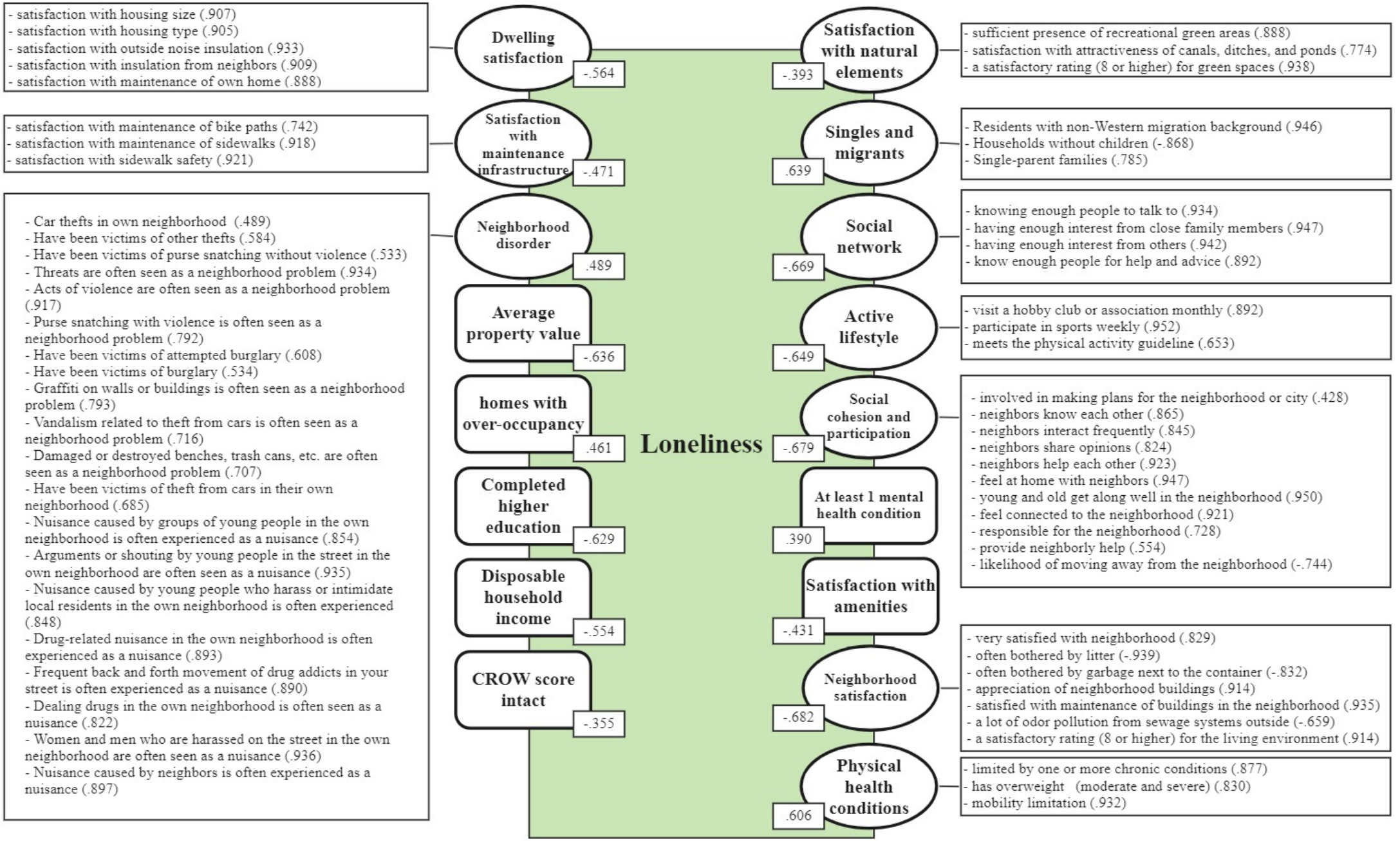
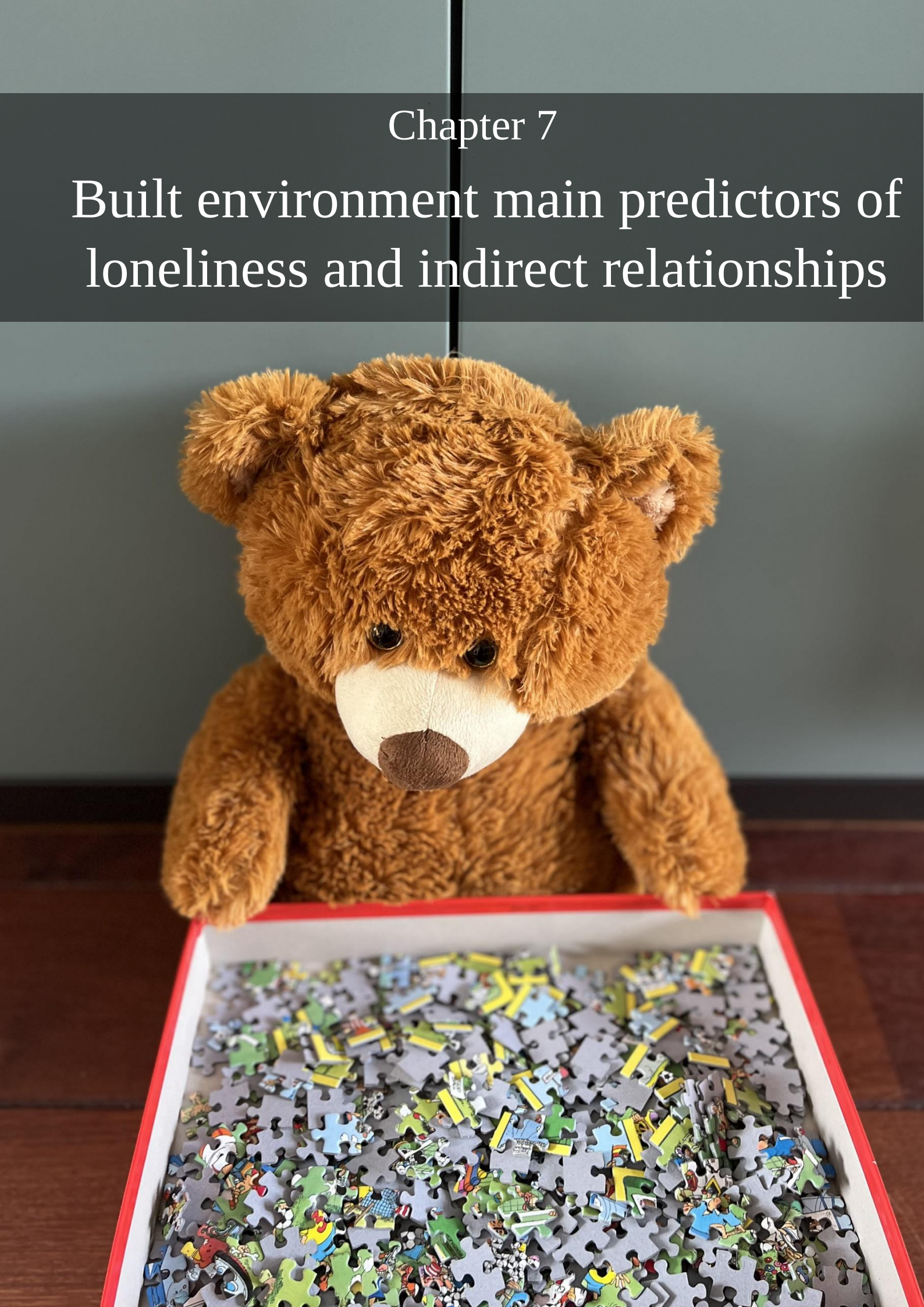


Figure 6.17 - Schematical representation of relationships between the built environment and loneliness

Chapter 7

Built environment main predictors of loneliness and indirect relationships



7. Built environment main predictors of loneliness and indirect relationships

In this chapter, two sub-questions will be answered. First the question '*Which built environment factors at the neighborhood level are most important predictors of loneliness?*' is answered by conducting a regression analysis. Secondly, an answer will be given to the question '*What are the direct and indirect relationships between the built environment factors related to loneliness at the neighborhood level?*' This is done by constructing a Bayesian belief network.

7.1 Multilinear regression

After conducting the factor analyses and correlation analyses, a regression analysis is performed to examine the effect of the independent variables on the dependent variable. It is already known which independent variables have a relationship with loneliness and only those who do have a relationship are included in the regression analysis. However, it is not known if certain variables explain the same portion of the variance and which variables are the most important predictors. Therefore, a regression analysis will be performed. By doing so, the main predictors of loneliness can be determined. This is important since these variables are most effective to improve in order to reduce feelings of loneliness.

7.1.1 Multicollinearity

The independent variables have significant correlations between each other. This is raising concerns about multicollinearity. Multicollinearity can cause problems, such as difficulty in distinguishing the individual effects of variables on the dependent variable. There are several ways to assess the presence of multicollinearity. One approach is to examine the correlations among the independent variables. According to Saunders, Lewis, and Thornhill (2016), Hair et al. (2019), and Tabachnick and Fidell (2007), the correlation should not exceed 0.9. However, opinions on this matter vary. Berry et al. (1985) and Field (2009) set a threshold of 0.8, for which Berry et al. (1985) state that it can be lowered to 0.7 when dealing with a limited number of observations. Given the small number of observations in the dataset (only 53 neighborhoods), a threshold of >0.700 was examined. Table 7.1 presents all variables that exceed this threshold in terms of their correlation.

From this table, it appears that many variables have correlations higher than 0.700. Variables should be removed to conduct a proper regression analysis. In this context, variables that have numerous relationships and variables of lesser importance are removed and highlighted in red. However, the question remains whether this threshold is the most appropriate to apply. By using this threshold, important variables that should actually be included in the regression analysis are being excluded. Therefore, it was decided to adopt Hair's threshold of 0.900 and apply an alternative test.

The alternative test that can be used it to examine the variance inflation factor (VIF), which is visible within the results of a regression analysis. Consequently, the regression will be performed with all variables using stepwise and then the VIF values will be examined. Opinions about the threshold of the VIF values differ. However, in this study, the threshold that was most found is used. This is the threshold of Myers (1990) and Alin (2010), which is a threshold of 10. This means that values above 10 indicate multicollinearity. Stepwise can already prevent multicollinearity to a high degree but the examination of the VIF values provides definite answers. If multicollinearity persists, it can be concluded that the dataset is not suitable for regression analysis.

Table 7.1 - Correlations >.700

Correlations >.700			
% homes with over-occupancy	↔	Neighborhood satisfaction	-.751**
% homes with over-occupancy	↔	Neighborhood composition	.844**
Satisfaction with dwelling	↔	Neighborhood disorder	-.700**
Satisfaction with dwelling	↔	Social cohesion and participation	.732**
average property value per square meter of living space	↔	% Completed higher education (HBO or WO)	.873**
average property value per square meter of living space	↔	Social network	.744**
average property value per square meter of living space	↔	Active lifestyle	.864**
average property value per square meter of living space	↔	Physical health conditions	-.741**
Neighborhood satisfaction	↔	Neighborhood composition	-.794**
Neighborhood satisfaction	↔	Neighborhood disorder	-.788**
Neighborhood satisfaction	↔	Social cohesion and participation	.832**
% satisfied with overall amenities	↔	Satisfaction with natural elements	.765**
Neighborhood composition	↔	Social network	-.711**
% Completed higher education (HBO or WO)	↔	Social network	.776**
% Completed higher education (HBO or WO)	↔	Active lifestyle	.870**
% Completed higher education (HBO or WO)	↔	Physical health conditions	-.881**
Social network	↔	Active lifestyle	.798**
Social network	↔	Physical health conditions	-.733**
Active lifestyle	↔	Physical health conditions	-.781**

7.1.2 Execution of analysis

The regression analysis is performed in SPSS using the Stepwise method. The stepwise method is the most suitable method for this study as there are correlations between the variables. The output of the regression analysis shows four models. The first model includes neighborhood satisfaction. In the second model, the variable physical health conditions is added to this. In the third model, social cohesion and participation is added on top of these two variables. In the last model, neighborhood satisfaction is removed. The adjusted R square values increase until the third model after which the value decreases. The highest adjusted R square is from model 3 and is 0.617, this means that 61.7% of the variance of loneliness is explained by the independent variables in the model. Considering the adjusted R square values, model 3 would be the best model. However, there are more outputs that are important, such as the significance of the models. Model 3 has an F value of 28.954 with a significance of <0.001. This means that the probability of a value of >28.954 is less than 0.001. Model 4 has an F value of 41.875 and also a significance of <0.001. In other words, the probability of a value above 41.847 is less than 0.001. Due to this, it can be concluded that the regression analysis contains explanatory variables. The last output table in SPSS is the coefficients table. This table provides information on the effect of the dependent variables on the independent variables. In this case of model 3, loneliness = 55,604 + -1,596

*neighborhood satisfaction + 2,984 * physical health conditions + -2,783 * social cohesion and participation. But firstly, it is important to check the significance, which is conducted using a t-test. The probability of a value of > -1.338 for neighborhood satisfaction is 0.187. Thus, this model is no longer significant. Therefore, model 3 should not be used and there will be looked at model 4 as this model had a high adjusted R squared value (0.611). Furthermore, all values are significant in this model, making it a suitable model. The coefficients table of model 4 is shown in Table 7.2.

Finally, as mentioned earlier, it is important to look at multicollinearity. This is done using the VIF values. These are also shown in Table 7.2. By looking at the VIF values of model 4, it is immediately noticeable that there are no values close to 10, which is the set threshold. In fact, both VIF values are 1,120. This is considerably lower than 10 and therefore it seems that there is no multicollinearity. It is noticeable that the VIF values in the third model are a lot higher than in the fourth model. This means that there is more mutual correlation in the third model than in the fourth model which is explained by neighborhood satisfaction. It was seen earlier that neighborhood satisfaction has a significant relationship with all other variables, so this observation is not surprising. However, the results of model 4 are used for the next section, which explains the results of this analysis.

Table 7.2 - Results of regression analysis

Model		*Unstandardized Coefficients*		*Standardized Coefficients*	*t*	*Sig.*	*Collinearity Statistics*	
		B	*Std. Error*	*Beta*			*Tolerance*	*VIF*
4	(Constant)	55.604	0.641		86.715	0,000		
	Physical health conditions	3.213	0.685	0.429	4.690	0,000	0.893	1.120
	Social cohesion and participation	-4,035	0.685	-0.539	-5.890	0,000	0.893	1.120

a. Dependent Variable: Moderately to severely lonely

7.1.3 Results

From the results of the regression analysis, it can be concluded that if the variable physical health conditions increases by 1%, loneliness increases by 3.213%. Thus, it is recommended to reduce physical health conditions in neighborhoods so that loneliness also decreases. Recommendations for this are given in chapter 8. As for social cohesion and participation, an even higher unstandardized coefficient is found. If social cohesion and participation is increased by 1% in a neighborhood, loneliness reduces by 4.035%. It is therefore important to promote neighborly contact and participation in one's own neighborhood.

Other variables are not included in the regression model. Consequently, it is not clear how the other variables are related to loneliness. This could be caused by the relatively small sample size of 53 neighborhoods. If a large sample is used, the t-distribution can better approach the normal distribution and the standard error will become smaller (van Beek et al., 2023). By using a larger sample size, it would be possible that more variables are included in the model. Besides the sample size, it is possible that these variables were not included because there are too many interrelationships. However, multicollinearity is tested, and this is not found in the current model. Additionally, indirect relationship between the independent variables can explain the results found in this regression analysis further because some variables, indicating the need to examine the indirect relationships. However, after conducting this regression analysis, it becomes clear that physical health conditions and social cohesion and participation are main predictors for loneliness.

7.2 Bayesian belief network

In the previous section it is seen that the main predictors for loneliness are physical health conditions and social cohesion and participation. However, the indirect relationships between built environment factors and loneliness are not examined yet. A Bayesian belief network (BBN) is a method used to find and visualize direct and indirect relationships between variables. By creating a Bayesian belief network, the direct and indirect relationships are clearly visible in the model. Moreover, a technique such as belief networks can be used even with multicollinearity (Hair et al., 2010). In the dataset of this study, there is no multicollinearity but there are strong relationships between the variables, indicating that a belief network is suitable for this study.

A BBN is based on conditional probabilities. It is constructed based on two steps. First, the structure of the network should be determined. In this step, there will be determined what depends on what, which is the conditional independence between variables. Secondly, the parameters should be determined by using the expectation maximization learning algorithm. The parameters are the strengths of the relationships (Cheng et al., 2001). This is also referred to as the conditional probabilities. Thus, the nodes represent variables with conditional probabilities and their relationships, while the arrows show the strengths of the relationships between the nodes. As a result, it creates a model with the inclusion of probabilities and strength indicators for the arrows.

One advantage of using a BBN is its applicability in situations characterized by significant correlations between variables, such as the present study. In such scenarios, a BBN provides a clear overview of how the variables relate not only to the dependent variable but also to the independent variables. Consequently, it is a suitable method for this particular study. However, it does require a large sample size depending on the number of variables used. In this case, the more variables that are included in the BBN, the more samples are needed. Therefore, it is decided that less important variables are not included in this analysis, making it more suitable for the analysis. Accordingly, the BBN will be more concise and comprehensible.

7.2.1 Dataset

To create a compact and usable BBN, the dataset should be changed. In addition to removing variables, the data should be changed in order to construct a proper BBN. The reason for this is that the BBN shows all answer options as a state. Currently, the variables are measured in percentages or fall within a factor which gives numbers between -3 and 2. In the case of loneliness, the BBN will show 40%, 41%, 42% until the highest value of loneliness. Since BBN uses states, the existing data could generate a hundred states, which would be overwhelming and impractical. Therefore, the variables need to be in a number of categories, so the variables need to be discretized. This is done in two steps. First of all, to maintain the valuable information of the variables, an equal distance between the categories is preferred. Because of that, the minimum and maximum value are distracted from each other and divided by five, as this is a proper number of categories. Secondly, the number of answers in each state are compared. If a state has only a few answers, it is combined with the second state. This helps to create states that are more equal in number of answers. Moreover, if one state has a lot of answers while the others do not, they will be transformed into other categories. This is the case for household income. A lot of people have an income below €40.000 per year but there are some outliers. For this variable, a low, medium and high income is used for the states. Overall, this way of discretizing data will ensure that the data keeps its valuable information. The final results of the discretized variables can be seen in Table 7.3. The percentages of answers for each state are also shown in this table, indicating the distribution of the answers over the states. Additionally, each state is labeled based on a ranking order. Still, this data is on the neighborhood level, so the label refers to people living in the neighborhood. For instance, in one neighborhood people hardly experience feelings of loneliness compared to the other neighborhoods in Rotterdam. These discretized variables will be used to construct the BBN.

Table 7.3 - Dataset for the Bayesian belief network (N = 53)

Variable	State	Label	Category	%	Variable	State	Label	Category	%
Loneliness	0	Least loneliness	< 47%	18					
	1	Less loneliness	47% - 55%	32					
	2	More loneliness	56% - 62%	28					
	3	A lot of loneliness	> 62%	23					
Dwelling									
Dwelling satisfaction	0	Very unsatisfied	<-1	19	Property value	0	Very affordable	< 1750	30
	1	Unsatisfied	-1 - 0	37		1	Affordable	1750 - 2250	29
	2	Satisfied	0 - 1	23		2	Somewhat expensive	2250 - 2750	26
	3	Very satisfied	> 1	21		3	Expensive	> 2750	16
General quality & Amenities									
Neighborhood satisfaction	0	Very unsatisfied	< - 1	19	Satisfaction with amenities	0	Very unsatisfied	< 34%	7
	1	Unsatisfied	-1 - 0	30		1	Unsatisfied	34% - 44%	31
	2	Satisfied	0 - 1	32		2	Neutral	45% - 55%	33
	3	Very satisfied	> 1	20		3	Satisfied	56% - 67%	19
						4	Very satisfied	> 67%	10
Mobility & Green									
Satisfaction with maintenance of infrastructure	0	Very unsatisfied	< - 1	14	Satisfaction with natural elements	0	Very unsatisfied	< - 1	23
	1	Unsatisfied	-1 - 0	38		1	Unsatisfied	-1 - 0	28
	2	Satisfied	0 - 1	31		2	Satisfied	0 - 1	30
	3	Very satisfied	> 1	18		3	Very satisfied	> 1	20
SES									
Completed higher education	0	Very few	< 25%	37	Disposable household income	0	Low	< 34	33
	1	Few	25% - 35%	19		1	Medium	34 - 40	37
	2	Some	36% - 46%	25		2	High	> 40	30
	3	A lot	> 46%	19					
Composition & Social safety									
Singles and migrants	0	Very few	< - 1	19	Neighborhood disorder	0	Little disorder	< - 1	16
	1	Few	-1 - 0	32		1	Some disorder	-1 - 0	35
	2	Some	0 - 1	28		2	Disorder	0 - 1	31
	3	A lot	> 1	22		3	A lot of disorder	> 1	19
Social environment & Network									
Social cohesion and participation	0	Very little	< - 1	17	Social network	0	Very small	< - 1	17
	1	Little	-1 - 0	39		1	Small	-1 - 0	34
	2	Some	0 - 1	26		2	Medium	0 - 1	34
	3	A lot	> 1	17		3	Large	> 1	15
Health									
Physical health conditions	0	Few	< - 1	18	Mental health conditions	0	Few	< 8%	18
	1	Medium	-1 - 0	32		1	Medium	8% - 11%	51
	2	Some	0 - 1	33		2	Some	12% - 15%	23
	3	A lot	> 1	17		3	A lot	> 15%	9
Activities									
Active lifestyle	0	Not active	< - 1	16					
	1	Somewhat active	-1 - 0	31					
	2	Active	0 - 1	35					
	3	Very active	> 1	18					

7.2.2 Implementation

The BBN is constructed using the GeNIe program (BayesFusion, 2023). This is a software program specifically designed for running BBN models. GeNIe is based on the expectation maximization algorithm to learn the probability distributions (BayesFusion, n.d.). Besides that, there are various learning algorithms to choose from within this program. In this research, the Greedy ThickThinning algorithm is used. This algorithm is based on the Bayesian search approach, which is a suitable approach for complex data. This is an approach that starts with an empty graph. First, links are added that increase

the marginal likelihood. This is done until there are no increases anymore. After that, links are removed until there is a positive increase, creating the final model. Within this algorithm there is only one parameter, which is the max parent count. This parameter gives a maximum number of parents that a node can have (BayesFusion, n.d.). In this study, the maximum is set at 4.

Another decision that needs to be made is about the background information. Within BBN models, background information can be added. Consequently, certain links can be forced and forbitten and tiers can be determined. By putting variables in certain links, the order is determined. Variables in tier two are not allowed to point to variables in tier one. Through this option, the dependent variable and any existing known relationships can be specified. In this study, the conceptual model shown in Figure 2.10 is used as a base. Consequently, loneliness is placed in tier two while all other variables are placed in tier one. No relationships are forced or forbitten as this is not the case in the conceptual model. By making all those choices, a proper BBN will be constructed.

7.2.3 Results

The BBN model, including its conditional probability tables, is presented in Figure 7.1. In the model, the physical built environment variables are represented by green nodes. Socio-demographics and other personal factors are coloured blue, while social factors are displayed in yellow. The dependent variable, loneliness, is shown in red. The conditional probilities are represented using bar icons. Additionally, the arrows are shown in a way that the strength of the relationship can be seen. In this context, a thick, so bolt, arrow represents a strong relationship.

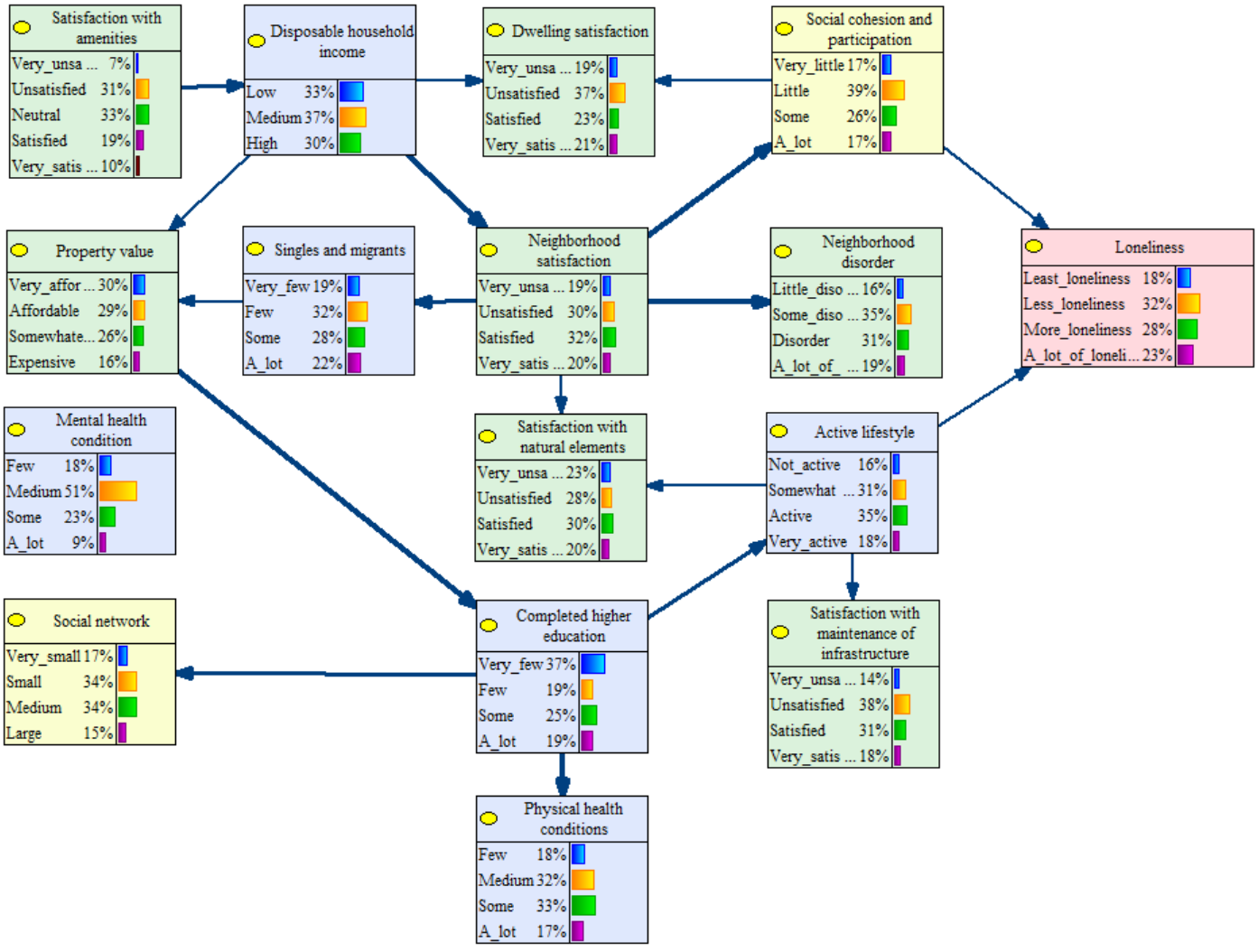


Figure 7.1 - Bayesian belief network

Firstly, the network structure is examined. It is immediately clear that in this model, the variable social cohesion and participation has a direct relationship with loneliness. This is not surprising as this was found to be the main predictor of loneliness in the regression analysis. However, it is noteworthy that active lifestyle also has a direct relationship with loneliness. This variable was not included in any of the models created in the regression analysis. Besides the direct relationships, it is important to examine the indirect relationships. There are some clusters within the model, indicating that these are important built environment factors. For instance, neighborhood satisfaction has a relationship with five other variables. This is not surprising as a lot of relationships were found between this variable and the other variables in the correlation analyses. Furthermore, SES values are connected with each other. Disposable household income has a relationship with property value and the property value has a relationship with educational level. Moreover, singles and migrants have a relationship with property value. These variables are related with satisfaction variables and the social network. This is indicating that there is a relationship between the satisfaction in neighborhoods and their SES. Lastly, mental health conditions does not have a relationship with any of the other variables. In the correlation analyses, few relationships were found between this variable and the other variables. However, this is indicating that these relationships are not as strong as other relationships.

In addition to the network structure, it is important to examine the strength of influence in the BBN model. The program calculates values to determine the strength of influence which is shown through the thickness of the arrows. The average strength of influence for each relationship is presented in Table 7.4. A higher value indicates a stronger link between the variables. The values in the table are sorted from high to low. It is noteworthy that there are no exceptional high values. The highest strength of influence is 0.463 while a score of 1 is possible. However, there are also no extreme low values present. The lowest value in the model is 0.201, which is the relationship between active lifestyle and loneliness. The most important relationships are examined in the sections below.

Table 7.4 - Average strength of influence BBN

Average strength of influence			
Completed higher education	→	Physical health conditions	0.463
Property value	→	Completed higher education	0.450
Disposable household income	→	Neighborhood satisfaction	0.450
Neighborhood satisfaction	→	Neighborhood disorder	0.420
Neighborhood satisfaction	→	Social cohesion and participation	0.405
Completed higher education	→	Active lifestyle	0.390
Neighborhood satisfaction	→	Singles and migrants	0.361
Completed higher education	→	Social network	0.332
Satisfaction with amenities	→	Disposable household income	0.307
Social cohesion and participation	→	Dwelling satisfaction	0.288
Disposable household income	→	Dwelling satisfaction	0.271
Singles and migrants	→	Property value	0.262
Active lifestyle	→	Satisfaction with maintenance of infrastructure	0.239
Disposable household income	→	Property value	0.218
Social cohesion and participation	→	Loneliness	0.213
Neighborhood satisfaction	→	Satisfaction with natural elements	0.211
Active lifestyle	→	Satisfaction with natural elements	0.207
Active lifestyle	→	Loneliness	0.201

Social cohesion and participation – Loneliness

The first relationship that is examined is the relationship between social cohesion and participation and loneliness. It is evident that this is an important relationship as it is the main predictor of loneliness according to the regression model. In a BBN, states can be selected to observe how the probabilities of variables change, creating updated probabilites. In Figure 7.2, the updated probabilities for the states within loneliness can be seen. It should be noted that there is a percentage >100%. This can be the case because the percentages are rounded. The bottom row of the figure represents the states in percentages of loneliness when there is no evidence, so the original percentages. The other states of social cohesion and participation are shown on the y-axis as well. The probabilities of states occurring within the variable loneliness are shown in percentages on the x-axis. In the context of Figure 7.2, if there is very little social cohesion and participation within all neighborhoods, the percentage of more loneliness and a lot of loneliness is 60% and the least loneliness is 18%. On the other hand, if there is a lot of social cohesion and participation, the percentage of more loneliness and a lot of loneliness decreases to 44% and the percentage of least loneliness increases to 27%. These results show that there is a clear relationship between the two variables. This indicates that residents living in neighborhoods with good social cohesion and participation have less chance of experiencing feelings of loneliness.

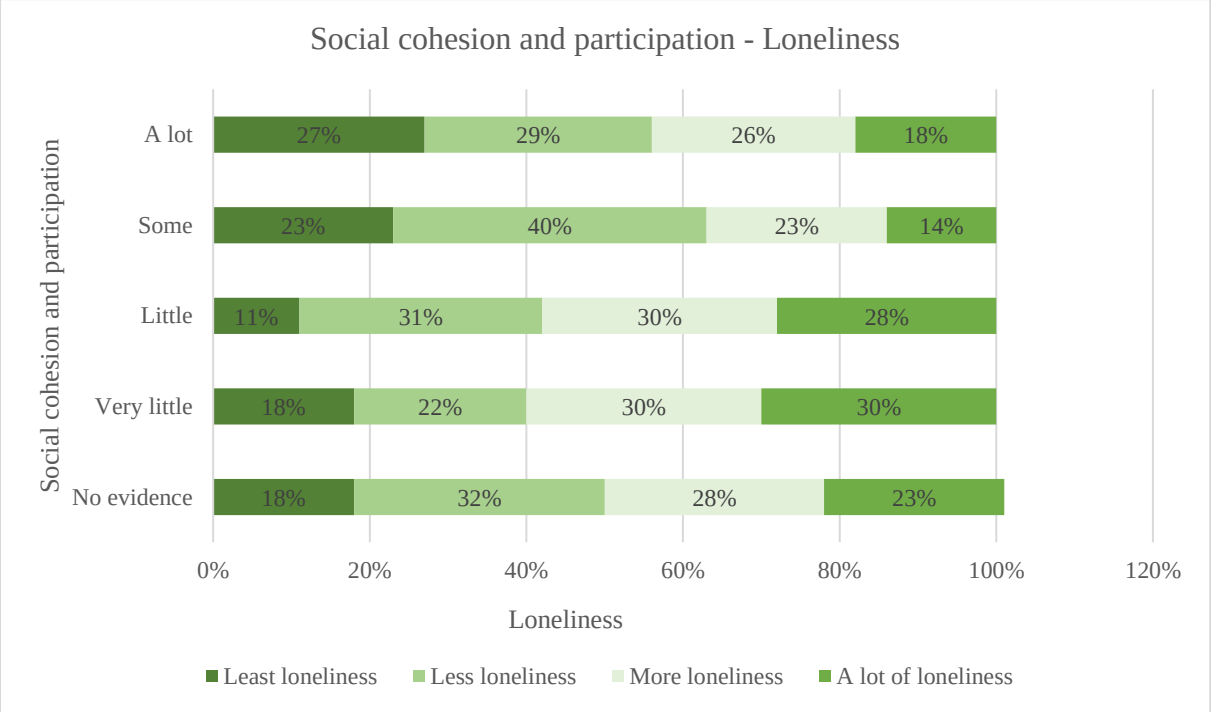


Figure 7.2 - Updated probabilities loneliness based on social cohesion and participation

Active lifestyle – Loneliness

Another direct relationship that is found is the relationship between active lifestyle and loneliness. The strength of influence for this relationship is relatively low, making the results from the updates probabilities interesting. The updated probabilities are presented in Figure 7.3. If residents of a neighborhood are not active, 60% of the resident's experience more or a lot of loneliness. Meanwhile, if all residents are very active, the percentage of more and a lot of loneliness decreased to 38%. From Figure 7.3, it can clearly be seen that the percentage of least loneliness and less loneliness increases from left to right while the percentage of more and a lot of loneliness decreases. This shows the importance of supporting people in having an active lifestyle.

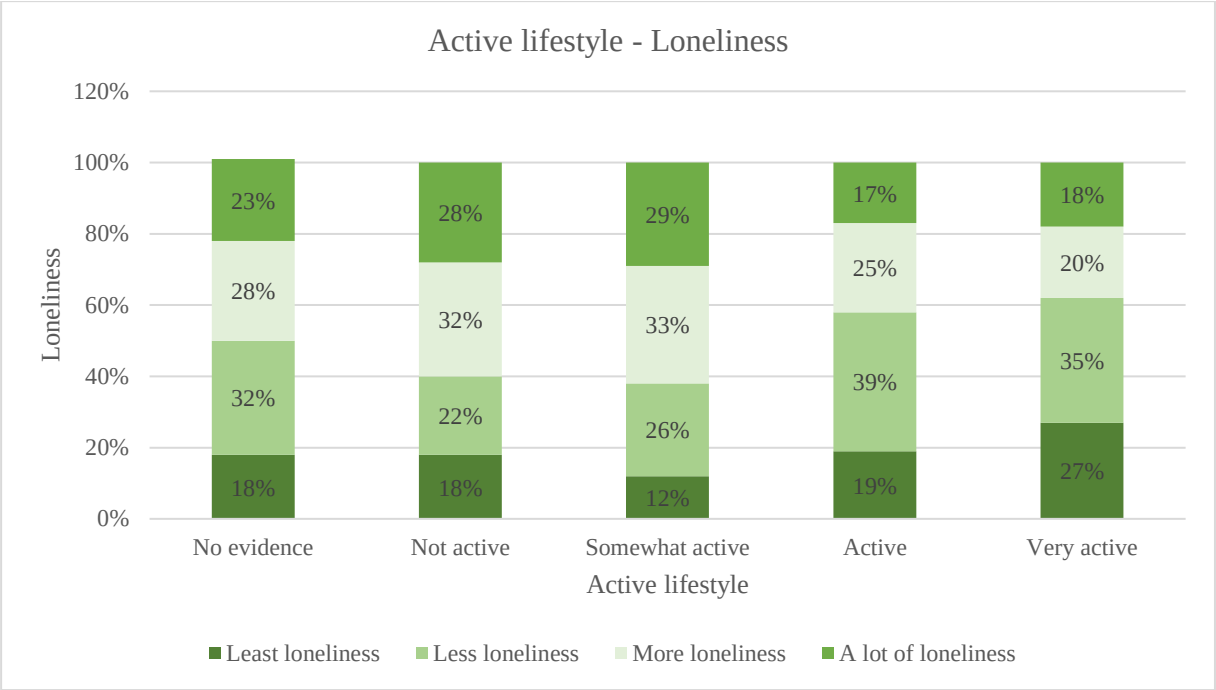


Figure 7.3 - Updated probabilities loneliness based on active lifestyle

Neighborhood satisfaction – Social cohesion and participation

The relationship between neighborhood satisfaction and social cohesion and participation is important as it is an indirect relationship to loneliness and neighborhood satisfaction is connected to a lot of other variables. Therefore, the updated probabilities for this relationship are discussed. The updated probabilities can be seen in Figure 7.4. From this figure it becomes clear that neighborhoods with low satisfaction rates have very little social cohesion and participation. In neighborhoods where people are very satisfied, social cohesion and participation increases. In this case, 43% of the neighborhoods have a lot of social cohesion and participation. Consequently, improving neighborhood satisfaction can lead to more social cohesion and participation and because of that it can indirectly reduce loneliness.

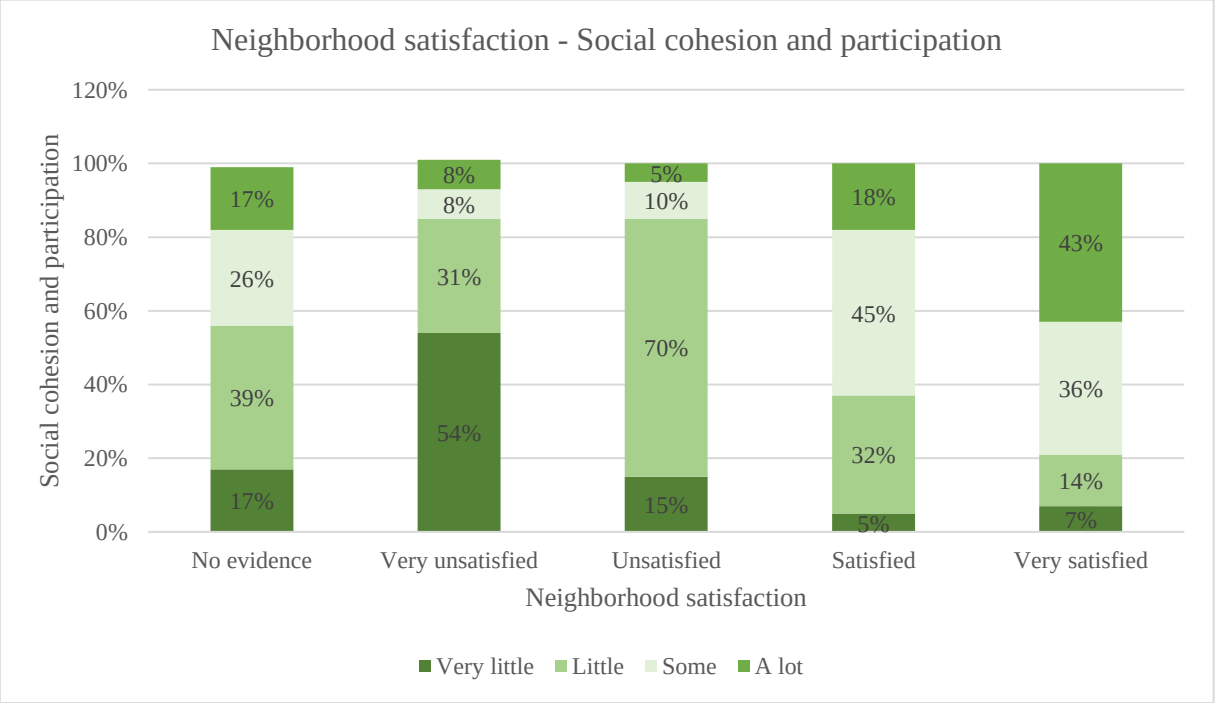


Figure 7.4 - Updated probabilities social cohesion and participation based on neighborhood satisfaction

Completed higher education – Active lifestyle

Completed higher education also has an indirect relationship with loneliness where active lifestyle is the mediating variable. Therefore, the relationship between education level and active lifestyle is examined. The updates probabilities for active lifestyle based on the education level are shown in Figure 7.5. From this figure, it becomes immediately clear that in neighborhoods with very few residents that are highly educated, the percentage of active and very active residents is low, namely 11%. This increases significantly, where ultimately in neighborhoods with a lot of residents that are highly educated, 83% is active or very active. However, the biggest increase is seen between very few completed higher education, and few completed higher education. Between these two states, the percentage of active and very active residents increases by 59%. This result indicates that promoting an active lifestyle is most useful in neighborhoods with a low percentage of highly educated residents.

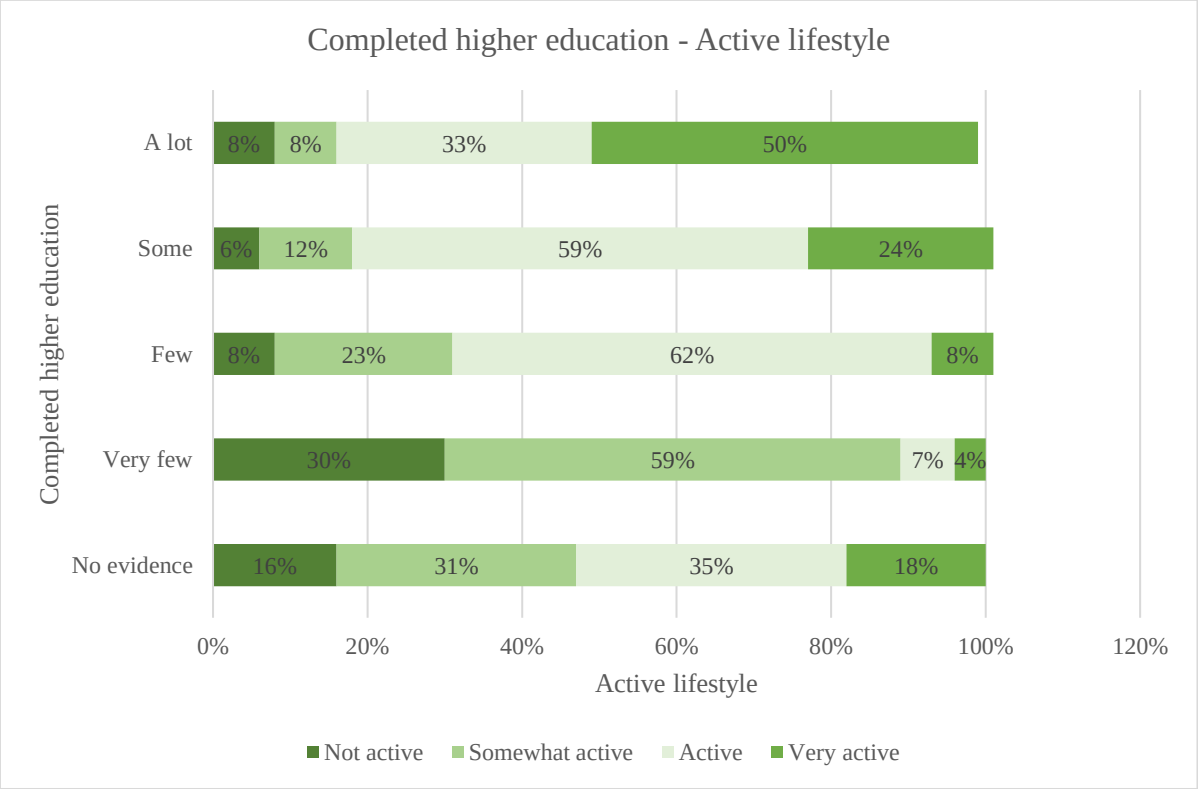


Figure 7.5 - Updated probabilities Active lifestyle based on completed higher education

Disposable household income – Neighborhood satisfaction

The last relationship for which the updated probabilities are examined is the relationship between disposable household income and neighborhood satisfaction. This is important as there is a cluster of SES variables and because neighborhood satisfaction has a cluster which is related to the social cohesion and partipation in neighborhoods. The updates probabilites of neighborhood satisfaction based on the disposable household income can be seen in Figure 7.6. It is evident that neighborhood satisfaction increases if residents have a high income. In neighborhoods were everyone has a low income, only 10% is (very) satisfied, while in neighborhood were everyone has a high income, 90% is (very) satisfied. The percentage of unsatisfied residents decreases if people have a high income. This is stressing the importance of improving neighborhood satisfaction in neighborhoods were the income is low on average.

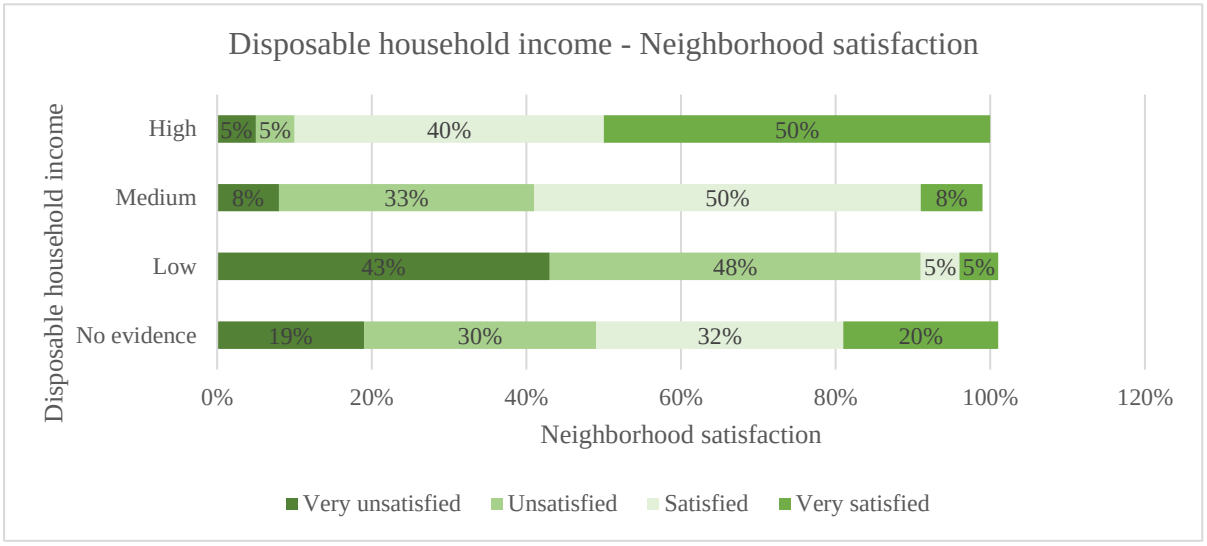


Figure 7.6 - Updated probabilities Neighborhood satisfaction based on disposable household income

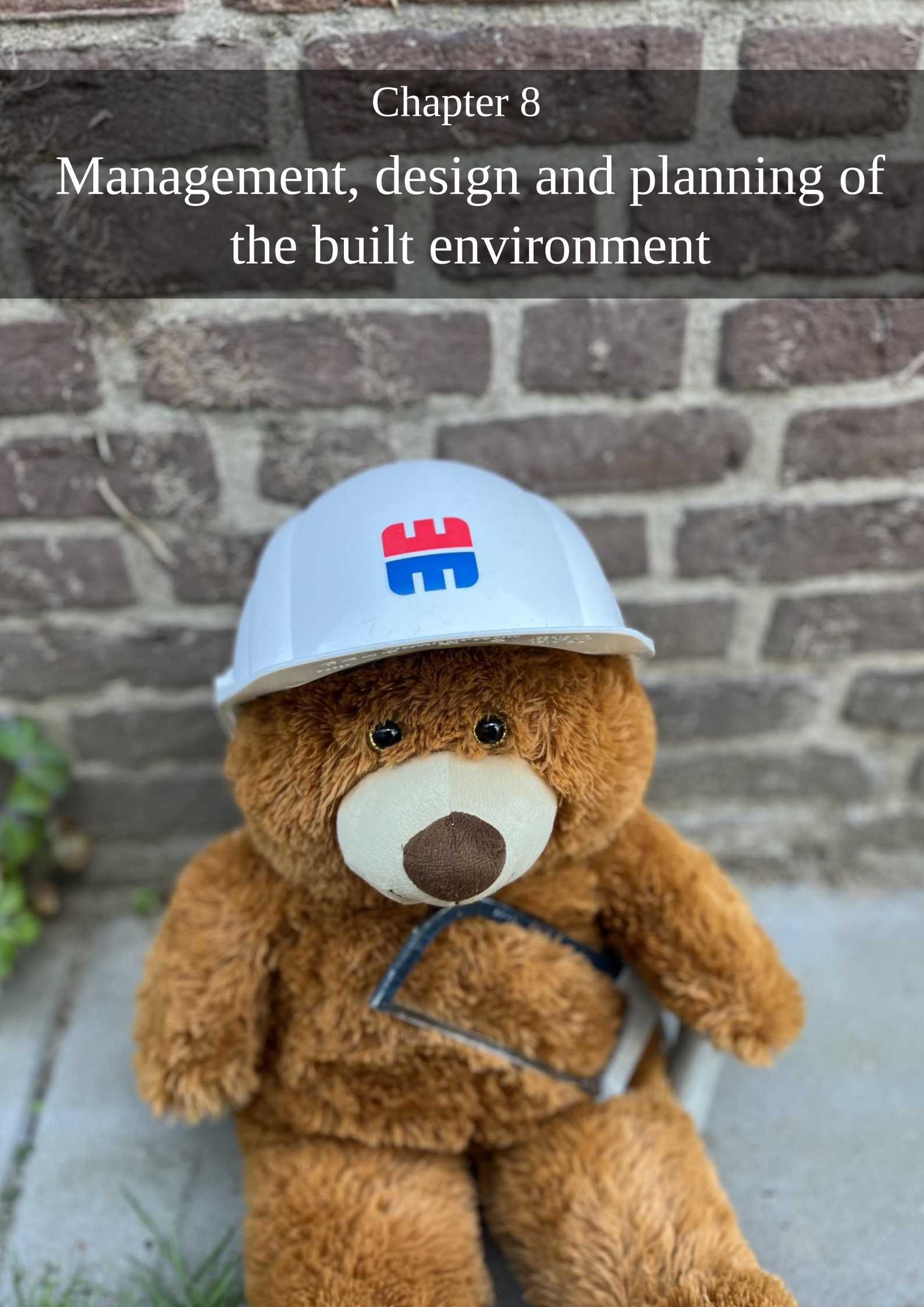
7.3 Conclusion

In this chapter, two sub questions were answered. The first question that was answered is '*Which built environment factors at the neighborhood level are most important predictors of loneliness?*' A regression analysis was performed to determine the main predictors of loneliness. From the analysis it became clear that social cohesion and participation and physical health conditions are main predictors of loneliness. A 1% increase in physical health conditions increases loneliness by 3.21%. This indicates that by improving physical health conditions, loneliness decreases. Additionally, by increasing social cohesion and participation with 1%, reduces loneliness with 4.03%, indicating the importance to improve social cohesion and participation. Interventions and measures to improve these variables will be given in the next chapter.

The second sub question that was answered in this chapter is '*What are the direct and indirect relationships between the built environment factors related to loneliness at the neighborhood level?*' From the bivariate analyses, it could already be seen that there are a lot of relationships between the independent variables and loneliness and that there are a lot of relationships between variables. However, these analyses did not provide a full answer to the question as indirect relationships were still not known. Therefore, a Bayesian belief network (BBN) was constructed to answer this question. From this model it became clear that social cohesion and participation and active lifestyle have a direct relationship with loneliness. Social cohesion and participation appeared to be a main predictor for loneliness in the regression analysis and now this evidence is even stronger. Additionally, clusters within the BBN can be seen. Neighborhood satisfaction has a relationship with five other variables, and it has an indirect relationship with loneliness where social cohesion and participation is the mediating variable. Improving neighborhood satisfaction can therefore indirectly lead to a reduction of loneliness. Moreover, SES variables are related, Disposable household income, singles and migrants and educational level all have a relationship with the property value. This could be an indication that neighborhoods with a low SES should get priority in implementing interventions as they might be most useful in those neighborhoods. In short, direct relationships between social cohesion and participation and active lifestyle and loneliness were discovered and indirect relationships between variables relating to satisfaction and SES factors and loneliness were found.

Chapter 8

Management, design and planning of the built environment



8. Interventions for the management, design and planning of the built environment

In this chapter, the sub question *'What advice can be given to urban planners and designers on how to reduce feelings of loneliness among residents?*' is answered. The aim of this chapter is to translate the findings of this research, to be applied in practical settings. This is done by first conducting a brainstorming session after which interventions and measures to contribute to a reduction in feelings of loneliness based on the results of the brainstorming session and literature are given.

8.1 Brainstorming session II

For the brainstorming session, it is important to find measures and interventions that are within the management department. This is important since the planning and design steps are quite logical but within the field of management, interventions are unknown. For example, neighborhood satisfaction can be influenced by the management, but concrete interventions are unknown. This brainstorming session helps to identify these measures and interventions.

The brainstorming session is conducted at the Municipality of Rotterdam, using the results from the systematic literature review and data analyses. Experts from various disciplines in public space management are invited to participate in the brainstorming session. These experts have a lot of knowledge of the existing practices and of realistic opportunities. Moreover, it is important to involve diverse disciplines to ensure that ideas are not limited to a single perspective and to develop an integrated plan. An integrated plan of measures and interventions is important since ideas can be excellent within one discipline but impossible within another discipline. For instance, by planting more trees, the discipline green will be satisfied but this may not be possible because of underground infrastructures and limited space, making this discipline unsatisfied. The invitations are sent a couple weeks in advance in order to get as many participants as possible.

The session started with a brief presentation of the research, followed by an explanation of the purpose of the brainstorming session. The experts were divided into three groups of four individuals each. This was done in order to facilitate collaborative discussions among them. Four big posters were plotted at which experts could stick a post-it note with their knowledge of existing interventions within the municipality of Rotterdam. The researcher walked around to help the three groups but also to clarify results. For instance, some groups were struggling in the beginning, so the researcher gave some examples of already known interventions. By doing so, the group had more ideas of in which direction to think. Furthermore, some post-it interventions were unclear, for instance, someone wrote down that the municipality of Rotterdam does maintenance on the roads. However, the question is what they do for maintenance, for example cleaning or repairing. By asking groups to write this down in a more specified way, the results became clearer.

Some interesting and unknown interventions can be seen from this brainstorming session. For example, the management department of the municipality of Rotterdam has neighborhood concierges. These are people that are present in a community center, and they walk around to see what is happening in the neighborhood. By doing so, social cohesion and participation can be improved. Furthermore, the municipality of Rotterdam has special routes for rollators but also green routes to ensure that residents can walk through green areas. These are some interventions that are very suitable to try and reduce feelings of loneliness among residents. All results of the brainstorming session can be found in Appendix XI. In the next section, interventions per topic will be discussed. These interventions will partly be based on the results of this study but also on existing literature.

8.2 Built environment interventions

This section discusses potential measures and interventions to contribute to reducing loneliness through the built environment for each topic.

8.2.1 Dwelling

In neighborhoods with higher property values, there tends to be less loneliness. Therefore, maintaining neighborhood diversity can be beneficial. This entails a mix of both homeownership and rental properties, with a range of different price points. However, this might affect social cohesion as the average property value is correlated with household income and education level. Tolsma et al. (2009) found a relationship between the average income of neighborhoods and social cohesion, indicating that neighborhoods with higher incomes have more social cohesion. Therefore, the effectiveness of this intervention is unsure. Additionally, over-occupancy has been found to be associated with loneliness. One option to address this is to provide larger housing options. However, in practice this can be a challenge because housing prices are often partly based on the size of the dwelling.

Furthermore, there is a relationship between dwelling satisfaction and loneliness. It is crucial to provide effective sound insulation from external sources and neighboring residents. Furthermore, dwellings should be of an adequate size. It is likely that individuals residing in larger homes are more satisfied compared to those living in small spaces. Therefore, the recommendation to make larger homes available applies in this context as well.

Another important aspect is proper maintenance of dwellings. Social housing units fall under the responsibility of housing cooperatives. Encouragements, such as subsidies and policy adjustments, can be implemented to encourage homeowners to maintain their properties effectively. Within new construction projects, consideration can be given to using low-maintenance materials, such as dark bricks and synthetic window frames. When replacing window frames, choosing synthetic frames instead of wooden ones can also be beneficial.

8.2.2 General quality

The variables within the factor neighborhood satisfaction were presented to the experts of the municipality of Rotterdam during the brainstorming session and a number of concrete interventions emerged. In order to prevent nuisance, the municipality of Rotterdam collects bulky waste free of charge. In addition, there are gardens next to the container so that people are less inclined to put garbage next to the container. Besides that, the containers can be adopted. This is done by residents of Rotterdam who, together with the municipality, keep an eye on the containers in the neighborhood. These adopters keep the containers clean and make reports of misplaced waste. This keeps the neighborhood cleaner, and another added benefit is that it can provide social contact in the neighborhood. There are also checks by officers, which could perhaps be done more in some neighborhoods to increase satisfaction.

Besides the nuisance variables within the factor, there are a number of satisfaction variables present. This could be improved by opting for self-management. In this principle, residents of a neighborhood manage a public area in the neighborhood. Here the residents get to choose how it looks and they get to work on it themselves. This is, in addition to providing a higher score on satisfaction, also beneficial for the social environment. It can provide neighbors with contacts and is a form of participation. Participation can, on the other hand, be used to increase satisfaction. People who see their ideas and wishes coming true are generally more satisfied with their neighborhood. A lot of participation projects are already being carried out within the municipality of Rotterdam. In addition, perception surveys are conducted to see how people experience public space and how this can be improved.

When developing a new project, it is important to place enough litter bins and to carry out a participation process beforehand. Additionally, it is important to ensure good maintenance by adding maintenance-free materials. With the above interventions, neighborhood satisfaction is likely to improve.

8.2.3 Amenities

Within the topic amenities, it is important to offer enough and a diverse selection of amenities in a neighborhood. By talking to experts within this field, the solution came to adopt policies that encourage people to start an amenity in a neighborhood. For instance, subsidies can be provided to entrepreneurs that start a business in the neighborhood that serves as an important amenity. By doing so, entrepreneurs might start a business sooner at a certain location. Another example is that developers need to have a certain number of amenities in the neighborhood before they can execute the project. Furthermore, municipalities should arrange space within the zoning plans, depending on the situation in a neighborhood. By providing certain space for amenities in the zoning plans, amenities need to be located and cannot be replaced for dwellings and industrial functions.

8.2.4 Mobility

For the topic mobility, it is important to keep the sidewalks well maintained and safe. The municipality of Rotterdam does a lot to keep the sidewalks this way. First of all, there is a website where complaints can be filed by residents. This helps in the early detection of defects. Furthermore, the municipality does a lot to keep the roads and sidewalks accessible. For example, by keeping the roads obstacle-free, which is done by cleaning the roads and not placing objects on the roads. Additionally, lighting is placed and maintained and replaced when needed.

When looking at the maintenance of sidewalks and bike paths, it can be divided into four types of maintenance. The first two types of maintenance are for minor maintenance and disruption maintenance. Both of these are done after a complaint is filed or if it is seen by a neighborhood concierge of officer. The third type of maintenance is major maintenance. This happens once in a while, and it involves removing the top layer of the road and putting a new one in. In the case of sidewalks, the sidewalk is repaved. The last type of maintenance is rehabilitative, in this case a road or sidewalks is replaced by a new road. It is very important that these four types of maintenance are conducted as it has a relationship with loneliness.

8.2.5 Green

The factor "Satisfaction with natural elements" has a negative relationship with loneliness. Therefore, it is important to improve attractiveness, recreational value and satisfaction. In the city of Rotterdam, a lot is already being done to achieve this: biodiversity is being increased so that the greenery is no longer so monotonous and seven large parks have been realized. They also have edible greenery, such as apple trees and blackberries. However, these things can also cause inconvenience. For example, a modified mowing policy for the sake of biodiversity can be perceived as messy, and an apple tree can cause a nuisance as apples rot on the ground. An analysis of where these places are located and their satisfaction with greenery could reveal this.

Green routes have also been created in Rotterdam. These are routes that pass by a lot of greenery, allowing people to enjoy nature. This could reduce loneliness because of the satisfaction and presence of greenery but also because of safe and well-maintained sidewalks and bicycle paths. However, no relationship was found between the number of trees and the area of greenery per neighborhood so it is questionable how much these routes could reduce loneliness.

Recreational places are likely to be green spaces where activities take place. Cohen et al. (2008) found that more parks provided more social cohesion and Moulay et al. (2017) adds that a clear structure can cause people to stay in a park longer and thus have more contact. Additionally, Kaźmierczak (2013) indicates that green space should be well maintained because this makes people use it as recreational space more often. Consequently, it is important for social cohesion in a neighborhood that there is enough recreational green space. Recreational green space can increase social cohesion and therefore reduce loneliness. The relationship between green space and social cohesion was seen in this study where a positive significant relationship was found. Thus, by improving greenery, social cohesion can

be improved and by doing so, loneliness reduces in theory. However, a full study could be devoted to this topic because there are many factors involved.

8.2.6 Composition

Three variables are present in the factor singles and migrants, namely non-western migration background, household without children and single-parent families. In new construction projects, housing for these target groups can be included in the design but note that there must be a diverse range of housing so that a diverse group is created. In existing areas, however, this is more difficult to address. The only way to really change this is by adjusting policies so that certain target groups can be given priority for housing, for example. However, this is difficult while there are other more concrete built environment factors that can be changed relatively easily. Furthermore, it should be noted that ethnic diversity has a negative relationship with social cohesion, indicating that people living in ethnic diverse neighborhoods experience less social cohesion (Koopmans & Schaeffer, 2016). Therefore, the effectiveness of these interventions is questionable.

8.2.7 SES

SES is also an issue that is difficult to improve. First, it is notable that people with higher SES tend to live in neighborhoods with a higher average property value than average. Therefore, a better distribution can be made by creating a diverse supply of housing. Furthermore, policies can be adjusted so that there are varying incomes and educational levels in a neighborhood. However, the average income has a relationship with loneliness, meaning that neighborhoods with higher incomes have more social cohesion (Tolsma et al., 2009). Therefore, it might be more suitable to implement other interventions in neighborhoods with a low SES and with a lot of singles and migrants. For example, green, amenities and infrastructure can be improved in these neighborhoods because they benefit the most from it.

8.2.8 Social safety

To improve the variable neighborhood disorder, there are a lot of options. A sense of safety can be created in different ways. For example, a neighborhood app can help with the feeling of safety, and this may make residents feel more responsible when they see something happen. Furthermore, the city of Rotterdam provides free safety boxes to its residents, which contains various attributes that residents can use to emphasize the speed limit, which might provide a safer feeling as well. Additionally, residents can go to the community center with their complaints or problems. This community center is a physical location where a neighborhood officer is present.

When looking at the literature, it can be seen that a sense of security can be created by reducing crime. This can be done by using the crime prevention through environmental design (CPTED) principle. This principle is shown in Figure 6.1. In this context, strategies are based on influencing the decisions of an offender. One strategy is natural surveillance. This means designing public spaces in a way that allows for visibility from surrounding buildings and ensures sufficient street activity. The use of low fences and shrubbery can also help deter criminal activity. Furthermore, good maintenance of public space shows that someone is alert and actively present, which can influence the decision-making process of an offender. Finally, an important intervention is to place enough streetlights (Cozens & Love, 2015).

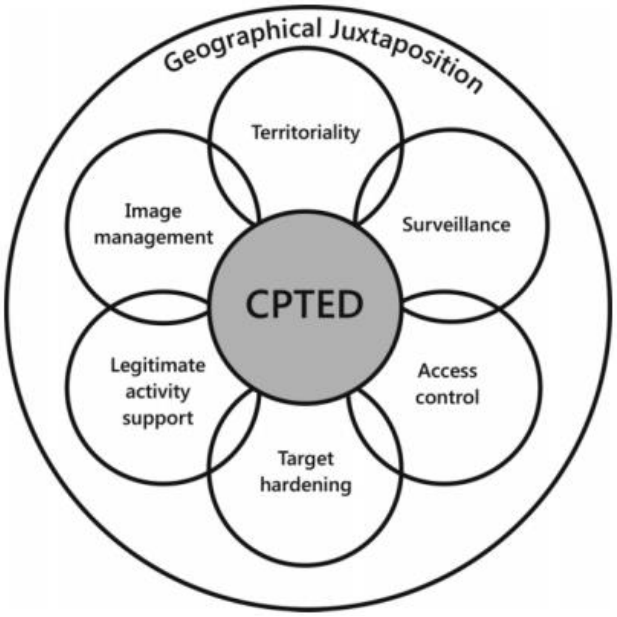


Figure 6.1 - Crime prevention through environmental design principles (Cozens, 2014)

8.2.9 Social environment

The most important factor in reducing loneliness is the social environment. It is important that people have a sense of belonging and that people experience social cohesion and actively participate in the neighborhood. To this end, the municipality of Rotterdam already does a number of things. For example, meetings and activities are organized and they have community centers. They also have an initiative called Citylab010. This is an organization set up by the municipality of Rotterdam in which residents can apply for a subsidy for an idea that makes Rotterdam more social, greener or safer. The municipality is trying to stimulate innovative ideas and to ensure that more people participate actively. In the Netherlands, some cities work with the platform my neighborhood plan (mijnwijkplan). Here residents can submit ideas and vote on other people's ideas, if a plan has enough votes it is implemented. This creates more involvement and connection in the neighborhood. In this platform, many ideas are posted about adding green spaces so this can also provide more satisfaction with green spaces. Additionally, neighborhood initiatives such as a neighborhood vegetable garden can improve social cohesion (Kingsley & Townsend, 2006; Teig et al., 2009; Veen et al., 2016; Whatley et al., 2015). However, social cohesion and participation is a broad topic so there are many interventions. These interventions can be discovered when doing a literature review on the topic.

8.2.10 Social network

This factor is more challenging to influence through built environment interventions because it includes qualitative social networks. Someone can feel satisfied about their social network by the social environment. Consequently, interventions within the topic social environment can contribute to an increase in social networks. However, an increase in this variable through built environment is hard as it is a personal increase and because it is not related to the built environment, interventions are not further discussed.

8.2.11 Activities

Within the topic activities, it is especially important to stimulate movement and activate people to participate in a hobby or sports club. In the city of Rotterdam, some things are already being done to stimulate movement. There is a vision established in Rotterdam to make sure people get outside more. Furthermore, there are fitness parks where various fitness equipment is available. This ensures that everyone can exercise. Besides that, there are skate parks and playgrounds, which ensures that children get outside and keep moving.

Literature indicates that improving active transportation infrastructure helps make residents more active (Smith et al., 2017). Recommendations for this have already been provided within the topic mobility. Moreover, it is indicated that parks, playgrounds and walkability benefit exercise and health (Smith et al., 2017). It is therefore recommended that playgrounds and parks are implemented in development projects. In existing neighborhoods, it is important to ensure that they are present and in good condition. To ensure that people practice hobbies it is advisable to organize, for example in the community center, activities or inexpensive courses. This already happens in many municipalities so perhaps this is also the case in the city of Rotterdam. This is however not a built environment factor and therefore not discussed further.

8.2.12 Health

Within the topic Health, various initiatives have been undertaken to promote physical activity. However, as mentioned before, these interventions have already been discussed, so it is not necessary to discuss those more. In short, stimulating active transport modes and sports is crucial. Some interventions are already implemented in the city of Rotterdam. For instance, parking areas are transformed into parking spaces for bicycles. Moreover, sport parks are installed and well maintained, and rollator routes are created. This all promotes physical activity and therefore health. Besides that, Halpin et al. (2010) found that policy adjustments and education campaigns can be implemented. However, reducing health is a

huge topic which is influenced by many factors so more research within this topic can provide more concrete interventions.

8.3 Customization of interventions

It is important to emphasize that the implementation of built environment factors remains a customized approach. The results indicate that neighborhoods with a low SES experience a higher level of loneliness. Therefore, it is a good idea to prioritize improving certain variables within these neighborhoods. By implementing interventions in these areas, it can lead to more social cohesion and a reduction in loneliness. In these neighborhoods, interventions targeting social cohesion and promoting an active lifestyle can make a significant difference. The BBN already showed that income, education level, social network, and active lifestyle are (in)directly related. Therefore, it may be more effective to initially focus on implementing interventions to encourage physical activity in neighborhoods with a low SES. It is essential to evaluate each neighborhood individually to determine which interventions will effectively improve the area and thus reduce loneliness. In this context, the BBN can be used to examine which interventions fit best with certain neighborhood characteristics. For example, a neighborhood with a low SES and many physical health conditions might benefit most from implementing interventions within the topic green, amenities and mobility.

8.4 Conclusion

The aim of this chapter was to provide an answer to the question: 'What advice can be given to urban planners and designers on how to reduce feelings of loneliness among residents?' An answer to this question has been given by taking several steps. First of all, the data analysis provided information on what to improve. The ways of improving those factors are based on a brainstorming session with experts within the field of management in the built environment and on relevant literature. Some concrete interventions are given, such as creating a diverse range of housing options and amenities in newly developed projects and the promotion of physical activity through the availability of walking routes, fitness parks and playgrounds. The most important variable to improve is social cohesion and participation. This can be done by adding green spaces and organizing community activities. Furthermore, an application can encourage greater participation. However, a literature review in the aspects influencing social network and cohesion might be effective as this is a broad topic and many interventions have probably been examined on their effectiveness. Additionally, neighborhoods with a low SES should receive special attention as variables within this topic are related to a lot of other variables. Increasing green, infrastructure and amenities in those neighborhoods might be most effective in reducing feelings of loneliness. However, interventions do, in practice, often not achieve the desired outcome (Fokkema & van Tilburg, 2006). This indicates that the effectiveness of the interventions suggested in this study is unknown. Therefore, measuring this is important to see how effective the interventions are in reality. Moreover, it is essential to recognize that implementing interventions requires a customized approach. For instance, neighborhoods with a lower SES may benefit more from initiatives that promote physical activity compared to neighborhoods with a higher socioeconomic status. Therefore, it is important to evaluate each neighborhood individually to determine the most impactful interventions for reducing feelings of loneliness among residents. An effective way of doing this is by the use of the BBN. By selecting certain states, for example the income and the health status, other variables that do not score well can be seen. By doing so, variables that are most effective to improve can be seen. Hence, the BBN can provide a solution in the customized approach for the implementation of interventions.

The advice that can be given to urban planners and designers is therefore: Improve social cohesion and participation, focus on neighborhoods with a low SES as loneliness is the greatest in those neighborhoods and customize interventions based on the BBN of this study.

Chapter 9

Conclusion, discussion and recommendations

9. Conclusion, discussion and recommendations

In this final chapter, the conclusions of this research are given, from which an answer to the research question is formulated. Additionally, the results are discussed and recommendations for future research is given.

9.1 Conclusion

The aim of this study was to address the question: *"How are objective and subjective physical and social built environmental factors associated with feelings of loneliness, and how can the management, planning, and design of the built environment reduce loneliness?"* To answer this question, the research has been divided into two parts for which several sub-questions have been formulated. The answers to the sub questions are discussed per topic below. Ultimately, this provides an answer to the main question.

Part I

The objective of part I was to synthesize and understand the relationships between the built environment and loneliness. In this context, several sub-questions were formulated from which the most important conclusions are given here. First, loneliness was defined, and a measurement method was determined. Loneliness is a negative situation where someone's actual relationships do not match the expectations and desires of relationships. This is usually measured by a loneliness scale, for instance the De Jong-Gierveld scale or the UCLA scale.

Next, factors that have a relationship with loneliness were determined. A literature review was conducted to find these factors. It was found that social networks are an important predictor of loneliness. In addition, socio-demographics, health conditions, life events and activities have a relationship with loneliness. Besides that, the built environment seemed to have a relationship with loneliness. To create a reliable and comprehensive overview of this relationship, a systematic literature review was conducted. A query was formulated, resulting in 102 articles of which, after manual filtering, 27 were included in the review. The variables identified in the studies were categorized into several topics, namely: Dwelling, general quality, amenities, density, green, mobility, SES, social safety, neighborhood composition and social environment. The findings of this literature review indicate that variables within the topic social environment and social safety are almost all related to feelings of loneliness. Within the topic social environment, improving social aspects such as social cohesion and neighborhood attachment, can lead to a decrease in feelings of loneliness. Additionally, by improving perceived safety, loneliness can be decreased. This already provides some guidelines which urban planners, designers and policymakers can use to contribute to the reduction of feelings of loneliness. None of the articles found a relationship between neighborhood composition and loneliness. Additionally, few articles found a relationship between SES and loneliness while most did not find a relationship. Hence, it can be concluded that variables within these topics are most likely not related to feelings of loneliness. Variables within the other topics had mixed results or were only examined once, making it difficult to draw firm conclusions. Lastly, it was notable that no objective variables within the topic general quality were included as well as subjective variables within the topic green. This is a clear research gap. Moreover, limited research has examined the relationship between neighborhood characteristics and loneliness while interventions in the built environment are not performed per individual but per neighborhood. Consequently, this information can provide crucial insights.

Part II

In part II, the research gaps found in part I were examined, which are relationships between neighborhood characteristics, where objective general quality variables and subjective green variables should be included, and loneliness. More specifically, relationships between neighborhood characteristics and loneliness were not always clear, main predictors were unknown and the network structure was unknown while this could provide valuable insights.

First a research method was determined. A data analysis is suitable as many factors were still unknown. Data from the municipality of Rotterdam could be used for this study. Four different data sources within the municipality of Rotterdam were used for this study in order to include all relevant variables. By doing so, a lot of variables from 53 neighborhoods were included. Therefore, several factor analyses were conducted to reduce the number of variables and to avoid multicollinearity. After this, the data analyses that were performed in order to answer the sub-question were executed.

The first analyses that were performed were correlation analyses. From these analyses it became clear that a lot of the selected variables have a relationship with loneliness. Subjective green variables proved to be important as three of them have a relationship with loneliness. Within the topic general quality, only one objective variable showed a relationship with loneliness. Within the topic's density and life events, no relationships with loneliness were found for all variables, indicating that loneliness is not related to these topics. This strengthens the findings of the systematic literature review. Furthermore, a lot of relationships between the independent variables were found. This indicated the importance of examining the underlying structures but also possible multicollinearity.

The second analysis performed was a regression analysis. This analysis was performed to find the variables that explain most of loneliness. The results of the analysis show that social cohesion and participation and physical health conditions explain loneliness the most. Multicollinearity was examined as a lot of correlations between independent variables were observed. However, multicollinearity was not found, indicating that the regression analysis was suitable.

A third analysis performed was a Bayesian Belief Network (BBN) to discover the network structure. This model is based on conditional probabilities and direct and indirect relationships between variables can be found using this model. All variables were discretized in order to get a clear overview. This model showed that social cohesion and participation has a direct relationship with loneliness, which is in line with the results of the regression analysis. Additionally, an active lifestyle has a direct relationship with loneliness. Furthermore, it was clearly visible that variables are related to each other. Neighborhood satisfaction and educational level were found to have a lot of relationships, indicating their importance when determining interventions and measures. By improving those factors, loneliness can indirectly be reduced, whereas social cohesion and participation or active lifestyle is the mediating variable.

The last step in this research was to translate the findings of this research into measures and interventions so that it can be applied in practical settings. Several interventions within the topics were given, such as the implementation of vegetable gardens and decreasing neighborhood disorder by applying CPTED principles. However, not all interventions might be effective in every neighborhood, so this is a customized approach. For example, a neighborhood with low educational levels and incomes might profit more from the interventions within the topic's mobility, green and amenities than other neighborhoods. The BBN can be used to examine which interventions are most effective in a neighborhood. By using the BBN, interventions and measures that are most effective can be selected.

In summary, the answer to the main research question is that built environment factors within the topics of dwelling, amenities, mobility, general quality, socioeconomic status (SES), composition, safety, green spaces, and social environment are associated with loneliness and are correlated with each other. Improving social cohesion and participation in neighborhoods has the most significant impact on reducing loneliness, but improving other factors also contributes to reducing loneliness. The management, planning and design can help reduce loneliness by improving one or more of the factors. However, it is crucial to examine each neighborhood individually to determine which interventions are most effective contributing to the reduction of feelings of loneliness.

9.2 Discussion

In this discussion, the conclusions of this study are compared to the expectations. Moreover, limitations, options for future research and implications are given. The aim of this study was to identify and examine

relationships between built environment factors and loneliness and to determine measures and interventions that contribute to a reduction in feelings of loneliness.

The results of this study indicate that variables within several topics have relationships with loneliness, which are the topics social environment, social network, dwellings, mobility, green spaces, socio-economic status (SES), composition, safety, health, general quality, activities, and amenities. These topics were created based on literature, so these relationships were expected.

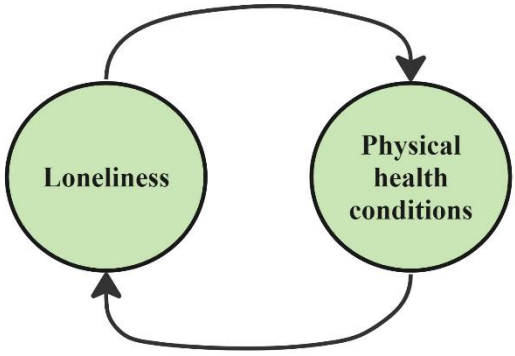


Figure 9.1 - Relationship between physical health conditions and loneliness

By conducting a regression analysis, it was found that social cohesion and participation and physical health conditions are main predictors of loneliness. The strong relationships between social cohesion and participation were expected as this relationship was found in several studies (Bergefurt et al., 2019; Domènech-Abella et al., 2021; Gan et al., 2022; Yang & Xiang, 2021; Yu et al., 2021). However, it is surprising that social networks are not a main predictor of loneliness while this is strongly connected to the social environment and to loneliness. This might be the case because this research is conducted at the neighborhood level. A neighborhood with little social cohesion can receive a lot of bad scores while not all residents will be dissatisfied with their social networks. Additionally, the outcome of physical health conditions being a main predictor of loneliness is seen. It is known that loneliness has an effect on health conditions (Doorakkers & Bos, 2019; Park et al., 2020; Heinrich & Gullone, 2006; Cherry, 2022). However, it is very well possible that this relationship goes in both directions, as shown in Figure 9.1. The relationship between physical health and loneliness at an individual level was found in earlier studies, which is explained due to limitations in engaging in activities (Pinquart & Sorensen, 2001; Van Beuningen & Moonen, 2014). When looking at the correlation analysis, a significant relationship between physical health conditions and active lifestyle is found (r -.781, p <0.01), indicating that the same relationships at the neighborhood level exists. Moreover, this is also indicating that there is a relationship that goes in both directions.

To visualize and examine the direct and indirect relationships, a BBN was created. It was found that social cohesion and participation and active lifestyle have a direct relationship with loneliness. The relationship between social cohesion and participation was expected as said before. The relationship with an active lifestyle is partly in line with literature. Wirtz et al. (2012) found a relationship between playing sports and loneliness. However, this study added more variables, namely visiting a hobby club and meeting the physical activity guideline. A positive relationship between the lack of a hobbies and loneliness was found in research (Arslantas et al., 2015). This is in line with the findings of this research, as a negative relationship was found for the positive formulated variable. No research has been found on the relationship between the physical activity guideline and loneliness.

Furthermore, several relationships between dependent variables were found. One of the studies identified in the systematic literature review created a BBN as well. When comparing this model with the model of this study, some differences are seen. The model of Kemperman et al. (2019) shows that satisfaction with the social network has a direct relationship with loneliness while social network in this model is only related to the educational level. Moreover, a direct relationship between active lifestyle and loneliness was found in this model whereas they found an indirect relationship with satisfaction with social network as a mediating variable. As said before, these differences can be caused by examining individuals versus neighborhoods. Therefore, this relationship might exist at the individual level but not at the neighborhood level. Additionally, the BBN created in this study showed that neighborhood satisfaction is related to a lot of the built environment factors and indirectly with loneliness. Scharf & de Jong-Gierveld (2008) and Matthews et al. (2019) found a direct relationship between the perceived neighborhood quality and loneliness. The finding of an indirect relationship in

this study might be explained through the fact that social cohesion in neighborhoods was also considered while the other studies did not take this into consideration. However, it should be noted that the study of Matthews et al. (2019) indicated that lower satisfaction rates are given by lonelier people. They compared satisfaction rates from people living in the same neighborhood whereas some felt lonely, and some did not and found higher satisfaction rates from people not experiencing feelings of loneliness. This indicates the importance of examining the causality of relationships. Moreover, these satisfaction rates can possibly not be increased by interventions but only by tackling loneliness from its source.

Moreover, in the BBN it could also be seen that neighborhood disorder has a relationship with neighborhood satisfaction which has a relationship with social cohesion and participation. The relationship between neighborhood safety and neighborhood satisfaction has been found in previous research (Hur & Morrow-Jones, 2008; Matthews et al., 2019). By constructing the BBN, a clearer relationship was discovered.

Lastly, interventions were determined to contribute to the reduction of loneliness. It is apparent that loneliness can be decreased by improving social cohesion and participation. This can be done by several interventions, such as adding vegetable gardens and implementing participation programs. By looking at the results from this study, improving neighborhoods with a low SES seems to be most effective in reducing feelings of loneliness. Scharf & de Jong-Gierveld (2008) found a relationship between the financial status of neighborhoods and loneliness, so these results are as expected. Additionally, the implementation of interventions is a tailored approach because of different expectations of residents. Implementing interventions within the topics green, amenities and mobility might be effective in neighborhoods with a low SES while other interventions are less effective in those neighborhoods. Furthermore, the interventions look effective based on the theory but in practice the effectiveness of these interventions is unknown. Fokkema & van Tilburg (2006) found that interventions are in practice not always effective. Additionally, no literature has been found on the effectiveness of these specific interventions.

After seeing the results of this study, it should be emphasized that almost all results align with the existing literature, indicating robust analyses and reliable data in the dataset.

9.2.1 Limitations

There are some limitations in this study. During the systematic literature review, the search terms did not include "social isolation" or similar terms. This decision was made because social isolation is objective, whereas loneliness is a subjective experience. However, important articles may have been missed because social isolation also has a subjective aspect. Therefore, it is recommended to include this aspect in future studies and focus only on subjective social isolation and not on objective social isolation. Another implication is that the data used in this study were collected during the COVID-19 pandemic, which may have influenced the responses. Data from 2022 will soon be available and may provide different insights. Additionally, this study established correlations rather than causal relationships. Therefore, longitudinal research or experiments could be conducted to determine causality. Additionally, these types of research can examine the effectiveness of the interventions made in this study. This is important as the effectiveness is unknown. With the data of the municipality of Rotterdam, it is possible to conduct longitudinal research. Therefore, it is advised to do this.

9.2.2 Future research

Several suggestions for future research can be made. The relationships between variables within subjective green spaces and objective general quality, and loneliness have not been previously investigated. This study found relationships between these variables and loneliness. However, new studies on these relationships can strengthen the findings of this research. Moreover, this study did not measure causality. Therefore, future research could focus on longitudinal studies or the implementation of experiments to determine causality and clarify the direction of relationships. Besides that, these types can measure the effectiveness of interventions. Lastly, determining specific built environment

interventions has proven challenging. This can be addressed through a case study, which can examine the experiences of implementing certain interventions.

9.2.3 Managerial implications

This research provides new insights into built environment interventions to reduce loneliness, which can be valuable for urban planners, designers, and policymakers. Specifically, interventions within neighborhoods with a low SES seem important as this is connected to a lot of other neighborhood characteristics. By implementing interventions such as replacing pavements for green, creating zones without cars and changing the policy regarding amenities, loneliness could decrease. Moreover, it is crucial to take action and apply this knowledge in practice, as loneliness continues to increase and current design and management practices do not consider these interventions. Loneliness has negative consequences for both mental and physical health and for society. These consequences will increase if loneliness is not addressed. Therefore, it is essential to implement interventions.

References

Alin, A. (2010). Multicollinearity. *WIREs Computational Statistics*, 2: 370-374. https://doi.org/10.1002/wics.84

Anderson, G. O. (2010). Loneliness among older adults: A national survey of adults 45+. *AARP Research*. https://doi.org/10.26419/res.00064.001

Andersson, L. (1998). Loneliness research and interventions: A review of the literature. *Aging & Mental Health*, 2(4), 264–274. https://doi.org/10.1080/13607869856506

Arslantaş, H., Adana, F., Abacigil Ergin, F., Kayar, D., & Acar, G. (2015). Loneliness in elderly people, associated factors an its correlation with quality of life: A field study from Western Turkey. *Iranian Journal of Public Health,* 44(1), 43–50.

Baart, A. (2021). Opinie: Overheid vergeet bij strijd tegen eenzaamheid enorme groepen, met grote gevolgen. *Volkskrant*. Retrieved October 15, 2022, from https://www.volkskrant.nl/columns-opinie/opinie-overheid-vergeet-bij-strijd-tegen-eenzaamheid-enorme-groepen-met-grote-gevolgen~b7582c03/?referrer=https%3A%2F%2Fwww.google.com%2F

BayesFusion. (2023). *Genie 2.1*. Retrieved May 23, 2023, from https://www.bayesfusion.com/news/

BayesFusion. (n.d.). Structural learning. Retrieved July 17, 2023, from https://support.bayesfusion.com/docs/GeNIe/index.html?structurelearning_gtt.html

BBC news. (2014, May 26). Woman dead in Bournemouth flat for six years. *BBC*. Retrieved March 15, 2023, from https://www.bbc.com/news/uk-england-dorset-28039848

Beaver, K. (2021). Loneliness on the increase worldwide, but an increase in local community support. *Ipsos*. Retrieved November 28, 2022, from https://www.ipsos.com/en/loneliness-increase-worldwide-increase-local-community-support

Bergefurt, L., Kemperman, A., van den Berg, P., Borgers, A., van der Waerden, P., Oosterhuis, G., & Hommel, M. (2019). Loneliness and life satisfaction explained by public-space use and mobility patterns. *International Journal of Environmental Research and Public Health*, 16(21), 4282. https://doi.org/10.3390/ijerph16214282

Beutel, M. E., Klein, E. M., Brähler, E., Reiner, I., Jünger, C., Michal, M., Wiltink, J., Wild, P. S., Münzel, T., Lackner, K. J., & Tibubos, A. N. (2017). Loneliness in the general population: prevalence, determinants and relations to mental health. *BMC Psychiatry*, 17(1), 97. https://doi.org/10.1186/s12888-017-1262-x

Bower, M., Buckle, C., Rugel, E., Donohoe-Bales, A., McGrath, L., Gournay, K., Barrett, E., Phibbs, P., & Teesson, M. (2021). 'Trapped', 'anxious' and 'traumatised': COVID-19 intensified the impact of housing inequality on Australians' mental health. *International Journal of Housing Policy*, 23(2), 260-291. https://doi.org/10.1080/19491247.2021.1940686

Buecker, S., Ebert, T., Götz, F. M., Entringer, T. M., & Luhmann, M. (2021). In a lonely place: Investigating regional differences in loneliness. *Social Psychological and Personality Science*, 12(2), 147–155. https://doi.org/10.1177/1948550620912881

Bustamante, G., Guzman, V., Kobayashi, L. C., & Finlay, J. (2022). Mental health and well-being in times of COVID-19: A mixed-methods study of the role of neighborhood parks, outdoor spaces, and nature among US older adults. *Health and Place*, 76, 102813. https://doi.org/10.1016/j.healthplace.2022.102813

Cacioppo, J. T., & Cacioppo, S. (2018). Loneliness in the modern age: An evolutionary theory of loneliness (ETL). *Advances in Experimental Social Psychology*, 58, 127–197. https://doi.org/https://doi.org/10.1016/bs.aesp.2018.03.003

Centraal Bureau voor de Statistiek. (2018). Zonder partner vaak sterk eenzaam. *CBS*. Retrieved November 28, 2022, from https://www.cbs.nl/nl-nl/nieuws/2018/39/zonder-partner-vaak-sterk-eenzaam

Centraal Bureau voor de Statistiek. (2020). Bijna 1 op de 10 Nederlanders voelde zich sterk eenzaam in 2019. *CBS*. November 28, 2022, from https://www.cbs.nl/nl-nl/nieuws/2020/13/bijna-1-op-de-10-nederlanders-voelde-zich-sterk-eenzaam-in-2019

Centraal bureau voor de Statistiek. (2022, September 29). Vooral jongeren emotioneel eenzaam in 2021. *CBS*. November 28, 2022, from https://www.cbs.nl/nl-nl/nieuws/2022/39/vooral-jongeren-emotioneel-eenzaam-in-2021

Chen, J., & Gong, L. (2022). Loneliness in urbanising China. *Health and Social Care in the Community*, 30(3), e812–e822. https://doi.org/10.1111/hsc.13451

Cherry, K. (2022). *The health consequences of loneliness*. Retrieved January 12, 2023 from https://www.verywellmind.com/loneliness-causes-effects-and-treatments-2795749#toc-health-risks-associated-with-loneliness

Cocozza, P. (2020, January 24). The agony of weekend loneliness: 'I won't speak to another human until Monday.' *Loneliness, The Guardian*. Retrieved July 10, 2023, from https://amp.theguardian.com/society/2020/jan/16/the-agony-of-weekend-loneliness-i-wont-speak-to-another-human-until-monday

Cohen, D. A., Inagami, S., & Finch, B. (2008). The built environment and collective efficacy. *Health & Place*, 14(2), 198–208. https://doi.org/https://doi.org/10.1016/j.healthplace.2007.06.001

Conkova, N., & Lindenberg, J. (2018). Gezondheid en welbevinden van oudere migranten in Nederland: Een narratieve literatuurstudie. *Tijdschrift voor Gerontologie en Geriatrie*, 49(6), 223–231. https://doi.org/10.1007/s12439-018-0268-2

Cozens, P. (2014). *Think crime! Using evidence, theory and crime prevention through environmental design for planning safer cities*. Praxis Education.

Cozens, P., & Love, T. (2015). A review and current status of crime prevention through environmental design (CPTED). *Journal of Planning Literature*, 30(4), 393-412. https://doi.org/10.1177/0885412215595440

Cuyvers, G., & Valerie, G. (2009). Kwetsbare ouderen. *Welzijnsgids*, 65(april), 51-74..

Dahlberg, L., McKee, K. J., Frank, A., & Naseer, M. (2022). A systematic review of longitudinal risk factors for loneliness in older adults. *Aging & Mental Health*, 26(2), 225–249. https://doi.org/10.1080/13607863.2021.1876638

Dahlberg, L., McKee, K. J., Lennartsson, C., & Rehnberg, J. (2022). A social exclusion perspective on loneliness in older adults in the Nordic countries. *European Journal of Ageing*, 19(2), 175–188. https://doi.org/10.1007/s10433-022-00692-4

De Jongh, C. & Erdem, Ö (2017) *Feitenkaart eenzaamheid: Gezondheidsmonitor*. Geraapleegd op December 11, 2022, from http://www.gezondheidsatlasrotterdamrijnmond.nl/

De Jong Gierveld, J., & van Tilburg, T. (2010). The De Jong Gierveld short scales for emotional and social loneliness: Tested on data from 7 countries in the UN generations and gender surveys. European *Journal of Ageing*, 7(2), 121–130. https://doi.org/10.1007/s10433-010-0144-6

De Jong Gierveld Scale. (n.d.). *MVDA*. Retrieved November 22, 2022 from https://mvda.info/resources/research-and-publications/research-tools-measuring-impact-wellbeing.

De Jong Gierveld, J. (1984). *Eenzaamheid: Een meersporig onderzoek*. Van Loghum Slaterus.

De Jong Gierveld, J. (1987). Developing and testing a model of loneliness. *Journal of Personality and Social Psychology*, 53(1), 119–128. https://doi.org/10.1037//0022-3514.53.1.119

De Jong Gierveld, J., & Kamphuls, F. (1985). The development of a Rasch-type loneliness scale. *Applied Psychological Measurement*, *9*(3), 289-299.

De Jong Gierveld, J., & Raadschelders, J. (1982). Types of loneliness. In *Loneliness. A sourcebook of current theory, research and therapy* (pp. 105–121). John Wiley & Sons.

Demakakos, P., Nunn, S., & Nazroo, J. (2006). *Retirement, health, and relationships of the older population in England: the 2004 English longitudinal study of ageing (wave 2)*. Institute for Fiscal Studies.

Deuning, C. M., & Giesbers, H. (2023, March 23). *Bevolking | regionaal | migratieachtergrond*. Staat van Volksgezondheid en Zorg. Retrieved August 7, 2023, from https://www.vzinfo.nl/bevolking/regionaal/migratieachtergrond#:~:text=Van%20de%2017%2C6%20miljoen,%2C%20Heerlen%20(2023).

Domènech-Abella, J., Mundó, J., Leonardi, M., Chatterji, S., Tobiasz-Adamczyk, B., Koskinen, S., Ayuso-Mateos, J. L., Haro, J. M., & Olaya, B. (2020). Loneliness and depression among older European adults: The role of perceived neighborhood built environment. *Health and Place*, 62, 102280. https://doi.org/10.1016/j.healthplace.2019.102280

Domènech-Abella, J., Switsers, L., Mundó, J., Dierckx, E., Dury, S., & De Donder, L. (2021). The association between perceived social and physical environment and mental health among older adults: mediating effects of loneliness. *Aging and Mental Health*, 25(5), 962–968. https://doi.org/10.1080/13607863.2020.1727853

Doorakkers, L., & Bos, H. (2019). Eenzaamheid en mentale gezondheid: verschillen in relatietypes. *Tijdschrift voor Seksulogie*, 43(3), 155-168.

Elliott, T. (2020, September 26). *Teddy bear peeking out of the window · Free stock photo*. Pexels. https://www.pexels.com/photo/teddy-bear-peeking-out-of-the-window-4652006/

Ellis, J. L. (2007*). Statistiek voor de psychologie - Verdeling van een variabele, samenhang tussen twee variabelen* (Dl. 1). Boom uitgevers .

Ellis, J. L. (2013). *Statistiek voor de psychologie - Factoranalyse en itemanalyse* (Dl. 5). Boom Lemma uitgevers.

Emerson, E., Fortune, N., Llewellyn, G., & Stancliffe, R. (2021). Loneliness, social support, social isolation and wellbeing among working age adults with and without disability: Cross-sectional study. *Disability and Health Journal*, 14(1), 100965. https://doi.org/https://doi.org/10.1016/j.dhjo.2020.100965

En Wee, L., Tsang, T. Y. Y., Yi, H., Toh, S. A., Lee, G. L., Yee, J., Lee, S., Oen, K., & Koh, G. C. H. (2019). Loneliness amongst low-socioeconomic status elderly Singaporeans and its association

with perceptions of the neighbourhood environment. *International Journal of Environmental Research and Public Health*, 16(6), 967. https://doi.org/10.3390/ijerph16060967

Ernst, M., Niederer, D., Werner, A. M., Czaja, S. J., Mikton, C., Ong, A. D., Rosen, T., Brähler, E., & Beutel, M. E. (2022). Loneliness before and during the COVID-19 pandemic: A systematic review with meta-analysis. *American Psychologist*, 77(5), 660–677. https://doi.org/10.1037/amp0001005

EU Science Hub. (2021, July 26). *New report: Loneliness doubles in Europe during the pandemic*. Retrieved August 4, 2023, from https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/new-report-loneliness-doubles-europe-during-pandemic-2021-07-26_en

Fardghassemi, S., & Joffe, H. (2022). The causes of loneliness: The perspective of young adults in London's most deprived areas. *PLOS ONE*, 17(4), e0264638-. https://doi.org/10.1371/journal.pone.0264638

Farooqi, S. (2014). The construct of relationship quality. *Journal of Relationships Research*, 5, E2. https://doi.org/10.1017/jrr.2014.2

Field, A. (2009). *Discovering statistics using IBM SPSS statistics*. (3rd ed.). Sage.

Finlay, J. M., & Kobayashi, L. C. (2018). Social isolation and loneliness in later life: A parallel convergent mixed-methods case study of older adults and their residential contexts in the Minneapolis metropolitan area, USA. *Social Science and Medicine*, 208, 25–33. https://doi.org/10.1016/j.socscimed.2018.05.010

Fokkema, C. M., & Van Tilburg, T. G. (2007). Zin en onzin van eenzaamheidsinterventies bij ouderen. *Tijdschrift voor Gerontologie en Geriatrie*, 38(4), 185–203. https://doi.org/10.1007/bf03074846

Fokkema, T., & Dykstra, P. (2009). De aanpak van eenzaamheid. *Demos*, 3, 5–8.

Fokkema, T., & Tilburg, T. (2005*). Eenzaam en dan? : de (on)mogelijkheden van interventies bij ouderen*. Nederlands Interdisciplinair Demografisch Instituut.

Fudge Schormans, A. (2014). Social Participation. In: A. C. Michalos (Ed.), *Encyclopedia of quality of life and well-being research.* (pp. 6135–6140). Springer. https://doi.org/10.1007/978-94-007-0753-5_2779

Gan, D. R. Y., Wister, A. V., & Best, J. R. (2022). Environmental influences on life satisfaction and depressive symptoms among older adults with multimorbidity: Path analysis through loneliness in the Canadian longitudinal study on aging. *The Gerontologist*, 62(6), 855–864. https://doi.org/10.1093/geront/gnac004

Gemeente Rotterdam. (2022). *Aan de slag met waarde!* Assetmanagement in Rotterdam.

Gezondheidsmonitor Volwassenen en Ouderen. (2020). *Gezondheid in kaart*. Gemeente Rotterdam.

Gezondheidsmonitor Volwassenen en Ouderen. (2023). Buurtatlas eenzaamheid. Retrieved April 8, 2023, from https://buurtatlas.vzinfo.nl/#eenzaamheid

Glass, A. P. (2020). Sense of community, loneliness, and satisfaction in five elder cohousing neighborhoods. *Journal of Women and Aging*, 32(1), 3–27. https://doi.org/10.1080/08952841.2019.1681888

Guiaux, M. (2010). *Social adjustment to widowhood: Changes in personal relationships and loneliness before and after partner loss*. [PhD thesis] Vrije Universiteit Amsterdam

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis* (7th ed.). Pearson Prentice Hall.

Halpin, H. A., Morales-Suárez-Varela, M. M., & Martin-Moreno, J. M. (2010). Chronic disease prevention and the new public health. *Public Health Reviews*, 32(1), 120–154. https://doi.org/10.1007/BF03391595

Hämmig, O. (2019). Health risks associated with social isolation in general and in young, middle and old age. *PLOS ONE*, 14(7), e0219663-. https://doi.org/10.1371/journal.pone.0219663

Hand, J. (2023, January 16). Body may have been lying dead in bed for 20 years in gruesome discovery as gardai rule out foul play. *Irish Mirror*. Retrieved March 15, 2023, from https://www.irishmirror.ie/news/irish-news/body-been-lying-dead-bed-28962776.

Hawkley, L. C., Hughes, M. E., Waite, L. J., Masi, C. M., Thisted, R. A., & Cacioppo, J. T. (2008). From social structural factors to perceptions of relationship quality and loneliness: The Chicago health, aging, and social relations study. *The Journals of Gerontology: Series B*, 63(6), S375–S384. https://doi.org/10.1093/geronb/63.6.S375

Heinisch, O. (1965). *Cochran, W. G.: Sampling Techniques*. (2nd Ed.). John Wiley and Sons.

Heinrich, L. M., & Gullone, E. (2006). The clinical significance of loneliness: a literature review. *Clinical Psychology Review*, 26(6), 695–718. https://doi.org/https://doi.org/10.1016/j.cpr.2006.04.002

Heylen, L. (2011). *Oud en eenzaam? Een studie naar de risicofactoren voor sociale en emotionele eenzaamheid bij ouderen*. Universiteit Antwerpen.

Holt-Lunstad, J., Smith, T. B., Baker, M., Harris, T., & Stephenson, D. (2015). Loneliness and social isolation as risk factors for mortality: A meta-analytic review. *Perspectives on Psychological Science*, 10(2), 227–237. https://doi.org/10.1177/1745691614568352

Holwerda, T. J. (2017). *Burden of loneliness and depression in late life*. [PhD-Thesis] Vrije Universiteit Amsterdam.

Hsueh, Y. C., Batchelor, R., Liebmann, M., Dhanani, A., Vaughan, L., Fett, A. K., Mann, F., & Pitman, A. (2022). A systematic review of studies describing the effectiveness, acceptability, and potential harms of place-based interventions to address loneliness and mental health problems. *International Journal of Environmental Research and Public Health*, 19(8), 4766. https://doi.org/10.3390/ijerph19084766

Hur, M., & Morrow-Jones, H. (2008). Factors that influence residents' satisfaction with neighborhoods. *Environment and Behavior* 40(5), 619–635. https://doi.org/10.1177/0013916507307483

Hyland, P., Shevlin, M., Cloitre, M., Karatzias, T., Vallières, F., McGinty, G., Fox, R., & Power, J. M. (2019). Quality not quantity: loneliness subtypes, psychological trauma, and mental health in the US adult population. *Social Psychiatry and Psychiatric Epidemiology*, 54(9), 1089–1099. https://doi.org/10.1007/s00127-018-1597-8

Kaźmierczak, A. (2013). The contribution of local parks to neighbourhood social ties. *Landscape and Urban Planning*, 109(1), 31–44. https://doi.org/https://doi.org/10.1016/j.landurbplan.2012.05.007

Kemperman, A., Van Den Berg, P., Weijs-Perrée, M., & Uijtdewillegen, K. (2019). Loneliness of older adults: Social network and the living environment. *International Journal of Environmental Research and Public Health*, 16(3), 406. https://doi.org/10.3390/ijerph16030406

Kingsley, J., & Townsend, M. (2006). 'Dig In' to social capital: community gardens as mechanisms for growing urban social connectedness. *Urban Policy and Research*, 24(4) 525–537. https://doi.org/10.1080/08111140601035200

Klok, J., & van Tilburg, T. (2018). Factoren van eenzaamheid: Een literatuuroverzicht. In: C. Van Campen, F. Vonk, & T. G. van Tilburg (Eds.) *Kwetsbaar en eenzaam? Risico's en bescherming in de ouder wordende bevolking.* (pp 21–30). Sociaal en Cultureel Planbureau.

Koopmans, R. & Schaeffer, M. (2016). Statistical and perceived diversity and their impacts on neighborhood social cohesion in Germany, France and the Netherlands. *Social Indicators Research* 125, 853–883. https://doi.org/10.1007/s11205-015-0863-3

Lai, K. Y., Sarkar, C., Kumari, S., Ni, M. Y., Gallacher, J., & Webster, C. (2021). Calculating a national Anomie Density Ratio: Measuring the patterns of loneliness and social isolation across the UK's residential density gradient using results from the UK Biobank study. *Landscape and Urban Planning*, 215, 104194. https://doi.org/10.1016/j.landurbplan.2021.104194

Lam, J., & Wang, S. (2022). Built environment and loneliness among older adults in South East Queensland, Australia. *Journal of Applied Gerontology*, 41(11), 2382–2391. https://doi.org/10.1177/07334648221114345

Livingstone, H. (2021, April 9). Man's body was found after lying in Norway flat for nine years, say police. *The Gardian.* Retrieved March 15, 2023 from https://www.theguardian.com/world/2021/apr/09/mans-body-was-found-after-lying-in-norway-flat-for-nine-years-say-police

Longitudinal Aging Study Amsterdam. (2022). *Depressie en eenzaamheid*. Retrieved January 9, 2023 from https://lasa-vu.nl/weetjes/depressie-en-eenzaamheid/

Lyu, Y., & Forsyth, A. (2022). Planning, aging, and loneliness: Reviewing evidence about built environment effects. *Journal of Planning Literature*, 37(1), 28–48. https://doi.org/10.1177/08854122211035131

Maas, J., van Dillen, S. M. E., Verheij, R. A., & Groenewegen, P. P. (2009). Social contacts as a possible mechanism behind the relation between green space and health. *Health and Place*, 15(2), 586–595. https://doi.org/10.1016/j.healthplace.2008.09.006

Malcolm, M., Frost, H., & Cowie, J. (2019). Loneliness and social isolation causal association with health-related lifestyle risk in older adults: a systematic review and meta-analysis protocol. *Systematic Reviews*, 8(1), 48. https://doi.org/10.1186/s13643-019-0968-x

Mao, S., Lou, V. W. Q., & Lu, N. (2022). Perceptions of neighborhood environment and loneliness among older Chinese adults: the mediator role of cognitive and structural social capital. *Aging and Mental Health*, 27(3), 595-603. https://doi.org/10.1080/13607863.2022.2053500

Matthews, T., Odgers, C. L., Danese, A., Fisher, H. L., Newbury, J. B., Caspi, A., Moffitt, T. E., & Arseneault, L. (2019). Loneliness and Neighborhood Characteristics: A Multi-Informant, Nationally Representative Study of Young Adults. *Psychological science*, 30(5), 765–775. https://doi.org/10.1177/0956797619836102

Meijers, J., & Bolt, S. (2021). Scoping review. *TVZ - Verpleegkunde in Praktijken Wetenschap*, 131(6), 56–57. https://doi.org/10.1007/s41184-021-1046-0

Ministry of Housing Communities & Local Government. (2019, September 26). *English indices of deprivation 2019*. Retrieved November 28, 2022, from https://Www.Gov.Uk/Government/Statistics/English-Indices-of-Deprivation-2019.

Moulay, A., Ujang, N., & Said, I. (2017). Legibility of neighborhood parks as a predicator for enhanced social interaction towards social sustainability. *Cities*, 61, 58–64. https://doi.org/https://doi.org/10.1016/j.cities.2016.11.007

Movisie. (2020). *Eenzaamheid: Wat weten we en waar staan we?* Retrieved July 19, 2023, from https://www.movisie.nl/artikel/aanpak-eenzaamheid-wat-weten-we-waar-staan-we

Mullins, L. C., Johnson, D. P., & Andersson, L. (1987). Loneliness of the elderly: The impact of family and friends. *Journal of Social Behavior & Personality*, 2(2), 225–238.

Munn, Z., Peters, M. D. J., Stern, C., Tufanaru, C., McArthur, A., & Aromataris, E. (2018). Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Medical Research Methodology*, 18(1), 143. https://doi.org/10.1186/s12874-018-0611-x

Myers, R. (1990). *Classical and modern regression with applications* (2nd ed.). Boston, MA: Duxbury

Neuroscience News. (2023, July 20). *Social Isolation: Health Implications: Unmasking the Mortality Risks of Loneliness*. Retrieved August 1, 2023, from https://neurosciencenews.com/social-isolations-mortality-23504/

Niedzwiedz, C. L., Richardson, E. A., Tunstall, H., Shortt, N. K., Mitchell, R. J., & Pearce, J. R. (2016). The relationship between wealth and loneliness among older people across Europe: Is social participation protective? *Preventive Medicine*, 91, 24–31. https://doi.org/10.1016/j.ypmed.2016.07.016

Nikitin, J., & Freund, A. (2017). Social motives predict loneliness during a developmental transition. *Swiss Journal of Psychology*, 76, 145–153. https://doi.org/10.1024/1421-0185/a000201

NOS Nieuws. (2023, May 28). Man ligt vijf maanden onopgemerkt dood in woning in Den Bosch. *NOS*. Geraapleegd op 1 juni 2023 van https://nos.nl/artikel/2476744-man-ligt-vijf-maanden-onopgemerkt-dood-in-woning-in-den-bosch

OBI. (2020). *Wijkprofiel Rotterdam 2020*. Retrieved April 14, 2023, from https://wijkprofiel.rotterdam.nl/nl/2022/uitleg

OBI. (2022). *Wijkprofiel Rotterdam*. Gemeente Rotterdam. Retrieved April 14, 2023, from https://wijkprofiel.rotterdam.nl/nl/2020/rotterdam

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*, 372, 160. https://doi.org/10.1136/bmj.n71

Park, C., Majeed, A., Gill, H., Tamura, J., Ho, C., Mansur, R. B., Nasri, F., Lee, Y., Rosenblat, J. D., Wong, E., & McIntyre, R.S.. (2020). The effect of loneliness on distinct health outcomes: A comprehensive review and meta-analysis. *Psychiatry Research*, 294, 113514. https://doi.org/10.1016/j.psychres.2020.113514

Paul, E., Bu, F., & Fancourt, D. (2021). Loneliness and risk for cardiovascular disease: Mechanisms and future directions. *Current Cardiology Reports*, 23(6), 68. https://doi.org/10.1007/s11886-021-01495-2

Penninx, B.W. J. H., van Tilburg, T., Kriegsman, D. M. W., Boeke, A. J. P., Deeg, D. J. H., & van Eijk, J. Th. M. (1999). Social network, social support, and loneliness in older persons with different

chronic diseases. *Journal of Aging and Health*, 11(2), 151–168. https://doi.org/10.1177/089826439901100202

Peplau, L., & Perlman, D. (1982). *Loneliness. A sourcebook of current theory, research and therapy*. John Wiley & Sons.

Perlman, D., & Peplau, L. A. (1981). Toward a social psychology of loneliness. *Personal Relationships*, 3, 31-56.

Pinquart, M., & Sorensen, S. (2001). Influences on loneliness in older adults: A meta-analysis. *Basic and Applied Social Psychology*, 23(4), 245–266. https://doi.org/10.1207/153248301753225702

Politie Den Bosch. (2023, May 27). Sociale controle. *Facebook*. Retrieved June 1, 2023, from https://www.facebook.com/politiedenbosch/posts/649530747213979/

Rico-Uribe, L. A., Caballero, F. F., Martín-María, N., Cabello, M., Ayuso-Mateos, J. L., & Miret, M. (2018). Association of loneliness with all-cause mortality: A meta-analysis. *PLOS ONE*, 13(1), e0190033-. https://doi.org/10.1371/journal.pone.0190033

Rook, K. S. (1984a). Promoting social bonding: Strategies for helping the lonely and socially isolated. *American Psychologist*, 39(12), 1389–1407. https://doi.org/10.1037/0003-066X.39.12.1389

Rook, K. S. (1984b). Research on social support, loneliness, and social isolation: Toward an integration. *Review of Personality & Social Psychology*, 5, 239–264.

Russel, D., Peplau, L. A., & Ferguson, M. L. (1978). Developing a measure of loneliness. *Journal of Personality Assessment*, 42(3), 290–294.

Rijksinstituut voor Volksgezondheid en Milieu. (2020). *Eenzaamheid in Nederland*. *Buurtatlas: Gezondheid per buurt, wijk en gemeente*. Retrieved April 28, 2023, from https://buurtatlas.vzinfo.nl/#eenzaamheid

Sbarra, D. A. (2015). Divorce and Health: Current trends and future directions. *Psychosomatic Medicine*, 77(3), 227. https://journals.lww.com/psychosomaticmedicine/Fulltext/2015/04000/Divorce_and_Health__Current_Trends_and_Future.4.aspx

Scharf, T., & de Jong Gierveld, J. (2008). Loneliness in urban neighbourhoods: an Anglo-Dutch comparison. European journal of ageing, 5(2), 103. https://doi.org/10.1007/s10433-008-0080-x

Schouten, G. M., & Koene-Smit, N. (2023). *Over de Corona gezondheidsmonitor volwassenen en ouderen 2022*. Retrieved June 1, 2023 from www.Gezondheidinkaart.nl.

Schrempft, S., Jackowska, M., Hamer, M., & Steptoe, A. (2019). Associations between social isolation, loneliness, and objective physical activity in older men and women. *BMC Public Health*, 19(1), 74. https://doi.org/10.1186/s12889-019-6424-y

Sekaran, U., & Bougie, R. (2016). *Research methods for business - A skill-building approach*. John Wiley & Sons Ltd.

Shatskikh, M. (2016, September 6). *Op Zoek Naar Een Vriend Bear · Gratis stockfoto*. Pexels. https://www.pexels.com/nl-nl/foto/op-zoek-naar-een-vriend-bear-165263/

Shovestul, B., Han, J., Germine, L., & Dodell-Feder, D. (2020). Risk factors for loneliness: The high relative importance of age versus other factors. *PLOS ONE*, 15(2), e0229087https://doi.org/10.1371/journal.pone.0229087

Skopeliti, C. (2023, June 19). 'Socially stunted': how Covid pandemic aggravated young people's loneliness. *Loneliness , the Guardian*. Retrieved July 26, 2023, from https://amp.theguardian.com/society/2023/jun/19/socially-stunted-how-covid-pandemic-aggravated-young-peoples-loneliness

Smith, M., Hosking, J., Woodward, A., Witten, K., MacMillan, A., Field, A., Baas, P., & Mackie, H. (2017). Systematic literature review of built environment effects on physical activity and active transport – an update and new findings on health equity. *International Journal of Behavioral Nutrition and Physical Activity*, 14(1), 158. https://doi.org/10.1186/s12966-017-0613-9

Smith, T. B., Baker, M., Harris, T., & Stephenson, D. (2015). Loneliness and social isolation as risk factors for mortality. *Perspectives on Psychological Science*, 10(2), 227–237. https://doi.org/10.1177/1745691614568352

Statista. (2021). *Feeling of loneliness among adults 2021, by country*. Retrieved December 12, 2022, from https://www.statista.com/statistics/1222815/loneliness-among-adults-by-country/#:%7E:text=According%20to%20a%20global%20survey,often%2C%20always%2C%20or%20sometimes.

Stewart, C. (2021). *Mental health changes due to the coronavirus in the Netherlands 2020*. Retrieved April 14, 2023, from https://www.statista.com/statistics/1115803/dutch-mental-health-coronavirus/

StudyPug (n.d). *What is the margin of error in statistics?* Retrieved May 1, 2023, from https://www.studypug.com/statistics-help/margin-of-error?camp_id=1404262255&grp_id=116515251098&kw=&mt=&source=s&pos=&tgt=dsa-592332628470&loc=1010481&device=c&adid=655115884289&gclid=CjwKCAjwxr2iBhBJEiwAdXECw49Ux-jvFDmbrnOEXZLBb7ig9I_QMMKD5QwQ9uqFFSBKPT1LB1oOOhoC1RsQAvD_BwE

Syed, M. A., McDonald, L., Smirle, C., Lau, K., Mirza, R. M., & Hitzig, S. L. (2017). Social isolation in Chinese older adults: Scoping review for age-friendly community planning. *Canadian Journal on Aging*, 36(2), 223–245https://doi.org/10.1017/S0714980817000101

Teig, E., Amulya, J., Bardwell, L., Buchenau, M., Marshall, J. A., & Litt, J. S. (2009). Collective efficacy in Denver, Colorado: Strengthening neighborhoods and health through community gardens. *Health & Place*, 15(4), 1115–1122. https://doi.org/https://doi.org/10.1016/j.healthplace.2009.06.003

Timmermans, E., Motoc, I., Noordzij, J. M., Beenackers, M. A., Wissa, R., Sarr, A., Gurer, A., Fabre, G., Ruiz, M., Doiron, D., Oude Groeniger, J., Deeg, D., Van Lenthe, F. J., & Huisman, M. (2021). Social and physical neighbourhood characteristics and loneliness among older adults: Results from the MINDMAP project. *Journal of Epidemiology and Community Health*, 75(5), 464–469. https://doi.org/10.1136/jech-2020-214217

Tolsma, J., van der Meer, T. & Gesthuizen, M. (2009). The impact of neighbourhood and municipality characteristics on social cohesion in the Netherlands. *Acta Politica* 44, 286–313. https://doi.org/10.1057/ap.2009.6

Van Amelsvoort, T. A. M. J. (2020). *Eenzaamheid is ongezond*. Retrieved December 12, 2022, from https://kenniscentrumphrenos.nl/assets/2021/05/Tijdschrift-Psychiatrie-Column-Eenzaamheid-is-ongezond-T.-van-Amelsvoort.pdf

Van Beek, J., Duif, M., Fischmann, J., van Geel, R., Hoek, D., de Hoog, N., Knippenberg, I., Leontjevas, R., Pat-El, R., Peters, G., Reniers, P., van Tuijl, P., Verboon, P. & de Zeeuw, T. (2023). *Open Methodologie en Statistiek*. Retrieved August 10, 2023. From https://openmens.nl

Van Beuningen, J., & Moonen, L. (2014). *De sociale context van geluk: wat is belangrijk voor wie?* CBS.

Van den Berg, P., Kemperman, A., de Kleijn, B., & Borgers, A. (2016). Ageing and loneliness: The role of mobility and the built environment. *Travel Behaviour and Society*, 5, 48–55. https://doi.org/10.1016/j.tbs.2015.03.001

Van Der A., D. L., Boekee, R., Geuijen, P., Hiemstra, M., Deuning, C., & Giesbers, H. (2023, June 20). *Sociaaleconomische status | Regionaal | Inkomen*. Staat van Volksgezondheid en Zorg. Retrieved August 7, 2023, from https://www.vzinfo.nl/sociaaleconomische-status/regionaal/inkomen

Van Der A, D. L., Boekee, R., Van Dorsselaer, S. a. F. M., Hiemstra, M., Geuijen, P., & Zantinge, E. M. (2021). *Eenzaamheid | Leeftijd en geslacht*. Staat van Volksgezondheid en Zorg. Retrieved March 19, 2023, from https://www.vzinfo.nl/eenzaamheid/leeftijd-en-geslacht#trend-eenzaam-volwassenen

Van Der A, D. L., Boekee, R., Van Dorsselaer, S. a. F. M., Hiemstra, M., Geuijen, P., & Zantinge, E. M. (2023, June 20). *Eenzaamheid | Leeftijd en geslacht*. Staat van Volksgezondheid en Zorg. Retrieved July 12, 2023, from https://www.vzinfo.nl/eenzaamheid/leeftijd-en-geslacht#trend-eenzaam-volwassenen

Van der A, D. L., Hiemstra, M., & Zantinge, E. M. (2022, June 22). Eenzaamheid | Burgerlijke staat. *VZinfo*. Retrieved July 12, 2023 van https://www.vzinfo.nl/eenzaamheid/burgelijke-staat

Van der Wilk, E. A. (2023, March 3). Eenzaamheid | Internationaal. *Vzinfo*. Retrieved July 12, 2023 van https://www.vzinfo.nl/eenzaamheid-internationaal

Van Tilburg, T. , & De Jong-Gierveld, J. (2007). *Zicht op eenzaamheid: Achtergronden, oorzaken en aanpak*. Vrije Universiteit.

Van Tilburg, T., & De Leeuw, E. (1991). Stability of scale quality under various data collection procedures: A mode comparison on the "de Jong Gierveld Loneliness Scale." *International Journal of Public Opinion Research*, 3(1), 69–85. https://doi.org/10.1093/ijpor/3.1.69

Van Tilburg, T. G., & Fokkema, T. (2018). Hogere eenzaamheid onder Marokkaanse en Turkse ouderen in Nederland: Op zoek naar een verklaring. *Tijdschrift voor Gerontologie en Geriatrie*, 49(6), 263–273. https://doi.org/10.1007/s12439-018-0269-1

Veen, E. J., Bock, B. B., Van den Berg, W., Visser, A. J., & Wiskerke, J. S. C. (2016). Community gardening and social cohesion: different designs, different motivations. *Local Environment*, 21(10), 1271–1287. https://doi.org/10.1080/13549839.2015.1101433

Victor, C. R., & Pikhartova, J. (2020). Lonely places or lonely people? Investigating the relationship between loneliness and place of residence. *BMC Public Health*, 20(1), 1-12. https://doi.org/10.1186/s12889-020-08703-8

Victor, C., Scambler, S., Bond, J., & Bowling, A. (2000). Being alone in later life: Loneliness, social isolation and living alone. *Reviews in Clinical Gerontology*, 10(4), 407–417. https://doi.org/10.1017/S0959259800104101

Weber, M. (2011). Systematisch literatuuronderzoek en onderzoekssynthese. In: J. Aken & D. Andriessen (Eds.) *Handboek ontwerpgericht wetenschappelijk onderzoek: wetenschap met effect.* Boom Lemma.

Weijs-Perrée, M., Van den Berg, P., Arentze, T., & Kemperman, A. (2015). Factors influencing social satisfaction and loneliness: A path analysis. *Journal of Transport Geography*, 45, 24–31. https://doi.org/10.1016/j.jtrangeo.2015.04.004

Weiss, R. S. (1973). *Loneliness: The experience of emotional and social isolation*. MIT Press.

Wen, M., Hawkley, L. C., & Cacioppo, J. T. (2006). Objective and perceived neighborhood environment, individual SES and psychosocial factors, and self-rated health: An analysis of older adults in Cook County, Illinois. *Social Science and Medicine*, 63(10), 2575–2590. https://doi.org/10.1016/j.socscimed.2006.06.025

Wenger, G. C., & Burholt, V. (2004). Changes in levels of social isolation and loneliness among older people in a rural area: A twenty-year longitudinal study. *Canadian Journal on Aging*, 23, 115–127.

Whatley, E., Fortune, T., & Williams, A. E. (2015). Enabling occupational participation and social inclusion for people recovering from mental ill-health through community gardening. *Australian Occupational Therapy Journal*, 62(6), 428–437. https://doi.org/https://doi.org/10.1111/1440-1630.12240

Wheelan, C. (2013). *Naked statistics: Stripping the dread from the data*. WW Norton & Company.

Wirtz, F. F. R., Aartsen, M. J., Visser, M., & Deeg, D. J. H. (2012). *Sport en eenzaamheid: Individuele en groepssport en de relatie met emotionele en sociale eenzaamheid bij ouderen*. Vrije Universiteit.

Xia, N., & Li, H. (2018). Loneliness, Social isolation, and cardiovascular health. *Antioxidants and Redox Signaling*, 28(9), 837–851. https://doi.org/10.1089/ars.2017.7312

Yang, Y., & Xiang, X. (2021). Examine the associations between perceived neighborhood conditions, physical activity, and mental health during the COVID-19 pandemic. *Health and Place*, 67, 102505https://doi.org/10.1016/j.healthplace.2021.102505

Young, J. E. (1982). Loneliness, depression and cognitive therapy: Theory and application. In: *Loneliness: A sourcebook of current theory, research and therapy*, 379-406.

Yu, R., Cheung, O., Lau, K., & Woo, J. (2017). Associations between perceived neighborhood walkability and walking time, wellbeing, and loneliness in community-dwelling older Chinese people in Hong Kong. *International Journal of Environmental Research and Public Health*, 14(10), 1199.https://doi.org/10.3390/ijerph14101199

Yu, X., Yang, J., Yin, Z., Jiang, W., & Zhang, D. (2021). Loneliness mediates the relationships between perceived neighborhood characteristics and cognition in middle-aged and older adults. *International Journal of Geriatric Psychiatry*, 36(12), 1858–1866. https://doi.org/10.1002/gps.5595

Zomer, C., Van Der Noordt, M., & Zantinge, E. M. (2022, August 9). *Eenzaamheid | Opleiding*. Volksgezondheid en Zorg. Retrieved March 30, 2023, from https://www.vzinfo.nl/eenzaamheid/eenzaamheid-opleiding

Zwillinger, D. (2003). *Standard mathematical tables and formulae*. Chapman and Hall/CRC

Appendices

In the appendices information can be found about the data gathering, conducted analyses and results from the brainstorming session. All appendices are gathered below.

Appendix I – Health monitor survey

In this appendix, the survey conducted to gather the information for the health monitor is shown.

Health Questionnaire 2020 E

Vragenlijst E (vertaling van A), Engels

Municipal Health Service Rotterdam-Rijnmond

It is great that you want to help with this survey.

- It's important that the questionnaire is filled in by person the letter is addressed to.
- There are no 'right' or 'wrong' answers. Just mark the answer that applies best to you.

General			
Important: In order to process your answers to the questionnaire, we need your permission. Your data will only be processed for research purposes and in accordance with the privacy statement. The privacy statement can be found at www.gezondheidsmeterrijnmond.nl			
A0	**Do you give your permission?** *Put a cross.*	☐	Yes, I give permission to use the answers I give in this questionnaire for research purposes
A1	**What is your sex?** *Indicate your sex as shown on your passport.*	☐	Male
		☐	Female
A2	**What is your year of birth?**		
A3	**What is your marital status?**		
	☐	Married / registered partnership	
	☐	Cohabitating	
	☐	Unmarried, have never been married	
	☐	Divorced or separated (and living separately)	
	☐	Widow / widower	

A4	Who lives with you <u>at present</u>? *Multiple answers are allowed.*	
	☐	My partner / husband or wife
	☐	A child / children below the age of 18
	☐	A child / children aged 18 or over
	☐	My parent(s)
	☐	Another adult / other adults
	☐	Do not live together with a partner, but I do have a long-term relationship
	☐	I live alone

Your health

B1 **How is your health in general?**

- ☐ Very good
- ☐ Good
- ☐ Fair
- ☐ Bad
- ☐ Very bad

B2 **How happy are you, all things considered?**

- ☐ Very happy
- ☐ Fairly happy
- ☐ Not very happy
- ☐ Not happy at all
- ☐ Don’t know

Height and weight

C1 **How tall are you (without shoes)?** ☐☐☐ centimetres

C2 **How many kilos do you weigh without clothes?** *If you are pregnant, please fill in your weight prior to the pregnancy.* ☐☐☐ kilogrammes *(round up or down to whole kilos)*

Nutrition

D1 How many days a week do you usually eat: *Check your answer in each line.*	**Less then once per week**	**Number of days per week** 1	2	3	4	5	6	7
breakfast?	☐	☐	☐	☐	☐	☐	☐	☐
vegetables? *(such as beans, spinich, carrots, cabbage, eggplant, paprika/ belle pepper, maïs, lettuce, cucumber, tomato)*	☐	☐	☐	☐	☐	☐	☐	☐
fruit? *(such as apple, orange, banana, mango, dates, grapes)*	☐	☐	☐	☐	☐	☐	☐	☐
meat?	☐	☐	☐	☐	☐	☐	☐	☐
Fries, fried snack, hamburger, pizza, shawarma or kebab	☐	☐	☐	☐	☐	☐	☐	☐

D2 How many days a week do you usually eat: *Check your answer in each line.*	**Less than 1 time per week**	**Number of days per week** 1	2	3	4	5	6	7
a home-made hot meal?	☐	☐	☐	☐	☐	☐	☐	☐
a ready-made meal or frozen meal?	☐	☐	☐	☐	☐	☐	☐	☐
a meal from a company canteen or cafetaria?	☐	☐	☐	☐	☐	☐	☐	☐
a meal from a fastfood restaurant or snack bar	☐	☐	☐	☐	☐	☐	☐	☐
a meal from a restaurant of cafe	☐	☐	☐	☐	☐	☐	☐	☐

Drinks containing sugar include:

- Coffee or tea with sugar or honey
- Soft drink with sugar (such as cola, orange, Icetea (green), Spa & Fruit or Dubbelfrisss)
- Energy drinks (such as Red Bull)
- Sport drinks (such as AA-drink or Extran)
- Squash/cordials (such as syrups of Ranja)
- Fruit juice (such as orange juice, apple juice, multivitamin juice or Dubbeldrank)
- Sweetened milk- or yoghurt drinks (such as chocolate milk, milkshake, Fristi or Yogidrink)

NOTE: Light drinks (such as cola light, Dubbelfrisss light, Crystal Clear or Optimel) do NOT count.

D2 How many days a week do you consume drinks containing sugar?

☐(Almost) never → GO TO QUESTION **E1**
☐1 day
☐2 days
☐3 days
☐4 days
☐5 days
☐6 days
☐Every day

D3If you consume drinks with sugar, how many glasses do you drink on average per day?

☐1 glass or fewer
☐2 glasses
☐3 glasses
☐4 glasses
☐5 glasses
☐6 glasses
☐More than 6 glasses

Smoking

E1 **Do you occasionally smoke?**

We are referring here to smoking all sorts of tobacco products, but not to the use of electronic cigarettes or devices that heat tabacco (heatstick, heat-not-burn), such as IQOS.

☐ Yes ➔ GO TO QUESTION **E3**

☐ No

E2 **Have you ever smoked?**

☐ Yes

☐ No

E3 **Do you ever use an electronic cigarette, or e-sigaret?**

Alternative names are e-smoker of shisha pen. Also referred to as 'vaping'.

☐ Yes

☐ No

Drinking alcohol

F1 **In the <u>last 12 months,</u> have you ever consumed alcoholic beverages, such as beer, wine, liquor, mixed drinks or cocktails?**

This includes low-alcohol beer, but <u>no</u> non-alcoholic beers.

☐ Yes ➔ GO TO QUESTION **F3**

☐ No

F2 **Have you ever consumed an alcoholic beverage?**

☐ Yes ➔ GO TO QUESTION **G1**

☐ No ➔ GO TO QUESTION **G1**

F3 **On average, on how many of the four weekdays (Monday through Thursday) do you drink alcoholic beverages?**

☐ 4 days
☐ 3 days
☐ 2 days
☐ 1 day
☐ Less than 1 day
☐ I never drink on weekdays ➔ GO TO QUESTION F5

F4 **When drinking alcoholic beverages on a weekday, how many glasses do you drink on average?**

☐ 16 or more glasses
☐ 11 – 15 glasses
☐ 7-10 glasses
☐ 6 glasses
☐ 5 glasses
☐ 4 glasses
☐ 3 glasses
☐ 2 glasses
☐ 1 glass

F5 **On average, on how many of the three weekend days (Friday through Sunday) do you drink alcoholic beverages?**

☐ 3 days
☐ 2 days
☐ 1 day
☐ Less than 1 day

☐ I never drink at the weekend ➔ GO TO QUESTION F7

F6 **When drinking alcoholic beverages on weekend days, how many glasses do you drink on average?**

☐ 16 or more glasses
☐ 11 - 15 glasses
☐ 7-10 glasses
☐ 6 glasses
☐ 5 glasses
☐ 4 glasses
☐ 3 glasses
☐ 2 glasses
☐ 1 glass

F7 **How often have you drunk 4 or more glasses of alcoholic beverages on one day in the last 6 months?**

☐ Every day
☐ 5-6 times a week
☐ 3-4 times a week
☐ 1-2 times a week
☐ 1-3 times a month
☐ 3-5 times in six months
☐ 1-2 times in six months
☐ Never ➔ GO TO QUESTION G1

F8 **How often have you drunk 6 or more glasses of alcoholic beverages on one day in the last 6 months?**

☐ Every day
☐ 5-6 times a week
☐ 3-4 times a week
☐ 1-2 times a week
☐ 1-3 times a month
☐ 3-5 times in six months
☐ 1-2 times in six months
☐ Never

Drugs

G1 **Have you ever taken the following substances?**

Check a box in each line.

	No, never	Yes, in the last 4 weeks	Yes, in the last 12 months, but not in the last 4 weeks	Yes, longer than 12 months ago
Cannabis (hash, weed or marijuana)	☐	☐	☐	☐
XTC (ecstasy, MDMA)	☐	☐	☐	☐
Laughing gas	☐	☐	☐	☐
Cocaine (or crack, cooked base or freebase)	☐	☐	☐	☐
Amphetamine (pep, speed, etc.)	☐	☐	☐	☐
Other drugs, specifically:	☐	☐	☐	☐

Exercise

Consider a normal week in the last months. Please indicate how many days a week you were engaged in the activities mentioned below and how much time you spent on them on average on such a day.

H1 **Commuting (there and back)**

If you have not engaged in an activity, fill in 0.		**Number of days per week**		**Average time per day**			
a.	Walking to / from work or school		days		hour(s)		minutes
b.	Cycling from / to work or school		days		hour(s)		minutes

H2 Physical activity at work or school

If you have not engaged in an activity, fill in 0.

		Number of hours per week	
a.	Light and moderately strenuous work (seated / standing work with occasional walking, such as desk work or work that requires walking with light loads).		hour(s)
b.	Very strenuous work (work that requires frequent walking or work that requires heavy loads to be lifted regularly).		hour(s)

H3 Household activities

If you have not engaged in an activity, fill in 0.

		Number of days per week		Average time per day			
a.	Light and moderately strenuous household activities (work that requires standing such as cooking, washing dishes, ironing, feeding / bathing a child and household work that requires walking such as vacuuming, shopping for groceries).		days		hour(s)		minutes
b.	Very strenuous household activities (such as scrubbing floors, beating carpets, walking with heavy shopping bags).		days		hour(s)		minutes

H4 Leisure time

If you have not engaged in an activity, fill in 0.

		Number of days per week		Average time per day			
a.	Walking		days		hour(s)		minutes
b.	Cycling		days		hour(s)		minutes
c.	Gardening		days		hour(s)		minutes

d.	Doing odd jobs around the house / DIY		days		hour (s)			minutes

H5 Sports

	Fill in a maximum of 4 sports e.g. fitness / endurance training, tennis, running / jogging, football.	**Number of days per week**		**Average time per day**			
a.			days		hour(s)		minutes
b.			days		hour(s)		minutes
c.			days		hour(s)		minutes
d.			days		hour(s)		minutes

Longterm illness

I1 Do you suffer from one or more chronic illnesses or disorders?

Chronic implies it has lasted or is expected to last for 6 months or longer.

☐ Yes

☐ No

I2 Do your health problems restrict you in your daily life?

☐ Yes, seriously restricted

☐ Yes, restricted but not seriously

☐ No, not restricted at all ➔ GO TO QUESTION **I4**

I3 **Have you been restricted <u>for 6 months or longer</u>?**

- ☐ Yes
- ☐ No

I4 Have you been infected with the coronavirus?

- ❑ Yes, this has been confirmed with a test
- ❑ Yes, I think so, but I have not been tested
- ❑ No, I do not think so ➔ GO TO **I6**

I5 How ill did you feel or do you feel because of the coronavirus?

- ❑ Not ill at all
- ❑ A little ill
- ❑ Quite ill
- ❑ Severely ill

I6 **The following questions are about what you are normally able to do. This is <u>not</u> about temporary problems of a transitory nature**

	Yes, without any difficulty	Yes, with some difficulty	Yes, with great difficulty	No, I am not able to do so
Can you follow a conversation in a group consisting of three or more persons (with a hearing aid if required)?	☐	☐	☐	☐
Can you have a conversation with one other person (with a hearing aid if required)?	☐	☐	☐	☐
Can you read small print in the newspaper (with glasses or contact lenses if required)?	☐	☐	☐	☐
Can you recognize someone's face from a distance of 4 metres (with glasses or contact lenses if required)?	☐	☐	☐	☐
Can you carry an object weighing 5 kilos (such as a full shopping bag) for a distance of 10 metres?	☐	☐	☐	☐
Can you bend over from a standing position and pick something up from the ground?	☐	☐	☐	☐
Can you walk 400 metres without pausing (with a walking stick if necessary)?	☐	☐	☐	☐

Wellbeing

J1 **The questions below are about how you felt in the last 4 weeks.**
Please answer all the questions below by checking the correct answer.

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
How often did you feel tired out for no good reason?	☐	☐	☐	☐	☐
How often did you feel nervous?	☐	☐	☐	☐	☐
How often did you feel so nervous that nothing could calm you down?	☐	☐	☐	☐	☐
How often did you feel hopeless?	☐	☐	☐	☐	☐
How often did you feel restless or fidgety?	☐	☐	☐	☐	☐
How often did you feel so restless that you could not sit still?	☐	☐	☐	☐	☐
How often did you feel down or depressed?	☐	☐	☐	☐	☐
How often did you feel that everything was an effort?	☐	☐	☐	☐	☐
How often did you feel so down that nothing could cheer you up?	☐	☐	☐	☐	☐
How often did you feel blameworthy, inferior or worthless?	☐	☐	☐	☐	☐

J2 **In the last 4 weeks, have you been suffering from stress and/or anxiety?**

This could be caused by, for example, work, education, child-raising, health, informal care, money matters or social media?

- ❑ No, or barely ➔ GO TO QUESTION **J4**
- ❑ Yes, a little bit of stress and / or anxiety
- ❑ Yes, much stress and/ or anxiety
- ❑ Yes, a lot of stress and/or anxiety

J3 **On what domain do you experience stress and/or anxiety?**
Multiple answers are allowed.

☐ Work ☐ Living conditions

☐ Education	☐ Health
☐ Relationship with partner	☐ Informal care
☐ Family	☐ Money matters
☐ Social contacts	☐ Social media
☐ Child-raising	☐ Other

J4 Please indicate how strongly you agree or disagree with the statements below?

Check your answer in each line.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I have little control over the things that happen to me	☐	☐	☐	☐	☐
There is really no way I can solve some of the problems I have	☐	☐	☐	☐	☐
There is little I can do to change many of the important things in my life	☐	☐	☐	☐	☐
I often feel helpless in dealing with life's problems	☐	☐	☐	☐	☐
Sometimes I feel that I'm being pushed around in life	☐	☐	☐	☐	☐
What happens to me in the future mostly depends on me	☐	☐	☐	☐	☐
I can do just about anything I really set my mind to	☐	☐	☐	☐	☐

Social contacts and support

K1 Please indicate for each of the following statements, the extent to which they apply to your situation, the way you feel now.

Check your answer in each line.

	Yes	More or less	No
There is always someone I can talk to about my day-to-day problems	☐	☐	☐

I miss having a really close friend	☐	☐	☐
I experience a general sense of emptiness	☐	☐	☐
There are plenty of people I can lean on when I have problems	☐	☐	☐
I miss the pleasure of the company of others	☐	☐	☐
I find my circle of friends and acquaintances too limited	☐	☐	☐
There are many people I trust completely	☐	☐	☐
There are enough people I feel close to	☐	☐	☐
I miss having people around	☐	☐	☐
I often feel abandoned	☐	☐	☐
I can call on my friends whenever I need them	☐	☐	☐

Chronic illnesses and disorders

L1 **Please indicate which of the following illnesses and disorders you have or have had in the <u>last 12 months</u>?**

Check your answer in each line.

	No	**Yes, <u>not</u> diagnosed by a doctor**	**Yes, diagnosed by a doctor**
Diabetes (type 1 or 2)	☐	☐	☐
Stroke, cerebral haemorrhage or cerebral infarction or the consequences of any of these	☐	☐	☐
Arrhythmia or heart rhythm problems	☐	☐	☐
Heart attack or any other serious heart condition, such as heart failure or angina pectoris	☐	☐	☐
Cancer	☐	☐	☐
Migraine or regular severe headaches	☐	☐	☐
High blood pressure	☐	☐	☐
Asthma	☐	☐	☐

COPD (chronic bronchitis, lung emphysema)	☐	☐	☐
Depression	☐	☐	☐
Severe stress, burn-out	☐	☐	☐
Anxiety disorder	☐	☐	☐
Other long-term disease or disorder, please specify:	☐	☐	☐

L2 **Have you ever suffered hearing loss after listening to music through earphones or headphones?**

Such as a whistling noise in your ears, muffled hearing, difficulty hearing.

☐ Yes, often

☐ Yes, sometimes

☐ No, never

☐ No, I never listen to music with earphones or headphones

L3 **Does your hearing ever trouble you when you're in a place with loud music, or after?** *Such as a whistling noise in your ears, muffled hearing, difficulty hearing.*

☐ Yes, often

☐ Yes, sometimes

☐ No, never

☐ No, I'm never in a place with loud music → GO TO QUESTION **L1**

L4 **Do you ever use earplugs to protect your hearing when you're in a place with loud music?**

☐ Yes, always

☐ Yes, sometimes

☐ No, never

Sexual Health

The following questions are about sexual health. The Municipal Health Service (GGD) would like to know how large the group is that is exposed to health risks due to sex. The results also indicate whether STD care is used in the region and whether it is sufficient.

- **M1 With whom have you had sex in the last 12 months?**
- *Sex = vaginal, anal of oral sex*
- ☐ Only with a man(men)
- ☐ Both with a man(men) and a woman(women)
- ☐ Only with a woman(women)
- ☐ I have not had sex → **GO TO QUESTION M3**
-
- **M2 How often did you use condoms during sexual intercourse with casual partner(s) in the last 12 months?**
- *Sexual intercourse is taken to mean vaginal sex as well as anal sex., NOT oral sex.*
- *A casual partner is someone with whom you did not have a steady relationship, or with whom the relationship was over within 3 months.*

☐ Not applicable, I do NOT have casual sexual partners or ONLY oral sex

☐ Always

☐ Usually yes

☐ Sometimes I did, sometimes I did not

☐ Usually no

☐ Never

M3 Have you been tested for STDs or HIV in the last 12 months?

Multiple answers are allowed.

STDs = sexually transmitted diseases. HIV = the virus which causes AIDS

☐ No

☐ Yes, at the general practitioner (family doctor)

☐ Yes, at the STD polyclinic or a GGD (Municipal Health Services)

☐ Yes, in a hospital

☐ Yes, at an obstetrician or gynaecologist concerning a pregnancy or at the blood bank concerning a blood donation

☐ yes, with a self-test(kit) that I sent to a laboratory for analysis

☐ yes, with a self-test that showed the results at home instantly

☐ yes, other

Informal care and volunteer work

Informal care is the care that you give to a person you know, such as your partner, parents, child, neighbours or friends, if this person is ill, in need of help, or handicapped for an extended period of time. This care may consist of household tasks, washing and dressing, keeping them company, providing transport, taking care of financial matters, etc.

- Informal care is unpaid.
- A volunteer from a volunteer centre is not an informal carer

N1 Have you <u>given</u> informal care in the <u>last 12 months</u>?

☐ Yes

☐ No ➔ GO TO QUESTION N**6**

N2 Are you currently caring for someone informally?

☐ Yes

☐ No ➔ GO TO QUESTION N**6**

N3 How many hours a week on average do you currently give informal care, including travelling time? *Round to whole hours.*

☐☐ Average number of hours per week

N4 How long have you been an informal carer?

☐ Less than 3 months

☐ 3 months or longer

N5 **Some people feel heavily burdened by providing care for another person. They find the care hard and difficult to maintain. For other people this applies to a lesser extent. All things considered, how burdened do you <u>currently</u> feel?**

- ☐ Not or hardly burdened
- ☐ Somewhat burdened
- ☐ Burdened considerably
- ☐ Heavily burdened
- ☐ Overburdened

N6 **Do you do any volunteer work?** *This refers to organised work (such as for a sports club, a church council, a school) for which you receive no pay.*

- ☐ Yes
- ☐ No

Domestic Violence

The following questions are about domestic violence.

Domestic violence is violence that is committed by family members, relatives, partners, ex-partners, family friends. This may be:

- Psychological or emotional violence (being bullied, humiliated or called names)
- Physical violence (physical abuse, being kicked and beaten)
- Sexual harassment (sexually oriented remarks, unwanted touching)
- Sexual abuse (sexual assault or rape)

O1 **Have you <u>ever</u> been a victim of domestic violence?**

- ☐ Yes
- ☐ No ➔ GO TO QUESTION **O1**

O2 **What form of domestic violence did this concern?** *Multiple answers are allowed.*

- ☐ Psychological or emotional violence
- ☐ Physical violence
- ☐ Sexual harassment
- ☐ Sexual abuse

O3 **How long ago were you the victim of domestic violence?**

- ☐ 1 year ago or less
- ☐ Between 1 and 5 years ago
- ☐ More than 5 years ago

Healthy living environment

P1 **If you think of the last 12 months, which number from 0 to 10 best indicates the extent to which you have been bothered, disturbed or annoyed by noise from the sources mentioned below when you were at home?**

If there is a noise that cannot be heard at your home, you can mark this in the last column.

Check your answer in each line.

	Not bothered at all ⟷ **Extremely bothered**											**Inaudible**
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
Traffic on roads where the speed limit is more than 50 km/hour	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Traffic on roads where the speed limit is 50 km/hour	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Trains	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Air traffic	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Tram / metro	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Mopeds / scooters	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Neighbours	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Companies / industries	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Wind turbines, windmills	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Shipping	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

P2 **If you think of the <u>last 12 months</u>, which number from 0 to 10 indicates best to what extent <u>your sleep was disturbed by noise</u> from the sources mentioned below when you were at home?**

If there is a noise that cannot be heard at your house, you can mark this in the last column.

Check your answer in each line.

	My sleep has not been disturbed at all					⟷					**My sleep has been extremely disturbed**	**Inaudible**
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
Traffic on roads where the speed limit is more than 50 km/hour	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Traffic on roads where the speed limit is 50 km/hour	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Trains	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Air traffic	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Neighbours	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Companies/ industries	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

P3 **If you think of the <u>last 12 months</u>, at which hours was your sleep disturbed by air traffic noise?** *Multiple answers are allowed.*

☐ 06:00 - 07:00 uur

☐ 07:00 - 08:00 uur

☐ 08:00 - 19:00 uur

☐ 19:00 - 22:00 uur

☐ 22:00 - 23:00 uur

☐ 23:00 - 24:00 uur

☐ 24:00 - 05:00 uur

☐ 05:00 - 06:00 uur

☐ Not applicable

P4 Do you sometimes have problems at home with dust, smoke or soot from an open fire or wood stove?

☐ Yes, often

☐ Yes, sometimes

☐ No, never

P5 Do you sometimes have problems at home with dust, smoke or soot from a brazier or BBQ?

☐ Yes, often

☐ Yes, sometimes

☐ No, never

P6 Do you ever have problems at home with dust, smoke or soot from companies, industry or shipping?

☐ Yes, often

☐ Yes, sometimes

☐ No, never

P7 Are you concerned about your health due to environmental factors in your environment?

Multiple answers are allowed.

☐ Yes, due to masts, antennas, cables

☐ Yes, due to air pollution

☐ Yes, due to contaminated soil

☐ Yes, due to wind turbines of windmills

☐ Yes, due to another environmental factor

☐ No, I am not concerned

P8 How satisfied are you with your house and your neighbourhood?
Give the following a mark out of 10.

	Very dissatisfied				⟷					Very satisfied
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
House	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Neighbourhood	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

P9 When the weather is hot, are you able to find somewhere cool in your house and in your garden or neighbourhood?

Give the following a mark out of 10.

	Almost impossible				⟷					Very able to do so
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Inside, in your house	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Outside, in your garden or neighbourhood	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Inside, in another building	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

P10 What applies to you?

I think that there are sufficient green spaces in my neighbourhood (such as.parks, public gardens, grassy areas, planted borders, or playgrounds

☐ Completely disagree

☐ Disagree

☐ Neither agree nor disagree

☐ Agree

☐ Completely agree

Consequences of the coronavirus crisis

For some, the influence of the coronavirus crisis on their lives is small. For others, the influence is larger, for example because of an infection with the coronavirus or due to the government measures to stop the spread of the virus.

Q1 Please indicate how the topics listed below changed for you because of the coronavirus crisis.

If one of these topics does not apply to you (if you do not smoke, for example), please indicate 'not applicable'. If you do smoke, but your smoking habits have not changed due to the coronavirus crisis, please indicate 'no change'.

	Better	No change	Worse	
General health	❑	❑	❑	
Financial situation	❑	❑	❑	
	More	**No change**	**Less**	**Not applicable**
Exercise / sports	❑	❑	❑	
Smoking	❑	❑	❑	❑
Drinking alcohol	❑	❑	❑	❑
Feeling of control about my life	❑	❑	❑	
Feeling anxious	❑	❑	❑	❑
Feeling depressed	❑	❑	❑	❑
Feeling lonely	❑	❑	❑	❑
Feeling stress	❑	❑	❑	❑
Providing informal care	❑	❑	❑	❑
Voluntering	❑	❑	❑	❑

Q8 Do you have plans to alter your lifestyle soon? If so, what do you want to alter?
Multiple answers are possible.

- ☐ Drink less alcohol
- ☐ Stop smoking
- ☐ Take more exercise / play sports
- ☐ Eat more healthily
- ☐ Lose weight / diet
- ☐ Solve personal problems
- ☐ Have more contact with other people
- ☐ Take things more easily
- ☐ Other
- ☐ Nothing

Education, work and income

S1 What is your highest completed education (with a diploma or a certificate or a certificate of proficiency)?

- ☐ No education (not finished primary school)
- ☐ Primary education (primary school, special primary education)
- ☐ Lower or preparatory vocational education (such as lts, leao, lhno, vmbo-b/k, special- or pre-vocational education)
- ☐ Junior general secondary education (such as (m)ulo, mavo, vmbo-g/t, mbo-kort, mbo-1)
- ☐ Upper secondary vocational education and apprenticeship training (such as training to become a baker or hairdresser, mbo-lang, mts, meao, bol, bbl, mbo-2, mbo-3, mbo-4)
- ☐ Upper general secondary education and pre-university education (such as hbs, mms, havo, vwo, atheneum, gymnasium)
- ☐ Higher professional education (such as teacher training college, hbo, hts, heao, hbo-v, kandidaats or bachelor)
- ☐ University (doctoral or master, postdoctoral, hbo-master)

S2 Which situation applies to you the most?

Multiple answers are allowed.

- ☐ I work, paid, 1-11 hours per week-
- ☐ I work, paid, 12-19 hours per week
- ☐ I work, paid, 20-32 hours per week
- ☐ I work, paid, 32 hour or more per week
- ☐ I have retired (AOW, prepensioen)
- ☐ I am unemployed / looking for employment (registered at the *UWV WERKbedrijf*)
- ☐ I am unfit for work, I receive invalidity benefit (*WAO, WAZ, WIA, Wajong*)
- ☐ I receive social assistance benefits (*bijstand*)
- ☐ I am a homemaker
- ☐ I go to school / I am a student

S3 **Have you had difficulties in the last 12 months to make ends meet with your household's income?**

- ☐ No, no difficulties at all
- ☐ No, no difficulties, but I have to pay attention to my expenditures
- ☐ Yes, some difficulties
- ☐ Yes, big difficulties

BEDANKT VOOR HET INVULLEN VAN DE VRAGENLIJST

Did you put a cross at question A0? Without that cross we cannot use your answers.

Appendix II – Neighborhood survey

In this appendix, the neighborhood survey used by the municipality of Rotterdam is shown. This is an English version while they also distributed version in Dutch.

Gemeente Rotterdam

QUESTIONNAIRE NEIGHBOURHOOD SURVEY (WIJKONDERZOEK) ROTTERDAM 2019

Tips on filling out the questionnaire

Thank you for your willingness to help with this questionnaire.

Who must fill out the questionnaire?

The questionnaire may be completed solely by the person to whom the letter is addressed.

Answering the questions and referrals

- Please complete the questionnaire in blue or black ink.
- Please put a cross in a single box for each question. Where more than one answer is possible, this is stated clearly.
- If you checked the wrong box, you can correct your answer by filling in the box ■ and then checking the box ☒ of the appropriate answer.
- Sometimes you can skip one or more questions which do not apply to you. This will be clearly indicated with a referral (for example ➔ ***Go to section 4 on page 7***).

Anonymity

We like to emphasise that all information given will be treated confidential and will not be used for any commercial purposes. Your answers will be processed **anonymously**.

Questions or assistance completing the questionnaire?

If you have any questions or if you require assistance completing the questionnaire, please contact I&O Research on 0800 – 0191 (toll free telephone number), available on weekdays from 9.00 to 21.30 and on Saturday from 10.00 to 16.00.

Returning the questionnaire

We kindly request that you fill out the questionnaire **within two weeks.** You can return the filled out questionnaire in the enclosed self-addressed envelope. A stamp is **not** needed on the reply envelope. If you lost your self-addressed envelope, please send the questionnaire without a stamp to:

Antwoordnummer 1104
7500 VB Enschede

THANK YOU FOR YOUR COOPERATION AND GOOD LUCK ANSWERING THE QUESTIONS!

Section 1 General questions

We will start with some general questions about yourself and your household.

1. What is your age?

☐☐ years old

2. Are you ...?

☐ Male
☐ Female

3. A 'household' consists of people who usually live together, eat together, share costs together and so on. What is the composition of your household?

☐ I live alone ➔ ***Go to Section 2 on page 3***
☐ (married) couple with **no** child(ren) living at home ➔ ***Go to Section 2 on page 3***
☐ (married) couple **with** child(ren) living at home ➔ ***Go to question 5***
☐ Single parent **with** child(ren) living at home ➔ ***Go to question 5***
☐ Another composition, namely: ☐ ➔ ***Go to question 4***

4. Do you live together with a partner or spouse?

☐ Yes
☐ No

5. What is your position in the household?

☐ I am a parent / guardian in the household
☐ I am a child living at home in the household
☐ Another position, namely: ☐

6. How many people are there in your household, including you?

☐☐ people

7. How many of those people are younger than fifteen years old?
If there are no persons younger than 15 years old in your household, please fill out 0.

☐☐ people

Section 2 Your home

The following questions are about your home.

8. How satisfied are you with the following features of your current home?

	Please tick one box on every line.	Very satisfied	Satisfied	Neutral	Dissatisfied	Very dissatisfied	Do not know / no opinion	Not applicable
a.	Size of your home	☐	☐	☐	☐	☐	☐	
b.	Type of house (single-family dwelling, flat, and so on)	☐	☐	☐	☐	☐	☐	
c.	Layout / floor plan of the house	☐	☐	☐	☐	☐	☐	
d.	Insulation against **outside** noise	☐	☐	☐	☐	☐	☐	
e.	Insulation against noise **from neighbours**	☐	☐	☐	☐	☐	☐	
f.	Thermal insulation	☐	☐	☐	☐	☐	☐	
g.	Ventilation	☐	☐	☐	☐	☐	☐	
h.	Price-quality ratio	☐	☐	☐	☐	☐	☐	
i.	View from the house	☐	☐	☐	☐	☐	☐	
j.	Size of storage space	☐	☐	☐	☐	☐	☐	☐
k.	Size of outdoor space (balcony, garden, terrace)	☐	☐	☐	☐	☐	☐	☐
l.	The safety of the entrance (porch, hall, hallway)	☐	☐	☐	☐	☐	☐	☐
m.	The safety of the storage room / storage cellar	☐	☐	☐	☐	☐	☐	☐

9. How would you assess the maintenance of ... ?

	Please tick one box on every line.	Very good	Good	Reasonable	Moderate	Poor	Do not know / no opinion
a.	… your own home?	☐	☐	☐	☐	☐	☐
b.	… the adjacent buildings and homes?	☐	☐	☐	☐	☐	☐
c.	… the buildings in the neighbourhood as a whole?	☐	☐	☐	☐	☐	☐

10. Is it possible to park your car near your home?

- ☐ Not applicable, I do not have a car
- ☐ No, parking spaces are situated far from my home
- ☐ No, it is often too busy (during the daytime and in the evening)
- ☐ Not always, especially **during the daytime** there are little parking spaces
- ☐ Not always, especially **in the evening** there are little parking spaces
- ☐ Yes, I have my own parking space near my house
- ☐ Yes, there are sufficient parking spaces

11. What is your overall assessment of your current home?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Neutral
- ☐ Dissatisfied
- ☐ Very dissatisfied
- ☐ Do not know / no opinion

12. Do you think your home is suitable for a family with 2 children?

- ☐ Yes
- ☐ No
- ☐ Do not know

Section 3 Your neighbourhood: general

The following questions are about the neighbourhood you live in.

13. Do you feel responsible for liveability and safety in your neighbourhood? 'Liveability' means that it is nice to live in your neighbourhood.

- ☐ Yes, very much
- ☐ Yes, a little
- ☐ No
- ☐ Do not know / no opinion

14. Have you been active for your neighbourhood in the past 12 months? If so, in what way were you active for your neighbourhood?

More than one answer is possible.

- ☐ Yes, I did volunteer work (for example in a residential facility for the elderly, at a school, at a sports club, for the church, a mosque or another religious organisation)
- ☐ Yes, by making an active contribution to the liveability of our own street or neighbourhood (for example 'Opzoomeren', neighbourhood watch, residents' association)
- ☐ Yes, an active contribution to politics, policy and management (for example debates, political party, citizens' participation)
- ☐ Yes, in another way namely: _____
- ☐ No ➔ ***Go to question 16***

15. How often were you active in this way for your neighbourhood in the past 12 months?

- ☐ Several times a week
- ☐ Once a week
- ☐ Two or three times a month
- ☐ Once a month
- ☐ Less than once a month
- ☐ Do not know

16. Below are statements listed about the neighbourhood you live in. Please indicate for each statement to what extent you agree or disagree with this statement.

	Please tick one box on every line.	Totally agree	Agree	Neither agree nor disagree	Disagree	Totally disagree	Do not know / no opinion
a.	Buildings and houses in this neighbourhood look attractive.	☐	☐	☐	☐	☐	☐
b.	It is not nice to live in this neighbourhood.	☐	☐	☐	☐	☐	☐
c.	I will move out of this neighbourhood if possible.	☐	☐	☐	☐	☐	☐
d.	You are lucky if you live in this neighbourhood.	☐	☐	☐	☐	☐	☐
e.	There are a lot of problems in this neighbourhood.	☐	☐	☐	☐	☐	☐
f.	I am proud of my own neighbourhood.	☐	☐	☐	☐	☐	☐

17. Do you think that in two years' time your neighbourhood will have improved, remained the same or deteriorated?

- ☐ Improved
- ☐ Remained the same
- ☐ Deteriorated
- ☐ Do not know

18. To what extent do you think <u>your neighbourhood</u> is suitable for ...?

	Please tick one box on every line.	Very suitable	Suitable	Unsuitable	Very unsuitable	Do not know / no opinion
a.	... children up to about 4 years old?	☐	☐	☐	☐	☐
b.	... children from 4 to about 13 years old?	☐	☐	☐	☐	☐
c.	... children and youths from 13 to about 18 years old?	☐	☐	☐	☐	☐

19. Please indicate how satisfied you are with ...?

	Please tick one box on every line.	Very satisfied	Satisfied	Neutral	Dissatisfied	Very dissatisfied	Do not know / no opinion
a.	... the accessibility of the neighbourhood for cars?	☐	☐	☐	☐	☐	☐
b.	... the safety of the bicycle lanes?	☐	☐	☐	☐	☐	☐
c.	... the maintenance of the bicycle lanes?	☐	☐	☐	☐	☐	☐
d.	... the safety of the footpaths?	☐	☐	☐	☐	☐	☐
e.	... the maintenance of the footpaths?	☐	☐	☐	☐	☐	☐
f.	... quality of street lighting?	☐	☐	☐	☐	☐	☐
g.	... the attractiveness of canals, ditches and ponds?	☐	☐	☐	☐	☐	☐
h.	... the attractiveness of parks and green spaces in your neighbourhood?	☐	☐	☐	☐	☐	☐

Section 4 Your neighbourhood: interaction between people

The following questions are about interaction between people in your neighbourhood.

20. Below are statements listed about interaction between people in your neighbourhood. Please indicate for each statement to what extent you agree or disagree with this statement.

	Please tick one box on every line.	Totally agree	Agree	Neither agree nor disagree	Disagree	Totally disagree	Do not know / no opinion
a.	People in this neighbourhood hardly know each other.	☐	☐	☐	☐	☐	☐
b.	I live in a pleasant neighbourhood, where people interact/socialize a lot with each other.	☐	☐	☐	☐	☐	☐
c.	In this neighbourhood Dutch people and people from elsewhere are not interacting/socializing well with each other.	☐	☐	☐	☐	☐	☐
d.	The residents in this neighbourhood have the same ideas about what is acceptable and unacceptable in this neighbourhood.	☐	☐	☐	☐	☐	☐
e.	Occasionally I have problems with certain neighbours.	☐	☐	☐	☐	☐	☐
f.	People in this neighbourhood help each other out when necessary.	☐	☐	☐	☐	☐	☐
g.	In this neighbourhood the various ethnic groups are interacting/socializing well with each other.	☐	☐	☐	☐	☐	☐
h.	I feel at home with the people who live in this neighbourhood.	☐	☐	☐	☐	☐	☐
i.	Youths and adults are interacting/socializing well with each other in this neighbourhood.	☐	☐	☐	☐	☐	☐
j.	When a child destroys something or behaves in a disrespectful manner, I will say something about it.	☐	☐	☐	☐	☐	☐

Section 5 Your neighbourhood: facilities

The following questions are about facilities in and around your neighbourhood.

21. Below are facilities listed. Please indicate for each facility to what extent you think that this facility is available in and around your neighbourhood.

	Please tick one box on every line.	More than sufficiently available	Sufficiently available	Insufficiently available	Not available	Do not know / no opinion
a.	Shops for groceries	☐	☐	☐	☐	☐
b.	Public transport	☐	☐	☐	☐	☐
c.	Bank, post office	☐	☐	☐	☐	☐
d.	Medical care (family doctor, GP, physiotherapy and so on)	☐	☐	☐	☐	☐
e.	Green areas in your neighbourhood, such as patches of grass, trees and parks	☐	☐	☐	☐	☐
f.	Grass areas to picnic, to play sports or just to play	☐	☐	☐	☐	☐
g.	Playgrounds/play areas for children under 4	☐	☐	☐	☐	☐
h.	Play areas and sports facilities for children from 4 to around 13	☐	☐	☐	☐	☐
i.	A community centre, neighbourhood centre, local cultural centre or youth centre	☐	☐	☐	☐	☐
j.	Indoor sports facilities, such as gyms, sports halls and swimming pools	☐	☐	☐	☐	☐
k.	Sports fields	☐	☐	☐	☐	☐
l.	Places of worship, such as churches and mosques	☐	☐	☐	☐	☐
m.	Areas for communal activities, such as community centres and squares	☐	☐	☐	☐	☐
n.	Facilities for the elderly	☐	☐	☐	☐	☐
o.	Primary schools	☐	☐	☐	☐	☐
p.	Secondary schools	☐	☐	☐	☐	☐

22. Various facilities for children, youths and adults have been mentioned. What is your overall opinion of the range of facilities in and around your neighbourhood?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Neutral
- ☐ Dissatisfied
- ☐ Very dissatisfied
- ☐ Do not know / no opinion

23. All things considered (your house, the neighbourhood, the people, the facilities and so on), what is your overall opinion of your current living situation in general?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Neutral
- ☐ Dissatisfied
- ☐ Very dissatisfied
- ☐ Do not know / no opinion

Section 6 Social facilities

The following questions are about social facilities to support people in Rotterdam.

24. Below are social facilities listed that could support you or the people in your surroundings. Please indicate for each facility whether you know what kind of facility this is?

		I DO NOT know what it is	I DO know what it is
a.	Social work *Huis van de Wijk*	☐	☐
b.	Organisations for domestic care, personal care or nursing *Thuiszorg voor huishoudelijke hulp, verzorging of verpleging*	☐	☐
c.	Welfare organisations, like *Dock*, *PALM010*, *SOL*, *Humanitas*, *Vitis*, *WMO-radar* *Welzijnsorganisaties, zoals Dock, PALM010, SOL, Humanitas, Vitis, WMO-radar*	☐	☐
d.	Centre for Youth and Family *Centrum voor Jeugd en Gezin*	☐	☐
e.	Neighbourhood team *Wijkteam*	☐	☐
f.	The 'VraagWijzer'	☐	☐
g.	Debt assistance *Schulddienstverlening (KBR)*	☐	☐
h.	Organisation for advice and support concerning domestic violence and child abuse *Veilig Thuis*	☐	☐
i.	Consultation hours of a residents' association *Spreekuur van een bewonersorganisatie*	☐	☐
j.	Discrimination helpline / RADAR *Meldpunt discriminatie / RADAR*	☐	☐
k.	Volunteer work *Rotterdammersvoorelkaar*	☐	☐
l.	Helpline Confused Persons *Advies- en Meldpunt Verwarde Personen*	☐	☐

Section 7 Rotterdam

The following questions are about city council and the city of Rotterdam.

Rotterdam members can influence the interests of their neighbourhoods through the regional committees, neighbourhood councils, and neighbourhood committees. There are three types of "Area management":

- **Areas with just a regional committee (gebiedscommissie) consisting of directly elected members.**
- **Areas that have a district committee and also a number of neighbourhood committees (wijkcomité) for certain neighbourhoods. The members of such neighbourhood committees are appointed through a lottery.**
- **Areas that have an elected neighbourhood council (wijkraad) for each neighbourhood. All neighbourhood councils together in the area form the area management.**

25. Do you know what type of area management applies to your neighbourhood?

- ☐ Only a regional committee
- ☐ Neighbourhood committee and regional committee
- ☐ Neighbourhood councils
- ☐ Do not know

26. Do you find this type of area management useful?

	Please tick one box on every line.	Yes	No	Do not know / no opinion
a.	At neighbourhood level	☐	☐	☐
b.	At district level	☐	☐	☐

27. Have you dealt with the area management directly?

- ☐ Yes
- ☐ No

28. Below is a list of statements about the city council and the city of Rotterdam. Please indicate for each statement to what extent you agree or disagree with this statement.

	Please tick one box on every line.	Totally agree	Agree	Neither agree nor disagree	Disagree	Totally disagree	Do not know / no opinion
a.	City council ensures that in Rotterdam everyone can participate in society.	☐	☐	☐	☐	☐	☐
b.	City council supports initiatives of citizens.	☐	☐	☐	☐	☐	☐
c.	I have a lot of confidence in the city council of Rotterdam.	☐	☐	☐	☐	☐	☐
d.	I have a lot of confidence in the area management of the area where I live.	☐	☐	☐	☐	☐	☐
e.	I have a lot of confidence in public organisations such as the police, the ambulance service and the fire department.	☐	☐	☐	☐	☐	☐
f.	I have confidence in the future of Rotterdam.	☐	☐	☐	☐	☐	☐

29. Please indicate to what extent you feel connected with ... ?

	Please tick one box on every line.	Very connected	Connected	A little connected	Unconnected	Completely unconnected	Do not know / no opinion
a.	... your neighbourhood?	☐	☐	☐	☐	☐	☐
b.	... Rotterdam?	☐	☐	☐	☐	☐	☐

30. Do you think that in <u>two years</u>' time the city of Rotterdam will have improved, remained the same or deteriorated?

- ☐ Improved
- ☐ Remained the same
- ☐ Deteriorated
- ☐ Do not know

Section 8 Activities and how you spend your time

The following questions are about activities and how you spend your time.

31. Do you have a <u>paid</u> job (in employment and/or self-employed)?

- ☐ Yes ➔ ***Go to question 32***
- ☐ No ➔ ***Go to question 33***
- ☐ Prefer not to say ➔ ***Go to question 33***

32. How many hours a week do you spend (on average) doing this work?

- ☐ Less than 12 hours a week, namely: ☐☐ hours a week ➔ ***Go to question 33***
- ☐ 12 hours or more a week, namely: ☐☐ hours a week ➔ ***Go to question 34***

33. Which situation is <u>most</u> applicable to you?

Only one answer is possible to this question.

- ☐ I am retired / in early retirement (AOW, VUT, FPU)
- ☐ I am unemployed / searching for employment (registered at the UWV WERKbedrijf: formerly CWI / het arbeidsbureau)
- ☐ I am unfit to work (WAO, AAW, WAZ, Wajong)
- ☐ I receive social security benefits / welfare (bijstandsuitkering)
- ☐ I am a housewife / househusband
- ☐ I go to school / I study
- ☐ Another situation, namely: ☐
- ☐ Prefer not to say

34. Are you active as an <u>unpaid</u> volunteer in one or more organisations?

*Unpaid means that you may receive some compensation, but **not** a salary. It can for instance be a music association, a sports club, a hobby association, a political organisation, a union, a church, a mosque, a school, a day care centre, a residential facility for the elderly and so on.*

- ☐ Yes ➔ ***Go to question 35***
- ☐ No ➔ ***Go to question 36***

35. How often do you carry out these voluntary activities?

- ☐ Several times a week
- ☐ Once a week
- ☐ Two or three times a month
- ☐ Once a month
- ☐ Less than once a month

36. Some people would appreciate some assistance. For instance, a neighbour who can no longer do the shopping. How often have you lent a hand in this way in the past 12 months?

- ☐ More than once per week
- ☐ Once per week
- ☐ Twice or three times per month
- ☐ Once per month
- ☐ Less than once per month
- ☐ Never

37. Are you part of a <u>group</u> of residents...

More than one answer possible.

- ☐ … that fights for residents' interests
- ☐ … that manages amenities, such as a community centre, swimming pool, reading room, communal green space
- ☐ … that organises practical help for residents, such as help with filling in forms
- ☐ … that organises social activities for residents, such as street parties or visits to elderly residents who may be lonely
- ☐ None of the above

38. In what way have you been involved in making plans for your area or the city as a whole in the past 12 months?

More than one answer possible.

- ☐ Through a residents' initiative or residents' organisation
- ☐ Through a questionnaire (printed and/or digital)
- ☐ Through an interactive website/email
- ☐ Through a platform or public participation meeting
- ☐ Through an advisory commission/client advisory board
- ☐ Through a regional committee, neighbourhood council or neighbourhood committee
- ☐ Other, namely: _____
- ☐ None of the above

39. The following questions are about how you spend your time. Please indicate how often you ...?

	Please tick one box on every line.	Several times a week	Once a week	Two or three times a month	Once a month	Less than once a month	Never
a.	... go out, for example, to the pub, out to dinner or a discotheque?	☐	☐	☐	☐	☐	☐
b.	... go out to the cinema, a theatre performance, a concert, a cultural festival and/or visit a museum?	☐	☐	☐	☐	☐	☐
c.	... participate in sporting activity, whether on your own or with others?	☐	☐	☐	☐	☐	☐
d.	... visit a church, mosque or other religious or philosophical meeting?	☐	☐	☐	☐	☐	☐
e.	… visit a festival, an event or a fair?	☐	☐	☐	☐	☐	☐
f.	... visit an activity in a community centre, a library or a local cultural centre?	☐	☐	☐	☐	☐	☐
g.	... participate in activities organised by clubs or other groups in the field of sport, theatre, music or dance?	☐	☐	☐	☐	☐	☐

40. The following questions are about meetings, contact by telephone and/or written contact and contact through Internet with people who do <u>not</u> live in your house. How often are you in contact with ...?

	Please tick one box on every line.	Almost daily	At least once a week	Two or three times a month	Once a month	Less than once a month	Never
a.	... one or more family members?	☐	☐	☐	☐	☐	☐
b.	... friends, girlfriends or really good acquaintances?	☐	☐	☐	☐	☐	☐
c.	... neighbours?	☐	☐	☐	☐	☐	☐
d.	... other people in your neighbourhood?	☐	☐	☐	☐	☐	☐
e.	... people through Internet (e-mail, Facebook, LinkedIn and so on)?	☐	☐	☐	☐	☐	☐

41. The following question relates to things you do, such as hobbies, contact with other people, family, exercise, days out and the like.

	Please tick one box on every line.	Never	Hardly ever	Every now and then	Regularly	Often	Very often
a.	How often do you actively make a decision to do something?	☐	☐	☐	☐	☐	☐
b.	How often do you actively decide to contact people you care about?	☐	☐	☐	☐	☐	☐

Section 9 Volunteer aid (mantelzorg)

The following questions are about volunteer aid. Volunteer aid is the care you give to a person you know in your environment, such as your partner, parents, child, neighbours or friends, if this person is ill, in need of help or handicapped for an extended period of time. This care may consist of housekeeping, washing and dressing, keeping company, transport, taking care of financial matters and so on.

- **Volunteer aid is not paid.**
- **A volunteer from a volunteer centre is not a volunteer aid worker.**
- **It is not about professional care.**
- **It is not about the normal every day care of parents for their children.**

42. Did you give volunteer aid in the past 12 months?

- ☐ Yes ➔ ***Go to question 43***
- ☐ No ➔ ***Go to question 46***

43. To whom did you give volunteer aid in the past 12 months?

More than one answer possible.

- ☐ A child in your household younger than 18
- ☐ An adult in your household (partner, children older than 18, parents)
- ☐ A family member that does **not** live in your house (parents, children living outside the home, uncle, aunt and so on)
- ☐ A friend or acquaintance
- ☐ A neighbour
- ☐ Someone else, namely: ____

44. Are you currently still giving this volunteer aid?

- ☐ Yes ➔ ***Go to question 45***
- ☐ No ➔ ***Go to question 46***

45. How many hours of volunteer aid do you currently give on average a week, including travelling time?

Please round off the hours.

☐☐ hours a week

46. To what extent would you be prepared to provide care for...

	Please tick one box on every line.	I already do	Certainly	Maybe	Certainly not	Not applicable	Do not know/ no opinion
a.	... family members who need assistance and live at a different address to you	☐	☐	☐	☐	☐	☐
b.	... neighbours or friends who need assistance	☐	☐	☐	☐	☐	☐
c.	... others in your area who you know less well, but need assistance	☐	☐	☐	☐	☐	☐

Section 10 Health and well-being

The following questions are about your health and well-being. These questions are required to get an impression of the health of the average Rotterdam citizen.
You are not obliged to answer. By answering you expressly give us permission to use this data solely for research purposes.
The data (just like the other data from this questionnaire) shall be treated in the strictest of confidence and shall not be given to third parties.

47. How would you describe your health in general?

- ☐ Excellent
- ☐ Very good
- ☐ Good
- ☐ Moderate
- ☐ Poor
- ☐ Prefer not to say

48. Are you impeded by physical or mental health problems in carrying out daily duties at home, at school, in your work or in leisure activities?

- ☐ Yes ➔ ***Go to question 49***
- ☐ No ➔ ***Go to question 50***
- ☐ Prefer not to say ➔ ***Go to question 50***

49. To what extent are you impeded by physical or mental health problems in carrying out daily duties at home, at school, in your work or in leisure activities?

- ☐ Greatly impeded
- ☐ Slightly impeded
- ☐ Prefer not to say

50. Below is a list of statements. Please indicate for each statement to what extent you agree or disagree with this statement.

	Please tick one box on every line.	Totally agree	Agree	Neither agree nor disagree	Disagree	Totally disagree	Do not know / no opinion
a.	There are only a few people with whom I can really talk.	☐	☐	☐	☐	☐	☐
b.	Even from close family members, you can no longer expect much interest.	☐	☐	☐	☐	☐	☐
c.	I often feel let down.	☐	☐	☐	☐	☐	☐
d.	There is nobody who takes a special interest in you.	☐	☐	☐	☐	☐	☐
e.	I know enough people whom I can ask for help or advice.	☐	☐	☐	☐	☐	☐
f.	There is very little I can do to change important circumstances in my life.	☐	☐	☐	☐	☐	☐

	Continue question 50	Totally agree	Agree	Neither agree nor disagree	Disagree	Totally disagree	Do not know / no opinion
g.	I have very little control over the things that happen to me.	☐	☐	☐	☐	☐	☐
h.	I often feel helpless in dealing with life's problems.	☐	☐	☐	☐	☐	☐
i.	There is no way I can solve some of my problems.	☐	☐	☐	☐	☐	☐
j.	Almost everything I put my mind to, I can do.	☐	☐	☐	☐	☐	☐
k.	Whatever happens to me in the future is up to me.	☐	☐	☐	☐	☐	☐
l.	I have little faith in official authorities and helpers.	☐	☐	☐	☐	☐	☐
m.	I find it difficult to ask neighbours, friends or family for assistance.	☐	☐	☐	☐	☐	☐

51. Have you felt discriminated against <u>in the past 12 months</u>?

☐ Yes ➔ ***Go to question 52***

☐ No ➔ ***Go to question 53***

52. Where have you felt discriminated against <u>in the past 12 months</u>?

More than one answer possible.

☐ In my neighbourhood

☐ Somewhere else in Rotterdam

☐ Outside Rotterdam

53. To what extent do you agree or disagree with the statement:

"I am satisfied about the way I participate in the society of Rotterdam"?

☐ Totally agree

☐ Agree

☐ Neither agree nor disagree

☐ Disagree

☐ Totally disagree

☐ Do not know / no opinion

54. All things considered (your outdoor activities, your contacts with family and friends, your health and well-being and so on), how satisfied are you with the quality of your life?

☐ Very satisfied

☐ Satisfied

☐ Neutral

☐ Dissatisfied

☐ Very dissatisfied

☐ Do not know / no opinion

Section 11 Education

55. What is the highest level of education for which you received a diploma (degree)?

- ☐ No education
- ☐ Primary education (primary school, special primary education)
- ☐ LBO / Lower vocational education
- ☐ MAVO, VMBO or VBO / Lower general secondary school, lower secondary professional school or pre-vocational education
- ☐ MBO / Intermediate vocational education
- ☐ MULO or MMS / Advanced elementary education or girls' secondary school
- ☐ HAVO / Senior or higher general secondary school
- ☐ HBS, VWO, lyceum, athenaeum or gymnasium / Pre-university education, grammar school or high school
- ☐ HBO / Higher vocational education
- ☐ University education
- ☐ Other, namely: _____
- ☐ Prefer not to say

56. Please indicate whether you have a lot of trouble, a little trouble or no trouble with ...?

	Please tick one box on every line.	A lot of trouble	A little trouble	No trouble
a.	... reading Dutch newspapers, letters, brochures?	☐	☐	☐
b.	... speaking Dutch?	☐	☐	☐
c.	... writing Dutch?	☐	☐	☐

57. Have there been situations where you needed help with translations in the past 12 months for example at the family doctor (GP), in the hospital, at school or at municipal inquires office?

- ☐ Yes
- ☐ No

Section 12 Income

58. Please indicate the monthly net (=after tax) joint income bracket of your household.
Social benefits, state pensions (AOW), pensions, alimony and so on are also regarded as income. Not to be included are holiday money, children's allowance (kinderbijslag) and reductions and allowances received from the tax authorities (such as healthcare allowance (zorgtoeslag),housing allowance (huurtoeslag) and child (care) allowance (kindertoeslag en kinderopvangtoeslag)) or returns from the tax authorities.

- ☐ Less than € 1.150 per month
- ☐ € 1.100 tot € 1.600 per month
- ☐ € 1.600 tot € 2.150 per month
- ☐ € 2.150 tot € 3.500 per month
- ☐ € 3.500 or more per month
- ☐ Do not know
- ☐ Prefer not to say

59. To what extent do you get by on the income of your household?

- ☐ Very easily
- ☐ Easily
- ☐ Reasonably
- ☐ With difficulty
- ☐ With great difficulty
- ☐ Not
- ☐ Do not know
- ☐ Prefer not to say

Section 13 Conclusion

60. On a regular basis web surveys commissioned by Rotterdam city council are being carried out. If you are willing to participate in future web surveys by Rotterdam city council, please enter your email address below. This e-mail address will only be used for surveys by Rotterdam city council.

E-mail address: _____ @ _____ . _____

The municipality of Rotterdam believes that it is important to involve its citizens. Questionnaires like these are one option to achieve this. The municipality would also like to consult you about topics related to the city and your neighbourhood at other times, however. You can take part in this using the **Gemeentepeiler** app. Interested in becoming involved with your city and neighbourhood this way? Then download the app to your smartphone from the Playstore or app store. For more information, visit:
www.gemeentepeiler.nl/rotterdam

Thank you very much for completing the questionnaire.

You can return the completed questionnaire in the enclosed prepaid envelope.

Appendix III –Safety survey

In this appendix, the safety survey is shown. This survey is conducted by the municipality of Rotterdam to gather data for the neighborhood profile.

Gemeente Rotterdam

QUESTIONNAIRE SAFETY AND SECURITY MONITOR (VEILIGHEIDSMONITOR) 2019 ROTTERDAM

Tips on filling out the questionnaire

Thank you for your willingness to help with this questionnaire.

Who must fill out the questionnaire?

The questionnaire may be completed solely by the person to whom the letter is addressed.

Answering the questions and referrals

- Please complete the questionnaire in blue or black ink.
- Please put a cross in a single box for each question. Where more than one answer is possible, this is stated clearly.
- If you checked the wrong box, you can correct your answer by filling in the box ■ and then checking the box of the appropriate answer ☒.
- Sometimes you can skip one or more questions which do not apply to you. This will be clearly indicated with a referral (for example ➔ ***Go to section 4 on page 7***).

Anonymity

We like to emphasise that all information given will be treated confidential and will not be used for any commercial purposes. Your answers will be processed **anonymously**.

Questions or assistance completing the questionnaire?

If you have any questions or if you require assistance completing the questionnaire, please contact I&O Research on 0800 – 0191 (toll free telephone number), available on weekdays from 9.00 to 21.30 and on Saturday from 10.00 to 16.00.

Returning the questionnaire

We kindly request that you fill out the questionnaire **within two weeks.** You can return the filled out questionnaire in the enclosed self-addressed envelope. A stamp is **not** needed on the reply envelope. If you lost your self-addressed envelope, please send the questionnaire without a stamp to:
Antwoordnummer 1104
7500 VB Enschede

THANK YOU FOR YOUR COOPERATION AND GOOD LUCK ANSWERING THE QUESTIONS!

Section 1 Problems that could occur in the neighbourhood

1. This question is about CRIMES that COULD occur in your neighbourhood. Please indicate for each type of crime how often, IN YOUR OPINION, this occurs in YOUR NEIGHBOURHOOD.

	Please tick one box on every line.	Occurs often	Occurs sometimes	Occurs (almost) never	Do not know / no opinion
a.	Bicycle theft	☐	☐	☐	☐
b.	Theft **out of** cars	☐	☐	☐	☐
c.	Damage and destruction to cars and theft **from the outside** of cars, for example hub caps and so on	☐	☐	☐	☐
d.	Burglary of homes	☐	☐	☐	☐
e.	Threats	☐	☐	☐	☐
f.	Violent crimes	☐	☐	☐	☐
g.	Street robbery	☐	☐	☐	☐

2. This question is about annoying incidents concerning TRAFFIC that COULD occur in your neighbourhood. Please indicate for each incident how often, IN YOUR OPINION, this occurs in YOUR NEIGHBOURHOOD.

	Please tick one box on every line.	Occurs often	Occurs sometimes	Occurs (almost) never	Do not know / no opinion
a.	Aggressive behaviour in traffic	☐	☐	☐	☐
b.	Driving too fast	☐	☐	☐	☐
c.	Traffic collisions	☐	☐	☐	☐
d.	Parking on the pavement	☐	☐	☐	☐

3. This question is about annoying incidents concerning PUBLIC SPACE that COULD occur in your neighbourhood. Please indicate for each incident how often, IN YOUR OPINION, this occurs in YOUR NEIGHBOURHOOD.

	Please tick one box on every line.	Occurs often	Occurs sometimes	Occurs (almost) never	Do not know / no opinion
a.	Dog's mess	☐	☐	☐	☐
b.	Trash in the streets	☐	☐	☐	☐
c.	Rubbish next to container	☐	☐	☐	☐
d.	Daubing of walls and/or buildings (graffiti)	☐	☐	☐	☐
e.	Destruction of bus or tram shelters	☐	☐	☐	☐
f.	Destroyed or damaged benches, rubbish bins or playground equipment	☐	☐	☐	☐
g.	Holes or subsidence in the pavement	☐	☐	☐	☐

Section 2 Being affected by nuisance in the neighbourhood

In the previous section you were asked to indicate how often various types of nuisance and annoying incidents in your opinion occur in your neighbourhood. The following questions are about the extent in which you PERSONALLY have been affected by these various types of nuisance in your neighbourhood.

4. This question is about various types of NUISANCE that COULD occur in your neighbourhood. Please indicate for each type of nuisance to what extent YOU PERSONALLY have been affected by it in YOUR NEIGHBOURHOOD.

	Please tick one box on every line.	Much nuisance	A little nuisance	(Almost) no nuisance	Do not know / no opinion
a.	People who hassle other people in the street	☐	☐	☐	☐
b.	Nuisance from neighbours	☐	☐	☐	☐
c.	Excessive water in gardens or courtyards	☐	☐	☐	☐
d.	Excessive water underneath houses (crawl space)	☐	☐	☐	☐

5. This question is about various types of NUISANCE concerning DRUGS that COULD occur in your neighbourhood. Please indicate for each type of nuisance to what extent YOU PERSONALLY have been affected by it in YOUR NEIGHBOURHOOD.

	Please tick one box on every line.	Much nuisance	A little nuisance	(Almost) no nuisance	Do not know / no opinion
a.	Drugs nuisance	☐	☐	☐	☐
b.	Drug addicts walking up and down your street	☐	☐	☐	☐
c.	Drug trafficking in the street	☐	☐	☐	☐

6. This question is about various types of NUISANCE concerning YOUTHS that COULD occur in your neighbourhood. Please indicate for each type of nuisance to what extent YOU PERSONALLY have been affected by it in YOUR NEIGHBOURHOOD.

	Please tick one box on every line.	Much nuisance	A little nuisance	(Almost) no nuisance	Do not know / no opinion
a.	Nuisance from groups of youths	☐	☐	☐	☐
b.	Groups of youths hanging around in the street, the square or the park	☐	☐	☐	☐
c.	Groups of youths hanging around coffee shops or bars	☐	☐	☐	☐
d.	Youths quarrelling and/or shouting in the street	☐	☐	☐	☐
e.	Nuisance from youths playing football	☐	☐	☐	☐
f.	Nuisance from youths who tease or intimidate local residents	☐	☐	☐	☐
g.	Nuisance from youths who drink alcohol or use drugs in the street	☐	☐	☐	☐
h.	Juvenile delinquency (youth crimes)	☐	☐	☐	☐

7. This question is about various types of NOISE AND STENCH NUISANCE that COULD occur in your neighbourhood. Please indicate for each type of nuisance to what extent YOU PERSONALLY have been affected by it in YOUR NEIGHBOURHOOD.

	Please tick one box on every line.	Much nuisance	A little nuisance	(Almost) no nuisance	Do not know / no opinion
a.	Noise nuisance from traffic	☐	☐	☐	☐
b.	Noise nuisance from building or demolition activities (also renovations)	☐	☐	☐	☐
c.	Noise nuisance from businesses and/or industries	☐	☐	☐	☐
d.	Stench nuisance (unpleasant smells) from traffic	☐	☐	☐	☐
e.	Stench nuisance (unpleasant smells) from water (canals, ditches, ponds)	☐	☐	☐	☐
f.	Stench nuisance (unpleasant smells) from sewers outside	☐	☐	☐	☐
g.	Stench nuisance (unpleasant smells) from businesses and/or industries	☐	☐	☐	☐

Section 3 Experiencing safety

8. Do you ever feel unsafe?

- ☐ Yes → ***Go to question 9***
- ☐ No → ***Go to question 10***
- ☐ Do not know → ***Go to question 10***

9. Do you often, sometimes or rarely feel unsafe?

- ☐ Often
- ☐ Sometimes
- ☐ Rarely
- ☐ Do not know

10. Do you ever feel unsafe in YOUR OWN NEIGHBOURHOOD?

- ☐ Yes → ***Go to question 11***
- ☐ No → ***Go to question 12 on page 5***
- ☐ Do not know → ***Go to question 12 on page 5***

11. Do you often, sometimes or rarely feel unsafe in YOUR OWN NEIGHBOURHOOD?

- ☐ Often
- ☐ Sometimes
- ☐ Rarely
- ☐ Do not know

12. How often do you feel unsafe in places where groups of youths hang out?

	Please tick one box on every line.	Often	Sometimes	Rarely	Never	Do not know / prefer not to say	Not applicable
a.	During the day (when it is **light**)	☐	☐	☐	☐	☐	☐
b.	In the evening (when it is **dark**)	☐	☐	☐	☐	☐	☐

13. How often does it occur that you ...

	Please tick one box on every line.	Often	Sometimes	Rarely	Never	Do not know / prefer not to say	Not applicable
a.	… do not open the door in the evening or at night because you do not think it is safe?	☐	☐	☐	☐	☐	☐
b.	… walk a different route in your own neighbourhood or take a detour by car to avoid unsafe areas?	☐	☐	☐	☐	☐	☐

14. How great do you think the risk is that you PERSONALLY will become a victim of the following crimes in YOUR OWN NEIGHBOURHOOD in the coming 12 months?

	Please tick one box on every line.	Very great	Great	Not great and not small	Small	Very small	Do not know
a.	Burglary of your home	☐	☐	☐	☐	☐	☐
b.	Pick pocketing (**without** violence)	☐	☐	☐	☐	☐	☐
c.	Robbery (**with** violence)	☐	☐	☐	☐	☐	☐
d.	Assault	☐	☐	☐	☐	☐	☐

15. How great do you think the risk is that SOMEONE ELSE IN YOUR HOUSEHOLD will become a victim of the following crimes in YOUR OWN NEIGHBOURHOOD in the coming 12 months?

	Please tick one box on every line.	Very great	Great	Not great and not small	Small	Very small	Do not know	Not applicable
a.	Pick pocketing (**without** violence)	☐	☐	☐	☐	☐	☐	☐
b.	Robbery (**with** violence)	☐	☐	☐	☐	☐	☐	☐
c.	Assault	☐	☐	☐	☐	☐	☐	☐

Section 4 Victimization

The following questions are about whether you or someone else in your household has been a victim of certain crimes.

Attempt to burglarize home

16a. Has there been an attempt to burglarize your home in the PAST 5 YEARS while NOTHING was stolen? If you own more than one house, the home where you reside during most of the year is meant.

- ☐ Yes → ***Go to question 16b***
- ☐ No → ***Go to question 17a***

16b. Has this also happened once or more in the PAST 12 MONTHS?

- ☐ Yes
- ☐ No

Burglary of home

17a. Has anything been stolen from your home at some time during the PAST 5 YEARS? If you own more than one house, the home where you reside during most of the year is meant.

- ☐ Yes → ***Go to question 17b***
- ☐ No → ***Go to question 18a***

17b. Has this also happened once or more in the PAST 12 MONTHS?

- ☐ Yes
- ☐ No

Bicycle theft

18a. Did your household have any bicycles at its disposal in the PAST 5 YEARS?

- ☐ Yes → ***Go to question 18b***
- ☐ No → ***Go to question 20a on page 7***

18b. Have you had one or more bicycles in your household for THE PAST 12 MONTHS?

- ☐ Yes
- ☐ No
- ☐ Prefer not to say

19a. Has a bicycle been stolen from you or someone else in your household at some time during the PAST 5 YEARS?

- ☐ Yes → ***Go to question 19b***
- ☐ No → ***Go to question 20a on page 7***

19b. Has this also happened once or more in the PAST 12 MONTHS?

- ☐ Yes → ***Go to question 19c on page 7***
- ☐ No → ***Go to question 20a on page 7***

19c. How many of these bicycle thefts in the PAST 12 MONTHS happened in ROTTERDAM (including Hoogvliet, Hoek van Holland, Pernis and Rozenburg)?

- ☐ None → *Go to question 20a*
- ☐ One or more → *Go to question 19d*
- ☐ Do not know / prefer not to say → *Go to question 20a*

19d. How many of these bicycle thefts in the PAST 12 MONTHS happened in YOUR OWN NEIGHBOURHOOD?

- ☐ None
- ☐ One or more
- ☐ Do not know / prefer not to say

Car crimes

20a. Did your household have any cars at its disposal in the PAST 5 YEARS?

- ☐ Yes → *Go to question 20b*
- ☐ No → *Go to question 24a on page 9*

20b. Have you had one or more cars in your household for THE PAST 12 MONTHS?

- ☐ Yes
- ☐ No
- ☐ Prefer not to say

Car theft

21a. Has a car been stolen from you or someone else in your household at some time during the PAST 5 YEARS?

- ☐ Yes → *Go to question 21b*
- ☐ No → *Go to question 22a on page 8*

21b. Has this also happened once or more in the PAST 12 MONTHS?

- ☐ Yes → *Go to question 21c*
- ☐ No → *Go to question 22a on page 8*

21c. How many of these car thefts in the PAST 12 MONTHS happened in ROTTERDAM (including Hoogvliet, Hoek van Holland, Pernis and Rozenburg)?

- ☐ None → *Go to question 22a on page 8*
- ☐ One or more → *Go to question 21d*
- ☐ Do not know / prefer not to say → *Go to question 22a on page 8*

21d. How many of these car thefts in the PAST 12 MONTHS happened in YOUR OWN NEIGHBOURHOOD?

- ☐ None
- ☐ One or more
- ☐ Do not know / prefer not to say

Something stolen out of the car

22a. Has anything been stolen OUT OF your car or a car belonging to someone in your household at some time during the PAST 5 YEARS, for example a car radio, laptop, a coat, a bag or other valuable items belonging to you or someone else?

- ☐ Yes → ***Go to question 22b***
- ☐ No → ***Go to question 23a***

22b. Has this also happened once or more in the PAST 12 MONTHS?

- ☐ Yes → ***Go to question 22c***
- ☐ No → ***Go to question 23a***

22c. How many of these thefts OUT OF a car in the PAST 12 MONTHS happened in ROTTERDAM (including Hoogvliet, Hoek van Holland, Pernis and Rozenburg)?

- ☐ None → ***Go to question 23a***
- ☐ One or more → ***Go to question 22d***
- ☐ Do not know / prefer not to say → ***Go to question 23a***

22d. How many of these thefts OUT OF a car in the PAST 12 MONTHS happened in YOUR OWN NEIGHBOURHOOD?

- ☐ None
- ☐ One or more
- ☐ Do not know / prefer not to say

Something stolen from or damaged on the outside of the car

23a. Has anything been stolen from or damaged on the OUTSIDE of your car or a car belonging to someone in your household at some time during the PAST 5 YEARS, apart from damages due to theft out of cars? For example mirrors, antennas, wheels, hub caps, windscreen wipers, luggage from the luggage rack and so on.

- ☐ Yes → ***Go to question 23b***
- ☐ No → ***Go to question 24a on page 9***

23b. Has this also happened once or more in the PAST 12 MONTHS?

- ☐ Yes → ***Go to question 23c***
- ☐ No → ***Go to question 24a on page 9***

23c. How many of these thefts from or damages on the outside of a car in the PAST 12 MONTHS happened in ROTTERDAM (including Hoogvliet, Hoek van Holland, Pernis and Rozenburg)?

- ☐ None → ***Go to question 24a on page 9***
- ☐ One or more → ***Go to question 23d***
- ☐ Do not know / prefer not to say → ***Go to question 24a on page 9***

23d. How many of these thefts from or damages on the outside of a car in the PAST 12 MONTHS happened in YOUR OWN NEIGHBOURHOOD?

- ☐ None
- ☐ One or more
- ☐ Do not know / prefer not to say

The following questions are about whether you YOURSELF have been a victim of certain crimes or incidents. It concerns you being a PERSONAL victim.

Theft of wallet, purse, mobile phone or jewellery WITHOUT violence (pick pocketing)

24a. Has your wallet, purse, mobile phone or jewellery been taken from your bag, clothing or from you WITHOUT the use of violence or the threat of violence at some time during the PAST 5 YEARS? This concerns being a personal victim of pick pocketing.

- ☐ Yes → ***Go to question 24b***
- ☐ No → ***Go to question 25a on page 10***

24b. Has this also happened once or more in the PAST 12 MONTHS?

- ☐ Yes → ***Go to question 24c***
- ☐ No → ***Go to question 25a on page 10***

24c. How many of these thefts WITHOUT violence in the PAST 12 MONTHS happened in ROTTERDAM (including Hoogvliet, Hoek van Holland, Pernis and Rozenburg)?

- ☐ None → ***Go to question 25a on page 10***
- ☐ One or more → ***Go to question 24d***
- ☐ Do not know / prefer not to say → ***Go to question 25a on page 10***

24d. How many of these thefts WITHOUT violence in the PAST 12 MONTHS happened in YOUR OWN NEIGHBOURHOOD?

- ☐ None
- ☐ One or more
- ☐ Do not know / prefer not to say

Theft of wallet, purse, mobile phone or jewellery WITH violence (robbery)

25a. Has your wallet, purse, mobile phone or jewellery been taken from your bag, clothing or from you WITH the use of violence or the threat of violence at some time during the PAST 5 YEARS? This concerns being a personal victim of robbery.

- ☐ Yes → ***Go to question 25b***
- ☐ No → ***Go to question 26a***

25b. Has this also happened once or more in the PAST 12 MONTHS?

- ☐ Yes → ***Go to question 25c***
- ☐ No → ***Go to question 26a***

25c. How many of these thefts WITH violence in the PAST 12 MONTHS happened in ROTTERDAM (including Hoogvliet, Hoek van Holland, Pernis and Rozenburg)?

- ☐ None → ***Go to question 26a***
- ☐ One or more → ***Go to question 25d***
- ☐ Do not know / prefer not to say → ***Go to question 26a***

25d. How many of these thefts WITH violence in the PAST 12 MONTHS happened in YOUR OWN NEIGHBOURHOOD?

- ☐ None
- ☐ One or more
- ☐ Do not know / prefer not to say

Theft of other objects

26a. Have other objects been stolen from you, apart from the thefts mentioned thus far, at some time during the PAST 5 YEARS? For example plants from the garden, tools from a boat, clothes from a dressing room or tent and so on.

- ☐ Yes → ***Go to question 26b***
- ☐ No → ***Go to question 27a on page 11***

26b. Has this also happened once or more in the PAST 12 MONTHS?

- ☐ Yes → ***Go to question 26c***
- ☐ No → ***Go to question 27a on page 11***

26c. How many of these thefts of other objects in the PAST 12 MONTHS happened in ROTTERDAM (including Hoogvliet, Hoek van Holland, Pernis and Rozenburg)?

- ☐ None → ***Go to question 27a on page 11***
- ☐ One or more → ***Go to question 26d***
- ☐ Do not know / prefer not to say → ***Go to question 27a on page 11***

26d. How many of these thefts of other objects in the PAST 12 MONTHS happened in YOUR OWN NEIGHBOURHOOD?

- ☐ None
- ☐ One or more
- ☐ Do not know / prefer not to say

Intentional damage or destruction

27a. Has something belonging to you been destroyed or damaged on purpose at some time during the PAST 5 YEARS, even though NOTHING was stolen? For example someone destroys your garden, your bicycle or the outside of your house. Damages or destructions to your car are NOT included.

- ☐ Yes → ***Go to question 27b***
- ☐ No → ***Go to question 28a***

27b. Has this also happened once or more in the PAST 12 MONTHS?

- ☐ Yes → ***Go to question 27c***
- ☐ No → ***Go to question 28a***

27c. How many of these damages or destructions in the PAST 12 MONTHS happened in ROTTERDAM (including Hoogvliet, Hoek van Holland, Pernis and Rozenburg)?

- ☐ None → ***Go to question 28a***
- ☐ One or more → ***Go to question 27d***
- ☐ Do not know / prefer not to say → ***Go to question 28a***

27d. How many of these damages or destructions in the PAST 12 MONTHS happened in YOUR OWN NEIGHBOURHOOD?

- ☐ None
- ☐ One or more
- ☐ Do not know / prefer not to say

Threatened with bodily harm

28a. Has someone threatened you with a beating, kicking, a gun, a knife or anything like that at some time during the PAST 5 YEARS WITHOUT attacking or assaulting you?

- ☐ Yes → ***Go to question 28b***
- ☐ No → ***Go to question 29a on page 12***

28b. Has this also happened once or more in the PAST 12 MONTHS?

- ☐ Yes → ***Go to question 28c***
- ☐ No → ***Go to question 29a on page 12***

28c. How many of these threats with bodily harm in the PAST 12 MONTHS happened in ROTTERDAM (including Hoogvliet, Hoek van Holland, Pernis and Rozenburg)?

- ☐ None → ***Go to question 29a on page 12***
- ☐ One or more → ***Go to question 28d***
- ☐ Do not know / prefer not to say → ***Go to question 29a on page 12***

28d. How many of these threats with bodily harm in the PAST 12 MONTHS happened in YOUR OWN NEIGHBOURHOOD?

- ☐ None
- ☐ One or more
- ☐ Do not know / prefer not to say

Assault

29a. Has anyone attacked or assaulted you by hitting you or kicking you, or by using a gun, a knife, a piece of wood, scissors or anything else against you at some time during the PAST 5 YEARS?

- ☐ Yes → ***Go to question 29b***
- ☐ No → ***Go to question 30a***

29b. Has this also happened once or more in the PAST 12 MONTHS?

- ☐ Yes → ***Go to question 29c***
- ☐ No → ***Go to question 30a***

29c. How many of these assaults in the PAST 12 MONTHS happened in ROTTERDAM (including Hoogvliet, Hoek van Holland, Pernis and Rozenburg)?

- ☐ None → ***Go to question 30a***
- ☐ One or more → ***Go to question 29d***
- ☐ Do not know / prefer not to say → ***Go to question 30a***

29d. How many of these assaults in the PAST 12 MONTHS happened in YOUR OWN NEIGHBOURHOOD?

- ☐ None
- ☐ One or more
- ☐ Do not know / prefer not to say

The following questions are about whether you YOURSELF have been a victim in a traffic collision.

Collision after which the other party drove off

30a. Have you had a collision in the PAST 5 YEARS after which the other party drove off?

- ☐ Yes → ***Go to question 30b***
- ☐ No → ***Go to question 31a on page 13***

30b. Has this also happened once or more in the PAST 12 MONTHS?

- ☐ Yes → ***Go to question 30c***
- ☐ No → ***Go to question 31a on page 13***

30c. How many of these collisions after which the other party drove off in the PAST 12 MONTHS happened in ROTTERDAM (including Hoogvliet, Hoek van Holland, Pernis and Rozenburg)?

- ☐ None → ***Go to question 31a on page 13***
- ☐ One or more → ***Go to question 30d***
- ☐ Do not know / prefer not to say → ***Go to question 31a on page 13***

30d. How many of these collisions after which the other party drove off in the PAST 12 MONTHS happened in YOUR OWN NEIGHBOURHOOD?

- ☐ None
- ☐ One or more
- ☐ Do not know / prefer not to say

Collision after which the other party did NOT drive off

31a. Have you had a collision in the PAST 5 YEARS after which the other party did NOT drive off?

- ☐ Yes → ***Go to question 31b***
- ☐ No → ***Go to section 5***

31b. Has this also happened once or more in the PAST 12 MONTHS?

- ☐ Yes → ***Go to question 31c***
- ☐ No → ***Go to section 5***

31c. How many of these collisions after which the other party did NOT drive off in the PAST 12 MONTHS happened in ROTTERDAM (including Hoogvliet, Hoek van Holland, Pernis and Rozenburg)?

- ☐ None → ***Go to section 5***
- ☐ One or more → ***Go to question 31d***
- ☐ Do not know / prefer not to say → ***Go to section 5***

31d. How many of these collisions after which the other party did NOT drive off in the PAST 12 MONTHS happened in YOUR OWN NEIGHBOURHOOD?

- ☐ None
- ☐ One or more
- ☐ Do not know / prefer not to say

Section 5 Satisfaction with neighbourhood

32. How satisfied are you with living in your neighbourhood?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Neither satisfied nor dissatisfied
- ☐ Dissatisfied
- ☐ Very dissatisfied
- ☐ Do not know / no opinion

Section 6 Cyber criminality

Society is becoming more and more digital. We buy our shopping online, do our banking online, and are always available. This offers a lot of opportunities, but it can also make us vulnerable. The questions below are about these vulnerable situations.

The previous questions asked you about nuisance and nasty incidences in ***your neighbourhood***. The questions below are about incidents that can occur ***online***.

33. For each incident, please indicate how often this occurs ACCORDING TO YOU.

	Please tick one box on every line.	Occurs often	Occurs sometimes	Occurs (almost) never	Do not know / no opinion
a.	Scams via auction and sales sites (e.g. marketplace or eBay)	☐	☐	☐	☐
b.	Online stalking (such as harassment and threats)	☐	☐	☐	☐
c.	Malware (malicious software such as viruses, worms, Trojan horses and spyware)	☐	☐	☐	☐
d.	Hacking (for example, hacking into a PC, e-mail account or profile sites such as Facebook and LinkedIn)	☐	☐	☐	☐
e.	Identity fraud (using personal or financial data without permission for financial gain)	☐	☐	☐	☐
f.	Phishing (for example being lured to a website by an e-mail or through WhatsApp, such as Tikkie fraud)	☐	☐	☐	☐

Section 7 Online safety experience

34. Do you ever feel unsafe ONLINE?

- ☐ Yes → ***Go to question 35***
- ☐ No → ***Go to question 36***
- ☐ Don not know → ***Go to question 36***

35. Do you feel unsafe ONLINE often, sometimes or rarely?

- ☐ Often
- ☐ Sometimes
- ☐ Rarely
- ☐ Do not know

36. Have you had one or more devices with an online connection, such as a computer/tablet/smartphone in the PAST 12 MONTHS?

- ☐ Yes
- ☐ No → ***Go to question 38 on page 15***

37. For each of the following measures, please indicate whether and how often you take these to secure yourself online.

	Please tick one box on every line.	Often	Sometimes	Rarely	Never	Do not know / do not want to	Not applicable
a.	I install updates as soon as they are available	☐	☐	☐	☐	☐	☐
b.	I check that the sender of an email is trustworthy	☐	☐	☐	☐	☐	☐
c.	When I pay online I check that the browser shows a lock	☐	☐	☐	☐	☐	☐
d.	I use strong passwords	☐	☐	☐	☐	☐	☐
e.	I have not set my profile sites (such as Facebook, Instagram, LinkedIn) to public	☐	☐	☐	☐	☐	☐
f.	I use a virus scanner	☐	☐	☐	☐	☐	☐
g.	I do not give my login details to strangers	☐	☐	☐	☐	☐	☐
h.	I always back up my valuable files	☐	☐	☐	☐	☐	☐
i.	I avoid using public WiFi	☐	☐	☐	☐	☐	☐

The following questions are about whether you have been the victim of certain ONLINE incidents. This concerns personal victimisation.

Internet-related incidents

Online hacking

38. Have you been a victim of online hacking in the PAST 5 YEARS?
Examples include malicious and unwanted software on your device (viruses, worms, Trojan horses or spyware) or if someone has broken into your device, e-mail account or profile site.

☐ Yes
☐ No ➔ *Go to question 40 on page 16*

39. Has this also happened once or more in the PAST 12 MONTHS?

☐ Yes
☐ No

Online fraud

40. Have you been the victim of online fraud in the PAST 5 YEARS?
Examples include scams (for example, you have ordered something online but never received it), identity fraud (your personal or financial data has been abused for financial gain), or phishing (you are lured to fake websites).

☐ Yes

☐ No → ***Go to question 42***

41. Has this also happened once or more in the PAST 12 MONTHS?

☐ Yes

☐ No

Online stalking

42. Have you been a victim of online stalking in the PAST 5 YEARS?
Think of repeated harassment or threats via the internet.

☐ Yes

☐ No → ***Go to section 8***

43. Has this also happened once or more in the PAST 12 MONTHS?

☐ Yes

☐ No

Section 8 What you think about the police

The following questions are about how much trust you personally have in the police. Even if you have had no direct contact with the police, we ask you to give your impression by indicating whether you agree with the following statements or not.

44. Please indicate for each statement to what extent you agree or disagree with this statement.

	Please tick one box on every line.	Totally agree	Agree	Neither agree nor disagree	Disagree	Totally disagree	Do not know /no opinion
a.	You can trust the police on the whole	☐	☐	☐	☐	☐	☐
b.	You can trust the police in my neighbourhood	☐	☐	☐	☐	☐	☐

Section 9 Your background

45. What is your age?

☐☐ years old

46. Are you ...?

- ☐ Male
- ☐ Female

47. A 'household' consists of people who usually live together, eat together, share costs together and so on. How many people are there in your household, including you?

☐☐ people

48. How many of those people are YOUNGER than fifteen years old?

If there are no persons younger than 15 years old in your household, please enter 0.

☐☐ people

49. What is the HIGHEST LEVEL of education for which you RECEIVED a diploma (degree)?

- ☐ No education
- ☐ Primary education (primary school, special primary education)
- ☐ LBO / Lower vocational education
- ☐ MAVO, VMBO or VBO / Lower general secondary school, lower secondary professional school, pre-vocational education
- ☐ MBO / Intermediate vocational education
- ☐ MULO or MMS / Advanced elementary education or girls' secondary school
- ☐ HAVO / Senior or higher general secondary school
- ☐ HBS, VWO, lyceum, athenaeum or gymnasium / Pre-university education, grammar school or high school
- ☐ HBO / Higher vocational education
- ☐ University education
- ☐ Other, namely: ☐
- ☐ Prefer not to say

50. Do you have a paid job (in employment and/or self-employed)?

- ☐ Yes → ***Go to question 51***
- ☐ No → ***Go to question 52 on page 18***
- ☐ Prefer not to say → ***Go to question 52 on page 18***

51. Is this for 12 hours or more a week?

- ☐ Yes
- ☐ No
- ☐ Prefer not to say

52. Do you own your home or do you rent your home?

- ☐ Own
- ☐ Rent
- ☐ Prefer not to say

53. Please indicate the monthly net (=after tax) joint income bracket of your HOUSEHOLD.
Social benefits, state pensions (AOW), pensions, alimony and so on are also regarded as income. Not to be included are holiday money, children's allowance (kinderbijslag) and reductions and allowances received from the tax authorities (such as healthcare allowance (zorgtoeslag),housing allowance (huurtoeslag) and child (care) allowance (kindertoeslag en kinderopvangtoeslag)) or returns from the tax authorities.

- ☐ Less than € 1.150 per month
- ☐ € 1.150 tot € 1.600 per month
- ☐ € 1.600 tot € 2.150 per month
- ☐ € 2.150 tot € 3.500 per month
- ☐ € 3.500 or more per month
- ☐ Do not know
- ☐ Prefer not to say

Section 10 Conclusion

54. On a regular basis web surveys commissioned by Rotterdam city council are being carried out. If you are willing to participate in future web surveys by Rotterdam city council, please enter your e-mail address below. This e-mail address will only be used for surveys by Rotterdam city council.

E-mail address: _____ @ _____ . _____

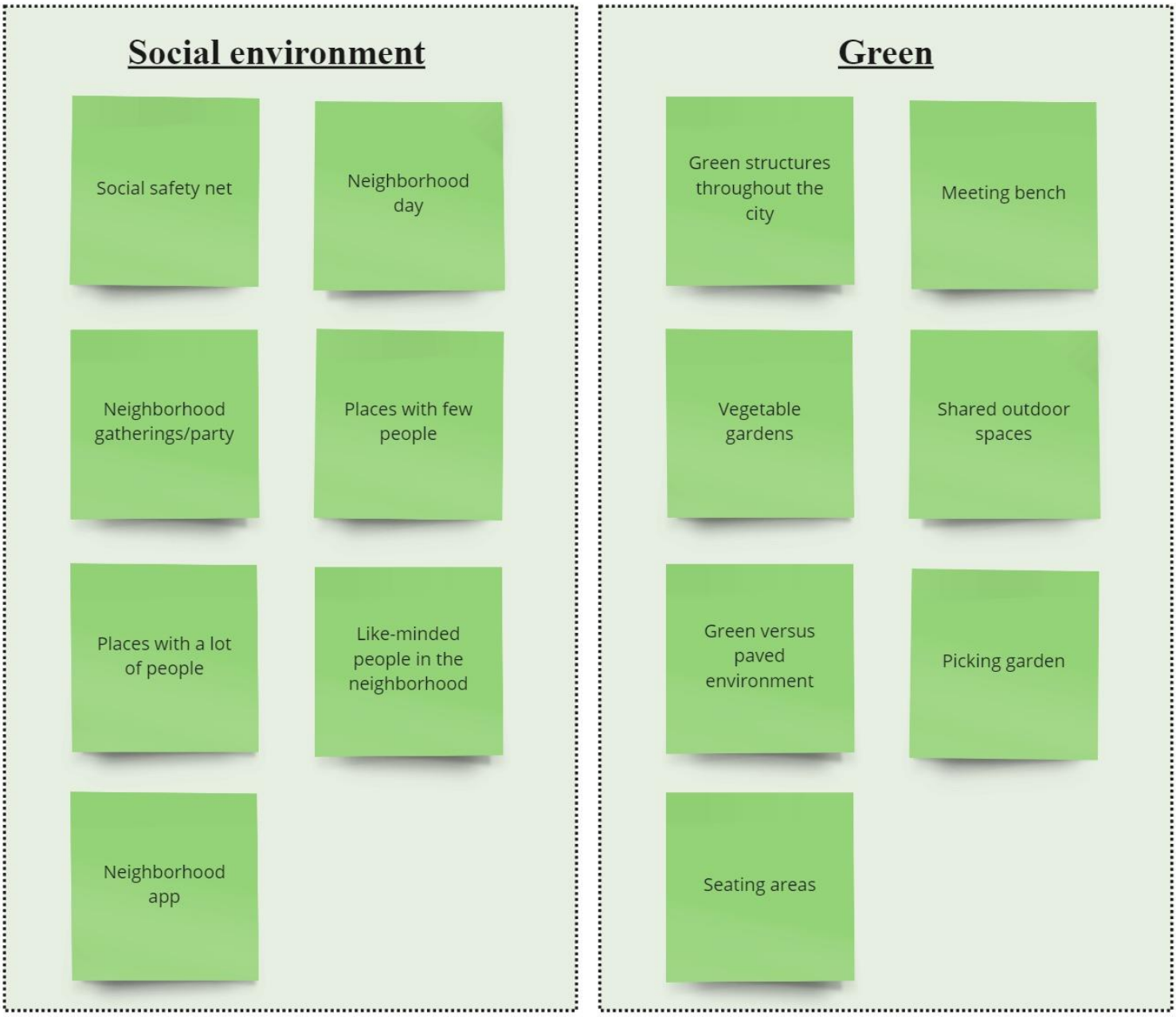
The municipality of Rotterdam believes that it is important to involve its citizens. Questionnaires like these are one option to achieve this. The municipality would also like to consult you about topics related to the city and your neighbourhood at other times, however. You can take part in this using the **Gemeentepeiler** app. Interested in becoming involved with your city and neighbourhood this way? Then download the app to your smartphone from the Playstore or app store. For more information, visit:
www.gemeentepeiler.nl/rotterdam

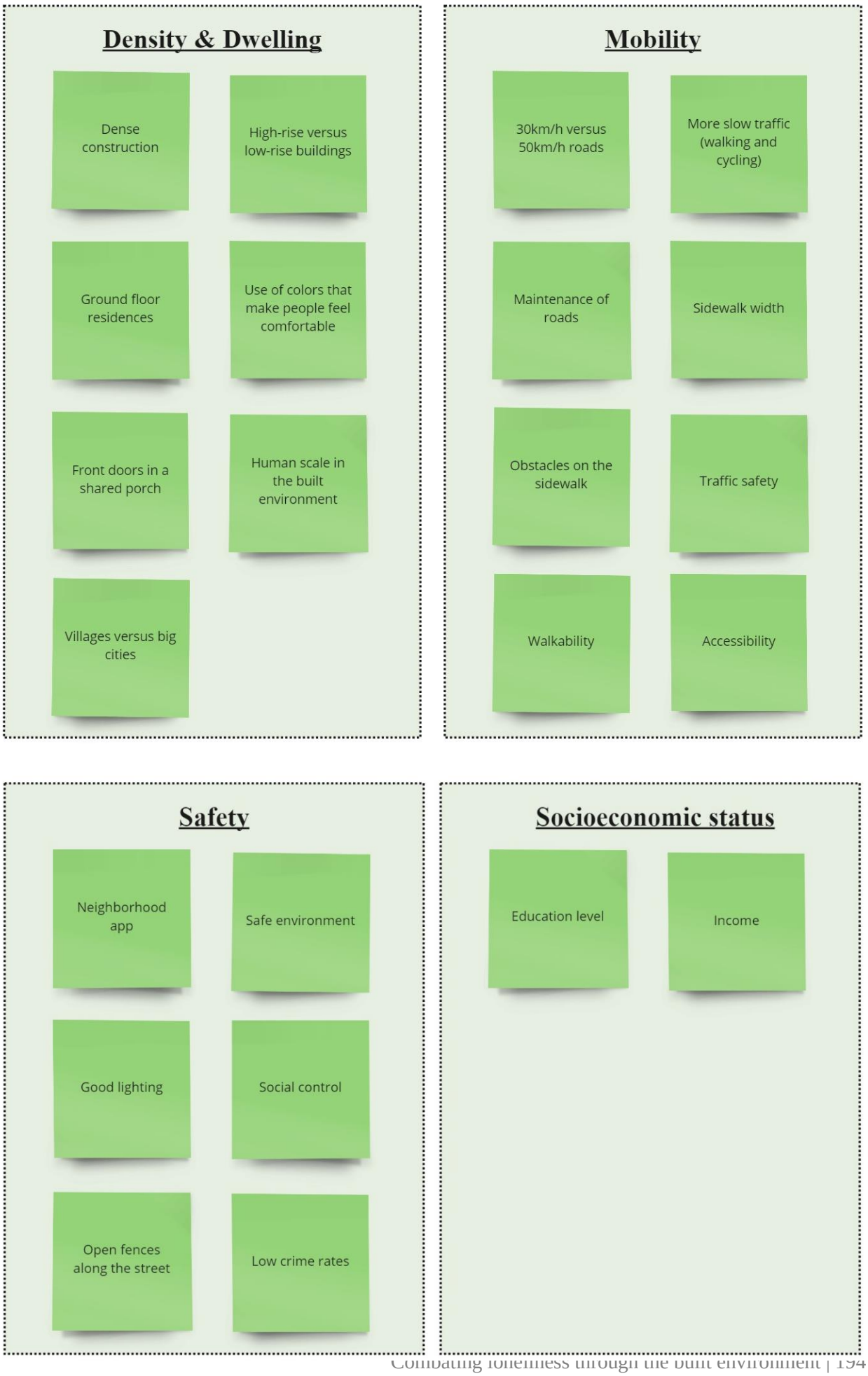
Thank you very much for completing the questionnaire.

You can return the completed questionnaire in the enclosed prepaid envelope.

Appendix IV – Results brainstorming session I

In this appendix, the results from the first brainstorming session are presented. The topics presented during the session are shown at individual papers. Furthermore, the post-it notes with possible variables influencing loneliness that the experts thought of are shown in the dark green post-it.




Density & Dwelling
Dense construction
High-rise versus low-rise buildings
Ground floor residences
Use of colors that make people feel comfortable
Front doors in a shared porch
Human scale in the built environment
Villages versus big cities
Mobility
30km/h versus 50km/h roads
More slow traffic (walking and cycling)
Maintenance of roads
Sidewalk width
Obstacles on the sidewalk
Traffic safety
Walkability
Accessibility
Safety
Neighborhood app
Safe environment
Good lighting
Social control
Open fences along the street
Low crime rates
Socioeconomic status
Education level
Income


Neighborhood Composition
Life phase
Age
Background
Culture
Similarity of mindset
General quality
Clean
Accessible
Tidy
Comfort
Amenities
Sport facilities
Playing areas
Community center
Facilities in the neighborhood
Activities for residents

Appendix V – Variables in dataset

In this appendix, the variables within the dataset are shown. The variables are sorted by topic and their measurement and level are shown. Additionally, an explanation of the variable is given and the source from where the variables was retrieved is shown. By doing so, a complete picture of the dataset arises.

	Variable	Source	Objective/subjective	Measurement	Measurement level	Explanation	Source
Amenities	% of residents who say that there are enough elderly facilities in the neighborhood	Social Index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who believe that there are (sufficiently) adequate facilities for the elderly.	Neighborhood survey Rotterdam. Reference year 2019.
	% satisfied with overall amenities	Physical Index Subjective Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households that are (very) satisfied with the overall provision of amenities.	Neighborhood survey Rotterdam. Reference year 2019.
	% sufficient presence of primary healthcare providers	Physical Index Subjective Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households that indicate that medical care (general practitioner, physiotherapy, etc.) is (sufficiently) present in and around the residential neighborhood.	Neighborhood survey Rotterdam. Reference year 2019.
	% sufficient presence of public transportation	Physical Index Subjective Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households that indicate that public transportation is (sufficiently) present in and around the residential neighborhood.	Neighborhood survey Rotterdam. Reference year 2019.
	% sufficient presence of shops for daily groceries	Physical Index Subjective Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households that indicate that shops for daily groceries are (sufficiently) present in and around the residential neighborhood.	Neighborhood survey Rotterdam. Reference year 2019.
	% sufficient presence of sports fields	Physical Index Subjective Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households that indicate that sports fields are (sufficiently) present in and around the residential neighborhood.	Neighborhood survey Rotterdam. Reference year 2019.
	% sufficient presence of indoor sports facilities	Physical Index Subjective Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households that indicate that indoor sports facilities, such as gymnasiums, sports halls, and swimming pools, are (sufficiently) present in and around the residential neighborhood.	Neighborhood survey Rotterdam. Reference year 2019.
	% of residents who say that there are enough leisure facilities for young people in the neighborhood	Social Index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (aged 15 and older) who believe that there are more than enough facilities available, such as a community center, neighborhood building, local cultural center, or meeting space for young people.	Neighborhood survey Rotterdam. Reference year 2019.
Composition	% 0 to 15 years	Onderzoek010	Objective	Percentage	Ratio	Number of residents aged 0 to 15 on January 1st.	Centraal Bureau voor de Statistiek (CBS)
	% 15 to 25 years	Onderzoek010	Objective	Percentage	Ratio	Number of residents aged 15 to 25 on January 1st.	Centraal Bureau voor de Statistiek (CBS)
	% 25 to 45 years	Onderzoek010	Objective	Percentage	Ratio	Number of residents aged 25 to 45 on January 1st.	Centraal Bureau voor de Statistiek (CBS)
	% 45 to 65 years	Onderzoek010	Objective	Percentage	Ratio	Number of residents aged 45 to 65 on January 1st.	Centraal Bureau voor de Statistiek (CBS)
	% 65 years or older	Onderzoek010	Objective	Percentage	Ratio	Number of residents aged 65 or older on January 1st.	Centraal Bureau voor de Statistiek (CBS)
	% divorced	Onderzoek010	Objective	Number	Ratio	The number of residents who were divorced on January 1st. The marital status "divorced" occurs after the dissolution of a marriage by divorce or after the dissolution of a registered partnership other than by the death of the partner. Persons who are legally separated are counted as married.	Centraal Bureau voor de Statistiek (CBS)
	% Households with children	Healthmonitor	Objective	Percentage	Ratio	The percentage of private households consisting of multiple persons with children living at home.	Centraal Bureau voor de Statistiek (CBS)

	% Households without children	Healthmonitor	Objective	Percentage	Ratio	The percentage of private households consisting of a couple without children living at home (and possibly other members).	Centraal Bureau voor de Statistiek (CBS)
	% married	Onderzoek010	Objective	Percentage	Ratio	The number of residents who were married on January 1st. The marital status "married" occurs after the conclusion of a marriage or the establishment of a registered partnership. Persons who are legally separated are also counted as married because they remain formally married.	Centraal Bureau voor de Statistiek (CBS)
	% men	Onderzoek010	Objective	Percentage	Ratio	Percentage of male population compared to the total population.	Centraal Bureau voor de Statistiek (CBS)
	% Residents with non-Western migration background	Healthmonitor	Objective	Percentage	Ratio	As a percentage of the total population.	CBS - Bevolkingsstatistiek
	% Residents with Western migration background	Healthmonitor	Objective	Percentage	Ratio	As a percentage of the total population.	CBS - Bevolkingsstatistiek
	% Single-parent families	Healthmonitor	Objective	Percentage	Ratio	The percentage of private households consisting of a single parent with children living at home.	-
	% Single-person households	Healthmonitor	Objective	Percentage	Ratio	The percentage of private households consisting of a single person	Centraal Bureau voor de Statistiek (CBS)
	% unmarried	Onderzoek010	Objective	Percentage	Ratio	The number of unmarried residents on January 1st. The marital status "unmarried" indicates that a person has never been married or entered into a registered partnership.	Centraal Bureau voor de Statistiek (CBS)
	% widowed	Onderzoek010	Objective	Percentage	Ratio	The number of widowed residents on January 1st. The marital status "widowed" occurs after the dissolution of a marriage or registered partnership due to the death of the partner.	Centraal Bureau voor de Statistiek (CBS)
	% women	Onderzoek010	Objective	Percentage	Ratio	Percentage of female population compared to the total population.	Centraal Bureau voor de Statistiek (CBS)
Daily life	% that engages in volunteer work, 18 years and older	Healthmonitor		Percentage	Ratio	Percentage of residents aged 18 and older who engage in volunteering.	Healthmonitor Adults and elderly
Daily life	% of residents who visit a hobby club or association monthly	Social Index Neighborhood profile	Objective	Percentage	Ratio	Percentage of residents (aged 15 and older) who report participating in one or more hobby clubs or associations related to sports, theater, music, or dance at least once a month.	Neighborhood survey Rotterdam. Reference year 2019.
Daily life	% of residents who participate in sports weekly	Social Index Neighborhood profile	Objective	Percentage	Ratio	Percentage of residents (aged 15 and older) who report engaging in individual or group sports activities alone or with others at least once a week.	Neighborhood survey Rotterdam. Reference year 2019.
Density	Residential density (inhabitants per km2)	Basisinformatie en Healthmonitor	Objective	Aantal	Ratio	A private household consists of one or more individuals who live together in a dwelling and do not provide themselves with daily necessities in a non-business manner.	CBS & Basisinformatie
Density	Urban density	Healthmonitor	Objective	schaal	Interval	The environmental address density forms the basis for the classification of municipalities into degrees of urbanization. The environmental address density of a municipality is the average value of a radius of 1 km around an address for all addresses within that municipality. There are five degrees of urbanization, based on class limits of 2.500, 1.500, 1,000, and 500 addresses per km². The following classes are distinguished: 1: Very urban (>= 2.500 addresses per km²); 2: Strongly urban (1.500 - 2.500 addresses per km²); 3: Moderately urban (1,000 - 1.500 addresses per	Centraal Bureau voor de Statistiek (CBS)

						km²); 4: Low urban (500 - 1,000 addresses per km²); 5: Non-urban (< 500 addresses per km²).	
Dwelling	% homes with over-occupancy	Physical Index Objective Neighborhood profile	Objective	Percentage	Ratio	Dwellings where the number of rooms is at least 1 less than the number of occupants. Overcrowding indicates that there is at least one room too few in the dwelling for the residents, resulting in one or more bedrooms being shared by more people. For single-parent families, one additional person is counted in the calculation since in a two-parent family, both partners will share a bedroom.	Woningen-Bevolking-Onderzoeksbestand (WBOB); peildatum 1-1-2021.
	% satisfaction with housing size	Physical Index Subjective Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households that are (very) satisfied with the size of their dwelling.	Neighborhood survey Rotterdam. Reference year 2021.
	% satisfaction with housing type	Physical Index Subjective Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households that are (very) satisfied with the type of their dwelling.	Neighborhood survey Rotterdam. Reference year 2021.
	% satisfaction with insulation from neighbors	Physical Index Subjective Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households that are (very) satisfied with sound insulation from neighbors.	Neighborhood survey Rotterdam. Reference year 2021.
	% satisfaction with outside noise insulation	Physical Index Subjective Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households that are (very) satisfied with sound insulation from outside.	Neighborhood survey Rotterdam. Reference year 2021.
	% satisfaction with size of outdoor space	Physical Index Subjective Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households that are (very) satisfied with the size of outdoor space.	Neighborhood survey Rotterdam. Reference year 2021.
	% satisfied with maintenance of own home	Physical Index Objective Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households that rate the condition of their own dwelling as (very) good.	Neighborhood survey Rotterdam. Reference year 2021.
	% likelihood of moving away from the neighborhood	Physical Index Subjective Neighborhood profile	Objective	Percentage	Ratio	Percentage of relocations, calculated as the total number of people who moved into or out of the neighborhood divided by the sum of the number of residents at the beginning and end of the year. Both out-of-town and within-town migration are included, but not moves within the neighborhood.	Municipality of Rotterdam (BRP). Reference year 2018.
General quality	% a lot of odor pollution from sewage systems outside	Physical Index Subjective Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households indicating that they experience a lot of nuisance from sewage-related odors outside.	Survey Safetymonitor Rotterdam. Reference year 2021.
	% often bothered by garbage next to the container	Physical Index Subjective Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households that frequently experience nuisance from garbage next to the container in the neighborhood.	Survey Safetymonitor Rotterdam. Reference year 2021.
	% often bothered by litter	Physical Index Subjective Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households that frequently experience nuisance from litter on the street in the neighborhood.	Survey Safetymonitor Rotterdam. Reference year 2021.
	% satisfied with maintenance of buildings in the neighborhood	Physical Index Objective Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households that rate the condition of the buildings in the residential neighborhood as (very) good.	Enquête Wijkonderzoek Rotterdam. Peiljaar 2021.
	A satisfactory rating (8 or higher) for the living environment, 18 years and older [%] [2020].	Healthmonitor	Subjective	Percentage	Ratio	Percentage of residents aged 18 and older who give a (sufficient) rating of 8 or higher for the living environment.	Healthmonitor Adults and elderly
	appreciation of neighborhood buildings	Physical Index Subjective Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households that strongly agree/agree with the statement: "Buildings and houses in this neighborhood look attractive."	Neighborhood survey Rotterdam. Reference year 2021.
	CROW score clean (average)	Physical Index Objective Neighborhood profile	Objective	5-puntsschaal	Interval	This refers to the average score on the CROW visual assessment scales for "cleanliness," including litter,	Municipality of Rotterdam – cluster

	CROW score intact (average)	Physical Index Objective Neighborhood profile	Objective	5-puntsschaal	Interval	trash bins, containers, weeds, graffiti, and feces. The visual assessment scales have a 5-point scale from A+ (very good) - A (good) - B (sufficient) - C (moderate) - D (poor), which has been converted into a numerical scale from 5 (A+) to 1 (D). An average value of 3 effectively corresponds to a B (sufficient) score. The CROW method was implemented in Rotterdam in 2019 and replaced the municipal product standard scoring. Since there are no historically comparable data available, the year 2019 serves as the baseline measurement. This concerns the average score on the CROW image measurement rods 'heel', which measure the quality of the road surface. The image measurement rods use a 5-point scale from A+ (very good) - A (good) - B (sufficient) - C (moderate) - D (poor), which we have converted into a numerical scale from 5 (A+) to 1 (D). An average value of 3 effectively corresponds to a score of B (sufficient). For the Neighborhood Profile, the aim is to reflect the differences in image quality between neighborhoods. The CROW method was implemented in Rotterdam in 2019 and replaces the municipal score Productnormering. Since there are no historically comparable data available, the year 2019 is considered as the baseline measurement.	Stadsbeheer; bewerking OBI. Reference year oktober 2020 t/m september 2021.
	% of residents who feel connected to the neighborhood	Social Index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (aged 15 and older) who feel (very) connected to their neighborhood.	Municipality of Rotterdam – cluster Stadsbeheer; bewerking OBI. Reference year oktober 2020 t/m september 2021. Neighborhood survey Rotterdam. Reference year 2019.
	% of residents who feel responsible for the neighborhood	Social Index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (aged 15 and older) who feel very or somewhat responsible for the livability and safety in their residential area.	Neighborhood survey Rotterdam. Reference year 2019.
	% (very) satisfied with the neighborhood	Neighborhood profile	Subjective	Percentage	Ratio	Last modification date.	Survey Safetymonitor Rotterdam. Reference year 2019.
Green	% satisfaction with attractiveness of canals, ditches, and ponds	Physical Index Subjective Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households that are (very) satisfied with the attractiveness of canals, ditches, and ponds.	Neighborhood survey Rotterdam. Reference year 2021.
	% sufficient presence of green areas (lawns, trees)	Physical Index Subjective Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households that indicate that green spaces, such as grass fields, trees, and parks, are (sufficiently) present in and around the residential neighborhood.	Neighborhood survey Rotterdam. Reference year 2021.
	% sufficient presence of recreational green areas (picnics, sports, games)	Physical Index Subjective Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households that indicate that green spaces for picnicking, sports, or play are (sufficiently) present in and around the residential neighborhood.	Neighborhood survey Rotterdam. Reference year 2021.
	A satisfactory rating (8 or higher) for green spaces, 19 years and older [%]	Healthmonitor	Subjective	Percentage	Ratio	Percentage of residents aged 19 and older who give a (sufficient) rating of 8 or higher for the greenery in the neighborhood.	Healthmonitor Adults and elderly
	Benches per km2	Basisinformatie	Objective	Number per km2	Ratio	The total number of banks per neighborhood divided by the area of the neighborhood.	nvt
	Green per km2	Basisinformatie	Objective	Number per km2	Ratio	The total green area per neighborhood divided by the area of the neighborhood.	nvt
	Trees per km2	Basisinformatie	Objective	Number per km2	Ratio	The total number of trees per neighborhood divided by the area of the neighborhood.	nvt

	CROW score green (average)	Physical Index Objective Neighborhood profile	Objective	5-puntsschaal	Interval	This refers to the average score on the CROW visual assessment scales for "greenery," which assess the quality of grass fields	Municipality of Rotterdam – cluster Stadsbeheer; bewerking OBI. Reference year oktober 2020 t/m september 2021.
Health	% that meets the physical activity guideline 2017, 18 years and older	Healthmonitor	Objective	Percentage	Ratio	Percentage of residents aged 18 and older who meet the exercise guideline of 2017. To meet the exercise guideline of 2017, one must engage in at least 150 minutes of moderate-intensity physical activity, such as walking and cycling, per week and engage in vigorous-intensity physical activity, such as running or playing sports, at least twice a week.	Healthmonitor Adults and elderly
	Limited by one or more chronic conditions, 19 years and older	Healthmonitor	Subjective	Percentage	Ratio	Percentage of residents aged 19 and older with a long-term illness or disability (lasting 6 months or longer) who feel limited in their daily activities.	Healthmonitor Adults and elderly
	At least 1 mental health condition, 18 years and older	Healthmonitor	Objective	Percentage	Ratio	Percentage of residents aged 18 and older who have had at least one mental disorder (depression, anxiety disorder, or burnout) in the past year (diagnosed or undiagnosed).	Healthmonitor Adults and elderly
	Drugs (soft drugs/hard drugs) (in the past 4 weeks), 18 to 64 years old	Healthmonitor	Objective	Percentage	Ratio	Percentage of residents aged 18 to 64 who have used soft drugs and/or hard drugs in the past 4 weeks.	Healthmonitor Adults and elderly
	Smokes, 18 years and older	Healthmonitor	Objective	Percentage	Ratio	Percentage of smokers aged 18 and older.	Healthmonitor Adults and elderly
	Has overweight (moderate and severe), 18 years and older	Healthmonitor	Objective	Percentage	Ratio	Percentage of residents aged 18 and older with overweight (moderate overweight and obesity). Body Mass Index (BMI) of 25 or higher.	Healthmonitor Adults and elderly
	Mobility limitation, 18 years and older	Healthmonitor	Objective	Percentage	Ratio	Percentage of residents aged 18 and older who have mobility limitations. Mobility limitation is based on 3 questions: 1) Can you carry an object weighing 5 kg (such as a full grocery bag) for 10 meters? 2) Can you bend down and pick something up from the ground while standing? 3) Can you walk 400 meters continuously without stopping (if necessary, with a cane)? The respondent is asked to indicate the extent to which they have difficulty performing these activities.	Healthmonitor Adults and elderly
Life events	% residents (18 years and older) who have only recently moved to the Netherlands	Social Index Neighborhood profile	Objective	Percentage	Ratio	Percentage of residents aged 18 and older who were born abroad and have been living in the Netherlands for less than two years.	Municipality of Rotterdam (BRP). Peildatum: 1 januari 2019.
Loneliness	Moderately to severely lonely, 18 years and older [%] [2020]	Healthmonitor		Percentage	Ratio	Percentage of residents aged 18 and older who feel moderately to severely lonely.	Healthmonitor Adults and elderly
Mobility	% of homes within norm distance of bus stops	Physical Index Objective Neighborhood profile	Objective	Percentage	Ratio	Percentage of homes with a bus stop within the standard distance (= 277 meters). The proximity of amenities is determined for each amenity by calculating the distance to the nearest amenity (as the crow flies) for each dwelling. The Rotterdam average of this is then used as the 'standard distance'. For each neighborhood, the percentage of homes that have the respective amenity available within the standard distance is determined. Neighborhoods with a high percentage have a large proximity to that amenity. In neighborhoods with a low percentage, residents have to	Gemeente Rotterdam. Peiljaar 2019.

						travel further than the average Rotterdam resident to reach the amenity.	
	% of homes within norm distance of metro stations	Physical Index Objective Neighborhood profile	Objective	Percentage	Ratio	Percentage of homes with a metro station within the standard distance (= 1.184 meters). The train station in Hoek van Holland is considered equivalent to a metro station. The proximity of amenities is determined for each amenity by calculating the distance to the nearest amenity (as the crow flies) for each dwelling. The Rotterdam average of this is then used as the 'standard distance'. For each neighborhood, the percentage of homes that have the respective amenity available within the standard distance is determined. Neighborhoods with a high percentage have a large proximity to that amenity. In neighborhoods with a low percentage, residents have to travel further than the average Rotterdam resident to reach the amenity.	Gemeente Rotterdam. Peiljaar 2019.
	% of homes within norm distance of tram stops	Physical Index Objective Neighborhood profile	Objective	Percentage	Ratio	Percentage of homes with a tram stop within the standard distance (= 1.747 meters). The proximity of amenities is determined for each amenity by calculating the distance to the nearest amenity (as the crow flies) for each dwelling. The Rotterdam average of this is then used as the 'standard distance'. For each neighborhood, the percentage of homes that have the respective amenity available within the standard distance is determined. Neighborhoods with a high percentage have a large proximity to that amenity. In neighborhoods with a low percentage, residents have to travel further than the average Rotterdam resident to reach the amenity.	Gemeente Rotterdam. Peiljaar 2019.
	% satisfaction with bike path safety	Physical Index Subjective Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households that are (very) satisfied with the safety of bike paths.	Neighborhood survey Rotterdam. Reference year 2021.
	% satisfaction with maintenance of bike paths	Physical Index Subjective Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households that are (very) satisfied with the maintenance of bike paths.	Neighborhood survey Rotterdam. Reference year 2021.
	% satisfaction with maintenance of sidewalks	Physical Index Subjective Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households that are (very) satisfied with the maintenance of sidewalks.	Neighborhood survey Rotterdam. Reference year 2021.
	% satisfaction with sidewalk safety	Physical Index Subjective Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households that are (very) satisfied with the safety of sidewalks.	Neighborhood survey Rotterdam. Reference year 2021.
Safety	Damaged/broken benches, trash cans, etc. are a common neighborhood problem	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households indicating that vandalism of benches, trash cans, or playground equipment frequently occurs in the neighborhood.	Survey Safetymonitor Rotterdam. Reference year 2019.
	Auto theft in own neighborhood in the past year as a percentage of the total number of cars	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) with a car who indicated being victims of car theft in their own neighborhood in the past year.	Survey Safetymonitor Rotterdam. Reference year 2019.
	Threats are a common neighborhood problem	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who indicated that the neighborhood problem of threats occurs frequently.	Survey Safetymonitor Rotterdam. Reference year 2019.
	Graffiti on walls and/or buildings is a common neighborhood problem	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who indicated that the neighborhood problem of graffiti on walls and/or buildings occurs frequently.	Survey Safetymonitor Rotterdam. Reference year 2019.

Theft from cars in own neighborhood in the past year as a percentage of the total number of cars	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) with a car who indicated being victims of theft from their car in their own neighborhood in the past year.	Survey Safetymonitor Rotterdam. Reference year 2019.
Theft from cars is a common neighborhood problem	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who indicated that the neighborhood problem of theft from cars occurs frequently.	Survey Safetymonitor Rotterdam. Reference year 2019.
Drug nuisance in the own neighborhood is frequently perceived as bothersome	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who indicated experiencing a high level of drug-related nuisance in their own neighborhood.	Survey Safetymonitor Rotterdam. Reference year 2019.
Bicycle theft in own neighborhood in the past year as a percentage of the total number of bicycles	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) with a bicycle who indicated being victims of bicycle theft in their own neighborhood in the past year.	Survey Safetymonitor Rotterdam. Reference year 2019.
Bicycle theft is a common neighborhood problem	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who indicated that the neighborhood problem of bicycle theft occurs frequently.	Survey Safetymonitor Rotterdam. Reference year 2019.
Violent offenses are a common neighborhood problem	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who indicated that the neighborhood problem of violent crimes occurs frequently.	Survey Safetymonitor Rotterdam. Reference year 2019.
Street-level drug dealing in the own neighborhood is frequently perceived as bothersome	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who indicated experiencing a high level of nuisance from drug dealing on the street in their own neighborhood.	Survey Safetymonitor Rotterdam. Reference year 2019.
Coming and going of drug addicts in your street is frequently perceived as bothersome	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who indicated experiencing a high level of nuisance from the presence of drug addicts walking around in the street in their own neighborhood.	Survey Safetymonitor Rotterdam. Reference year 2019.
Residential burglary is a common neighborhood problem	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who indicated that the neighborhood problem of residential burglary occurs frequently.	Survey Safetymonitor Rotterdam. Reference year 2019.
Nuisance caused by neighbors is frequently perceived as bothersome	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who indicated experiencing a high level of nuisance from neighbors in their own neighborhood.	Survey Safetymonitor Rotterdam. Reference year 2019.
Trouble caused by groups of young people in the own neighborhood is frequently perceived as bothersome	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who indicated experiencing a high level of nuisance from groups of young people in their own neighborhood.	Survey Safetymonitor Rotterdam. Reference year 2019.
Bother caused by young people who harass or intimidate residents in the own neighborhood is frequently perceived as bothersome	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who indicated experiencing a high level of nuisance from young people who bully or intimidate neighborhood residents in their own neighborhood.	Survey Safetymonitor Rotterdam. Reference year 2019.
Percentage of residents who have been victims of threats with violence in the past year in their own neighborhood	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who indicated being victims of threats with violence in their own neighborhood in the past year.	Survey Safetymonitor Rotterdam. Reference year 2019.
Percentage of residents who have been victims of burglary in the past year	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who indicated being victims of burglary in their own neighborhood in the past year.	Survey Safetymonitor Rotterdam. Reference year 2019.
Percentage of residents who have been victims of assault in the past year in their own neighborhood	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who indicated being victims of assault in their own neighborhood in the past year.	Survey Safetymonitor Rotterdam. Reference year 2019.
Percentage of residents who have been victims of other theft in the past year in their own neighborhood	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who indicated being victims of other theft in their own neighborhood in the past year.	Survey Safetymonitor Rotterdam. Reference year 2019.
Percentage of residents who have been victims of other vandalism in	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who indicated being victims of other vandalism in their own neighborhood in the past year.	Survey Safetymonitor Rotterdam. Reference year 2019.

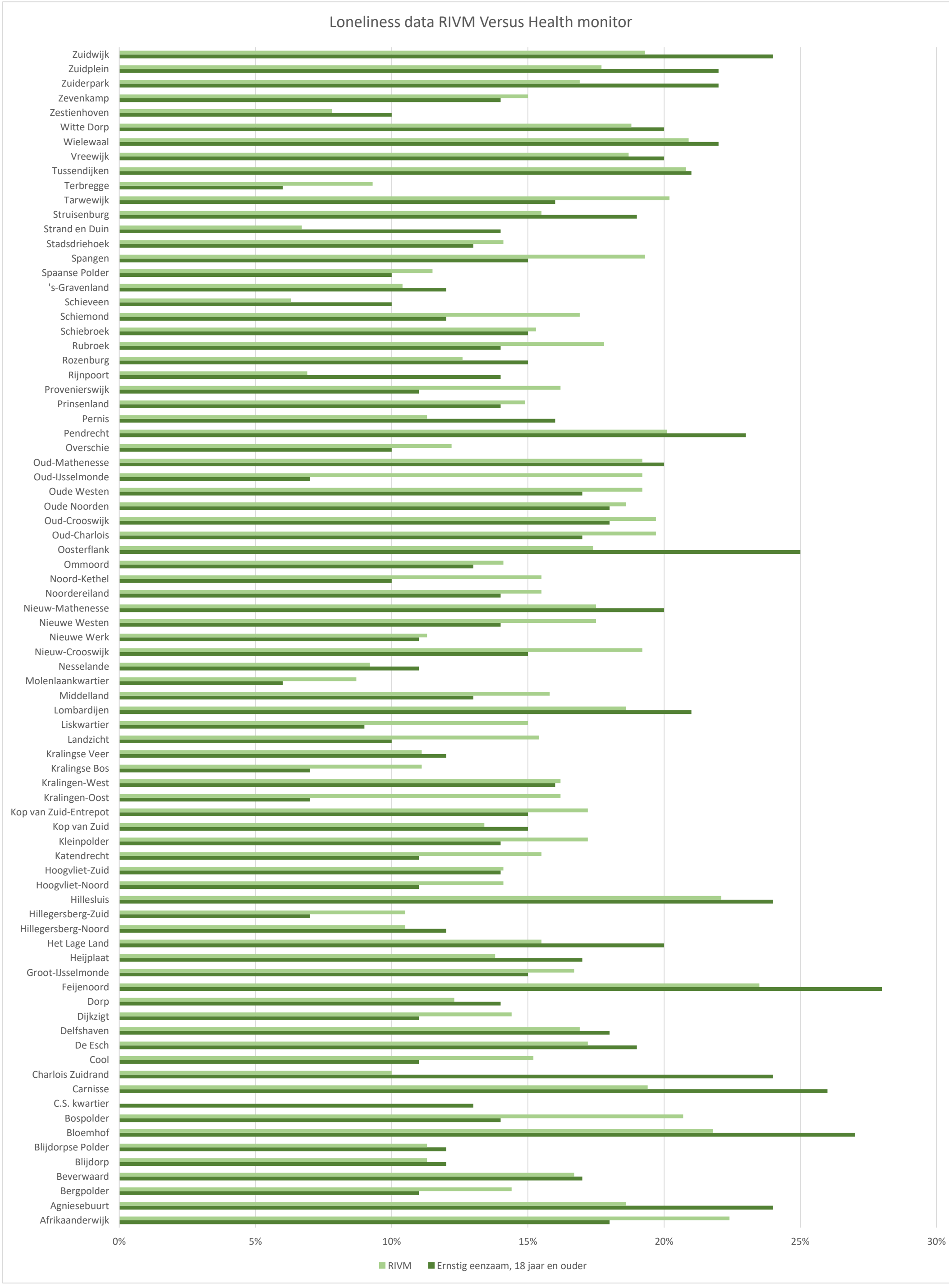
	the past year in their own neighborhood						
	Percentage of residents who have been victims of attempted burglary in the past year	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who indicated being victims of attempted burglary in their own neighborhood in the past year.	Survey Safetymonitor Rotterdam. Reference year 2019.
	Vandalism of telephone booths, bus or tram shelters is a common neighborhood problem	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of households indicating that vandalism of bus/tram shelters frequently occurs in the neighborhood.	Survey Safetymonitor Rotterdam. Reference year 2019.
	Percentage of residents who have been victims of purse snatching with violence in the past year in their own neighborhood	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who indicated being victims of violent purse snatching in their own neighborhood in the past year.	Survey Safetymonitor Rotterdam. Reference year 2019.
	Percentage of residents who have been victims of purse snatching without violence in the past year in their own neighborhood	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who indicated being victims of non-violent purse snatching in their own neighborhood in the past year.	Survey Safetymonitor Rotterdam. Reference year 2019.
	Quarreling and/or shouting young people on the street in the own neighborhood is frequently perceived as bothersome	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who indicated experiencing a high level of nuisance from quarreling and/or shouting young people on the street in their own neighborhood.	Survey Safetymonitor Rotterdam. Reference year 2019.
	Purse snatching with violence is a common neighborhood problem	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who indicated that the neighborhood problem of violent purse snatching occurs frequently.	Survey Safetymonitor Rotterdam. Reference year 2019.
	Vandalism/theft from cars is a common neighborhood problem	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who indicated that the neighborhood problem of vandalism/theft from cars occurs frequently.	Survey Safetymonitor Rotterdam. Reference year 2019.
	Vandalism/theft from cars in own neighborhood in the past year as a percentage of the total number of cars	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) with a car who indicated being victims of vandalism/theft from their car in their own neighborhood in the past year.	Survey Safetymonitor Rotterdam. Reference year 2019.
	Harassment of women and men on the street in the own neighborhood is frequently perceived as bothersome	Safety index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who indicated experiencing a high level of nuisance from harassment of women and men on the street in their own neighborhood.	Survey Safetymonitor Rotterdam. Reference year 2019.
SES	average property value per square meter of living space	Physical Index Objective Neighborhood profile	Objective	Euro	Ratio	Average WOZ value in euros per square meter of living space. The following WOZ reference dates apply for the different measurement years: 2014 = January 1, 2012; 2016 = January 1, 2014; 2018 = January 1, 2016; 2020 = January 1, 2018; 2022 = January 1, 2020.	Woningen-Bevolking-Onderzoeksbestand (WBOB); peildatum 1-1-2021.
	% Completed higher education (HBO or WO), 15 to 75 years old	Healthmonitor	Objective	Percentage	Ratio	Percentage of individuals (aged 15 to 75) who have completed a higher professional education (HBO) or university (WO) degree.	Sociaal Statistisch Bestand CBS
	Disposable household income [in thousands of euros]	Healthmonitor	Objective	Euro	Ratio	The average disposable income of households is the average amount of income available after deducting taxes, premiums for income insurance, health insurance premiums, and income and wealth taxes. This includes all private households with known income, and student households are not excluded. Disposable income is defined as the gross income reduced by paid income transfers, premiums for income insurance, health insurance premiums, and income and wealth taxes. Paid income transfers refer to transfers between households, such as alimony paid to ex-spouses. Premiums for income insurance include premiums paid for social insurance, national insurance, and private	CBS, Het Regionaal Inkomensonderzoek

						insurance related to unemployment, sickness and disability, and old age and survivors' benefits.	
Social environment	% of residents who say that neighbors help each other	Social Index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (aged 15 and older) who (completely) agree with the statement: People in this neighborhood help each other when needed.	Neighborhood survey Rotterdam. Reference year 2019.
	% of residents who say that neighbors know each other	Social Index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (aged 15 and older) who (completely) disagree with the statement: The people in this neighborhood barely know each other.	Neighborhood survey Rotterdam. Reference year 2019.
	% of residents who provide neighborly help	Social Index Neighborhood profile	Objective	Percentage	Ratio	Percentage of residents (aged 15 and older) who report having provided neighborly assistance in the past year.	Neighborhood survey Rotterdam. Reference year 2019.
	% of residents who have lived in the neighborhood for a long time	Social Index Neighborhood profile	Objective	Percentage	Ratio	Percentage of dwellings where the main resident has lived in the same dwelling for an extended period. For dwellings between 2 and 10 years old, the length of stay for the main resident is at most one year less than the age of the dwelling. For dwellings older than 10 years, the main resident must have lived in the same dwelling for ten years or longer.	Municipality of Rotterdam (WBOB). Reference year 1 januari 2019.
	% of residents who say that neighbors share opinions	Social Index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (aged 15 and older) who (completely) agree with the statement: The residents in this neighborhood share the same opinions on what is acceptable or not in the neighborhood.	Neighborhood survey Rotterdam. Reference year 2019.
	% of residents who say that there are enough places in the neighborhood for joint resident activities	Social Index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (aged 15 and older) who believe that there are (more than) sufficient facilities available to engage in activities with others, such as community centers and public squares.	Neighborhood survey Rotterdam. Reference year 2019.
	% of residents who say that young and old get along well in the neighborhood	Social Index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (aged 15 and older) who (completely) agree with the statement: Young people and adults interact well with each other.	Neighborhood survey Rotterdam. Reference year 2019.
	% of residents who say they feel at home with neighbors	Social Index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (aged 15 and older) who (completely) agree with the statement: I feel at home among the people who live in this neighborhood.	Neighborhood survey Rotterdam. Reference year 2019.
	% residents who have been involved in making plans for the neighborhood or city. (objective)	Social Index Neighborhood profile	objective	Percentage	Ratio	Percentage of residents (15 years and older) who report being involved in making plans for the neighborhood or city in the past year, for example through a residents' initiative or organization, through a survey, through a website, through a discussion or consultation meeting, through an advisory or client council, or through a district committee, neighborhood council, or neighborhood committee.	Neighborhood survey Rotterdam. Reference year 2019.
	% of residents who say that neighbors interact frequently	Social Index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who (completely) agree with the statement: "I live in a friendly neighborhood where people interact with each other a lot."	Neighborhood survey Rotterdam. Reference year 2019.
Social network	% of residents who report knowing enough people to talk to	Social Index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who (completely) disagree with the statement: "There are very few people with whom I can truly talk."	Neighborhood survey Rotterdam. Reference year 2019.
	% of residents who report having enough interest from close family members	Social Index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who (completely) disagree with the statement: "You can expect little interest even from your closest family members."	Neighborhood survey Rotterdam. Reference year 2019.
	% of residents who report having enough interest from others	Social Index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who (completely) disagree with the statement: "There is no one who has a special interest in you."	Neighborhood survey Rotterdam. Reference year 2019.

	% of residents who say they know enough people for help and advice	Social Index Neighborhood profile	Subjective	Percentage	Ratio	Percentage of residents (15 years and older) who (completely) agree with the statement: "I know enough people whom I can ask for help or advice."	Neighborhood survey Rotterdam. Reference year 2019.

Appendix VI – Loneliness data RIVM and Health monitor

In the figure of this appendix, the loneliness data measured by RIVM is compared to the data from the health monitor of the municipality of Rotterdam.



Appendix VII – Descriptive statistics

In this appendix, the descriptive statistics of all variables before the factor analysis are shown.

Dwelling

Dwelling					
	Mean	Median	Std. Deviation	Minimum	Maximum
% satisfaction with housing size	79.9%	80.6%	6.8%	61.5%	94.5%
% satisfaction with housing type	79.7%	80.6%	8.3%	57.7%	95.2%
% satisfaction with size of outdoor space	69.5%	69.5%	8.2%	53.3%	85.9%
% satisfaction with outside noise insulation	55.9%	54.1%	9.4%	36.9%	80.2%
% satisfaction with insulation from neighbors	47.1%	45.2%	11.4%	26.4%	73.3%
average property value per square meter of living space	2042.7	1935	455.45	1362.83	3253.41
% homes with over-occupancy	9.4%	8.5%	4.1%	3.2%	18.8%
% satisfied with maintenance of own home	57.4%	55.7%	10.7%	40.9%	91.3%

General quality

General quality					
	Mean	Median	Std. Deviation	Minimum	Maximum
% (very) satisfied with the neighborhood	77.9%	80.2%	12.9%	46.2%	95.4%
CROW score clean (average)	3.66	3.66	0.13	3.44	3.95
CROW score intact (average)	3.83	3.83	0,08	3.59	3.98
% often bothered by litter	59.1%	61.6%	14.5%	29.6%	83.8%
% often bothered by garbage next to the container	58.5%	61.7%	18.2%	18.7%	86.5%

% often dog poop	37.2%	36.8%	8.9%	20.5%	63.5%
appreciation of neighborhood buildings	55.3%	56.9%	16,0%	20.3%	90.5%
% satisfied with maintenance of buildings in the neighborhood	47.6%	43.8%	14.4%	24.7%	80.3%
% a lot of odor pollution from sewage systems outside	5,0%	4.3%	3.1%	0.4%	16.1%
A satisfactory rating (8 or higher) for the living environment, 18 years and older [%] [2020].	51.1%	53,0%	14.1%	26,0%	79,0%

Amenities

Amenities					
	Mean	Median	Std. Deviation	Minimum	Maximum
% satisfied with overall amenities	50.4%	50.3%	11.1%	22.1%	75.4%
% sufficient presence of shops for daily groceries	82.3%	89.3%	19,0%	0.5%	98.9%
% sufficient presence of primary healthcare providers	85.8%	90.2%	14.6%	10.1%	97.7%
% sufficient presence of sports facilities	52.4%	52.9%	14.4%	24.6%	87.8%
% of residents who say that there are enough places in the neighborhood for joint resident activities	50.3%	49.3%	9.1%	24.6%	84.3%
% of residents who say that there are enough elderly facilities in the neighborhood	34.7%	34.1%	12.3%	13.8%	62.5%
% of residents who say that there are enough leisure facilities for young people in the neighborhood	37.5%	39.1%	11.6%	16.5%	74.4%

Density

Density					
	Mean	Median	Std. Deviation	Minimum	Maximum
Residential density (inhabitants per km2)	8403	6452.6	5888.93	35.23	20210.19
Urban density	1.38	1	0.882	1	5

Mobility

Mobility					
	Mean	Median	Std. Deviation	Minimum	Maximum
% of homes within norm distance of bus stops	67.9%	76,0%	24,0%	0.3%	100,0%
% of homes within norm distance of metro stations	70.4%	96.6%	39.6%	0,0%	100,0%
% of homes within norm distance of tram stops	77.4%	100,0%	41.3%	0,0%	100,0%
% satisfaction with maintenance of bike paths	51.6%	51.8%	9.3%	34.5%	80.1%
% satisfaction with maintenance of sidewalks	49.5%	49.3%	6.4%	37.8%	69.4%
% satisfaction with bike path safety	50.9%	51.5%	11.5%	29.3%	81,0%
% satisfaction with sidewalk safety	57.5%	57.3%	7.6%	37.5%	76.7%
% often parked on the sidewalk	35.8%	34.7%	10.8%	17.1%	61.1%
% sufficient presence of public transportation	89.2%	92.8%	10.5%	52.5%	99.7%

Green

Green					
	Mean	Median	Std. Deviation	Minimum	Maximum
Trees per km2	1436	1515	630.68	15.37	2413.35
Green per km2	17752	15080	10914.76	362.4	48741.39
Benches per km2	110.49	73.66	83.99	1,07	349.47
% sufficient presence of green areas (lawns, trees)	78.6%	81.9%	13.4%	50.2%	98.1%
% sufficient presence of recreational green areas (picnics, sports, games)	63.4%	66,0%	15,0%	30.5%	90.5%
% satisfaction with attractiveness of canals, ditches, and ponds	53.8%	55.7%	15.3%	16.4%	85.6%

CROW score green (average)	3.81	3.8	0.1	3.64	4,08
A satisfactory rating (8 or higher) for green spaces	42.5%	41,0%	18,0%	15,0%	79,0%

Composition

Composition					
	Mean	Median	Std. Deviation	Minimum	Maximum
% Residents with Western migration background	13.6%	13,0%	4.7%	7.5%	32,0%
% Residents with non-Western migration background	41.5%	40,0%	16.5%	11,0%	75,0%
% Single-person households	49.4%	49,0%	9.2%	22,0%	75,0%
% Households without children	21,0%	20,0%	4,0%	15,0%	31,0%
% Households with children	18.2%	18,0%	6.4%	4,0%	46,0%
% Single-parent families	11.4%	11,0%	3.3%	3,0%	20,0%
% men	49.6%	49.7%	1.7%	46.4%	54,0%
% women	50.4%	50.3%	1.7%	46,0%	53.7%
% 0 to 15 years	15.7%	15.7%	4,0%	4.1%	26,0%
% 15 to 25 years	13.3%	12.7%	4.2%	7.7%	36.2%
% 25 to 45 years	31.9%	30.8%	7.1%	19.3%	54.6%
% 45 to 65 years	24.4%	24.1%	3.6%	13.8%	32.4%
% 65 years or older	14.8%	13.3%	5.8%	6.7%	30.8%
% unmarried	58.4%	59,0%	8.5%	42.9%	78.2%
% married	28,0%	27.7%	6.9%	13.6%	42.4%
% divorced	9.7%	9.9%	1.8%	5.6%	13.6%
% widowed	3.9%	3.1%	2.1%	1.6%	12.4%

SES

SES					
	Mean	Median	Std. Deviation	Minimum	Maximum
Disposable household income [in thousands of euros]	39.41	36.3	13.17	29.2	113
% Completed higher education (HBO or WO)	30.8%	28,0%	14.3%	13,0%	64,0%

Social safety

Social safety					
	Mean	Median	Std. Deviation	Minimum	Maximum
Bicycle theft is a common neighborhood problem	18.7%	18.8%	8.2%	1,0%	31.4%
Theft from cars is a common neighborhood problem	8.3%	7.6%	3.9%	0.4%	22.3%
Auto theft in own neighborhood in the past year as a percentage of the total number of cars	1.5%	0.9%	1.4%	0,0%	5.6%
Theft from cars in own neighborhood in the past year as a percentage of the total number of cars	5.6%	5.5%	3.4%	0,0%	16.6%
Bicycle theft in own neighborhood in the past year as a percentage of the total number of bicycles	13.5%	15,0%	7.7%	0,0%	29.5%
Percentage of residents who have been victims of other theft in the past year in their own neighborhood	3.9%	3.7%	1.9%	0,0%	8.7%
Percentage of residents who have been victims of purse snatching without violence in the past year in their own neighborhood	1,0%	0.8%	0.9%	0,0%	3.6%
Threats are a common neighborhood problem	7.8%	7.1%	5.7%	0,0%	25.4%
Violent offenses are a common neighborhood problem	8.5%	7,0%	7.1%	0,0%	28.1%
Purse snatching with violence is a common neighborhood problem	4.6%	3.6%	4.1%	0,0%	18.3%
Percentage of residents who have been victims of purse snatching with violence in the past year in their own neighborhood	0.4%	0,0%	0.5%	0,0%	2,0%
Percentage of residents who have been victims of threats with violence in the past year in their own neighborhood	3.4%	3.3%	2,0%	0.6%	8.6%
Percentage of residents who have been victims of assault in the past year in their own neighborhood	1.1%	0.8%	1.1%	0,0%	4.1%
Residential burglary is a common neighborhood problem	11.2%	9.5%	7.8%	1.7%	38.6%
Percentage of residents who have been victims of attempted burglary in the past year	3.4%	2.6%	2.3%	0,0%	10.2%
Percentage of residents who have been victims of burglary in the past year	1.9%	1.6%	1.5%	0,0%	7.1%
Graffiti on walls and/or buildings is a common neighborhood problem	10.9%	10.4%	6.5%	0,0%	28.5%
Vandalism of telephone booths, bus or tram shelters is a common neighborhood problem	8,0%	6.9%	5.9%	0,0%	24.9%
Vandalism/theft from cars is a common neighborhood problem	12.4%	12,0%	5.7%	2,0%	27.1%
Damaged/broken benches, trash cans, etc. are a common neighborhood problem	8.3%	7.4%	5.1%	0.6%	22.4%

Percentage of residents who have been victims of other vandalism in the past year in their own neighborhood	7.9%	7.2%	3.8%	0.9%	16.2%
Vandalism/theft from cars in own neighborhood in the past year as a percentage of the total number of cars	20.7%	21.4%	6.4%	8.7%	34.7%
Trouble caused by groups of young people in the own neighborhood is frequently perceived as bothersome	11,0%	11.2%	7.2%	0.6%	31.4%
Quarreling and/or shouting young people on the street in the own neighborhood is frequently perceived as bothersome	11.6%	11,0%	7.2%	0.6%	33.9%
Bother caused by young people who harass or intimidate residents in the own neighborhood is frequently perceived as bothersome	3.3%	2.7%	2.5%	0,0%	9.8%
Drug nuisance in the own neighborhood is frequently perceived as bothersome	11,0%	9,0%	8.3%	1,0%	34,0%
Coming and going of drug addicts in your street is frequently perceived as bothersome	8.7%	6.7%	7.9%	0,0%	35.3%
Street-level drug dealing in the own neighborhood is frequently perceived as bothersome	9.1%	7.7%	7.3%	0,0%	35.9%
Harassment of women and men on the street in the own neighborhood is frequently perceived as bothersome	7.8%	5.8%	6.4%	0,0%	29.4%
Nuisance caused by neighbors is frequently perceived as bothersome	11.2%	10.4%	5.9%	2,0%	25.7%

Social environment

Social environment					
	Mean	Median	Std. Deviation	Minimum	Maximum
% residents who have been involved in making plans for the neighborhood or city. (objective)	28.4%	29,0%	5.9%	19.2%	44.2%
% of residents who say that neighbors know each other	36.2%	32.5%	12,0%	15.1%	72,0%
% % of residents who say that neighbors interact frequently	28.4%	27.1%	9.1%	9.4%	51.9%
% of residents who say that neighbors share opinions	30,0%	28,0%	9.1%	16,0%	54.2%
% of residents who say that neighbors help each other	54.4%	52.6%	10.5%	37.6%	75.8%
% of residents who say they feel at home with neighbors	53.1%	52.7%	10.3%	28.2%	75,0%
% of residents who say that young and old get along well in the neighborhood	48.1%	44.9%	10.2%	25.6%	71.3%

% of residents who feel connected to the neighborhood	52.2%	51.5%	9.3%	33.5%	71.9%
% of residents who feel responsible for the neighborhood	84.5%	84.4%	4.3%	76.4%	94.8%
% of residents who provide neighborly help	40.5%	39.3%	5,0%	31.6%	52.2%
% of residents who have lived in the neighborhood for a long time	42.9%	42.3%	7.2%	18.7%	55.9%
% likelihood of moving away from the neighborhood	19.3%	18,0%	9.7%	3.7%	44,0%

Social network

Social network					
	Mean	Median	Std. Deviation	Minimum	Maximum
% of residents who report knowing enough people to talk to	58.8%	58.6%	6.9%	45.2%	73.9%
% of residents who report having enough interest from close family members	72.2%	71.9%	8,0%	52.3%	88.3%
% of residents who report having enough interest from others	81.1%	81.4%	6,0%	69.7%	93.8%
% of residents who say they know enough people for help and advice	77.3%	77.4%	5.3%	67.9%	86.9%

Life events

Life events					
	Mean	Median	Std. Deviation	Minimum	Maximum
% residents who have only recently moved to the Netherlands	4.4%	3.5%	3.9%	0.8%	26.3%

Activities

Activities					
	Mean	Median	Std. Deviation	Minimum	Maximum
% that engages in volunteer work, 18 years and older	18.5%	18,0%	4.6%	10,0%	29,0%

% of residents who visit a hobby club or association monthly	23.3%	23,0%	6,0%	11.1%	39.4%
% of residents who participate in sports weekly	47.9%	49.1%	9.5%	21.5%	71.4%
% that meets the physical activity guideline 2017, 18 years and older	46.1%	45,0%	7.8%	27,0%	63,0%

Health

Health					
	Mean	Median	Std. Deviation	Minimum	Maximum
Limited by one or more chronic conditions	27,0%	26,0%	5.7%	16,0%	42,0%
At least 1 mental health condition	10.1%	10,0%	3.4%	3,0%	19,0%
Drugs (soft drugs/hard drugs) (in the past 4 weeks)	10.1%	9,0%	4.4%	4,0%	19,0%
Smokes	20.8%	20,0%	5.2%	13,0%	37,0%
Has overweight (moderate and severe)	48.9%	48,0%	10.3%	26,0%	69,0%
Mobility limitation	12.2%	12,0%	5.5%	3,0%	27,0%

Appendix VIII – Correlation analyses to reduce number of variables

The correlation analyses for each topic are shown in this appendix. This is done in order to determine which variables should be included in the factor analyses and which variables should be excluded. Variables that do not have a relationship with loneliness are shown in red.

Dwelling

		Moderately to severely lonely, 18 years and older [%] [2020]	% satisfaction with housing size	% satisfaction with housing type	% satisfaction with size of outdoor space	% satisfaction with outside noise insulation	% satisfaction with insulation from neighbors	average property value per square meter of living space	% homes with over-occupancy	% satisfied with maintenance of own home
Moderately to severely lonely, 18 years and older [%] [2020]	**Pearson Correlation**	1	-,542**	-,589**	-0.232	-,459**	-,415**	-,636**	,461**	-,560**
	Sig. (2-tailed)		0.000	0.000	0.094	0.001	0.002	0.000	0.001	0.000
	N	53	53	53	53	53	53	53	53	53
% satisfaction with housing size	**Pearson Correlation**	-,542**	1	,873**	,737**	,803**	,731**	,300*	-,580**	,712**
	Sig. (2-tailed)	2.7213E-05		0.000	0.000	0.000	0.000	0.029	0.000	0.000
	N	53	53	53	53	53	53	53	53	53
% satisfaction with housing type	**Pearson Correlation**	-,589**	,873**	1	,687**	,769**	,716**	,473**	-,642**	,754**
	Sig. (2-tailed)	3.4452E-06	0.000		0.000	0.000	0.000	0.000	0.000	0.000
	N	53	53	53	53	53	53	53	53	53
% satisfaction with size of outdoor space	**Pearson Correlation**	0	,737**	,687**	1.000	,708**	,701**	0.04507877	-,377**	,646**
	Sig. (2-tailed)	0.09425455	0.000	0.000		0.000	0.000	0.749	0.005	0.000
	N	53	53	53	53	53	53	53	53	53
% satisfaction with outside noise insulation	**Pearson Correlation**	-,459**	,803**	,769**	,708**	1	,885**	0.26221551	-,470**	,774**
	Sig. (2-tailed)	0.00053982	0.000	0.000	0.000		0.000	0.058	0.000	0.000
	N	53	53	53	53	53	53	53	53	53
% satisfaction with insulation from neighbors	**Pearson Correlation**	-,415**	,731**	,716**	,701**	,885**	1	0.18959787	-,301*	,797**
	Sig. (2-tailed)	0.00203008	0.000	0.000	0.000	0.000		0.174	0.029	0.000
	N	53	53	53	53	53	53	53	53	53
average property value per square meter of living space	**Pearson Correlation**	-,636**	,300*	,473**	0.045	0.26221551	0.18959787	1	-,513**	,442**
	Sig. (2-tailed)	3.1404E-07	0.029	0.000	0.749	0.058	0.174		0.000	0.001
	N	53	53	53	53	53	53	53	53	53
% homes with over-occupancy	**Pearson Correlation**	,461**	-,580**	-,642**	-,377**	-,470**	-,301*	-,513**	1	-,460**
	Sig. (2-tailed)	0.00050557	0.000	0.000	0.005	0.000	0.029	0.000		0.001
	N	53	53	53	53	53	53	53	53	53
% satisfied with maintenance of own home	**Pearson Correlation**	-,560**	,712**	,754**	,646**	,774**	,797**	,442**	-,460**	1
	Sig. (2-tailed)	1.2885E-05	0.000	0.000	0.000	0.000	0.000	0.001	0.001	
	N	53	53	53	53	53	53	53	53	53

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

General quality

		Moderately to severely lonely, 18 years and older [%] [2020]	CROW score clean (average)	CROW score intact (average)	% often bothered by litter	% often bothered by garbage next to the container	% often dog poop	appreciation of neighborhood buildings	% satisfied with maintenance of buildings in the neighborhood	% a lot of odor pollution from sewage systems outside	A satisfactory rating (8 or higher) for the living environment, 18 years and older [%] [2020].
Moderately to severely lonely, 18 years and older [%] [2020]	**Pearson Correlation**	1	-0,2121962	-,355**	,545**	,371**	,319*	-,750**	-,665**	,499**	-,660**
	Sig. (2-tailed)		0,127	0,009	0,000	0,006	0,020	0,000	0,000	0,000	0,000
	N	53	53	53	53	53	53	53	53	53	53
CROW score clean (average)	**Pearson Correlation**	0	1	-0,1639662	-,556**	-,550**	0,20088697	,337*	,416**	-,393**	,353**
	Sig. (2-tailed)	0,12715813		0,241	0,000	0,000	0,149	0,014	0,002	0,004	0,010
	N	53	53	53	53	53	53	53	53	53	53
CROW score intact (average)	**Pearson Correlation**	-,355**	-0,1639662	1	-0,248	-0,2104789	-,416**	,404**	,382**	-0,2504896	,397**
	Sig. (2-tailed)	0,00919504	0,241		0,073	0,130	0,002	0,003	0,005	0,070	0,003
	N	53	53	53	53	53	53	53	53	53	53
% often bothered by litter	**Pearson Correlation**	,545**	-,556**	-0,2479579	1,000	,897**	0,21029685	-,785**	-,852**	,570**	-,824**
	Sig. (2-tailed)	2,4324E-05	0,000	0,073		0,000	0,131	0,000	0,000	0,000	0,000
	N	53	53	53	53	53	53	53	53	53	53
% often bothered by garbage next to the container	**Pearson Correlation**	,371**	-,550**	-0,2104789	,897**	1	0,03784467	-,636**	-,764**	,375**	-,674**
	Sig. (2-tailed)	0,00627843	0,000	0,130	0,000		0,788	0,000	0,000	0,006	0,000
	N	53	53	53	53	53	53	53	53	53	53
% often dog poop	**Pearson Correlation**	,319*	0,20088697	-,416**	0,210	0,03784467	1	-,416**	-,291*	0,2682344	-,382**
	Sig. (2-tailed)	0,02002304	0,149	0,002	0,131	0,788		0,002	0,034	0,052	0,005
	N	53	53	53	53	53	53	53	53	53	53
appreciation of neighborhood buildings	**Pearson Correlation**	-,750**	,337*	,404**	-,785**	-,636**	-,416**	1	,903**	-,539**	,848**
	Sig. (2-tailed)	1,0211E-10	0,014	0,003	0,000	0,000	0,002		0,000	0,000	0,000
	N	53	53	53	53	53	53	53	53	53	53
% satisfied with maintenance of buildings in the neighborhood	**Pearson Correlation**	-,665**	,416**	,382**	-,852**	-,764**	-,291*	,903**	1	-,505**	,840**
	Sig. (2-tailed)	5,4379E-08	0,002	0,005	0,000	0,000	0,034	0,000		0,000	0,000
	N	53	53	53	53	53	53	53	53	53	53
% a lot of odor pollution from sewage systems outside	**Pearson Correlation**	,499**	-,393**	-0,2504896	,570**	,375**	0,2682344	-,539**	-,505**	1	-,641**
	Sig. (2-tailed)	0,00014062	0,004	0,070	0,000	0,006	0,052	0,000	0,000		0,000
	N	53	53	53	53	53	53	53	53	53	53
A satisfactory rating (8 or higher) for the living environment, 18 years and older [%] [2020].	**Pearson Correlation**	-,660**	,353**	,397**	-,824**	-,674**	-,382**	,848**	,840**	-,641**	1
	Sig. (2-tailed)	7,7097E-08	0,010	0,003	0,000	0,000	0,005	0,000	0,000	0,000	
	N	53	53	53	53	53	53	53	53	53	53

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Amenities

		Moderately to severely lonely, 18 years and older [%] [2020]	% satisfied with overall amenities	% sufficient presence of shops for daily groceries	% sufficient presence of primary healthcare providers	% sufficient presence of sports facilities	% of residents who say that there are enough places in the neighborhood for joint resident activities	% of residents who say that there are enough elderly facilities in the neighborhood	% of residents who say that there are enough leisure facilities for young people in the neighborhood
Moderately to severely lonely, 18 years and older [%] [2020]	**Pearson Correlation**	1	-,431**	0,15435477	0,038	-0,1846386	0,07096856	-0,0829818	0,24088335
	Sig. (2-tailed)		0,001	0,270	0,785	0,186	0,614	0,555	0,082
	N	53	53	53	53	53	53	53	53
% satisfied with overall amenities	**Pearson Correlation**	-,431**	1	,381**	,558**	,676**	,315*	,484**	0,11224545
	Sig. (2-tailed)	0,00127426		0,005	0,000	0,000	0,022	0,000	0,424
	N	53	53	53	53	53	53	53	53
% sufficient presence of shops for daily groceries	**Pearson Correlation**	0	,381**	1	,695**	0,10238272	-0,0676261	0,11722849	-0,1722783
	Sig. (2-tailed)	0,26978667	0,005		0,000	0,466	0,630	0,403	0,217
	N	53	53	53	53	53	53	53	53
% sufficient presence of primary healthcare providers	**Pearson Correlation**	0	,558**	,695**	1,000	,338*	0,17663584	0,24572246	0,17490007
	Sig. (2-tailed)	0,78455575	0,000	0,000		0,013	0,206	0,076	0,210
	N	53	53	53	53	53	53	53	53
% sufficient presence of sports facilities	**Pearson Correlation**	0	,676**	0,10238272	,338*	1	0,21972198	,560**	0,1117199
	Sig. (2-tailed)	0,1856528	0,000	0,466	0,013		0,114	0,000	0,426
	N	53	53	53	53	53	53	53	53
% of residents who say that there are enough places in the neighborhood for joint resident activities	**Pearson Correlation**	0	,315*	-0,0676261	0,177	0,21972198	1	,459**	,781**
	Sig. (2-tailed)	0,61357532	0,022	0,630	0,206	0,114		0,001	0,000
	N	53	53	53	53	53	53	53	53
% of residents who say that there are enough elderly facilities in the neighborhood	**Pearson Correlation**	0	,484**	0,11722849	0,246	,560**	,459**	1	,371**
	Sig. (2-tailed)	0,55470015	0,000	0,403	0,076	0,000	0,001		0,006
	N	53	53	53	53	53	53	53	53
% of residents who say that there are enough leisure facilities for young people in the neighborhood	**Pearson Correlation**	0	0,11224545	-0,1722783	0,175	0,1117199	,781**	,371**	1
	Sig. (2-tailed)	0,08229415	0,424	0,217	0,210	0,426	0,000	0,006	
	N	53	53	53	53	53	53	53	53

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Urban density

		Moderately to severely lonely, 18 years and older [%] [2020]	Residential density (inhabitants per km2)	Urban density
Moderately to severely lonely, 18 years and older [%] [2020]	**Pearson Correlation**	1	0,22367138	-0,2332006
	Sig. (2-tailed)		0,107	0,093
	N	53	53	53
Residential density (inhabitants per km2)	**Pearson Correlation**	0	1	-,480**
	Sig. (2-tailed)	0,10739897		0,000
	N	53	53	53
Urban density	**Pearson Correlation**	0	-,480**	1
	Sig. (2-tailed)	0,09285982	0,000	
	N	53	53	53

**. Correlation is significant at the 0.01 level (2-tailed).

Mobility

		Moderately to severely lonely, 18 years and older [%] [2020]	% of homes within norm distance of bus stops	% of homes within norm distance of metro stations	% of homes within norm distance of tram stops	% satisfaction with maintenance of bike paths	% satisfaction with maintenance of sidewalks	% satisfaction with bike path safety	% satisfaction with sidewalk safety	% often parked on the sidewalk	% sufficient presence of public transportation
Moderately to severely lonely, 18 years and older [%] [2020]	**Pearson Correlation**	1	0,03731781	0,09998716	0,140	-,408**	-,375**	-0,2315296	-,443**	,387**	0,21361772
	Sig. (2-tailed)		0,791	0,476	0,316	0,002	0,006	0,095	0,001	0,004	0,125
	N	53	53	53	53	53	53	53	53	53	53
% of homes within norm distance of bus stops	**Pearson Correlation**	0	1	-0,1374794	-0,128	-0,0736723	-0,1007867	-0,0199381	-0,039437	0,05807156	-0,2543961
	Sig. (2-tailed)	0,79078461		0,326	0,360	0,600	0,473	0,887	0,779	0,680	0,066
	N	53	53	53	53	53	53	53	53	53	53
% of homes within norm distance of metro stations	**Pearson Correlation**	0	-0,1374794	1	0,015	0,01479159	0,14049179	-0,1389307	0,09741705	0,07019883	,382**
	Sig. (2-tailed)	0,47624915	0,326		0,913	0,916	0,316	0,321	0,488	0,617	0,005
	N	53	53	53	53	53	53	53	53	53	53
% of homes within norm distance of tram stops	**Pearson Correlation**	0	-0,1281528	0,01540232	1,000	-,370**	0,12108783	-,622**	0,04845339	,330*	,294*
	Sig. (2-tailed)	0,3157027	0,360	0,913		0,006	0,388	0,000	0,730	0,016	0,032
	N	53	53	53	53	53	53	53	53	53	53
% satisfaction with maintenance of bike paths	**Pearson Correlation**	-,408**	-0,0736723	0,01479159	-,370**	1	,497**	,839**	,504**	-,359**	-0,0966676
	Sig. (2-tailed)	0,00240311	0,600	0,916	0,006		0,000	0,000	0,000	0,008	0,491
	N	53	53	53	53	53	53	53	53	53	53
% satisfaction with maintenance of sidewalks	**Pearson Correlation**	-,375**	-0,1007867	0,14049179	0,121	,497**	1	0,25093304	,837**	-0,1124649	-0,0938064
	Sig. (2-tailed)	0,00560661	0,473	0,316	0,388	0,000		0,070	0,000	0,423	0,504
	N	53	53	53	53	53	53	53	53	53	53
% satisfaction with bike path safety	**Pearson Correlation**	0	-0,0199381	-0,1389307	-,622**	,839**	0,25093304	1	,305*	-,383**	-0,2273161
	Sig. (2-tailed)	0,09529187	0,887	0,321	0,000	0,000	0,070		0,026	0,005	0,102
	N	53	53	53	53	53	53	53	53	53	53
% satisfaction with sidewalk safety	**Pearson Correlation**	-,443**	-0,039437	0,09741705	0,048	,504**	,837**	,305*	1	-0,1454277	-0,2594338
	Sig. (2-tailed)	0,00089484	0,779	0,488	0,730	0,000	0,000	0,026		0,299	0,061
	N	53	53	53	53	53	53	53	53	53	53
% often parked on the sidewalk	**Pearson Correlation**	,387**	0,05807156	0,07019883	,330*	-,359**	-0,1124649	-,383**	-0,1454277	1	0,2414599
	Sig. (2-tailed)	0,00415166	0,680	0,617	0,016	0,008	0,423	0,005	0,299		0,082
	N	53	53	53	53	53	53	53	53	53	53
% sufficient presence of public transportation	**Pearson Correlation**	0	-0,2543961	,382**	,294*	-0,0966676	-0,0938064	-0,2273161	-0,2594338	0,2414599	1
	Sig. (2-tailed)	0,12457126	0,066	0,005	0,032	0,491	0,504	0,102	0,061	0,082	
	N	53	53	53	53	53	53	53	53	53	53

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Green

		Moderately to severely lonely, 18 years and older [%] [2020]	Trees per km2	Green per km2	Benches per km2	% sufficient presence of green areas (lawns, trees)	% sufficient presence of recreational green areas (picnics, sports, games)	% satisfaction with attractiveness of canals, ditches, and ponds	CROW score green (average)	A satisfactory rating (8 or higher) for green spaces, 19 years and older [%]
Moderately to severely lonely, 18 years and older [%] [2020]	**Pearson Correlation**	1	0,22999485	0,06039294	0,184	-0,2356254	-,299*	-,415**	-0,2153301	-,325*
	Sig. (2-tailed)		0,098	0,668	0,187	0,089	0,030	0,002	0,122	0,018
	N	53	53	53	53	53	53	53	53	53
Trees per km2	**Pearson Correlation**	0	1	,279*	,520**	-0,1343488	-0,1967477	0,16973714	0,14988835	-0,1986194
	Sig. (2-tailed)	0,09756908		0,043	0,000	0,338	0,158	0,224	0,284	0,154
	N	53	53	53	53	53	53	53	53	53
Green per km2	**Pearson Correlation**	0	,279*	1	-0,270	,616**	,462**	,396**	-,348*	,610**
	Sig. (2-tailed)	0,66750426	0,043		0,051	0,000	0,000	0,003	0,011	0,000
	N	53	53	53	53	53	53	53	53	53
Benches per km2	**Pearson Correlation**	0	,520**	-0,2695639	1,000	-,670**	-,510**	-,278*	,492**	-,651**
	Sig. (2-tailed)	0,1868414	0,000	0,051		0,000	0,000	0,044	0,000	0,000
	N	53	53	53	53	53	53	53	53	53
% sufficient presence of green areas (lawns, trees)	**Pearson Correlation**	0	-0,1343488	,616**	-,670**	1	,853**	,599**	-,415**	,865**
	Sig. (2-tailed)	0,08941686	0,338	0,000	0,000		0,000	0,000	0,002	0,000
	N	53	53	53	53	53	53	53	53	53
% sufficient presence of recreational green areas (picnics, sports, games)	**Pearson Correlation**	-,299*	-0,1967477	,462**	-,510**	,853**	1	,468**	-0,2235561	,812**
	Sig. (2-tailed)	0,02970431	0,158	0,000	0,000	0,000		0,000	0,108	0,000
	N	53	53	53	53	53	53	53	53	53
% satisfaction with attractiveness of canals, ditches, and ponds	**Pearson Correlation**	-,415**	0,16973714	,396**	-,278*	,599**	,468**	1	-0,2150316	,602**
	Sig. (2-tailed)	0,00199405	0,224	0,003	0,044	0,000	0,000		0,122	0,000
	N	53	53	53	53	53	53	53	53	53
CROW score green (average)	**Pearson Correlation**	0	0,14988835	-,348*	,492**	-,415**	-0,2235561	-0,2150316	1	-,380**
	Sig. (2-tailed)	0,12150825	0,284	0,011	0,000	0,002	0,108	0,122		0,005
	N	53	53	53	53	53	53	53	53	53
A satisfactory rating (8 or higher) for green spaces, 19 years and older [%]	**Pearson Correlation**	-,325*	-0,1986194	,610**	-,651**	,865**	,812**	,602**	-,380**	1
	Sig. (2-tailed)	0,01773123	0,154	0,000	0,000	0,000	0,000	0,000	0,005	
	N	53	53	53	53	53	53	53	53	53

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

2.7 Composition

		Moderately to severely lonely, 18 years and older [%] [2020]	% Residents with Western migration background	% Residents with non-Western migration background	% Single-person households	% Households without children	% Households with children	% Single-parent families	% men	% women	% 0 to 15 years	% 15 to 25 years	% 25 to 45 years	% 45 to 65 years	% 65 years or older	% unmarried	% married	% divorced	% widowed
Moderately to severely lonely, 18 years and older [%] [2020]	**Pearson Correlation**	1	0,07491799	,581**	0,171	-,528**	-0,1685186	,559**	0,08723938	-0,087	-0,1082125	-0,097	-0,0867047	,274*	0,079	-0,082	0,01102087	0,24490354	0,087
	Sig. (2-tailed)		0,594	0,000	0,220	0,000	0,228	0,000	0,534	0,534	0,441	0,489	0,537	0,047	0,575	0,558	0,938	0,077	0,538
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
% Residents with Western migration background	**Pearson Correlation**	0	1	-0,0340117	,619**	-0,2436362	-,537**	-,341*	0,18638233	-0,186	0,18020477	0,008	0,03032501	-0,029199	-0,150	0,084	-0,0475942	-0,0728317	-0,119
	Sig. (2-tailed)	0,59392561		0,809	0,000	0,079	0,000	0,012	0,181	0,181	0,197	0,954	0,829	0,836	0,285	0,552	0,735	0,604	0,395
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
% Residents with non-Western migration background	**Pearson Correlation**	,581**	-0,0340117	1	0,157	-,795**	-0,0413693	,645**	0,21385894	-0,214	0,12966715	-0,046	-0,1530888	0,26930146	-0,039	-0,163	0,19802434	0,03240064	-0,012
	Sig. (2-tailed)	5,0003E-06	0,809		0,261	0,000	0,769	0,000	0,124	0,124	0,355	0,742	0,274	0,051	0,784	0,244	0,155	0,818	0,929
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
% Single-person households	**Pearson Correlation**	0	,619**	0,15704073	1,000	-,441**	-,927**	-,405**	0,13966315	-0,1396631	-0,0258538	0,048	0,11242855	-0,0228572	-0,140	0,153	-0,1107318	-0,0852474	-0,182
	Sig. (2-tailed)	0,21958213	0,000	0,261		0,001	0,000	0,003	0,319	0,319	0,854	0,732	0,423	0,871	0,317	0,275	0,430	0,544	0,191
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
% Households without children	**Pearson Correlation**	-,528**	-0,2436362	-,795**	-,441**	1	0,21890675	-,441**	-0,2683102	0,26831022	-0,0879838	0,042	0,03586462	-0,1959825	0,110	0,064	-0,1191854	0,04079907	0,093
	Sig. (2-tailed)	4,8618E-05	0,079	0,000	0,001		0,115	0,001	0,052	0,052	0,531	0,764	0,799	0,160	0,433	0,650	0,395	0,772	0,506
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
% Households with children	**Pearson Correlation**	0	-,537**	-0,0413693	-,927**	0,21890675	1	,346*	-0,0194113	0,01941133	0,07332163	-0,020	-0,076781	0,00871462	0,052	-0,127	0,11668399	0,04677519	0,094
	Sig. (2-tailed)	0,22772912	0,000	0,769	0,000	0,115		0,011	0,890	0,890	0,602	0,885	0,585	0,951	0,710	0,364	0,405	0,739	0,502
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
% Single-parent families	**Pearson Correlation**	,559**	-,341*	,645**	-,405**	-,441**	,346*	1	-0,0199423	0,01994228	0,07617171	-0,186	-0,238431	,339*	0,160	-,284*	0,25284545	0,12721882	0,215
	Sig. (2-tailed)	1,3736E-05	0,012	0,000	0,003	0,001	0,011		0,887	0,887	0,588	0,182	0,086	0,013	0,252	0,039	0,068	0,364	0,123
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
% men	**Pearson Correlation**	0	0,18638233	0,21385894	0,140	-0,2683102	-0,0194113	-0,0199423	1	-1,000**	-0,0468781	0,187	,564**	-0,2398536	-,642**	,465**	-,337*	-0,2294774	-,579**
	Sig. (2-tailed)	0,53449837	0,181	0,124	0,319	0,052	0,890	0,887		0,000	0,739	0,180	0,000	0,084	0,000	0,000	0,014	0,098	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
% women	**Pearson Correlation**	0	-0,1863823	-0,2138589	-0,140	0,26831022	0,01941133	0,01994228	-1,000**	1	0,04687813	-0,187	-,564**	0,23985363	,642**	-,465**	,337*	0,22947737	,579**
	Sig. (2-tailed)	0,53449837	0,181	0,124	0,319	0,052	0,890	0,887	0,000		0,739	0,180	0,000	0,084	0,000	0,000	0,014	0,098	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
% 0 to 15 years	**Pearson Correlation**	0	0,18020477	0,12966715	-0,026	-0,0879838	0,07332163	0,07617171	-0,0468781	0,04687813	1	-,447**	-,394**	,398**	-0,139	-,394**	,508**	0,04257041	-0,095
	Sig. (2-tailed)	0,44053954	0,197	0,355	0,854	0,531	0,602	0,588	0,739	0,739		0,001	0,004	0,003	0,320	0,004	0,000	0,762	0,499
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
% 15 to 25 years	**Pearson Correlation**	0	0,00804723	-0,0463637	0,048	0,04222687	-0,020	-0,1863164	0,18699251	-0,187	-,447**	1,000	,343*	-,654**	-,422**	,643**	-,578**	-,319*	-,444**
	Sig. (2-tailed)	0,48890283	0,954	0,742	0,732	0,764	0,885	0,182	0,180	0,180	0,001		0,012	0,000	0,002	0,000	0,000	0,020	0,001
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
% 25 to 45 years	**Pearson Correlation**	0	0,03032501	-0,1530888	0,112	0,03586462	-0,077	-0,238431	,564**	-,564**	-,394**	,343*	1	-,741**	-,732**	,894**	-,813**	-,362**	-,657**
	Sig. (2-tailed)	0,53701562	0,829	0,274	0,423	0,799	0,585	0,086	0,000	0,000	0,004	0,012		0,000	0,000	0,000	0,000	0,008	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
% 45 to 65 years	**Pearson Correlation**	,274*	-0,029199	0,26930146	-0,023	-0,1959825	0,009	,339*	-0,2398536	0,240	,398**	-,654**	-,741**	1	,474**	-,829**	,829**	,308*	,388**
	Sig. (2-tailed)	0,04679696	0,836	0,051	0,871	0,160	0,951	0,013	0,084	0,084	0,003	0,000	0,000		0,000	0,000	0,000	0,025	0,004
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
% 65 years or older	**Pearson Correlation**	0	-0,149552	-0,0385844	-0,140	0,10993876	0,052	0,1602456	-,642**	,642**	-0,1392306	-,422**	-,732**	,474**	1	-,765**	,539**	,450**	,947**
	Sig. (2-tailed)	0,57490912	0,285	0,784	0,317	0,433	0,710	0,252	0,000	0,000	0,320	0,002	0,000	0,000		0,000	0,000	0,001	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
% unmarried	**Pearson Correlation**	0	0,08352114	-0,1628942	0,153	0,06377678	-0,127	-,284*	,465**	-,465**	-,394**	,643**	,894**	-,829**	-,765**	1,000	-,925**	-,372**	-,710**
	Sig. (2-tailed)	0,55774544	0,552	0,244	0,275	0,650	0,364	0,039	0,000	0,000	0,004	0,000	0,000	0,000	0,000		0,000	0,006	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
% married	**Pearson Correlation**	0	-0,0475942	0,19802434	-0,111	-0,1191854	0,117	0,25284545	-,337*	,337*	,508**	-,578**	-,813**	,829**	,539**	-,925**	1	0,04769934	,443**
	Sig. (2-tailed)	0,93757169	0,735	0,155	0,430	0,395	0,405	0,068	0,014	0,014	0,000	0,000	0,000	0,000	0,000	0,000		0,734	0,001
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
% divorced	**Pearson Correlation**	0	-0,0728317	0,03240064	-0,085	0,04079907	0,047	0,12721882	-0,2294774	0,229	0,04257041	-,319*	-,362**	,308*	,450**	-,372**	0,04769934	1	,489**
	Sig. (2-tailed)	0,07715549	0,604	0,818	0,544	0,772	0,739	0,364	0,098	0,098	0,762	0,020	0,008	0,025	0,001	0,006	0,734		0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
% widowed	**Pearson Correlation**	0	-0,1191592	-0,0124757	-0,182	0,0933421	0,094	0,21472235	-,579**	,579**	-0,0948231	-,444**	-,657**	,388**	,947**	-,710**	,443**	,489**	1,000
	Sig. (2-tailed)	0,5379737	0,395	0,929	0,191	0,506	0,502	0,123	0,000	0,000	0,499	0,001	0,000	0,004	0,000	0,000	0,001	0,000	
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

SES

		Moderately to severely lonely, 18 years and older [%] [2020]	Disposable household income [in thousands of euros]	% Completed higher education (HBO or WO), 15 to 75 years old
Moderately to severely lonely, 18 years and older [%] [2020]	**Pearson Correlation**	1	-,554**	-,629**
	Sig. (2-tailed)		0,000	0,000
	N	53	53	53
Disposable household income [in thousands of euros]	**Pearson Correlation**	-,554**	1	,517**
	Sig. (2-tailed)	1,6899E-05		0,000
	N	53	53	53
% Completed higher education (HBO or WO), 15 to 75 years old	**Pearson Correlation**	-,629**	,517**	1
	Sig. (2-tailed)	4,6748E-07	0,000	
	N	53	53	53

**. Correlation is significant at the 0.01 level (2-tailed).

Social safety

		Moderately to severely lonely, 18 years and older [%] [2020]	Bicycle theft is a common neighborhood problem	Theft from cars is a common neighborhood problem	Auto theft in own neighborhood in the past year as a percentage of the total number of cars	Theft from cars in own neighborhood in the past year as a percentage of the total number of cars	Bicycle theft in own neighborhood in the past year as a percentage of the total number of bicycles	Percentage of residents who have been victims of other theft in the past year in their own neighborhood	Percentage of residents who have been victims of purse snatching without violence in the past year in their own neighborhood	Threats are a common neighborhood problem	Violent offenses are a common neighborhood problem	Purse snatching with violence is a common neighborhood problem	Percentage of residents who have been victims of purse snatching with violence in the past year in their own neighborhood	Percentage of residents who have been victims of threats with violence in the past year in their own neighborhood	Percentage of residents who have been victims of assault in the past year in their own neighborhood	Residential burglary is a common neighborhood problem	Percentage of residents who have been victims of attempted burglary in the past year	Percentage of residents who have been victims of burglary in the past year	Graffiti on walls and/or buildings is a common neighborhood problem	Vandalism of telephone booths, bus or tram shelters is a common neighborhood problem	Vandalism/theft from cars is a common neighborhood problem	Damaged/broken benches, trash cans, etc. are a common neighborhood problem	Percentage of residents who have been victims of other vandalism in the past year in their own neighborhood	Vandalism/theft from cars in own neighborhood in the past year as a percentage of the total number of cars	Trouble caused by groups of young people in the own neighborhood is frequently perceived as bothersome	Quarreling and/or shouting young people on the street in the own neighborhood is frequently perceived as bothersome	Bother caused by young people who harass or intimidate residents in the own neighborhood is frequently perceived as bothersome	Drug nuisance in the own neighborhood is frequently perceived as bothersome	Coming and going of drug addicts in your street is frequently perceived as bothersome	Street-level drug dealing in the own neighborhood is frequently perceived as bothersome	Harassment of women and men on the street in the own neighborhood is frequently perceived as bothersome	Nuisance caused by neighbors is frequently perceived as bothersome
Moderately to severely lonely, 18 years and older [%] [2020]	**Pearson Correlation**	1	0,1640317	0,22183821	0,139	,349*	0,10634459	,272*	,298*	,366**	,419**	,415**	,400**	0,18128171	0,08570725	,342*	,402**	,401**	,364**	,454**	,444**	,577**	0,175	,330*	,330*	,368**	,413**	,392**	,378**	,307*	,361**	,553**
	Sig. (2-tailed)		0,241	0,110	0,322	0,010	0,449	0,049	0,030	0,007	0,002	0,002	0,003	0,194	0,542	0,012	0,003	0,003	0,007	0,001	0,001	0,000	0,210	0,016	0,016	0,007	0,002	0,004	0,005	0,025	0,008	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Bicycle theft is a common neighborhood problem	**Pearson Correlation**	0	1	,283*	,271*	,509**	,786**	,426**	,507**	,655**	,561**	,515**	-0,0302	,595**	,460**	0,170846	,456**	,347*	,693**	-0,2120	,533**	0,25891389	,637**	,657**	,550**	,650**	,603**	,599**	,695**	,591**	,717**	,665**
	Sig. (2-tailed)	0,2405298		0,040	0,050	0,000	0,000	0,001	0,000	0,000	0,000	0,000	0,830	0,000	0,001	0,221	0,001	0,011	0,000	0,127	0,000	0,061	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Theft from cars is a common neighborhood problem	**Pearson Correlation**	0	,283*	1	0,252	0,25999891	0,15163317	0,17931789	0,24356387	,300*	,275*	0,23565801	0,22434941	0,11476337	0,18191956	,338*	0,156	0,1284227	0,1019077	0,05307486	,708**	0,1690342	0,019	0,24512111	,271*	0,24380868	,286*	0,26446046	,279*	0,22965421	0,2585241	0,17537806
	Sig. (2-tailed)	0,11038634	0,040		0,068	0,060	0,278	0,199	0,079	0,029	0,046	0,089	0,106	0,413	0,192	0,013	0,263	0,359	0,468	0,706	0,000	0,226	0,891	0,077	0,049	0,079	0,038	0,056	0,043	0,098	0,062	0,209
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Auto theft in own neighborhood in the past year as a percentage of the total number of cars	**Pearson Correlation**	0	,271*	0,25219224	1,000	,363**	,298*	0,11309896	0,14768401	0,22733661	0,262	0,19837642	-0,084601	0,08032542	-0,0778876	0,05767125	0,159	-0,0957144	0,25020229	0,02682245	,363**	0,14281615	0,170	,410**	,277*	,325*	0,16942805	0,23663639	0,246	0,21865954	,296*	,295*
	Sig. (2-tailed)	0,32231552	0,050	0,068		0,008	0,030	0,420	0,291	0,102	0,058	0,154	0,547	0,567	0,579	0,682	0,254	0,495	0,071	0,849	0,008	0,308	0,223	0,002	0,045	0,017	0,225	0,088	0,075	0,116	0,031	0,032
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Theft from cars in own neighborhood in the past year as a percentage of the total number of cars	**Pearson Correlation**	,349*	,509**	0,25999891	,363**	1	,507**	,294*	,285*	,333*	,317*	0,12540894	0,12901389	,390**	,311*	-0,0232494	,355**	0,22218808	,434**	-0,041132	,449**	0,0782402	,395**	,701**	,394**	,375**	,387**	,427**	,404**	,429**	,400**	,507**
	Sig. (2-tailed)	0,01039432	0,000	0,060	0,008		0,000	0,033	0,038	0,015	0,021	0,371	0,357	0,004	0,023	0,869	0,009	0,110	0,001	0,770	0,001	0,578	0,003	0,000	0,003	0,006	0,004	0,001	0,003	0,001	0,003	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Bicycle theft in own neighborhood in the past year as a percentage of the total number of bicycles	**Pearson Correlation**	0	,786**	0,15163317	,298*	,507**	1	,329*	,352**	,510**	,470**	,337*	-0,0506672	,537**	,370**	-0,1212874	,300*	,279*	,637**	-,368**	,389**	0,12593442	,709**	,777**	,427**	,532**	,460**	,537**	,635**	,555**	,627**	,571**
	Sig. (2-tailed)	0,44851547	0,000	0,278	0,030	0,000		0,016	0,010	0,000	0,000	0,014	0,719	0,000	0,006	0,387	0,029	0,043	0,000	0,007	0,004	0,369	0,000	0,000	0,001	0,000	0,001	0,000	0,000	0,000	0,000	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Percentage of residents who have been victims of other theft in the past year in their own neighborhood	**Pearson Correlation**	,272*	,426**	0,17931789	0,113	,294*	,329*	1	0,23084835	,528**	,524**	,454**	-0,0062123	,579**	,364**	,378**	,401**	,467**	,356**	,272*	,400**	,310*	,316*	,396**	,364**	,478**	,420**	,515**	,534**	,477**	,512**	,560**
	Sig. (2-tailed)	0,04914505	0,001	0,199	0,420	0,033	0,016		0,096	0,000	0,000	0,001	0,965	0,000	0,007	0,005	0,003	0,000	0,009	0,049	0,003	0,024	0,021	0,003	0,007	0,000	0,002	0,000	0,000	0,000	0,000	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Percentage of residents who have been victims of purse snatching without violence in the past year in their own neighborhood	**Pearson Correlation**	,298*	,507**	0,24356387	0,148	,285*	,352**	0,23084835	1	,443**	,435**	,387**	,347*	,422**	,595**	,332*	,488**	,342*	,424**	0,07055561	,475**	,427**	,318*	,398**	,435**	,488**	,419**	,425**	,414**	,321*	,490**	,502**
	Sig. (2-tailed)	0,03003546	0,000	0,079	0,291	0,038	0,010	0,096		0,001	0,001	0,004	0,011	0,002	0,000	0,015	0,000	0,012	0,002	0,616	0,000	0,001	0,020	0,003	0,001	0,000	0,002	0,002	0,002	0,019	0,000	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Threats are a common neighborhood problem	**Pearson Correlation**	,366**	,655**	,300*	0,227	,333*	,510**	,528**	,443**	1	,932**	,806**	0,16586486	,623**	,464**	,381**	,510**	,471**	,698**	0,22144408	,682**	,681**	,393**	,580**	,776**	,869**	,784**	,839**	,848**	,760**	,909**	,784**
	Sig. (2-tailed)	0,00711611	0,000	0,029	0,102	0,015	0,000	0,000	0,001		0,000	0,000	0,235	0,000	0,000	0,005	0,000	0,000	0,000	0,111	0,000	0,000	0,004	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Violent offenses are a common neighborhood problem	**Pearson Correlation**	,419**	,561**	,275*	0,262	,317*	,470**	,524**	,435**	,932**	1,000	,808**	0,16457123	,659**	,522**	,422**	,508**	,469**	,665**	0,24942488	,617**	,738**	,385**	,539**	,766**	,860**	,779**	,790**	,817**	,733**	,879**	,804**
	Sig. (2-tailed)	0,00179109	0,000	0,046	0,058	0,021	0,000	0,000	0,001	0,000		0,000	0,239	0,000	0,000	0,002	0,000	0,000	0,000	0,072	0,000	0,000	0,004	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Purse snatching with violence is a common neighborhood problem	**Pearson Correlation**	,415**	,515**	0,23565801	0,198	0,12540894	,337*	,454**	,387**	,806**	,808**	1	0,22613818	,504**	,474**	,645**	,514**	,452**	,617**	,323*	,557**	,759**	,330*	,379**	,628**	,725**	,689**	,605**	,664**	,531**	,705**	,685**
	Sig. (2-tailed)	0,00200888	0,000	0,089	0,154	0,371	0,014	0,001	0,004	0,000	0,000		0,103	0,000	0,000	0,000	0,000	0,001	0,000	0,018	0,000	0,000	0,016	0,005	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Percentage of residents who have been victims of purse snatching with violence in the past year in their own neighborhood	**Pearson Correlation**	,400**	-0,0301844	0,22434941	-0,085	0,1290	-0,0507	-0,0062	,347*	0,16586486	0,165	0,2261	1,0000	0,1253	0,2620	,421**	,306*	,404**	0,0606	,297*	,273*	0,26951221	0,096	0,1597	0,0419	0,0760	0,1448	0,06538472	0,033	-0,0007	0,0741	0,1489
	Sig. (2-tailed)	0,00302376	0,830	0,106	0,547	0,357	0,719	0,965	0,011	0,235	0,239	0,103		0,371	0,058	0,002	0,026	0,003	0,666	0,031	0,048	0,051	0,496	0,253	0,766	0,588	0,301	0,642	0,817	0,996	0,598	0,287
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Percentage of residents who have been victims of threats with violence in the past year in their own neighborhood	**Pearson Correlation**	0	,595**	0,11476337	0,080	,390**	,537**	,579**	,422**	,623**	,659**	,504**	0,12526977	1	,642**	,287*	,394**	,399**	,494**	-0,0481446	,356**	,303*	,507**	,533**	,501**	,593**	,553**	,607**	,672**	,567**	,668**	,576**
	Sig. (2-tailed)	0,19391821	0,000	0,413	0,567	0,004	0,000	0,000	0,002	0,000	0,000	0,000	0,371		0,000	0,037	0,004	0,003	0,000	0,732	0,009	0,028	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Percentage of residents who have been victims of assault in the past year in their own neighborhood	**Pearson Correlation**	0	,460**	0,18191956	-0,078	,311*	,370**	,364**	,595**	,464**	,522**	,474**	0,26199928	,642**	1	,339*	,454**	,405**	,441**	0,05352193	,397**	,391**	,384**	,430**	,392**	,442**	,412**	,402**	,472**	,339*	,445**	,491**
	Sig. (2-tailed)	0,54172655	0,001	0,192	0,579	0,023	0,006	0,007	0,000	0,000	0,000	0,000	0,058	0,000		0,013	0,001	0,003	0,001	0,703	0,003	0,004	0,005	0,001	0,004	0,001	0,002	0,003	0,000	0,013	0,001	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Residential burglary is a common neighborhood problem	**Pearson Correlation**	,342*	0,170846	,338*	0,058	-0,0232	-0,1213	,378**	,332*	,381**	,422**	,645**	,421**	,287*	,339*	1	,478**	,535**	0,1359	,502**	,423**	,491**	-0,087	0,0696	,293*	,281*	,316*	0,16954407	0,181	0,0487	0,2038	,321*
	Sig. (2-tailed)	0,01229147	0,221	0,013	0,682	0,869	0,387	0,005	0,015	0,005	0,002	0,000	0,002	0,037	0,013		0,000	0,000	0,332	0,000	0,002	0,000	0,535	0,621	0,033	0,041	0,021	0,225	0,194	0,729	0,143	0,019
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Percentage of residents who have been victims of attempted burglary in the past year	**Pearson Correlation**	,402**	,456**	0,1564793	0,159	,355**	,300*	,401**	,488**	,510**	,508**	,514**	,306*	,394**	,454**	,478**	1,000	,736**	,440**	0,22781358	,384**	,483**	,324*	,391**	,371**	,469**	,573**	,403**	,416**	,308*	,445**	,612**
	Sig. (2-tailed)	0,00286411	0,001	0,263	0,254	0,009	0,029	0,003	0,000	0,000	0,000	0,000	0,026	0,004	0,001	0,000		0,000	0,001	0,101	0,004	0,000	0,018	0,004	0,006	0,000	0,000	0,003	0,002	0,025	0,001	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Percentage of residents who have been victims of burglary in the past year	**Pearson Correlation**	,401**	,347*	0,1284227	-0,096	0,22218808	,279*	,467**	,342*	,471**	,469**	,452**	,404**	,399**	,405**	,535**	,736**	1	,331*	0,2632547	,333*	,367**	0,213	,376**	,361**	,425**	,472**	,329*	,328*	0,24058258	,391**	,548**
	Sig. (2-tailed)	0,00289002	0,011	0,359	0,495	0,110	0,043	0,000	0,012	0,000	0,000	0,001	0,003	0,003	0,003	0,000	0,000		0,016	0,057	0,015	0,007	0,125	0,006	0,008	0,002	0,000	0,016	0,017	0,083	0,004	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Graffiti on walls and/or buildings is a common neighborhood problem	**Pearson Correlation**	,364**	,693**	0,1019077	0,250	,434**	,637**	,356**	,424**	,698**	,665**	,617**	0,060611	,494**	,441**	0,13586228	,440**	,331*	1	0,03496937	,478**	,605**	,621**	,588**	,626**	,756**	,625**	,646**	,712**	,671**	,735**	,760**
	Sig. (2-tailed)	0,00735996	0,000	0,468	0,071	0,001	0,000	0,009	0,002	0,000	0,000	0,000	0,666	0,000	0,001	0,332	0,001	0,016		0,804	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Vandalism of telephone booths, bus or tram shelters is a common neighborhood problem	**Pearson Correlation**	,454**	-0,2120487	0,05307486	0,027	-0,041132	-,368**	,272*	0,07055561	0,22144408	0,249	,323*	,297*	-0,0481446	0,05352193	,502**	0,228	0,2632547	0,03496937	1	0,1718401	,581**	-0,257	-0,044417	0,09275736	0,11823323	0,11681637	0,06368176	0,051	-0,0427911	0,06276344	0,22698567
	Sig. (2-tailed)	0,00063457	0,127	0,706	0,849	0,770	0,007	0,049	0,616	0,111	0,072	0,018	0,031	0,732	0,703	0,000	0,101	0,057	0,804		0,219	0,000	0,063	0,752	0,509	0,399	0,405	0,651	0,716	0,761	0,655	0,102
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Vandalism/theft from cars is a common neighborhood problem	**Pearson Correlation**	,444**	,533**	,708**	,363**	,449**	,389**	,400**	,475**	,682**	,617**	,557**	,273*	,356**	,397**	,423**	,384**	,333*	,478**	0,1718401	1	,460**	0,266	,617**	,620**	,631**	,561**	,614**	,574**	,528**	,586**	,584**
	Sig. (2-tailed)	0,00086774	0,000	0,000	0,008	0,001	0,004	0,003	0,000	0,000	0,000	0,000	0,048	0,009	0,003	0,002	0,004	0,015	0,000	0,219		0,001	0,055	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Damaged/broken benches, trash cans, etc. are a common neighborhood problem	**Pearson Correlation**	,577**	0,25891389	0,1690342	0,143	0,0782	0,1259	,310*	,427**	,681**	,738**	,759**	0,2695	,303*	,391**	,491**	,483**	,367**	,605**	,581**	,460**	1	0,202	0,2458	,569**	,681**	,628**	,522**	,559**	,436**	,593**	,659**
	Sig. (2-tailed)	6,1995E-06	0,061	0,226	0,308	0,578	0,369	0,024	0,001	0,000	0,000	0,000	0,051	0,028	0,004	0,000	0,000	0,007	0,000	0,000	0,001		0,146	0,076	0,000	0,000	0,000	0,000	0,000	0,001	0,000	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Percentage of residents who have been victims of other vandalism in the past year in their own neighborhood	**Pearson Correlation**	0	,637**	0,01932166	0,170	,395**	,709**	,316*	,318*	,393**	,385**	,330*	0,0956556	,507**	,384**	-0,0870341	,324*	0,21312337	,621**	-0,2574835	0,2655638	0,20249221	1,000	,565**	,393**	,505**	,395**	,460**	,573**	,555**	,523**	,461**
	Sig. (2-tailed)	0,21013714	0,000	0,891	0,223	0,003	0,000	0,021	0,020	0,004	0,004	0,016	0,496	0,000	0,005	0,535	0,018	0,125	0,000	0,063	0,055	0,146		0,000	0,004	0,000	0,003	0,001	0,000	0,000	0,000	0,001
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Vandalism/theft from cars in own neighborhood in the past year as a percentage of the total number of cars	**Pearson Correlation**	,330*	,657**	0,24512111	,410**	,701**	,777**	,396**	,398**	,580**	,539**	,379**	0,15971655	,533**	,430**	0,06957571	,391**	,376**	,588**	-0,044417	,617**	0,24584268	,565**	1	,532**	,579**	,426**	,596**	,614**	,541**	,624**	,662**
	Sig. (2-tailed)	0,01567812	0,000	0,077	0,002	0,000	0,000	0,003	0,003	0,000	0,000	0,005	0,253	0,000	0,001	0,621	0,004	0,006	0,000	0,752	0,000	0,076	0,000		0,000	0,000	0,001	0,000	0,000	0,000	0,000	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Trouble caused by groups of young people in the own neighborhood is frequently perceived as bothersome	**Pearson Correlation**	,330*	,550**	,271*	,277*	,394**	,427**	,364**	,435**	,776**	,766**	,628**	0,04191071	,501**	,392**	,293*	,371**	,361**	,626**	0,09275736	,620**	,569**	,393**	,532**	1	,917**	,798**	,834**	,712**	,749**	,808**	,710**
	Sig. (2-tailed)	0,01575291	0,000	0,049	0,045	0,003	0,001	0,007	0,001	0,000	0,000	0,000	0,766	0,000	0,004	0,033	0,006	0,008	0,000	0,509	0,000	0,000	0,004	0,000		0,000	0,000	0,000	0,000	0,000	0,000	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Quarreling and/or shouting young people on the street in the own neighborhood is frequently perceived as bothersome	**Pearson Correlation**	,368**	,650**	0,24380868	,325*	,375**	,532**	,478**	,488**	,869**	,860**	,725**	0,07602508	,593**	,442**	,281*	,469**	,425**	,756**	0,11823323	,631**	,681**	,505**	,579**	,917**	1	,847**	,838**	,800**	,776**	,897**	,819**
	Sig. (2-tailed)	0,00677564	0,000	0,079	0,017	0,006	0,000	0,000	0,000	0,000	0,000	0,000	0,588	0,000	0,001	0,041	0,000	0,002	0,000	0,399	0,000	0,000	0,000	0,000	0,000		0,000	0,000	0,000	0,000	0,000	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Bother caused by young people who harass or intimidate residents in the own neighborhood is frequently perceived as bothersome	**Pearson Correlation**	,413**	,603**	,286*	0,169	,387**	,460**	,420**	,419**	,784**	,779**	,689**	0,14479619	,553**	,412**	,316*	,573**	,472**	,625**	0,11681637	,561**	,628**	,395**	,426**	,798**	,847**	1	,710**	,664**	,622**	,774**	,805**
	Sig. (2-tailed)	0,00214459	0,000	0,038	0,225	0,004	0,001	0,002	0,002	0,000	0,000	0,000	0,301	0,000	0,002	0,021	0,000	0,000	0,000	0,405	0,000	0,000	0,003	0,001	0,000	0,000		0,000	0,000	0,000	0,000	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Drug nuisance in the own neighborhood is frequently perceived as bothersome	**Pearson Correlation**	,392**	,599**	0,26446046	0,237	,427**	,537**	,515**	,425**	,839**	,790**	,605**	0,0654	,607**	,402**	0,16954407	,403**	,329*	,646**	0,0637	,614**	,522**	,460**	,596**	,834**	,838**	,710**	1	,916**	,930**	,905**	,728**
	Sig. (2-tailed)	0,00366018	0,000	0,056	0,088	0,001	0,000	0,000	0,002	0,000	0,000	0,000	0,642	0,000	0,003	0,225	0,003	0,016	0,000	0,651	0,000	0,000	0,001	0,000	0,000	0,000	0,000		0,000	0,000	0,000	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Coming and going of drug addicts in your street is frequently perceived as bothersome	**Pearson Correlation**	,378**	,695**	,279*	0,246	,404**	,635**	,534**	,414**	,848**	,817**	,664**	0,03258163	,672**	,472**	0,18128568	,416**	,328*	,712**	0,05118305	,574**	,559**	,573**	,614**	,712**	,800**	,664**	,916**	1,000	,880**	,927**	,737**
	Sig. (2-tailed)	0,00522455	0,000	0,043	0,075	0,003	0,000	0,000	0,002	0,000	0,000	0,000	0,817	0,000	0,000	0,194	0,002	0,017	0,000	0,716	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000		0,000	0,000	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Street-level drug dealing in the own neighborhood is frequently perceived as bothersome	**Pearson Correlation**	,307*	,591**	0,22965421	0,219	,429**	,555**	,477**	,321*	,760**	,733**	,531**	-0,0007296	,567**	,339*	0,04874485	,308*	0,24058258	,671**	-0,0427911	,528**	,436**	,555**	,541**	,749**	,776**	,622**	,930**	,880**	1	,858**	,643**
	Sig. (2-tailed)	0,02530592	0,000	0,098	0,116	0,001	0,000	0,000	0,019	0,000	0,000	0,000	0,996	0,000	0,013	0,729	0,025	0,083	0,000	0,761	0,000	0,001	0,000	0,000	0,000	0,000	0,000	0,000	0,000		0,000	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Harassment of women and men on the street in the own neighborhood is frequently perceived as bothersome	**Pearson Correlation**	,361**	,717**	0,2585241	,296*	,400**	,627**	,512**	,490**	,909**	,879**	,705**	0,07405563	,668**	,445**	0,20376023	,445**	,391**	,735**	0,06276344	,586**	,593**	,523**	,624**	,808**	,897**	,774**	,905**	,927**	,858**	1	,785**
	Sig. (2-tailed)	0,00790111	0,000	0,062	0,031	0,003	0,000	0,000	0,000	0,000	0,000	0,000	0,598	0,000	0,001	0,143	0,001	0,004	0,000	0,655	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000		0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Nuisance caused by neighbors is frequently perceived as bothersome	**Pearson Correlation**	,553**	,665**	0,17537806	,295*	,507**	,571**	,560**	,502**	,784**	,804**	,685**	0,1489276	,576**	,491**	,321*	,612**	,548**	,760**	0,22698567	,584**	,659**	,461**	,662**	,710**	,819**	,805**	,728**	,737**	,643**	,785**	1
	Sig. (2-tailed)	1,7444E-05	0,000	0,209	0,032	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,287	0,000	0,000	0,019	0,000	0,000	0,000	0,102	0,000	0,000	0,001	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	
	N	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Social environment

		Moderately to severely lonely, 18 years and older [%] [2020]	% residents who have been involved in making plans for the neighborhood or city. (objective)	% of residents who say that neighbors know each other	% % of residents who say that neighbors interact frequently	% of residents who say that neighbors share opinions	% of residents who say that neighbors help each other	% of residents who say they feel at home with neighbors	% of residents who say that young and old get along well in the neighborhood	% of residents who feel connected to the neighborhood	% of residents who feel responsible for the neighborhood	% of residents who provide neighborly help	% of residents who have lived in the neighborhood for a long time	% likelihood of moving away from the neighborhood
Moderately to severely lonely, 18 years and older [%] [2020]	**Pearson Correlation**	1	-,379**	-,464**	-,479**	-,485**	-,567**	-,669**	-,647**	-,636**	-,631**	-,343*	0,12494052	,705**
	Sig. (2-tailed)		0,005	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,012	0,373	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53
% residents who have been involved in making plans for the neighborhood or city. (objective)	**Pearson Correlation**	-,379**	1	,278*	,438**	0,1328	0,2574	,387**	,337*	,406**	,449**	0,05463268	-,271*	-,378**
	Sig. (2-tailed)	0,0051695		0,044	0,001	0,343	0,063	0,004	0,014	0,003	0,001	0,698	0,050	0,005
	N	53	53	53	53	53	53	53	53	53	53	53	53	53
% of residents who say that neighbors know each other	**Pearson Correlation**	-,464**	,278*	1	,860**	,679**	,886**	,785**	,841**	,727**	,437**	,500**	,333*	-,464**
	Sig. (2-tailed)	0,00046058	0,044		0,000	0,000	0,000	0,000	0,000	0,000	0,001	0,000	0,015	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53
% % of residents who say that neighbors interact frequently	**Pearson Correlation**	-,479**	,438**	,860**	1,000	,604**	,787**	,740**	,780**	,805**	,497**	,413**	0,13900311	-,428**
	Sig. (2-tailed)	0,00028678	0,001	0,000		0,000	0,000	0,000	0,000	0,000	0,000	0,002	0,321	0,001
	N	53	53	53	53	53	53	53	53	53	53	53	53	53
% of residents who say that neighbors share opinions	**Pearson Correlation**	-,485**	0,13277806	,679**	,604**	1	,782**	,765**	,808**	,697**	,484**	,627**	0,23228654	-,547**
	Sig. (2-tailed)	0,00023459	0,343	0,000	0,000		0,000	0,000	0,000	0,000	0,000	0,000	0,094	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53
% of residents who say that neighbors help each other	**Pearson Correlation**	-,567**	0,25737401	,886**	,787**	,782**	1	,847**	,895**	,778**	,616**	,496**	0,23143217	-,606**
	Sig. (2-tailed)	9,5512E-06	0,063	0,000	0,000	0,000		0,000	0,000	0,000	0,000	0,000	0,095	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53
% of residents who say they feel at home with neighbors	**Pearson Correlation**	-,669**	,387**	,785**	,740**	,765**	,847**	1	,909**	,879**	,680**	,438**	0,18610096	-,789**
	Sig. (2-tailed)	4,4945E-08	0,004	0,000	0,000	0,000	0,000		0,000	0,000	0,000	0,001	0,182	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53
% of residents who say that young and old get along well in the neighborhood	**Pearson Correlation**	-,647**	,337*	,841**	,780**	,808**	,895**	,909**	1	,828**	,627**	,520**	0,16595009	-,639**
	Sig. (2-tailed)	1,6332E-07	0,014	0,000	0,000	0,000	0,000	0,000		0,000	0,000	0,000	0,235	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53
% of residents who feel connected to the neighborhood	**Pearson Correlation**	-,636**	,406**	,727**	,805**	,697**	,778**	,879**	,828**	1	,717**	,430**	0,07359681	-,762**
	Sig. (2-tailed)	3,0429E-07	0,003	0,000	0,000	0,000	0,000	0,000	0,000		0,000	0,001	0,600	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53
% of residents who feel responsible for the neighborhood	**Pearson Correlation**	-,631**	,449**	,437**	,497**	,484**	,616**	,680**	,627**	,717**	1	0,26042739	-0,1613497	-,696**
	Sig. (2-tailed)	4,0879E-07	0,001	0,001	0,000	0,000	0,000	0,000	0,000	0,000		0,060	0,248	0,000
	N	53	53	53	53	53	53	53	53	53	53	53	53	53
% of residents who provide neighborly help	**Pearson Correlation**	-,343*	0,05463268	,500**	,413**	,627**	,496**	,438**	,520**	,430**	0,26042739	1	,335*	-0,2235051
	Sig. (2-tailed)	0,01196449	0,698	0,000	0,002	0,000	0,000	0,001	0,000	0,001	0,060		0,014	0,108
	N	53	53	53	53	53	53	53	53	53	53	53	53	53
% of residents who have lived in the neighborhood for a long time	**Pearson Correlation**	0	-,271*	,333*	0,139	0,2323	0,2314	0,1861	0,1660	0,0736	-0,1613	,335*	1	-0,0248579
	Sig. (2-tailed)	0,37271925	0,050	0,015	0,321	0,094	0,095	0,182	0,235	0,600	0,248	0,014		0,860
	N	53	53	53	53	53	53	53	53	53	53	53	53	53
% likelihood of moving away from the neighborhood	**Pearson Correlation**	,705**	-,378**	-,464**	-,428**	-,547**	-,606**	-,789**	-,639**	-,762**	-,696**	-0,2235051	-0,0248579	1
	Sig. (2-tailed)	3,8147E-09	0,005	0,000	0,001	0,000	0,000	0,000	0,000	0,000	0,000	0,108	0,860	
	N	53	53	53	53	53	53	53	53	53	53	53	53	53

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Activities

		Moderately to severely lonely, 18 years and older [%] [2020]	% that engages in volunteer work, 18 years and older	% of residents who attend monthly spiritual or religious gatherings	% of residents who visit a hobby club or association monthly	% of residents who participate in sports weekly	% that meets the physical activity guideline 2017, 18 years and older
Moderately to severely lonely, 18 years and older [%] [2020]	**Pearson Correlation**	1	-0,2303536	,678**	-,602**	-,635**	-,367**
	Sig. (2-tailed)		0,097	0,000	0,000	0,000	0,007
	N	53	53	53	53	53	53
% that engages in volunteer work, 18 years and older	**Pearson Correlation**	0	1	-,281*	,409**	,362**	,335*
	Sig. (2-tailed)	0,09703299		0,042	0,002	0,008	0,014
	N	53	53	53	53	53	53
% of residents who attend monthly spiritual or religious gatherings	**Pearson Correlation**	,678**	-,281*	1	-,618**	-,637**	-0,2091516
	Sig. (2-tailed)	2,4071E-08	0,042		0,000	0,000	0,133
	N	53	53	53	53	53	53
% of residents who visit a hobby club or association monthly	**Pearson Correlation**	-,602**	,409**	-,618**	1,000	,847**	,305*
	Sig. (2-tailed)	1,8937E-06	0,002	0,000		0,000	0,027
	N	53	53	53	53	53	53
% of residents who participate in sports weekly	**Pearson Correlation**	-,635**	,362**	-,637**	,847**	1	,488**
	Sig. (2-tailed)	3,224E-07	0,008	0,000	0,000		0,000
	N	53	53	53	53	53	53
% that meets the physical activity guideline 2017, 18 years and older	**Pearson Correlation**	-,367**	,335*	-0,2091516	,305*	,488**	1
	Sig. (2-tailed)	0,00688297	0,014	0,133	0,027	0,000	
	N	53	53	53	53	53	53

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Health

		Moderately to severely lonely, 18 years and older [%] [2020]	Limited by one or more chronic conditions, 19 years and older	At least 1 mental health condition, 18 years and older	Drugs (soft drugs/hard drugs) (in the past 4 weeks), 18 to 64 years old	Smokes, 18 years and older	Has overweight (moderate and severe), 18 years and older	Mobility limitation, 18 years and older
Moderately to severely lonely, 18 years and older [%] [2020]	**Pearson Correlation**	1	,516**	,390**	-0,059	,541**	,458**	,618**
	Sig. (2-tailed)		0,000	0,004	0,673	0,000	0,001	0,000
	N	53	53	53	53	53	53	53
Limited by one or more chronic conditions, 19 years and older	**Pearson Correlation**	,516**	1	,383**	-0,159	0,21333717	,538**	,770**
	Sig. (2-tailed)	7,5427E-05		0,005	0,254	0,125	0,000	0,000
	N	53	53	53	53	53	53	53
At least 1 mental health condition, 18 years and older	**Pearson Correlation**	,390**	,383**	1	0,208	,310*	0,03139768	0,2383516
	Sig. (2-tailed)	0,00389632	0,005		0,135	0,024	0,823	0,086
	N	53	53	53	53	53	53	53
Drugs (soft drugs/hard drugs) (in the past 4 weeks), 18 to 64 years old	**Pearson Correlation**	0	-0,1594533	0,20785507	1,000	,406**	-,543**	-0,2184125
	Sig. (2-tailed)	0,67310399	0,254	0,135		0,003	0,000	0,116
	N	53	53	53	53	53	53	53
Smokes, 18 years and older	**Pearson Correlation**	,541**	0,21333717	,310*	,406**	1	0,21498054	0,23092571
	Sig. (2-tailed)	2,9412E-05	0,125	0,024	0,003		0,122	0,096
	N	53	53	53	53	53	53	53
Has overweight (moderate and severe), 18 years and older	**Pearson Correlation**	,458**	,538**	0,03139768	-,543**	0,21498054	1	,675**
	Sig. (2-tailed)	0,00057067	0,000	0,823	0,000	0,122		0,000
	N	53	53	53	53	53	53	53
Mobility limitation, 18 years and older	**Pearson Correlation**	,618**	,770**	0,2383516	-0,218	0,23092571	,675**	1
	Sig. (2-tailed)	8,0459E-07	0,000	0,086	0,116	0,096	0,000	
	N	53	53	53	53	53	53	53

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Life events

		Moderately to severely lonely, 18 years and older [%] [2020]	% residents (18 years and older) who have only recently moved to the Netherlands
Moderately to severely lonely, 18 years and older [%] [2020]	**Pearson Correlation**	1	0,08158953
	Sig. (2-tailed)		0,561
	N	53	53
% residents (18 years and older) who have only recently moved to the Netherlands	**Pearson Correlation**	0	1
	Sig. (2-tailed)	0,56138415	
	N	53	53

Social network

		Moderately to severely lonely, 18 years and older [%] [2020]	% of residents who report knowing enough people to talk to	% of residents who report having enough interest from close family members	% of residents who report having enough interest from others	% of residents who say they know enough people for help and advice
Moderately to severely lonely, 18 years and older [%] [2020]	**Pearson Correlation**	1	-,675**	-,674**	-,602**	-,529**
	Sig. (2-tailed)		0,00000003	0,00000003	0,00000182	0,00004665
	N	53	53	53	53	53
% of residents who report knowing enough people to talk to	**Pearson Correlation**	-,675**	1	,853**	,843**	,771**
	Sig. (2-tailed)	2,9951E-08		0,00000000	0,00000000	0,00000000
	N	53	53	53	53	53
% of residents who report having enough interest from close family members	**Pearson Correlation**	-,674**	,853**	1	,879**	,780**
	Sig. (2-tailed)	3,0855E-08	0,00000000		0,00000000	0,00000000
	N	53	53	53	53	53
% of residents who report having enough interest from others	**Pearson Correlation**	-,602**	,843**	,879**	1,000	,774**
	Sig. (2-tailed)	1,8213E-06	0,00000000	0,00000000		0,00000000
	N	53	53	53	53	53
% of residents who say they know enough people for help and advice	**Pearson Correlation**	-,529**	,771**	,780**	,774**	1
	Sig. (2-tailed)	4,6651E-05	0,00000000	0,00000000	0,00000000	
	N	53	53	53	53	53

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix IX – Results brainstorming session II

In this appendix, the results from the second brainstorming session are shown. The layout is the same as the layout that was used during the brainstorming session. Additionally, the text under the variable was given to give an indication of with direction to think. For instance, nuisance can be a lot, so this was specified as intactness, garbage next to containers and odor nuisance. The answers given are already implemented within the public space management of the municipality of Rotterdam.

General quality

Nuisance

Intactness, garbage next to container and odor nuisance

- Container adopter
- Free collection of bulky waste
- Gardens next to waste containers
- Officers
- Pop-up waste gathering park in the neighborhood
- Waste management coach

Buildings

Maintenance and appearance

- Garden coach
- Lively ground floor
- Neighborhood community center
- Enhance the appearance of rental properties
- Financial support from the municipality for maintenance

Neighborhood satisfaction

Increase neighborhood satisfaction

- Inclusive participation
- Self-management
- Experience research
- Tailored program

Mobility

Maintenance

Maintenance of bike paths and sidewalks

- Cycle comfort assessment
- Visual inspection every two years
- Complaint portal
- Maintenance of malfunctions
- Minor maintenance
- Major maintenance (drilling and replacement of intermediate layer, re-paving of sidewalks)
- Rehabilitation maintenance (reconstruction)
- Sweeping
- Design with management awareness

Safety

Safety of sidewalks

- Obstacle-free for people with disabilities
- Ensuring accessibility
- Accessible for everyone
- Neighborhood governance
- Unevenness of sidewalks fixed
- Good lighting
- Warning markings
- Trees and green strips along the sidewalk
- Plus routes for the elderly
- Tiles and road surface must meet anti-skid requirements against slippery conditions

Personal activity

Promote exercising, engagement in sports and decrease obesity

- Fewer cars make socializing and exercising easier
- Car-light city
- Transform parking spaces into bike parking spaces
- Vision 'come outside'
- Calisthenics
- Fitness parks
- Home-on-the-street programming
- Athletics track
- Kralingse Plas (a park)
- Wooden play equipment
- Skatepark

Green and amenities

Amount of green

Adding green

- Add 20 hectares of green spaces
- Replace pavement with grass
- Greenify squares and plazas
- Swap out concrete for vegetation
- Green roofs program
- Removing pavement tiles
- Community-managed green spaces

Attractiveness

Attractiveness of water and greenery

- Boost biodiversity to reduce monotony
- Add color and variety to green food sources
- Seven major urban projects (parks)
- Information signs about local history and nature
- Cooling through greenery, fruit trees, and blackberry bushes

Recreation

Facilities for joint activities and for young and old

- Rollator routes
- Green routes
- Activities
- Rotterdam pass
- Programming parks
- Sports routes for evenings

Social environment

Social cohesion

Neighbors know each other, neighborhood contact, young and old get along well and share opinions

- Organize gatherings and activities
- Stimulate to participate and bring your neighbor (responsibility)
- Community hub (neighborhood center)
- Creating spaces to come together
- Play areas
- Vision 'Come outside'
- Neighborhood concierge

Participation

Involved in making plans and active in neighborly help

- Citylab 010 / My neighborhood plan (mijnwijkplan)
- Activating residents' involvement
- Discussion booth at markets
- Organizing activities
- Neighborhood councils
- Aging in place

Attachment

Attachment to neighborhood, relocation and responsibility for neighborhood

- Create a pleasant living environment
- Satisfaction with your home