Onto a 'default Dutch lifestyle':

Measuring, testing, and applying the default American lifestyle in the context of the Netherlands

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Abstract The theoretical concept of the default American lifestyle can be helpful in explaining the high prevalence of obesity and overweight, not only in the United States, but also in other Western countries such as the Netherlands. According to this concept, human energy is displaced by mechanical energy, household food production is replaced by industrial food production, and health maintenance is displaced by medical dependency. In this study, the default lifestyle is operationalised and empirically tested for the first time in the context of the Netherlands. Using the 2016 wave of the Health Monitor it is tested to what extent this lifestyle can be considered the default. A multilevel linear regression analysis revealed that neighbourhood safety and population density can be considered risk factors for a high BMI when operationalising the displacement of human energy by mechanical energy. Regarding the displacement of household food production by industrial food production, the proximity and density of fast food outlets are inversely related to BMI. Lastly, educational level creates knowledge about healthy living, which means the higher educated are better able to identify the structure that is essential to the default lifestyle. Thus, educational level can override the default lifestyle. When studying the default lifestyle this is therefore an important factor to take into account. This study has contributed to scientific knowledge by operationalising and testing the default lifestyle while applying it to the context of the Netherlands for the first time.

Keywords BMI ● overweight ● obesity ● Netherlands ● default lifestyle

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Milou van den Bemd (296573) master's thesis
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1. Introduction

Since the beginning of mankind, struggles such as food scarcity and malnutrition are prevalent and were for a long time the main causes of death across the world. Yet, as industrial development increased, overall living conditions improved: working and housing conditions improved, medical care improved, and consequently, life expectancies went up. However, affluence has its downsides (Mirowsky & Ross, 2015). With the improvement of living standards and increased wealth, obesity also became more widespread. In fact, between 1980 and 2015, the prevalence of overweight and obesity has doubled in more than seventy countries (Afshin et al., 2017). It is not surprising some speak of a global obesity epidemic, also called *globesity* (Delpeuch, 2013; World Health Organisation, 2003). Its consequences, defined by a high body mass index (further called BMI), were even found to be responsible for more than four million deaths across the world (Afshin et al., 2017), as obesity has various health risks varying from diabetes and cardiovascular diseases to eventually premature morbidity (Rizzuto, Mossello, Fratiglioni, Santoni, & Wang, 2017).

Because of the severe health consequences of a high BMI it is important to gain insight in its causes. The literature points to a wide variety of determinants, ranging from a decline in physical activity or sleep deprivation (Monasta et al., 2010; Popkin & Gordon-Larsen, 2004), to maternal smoking, socioeconomic status (McMurray et al., 2000; Monasta et al., 2010), or genetic factors (Frayling et al., 2007). Yet, the context is also important. Some argue obesity can only occur in surroundings that stimulate increased food intake and discourage physical activity, also called obesogenic environments (Hill & Peters, 1998). But also other area-level factors such as income inequality and neighbourhood deprivation are found to be of influence on obesity (Pickett, Kelly, Brunner, Lobstein, & Wilkinson, 2005; Sundquist, Malmström, & Johansson, 1999). Merely looking at individual-level factors is thus not sufficient to fully grasp *globesity*.

Although lifestyles are often not defined by both environmental and individual factors (Ståhl et al., 2001), they can provide an interesting insight in obesity. Scholars often define lifestyles merely by looking at factors such as smoking, alcohol intake, and dietary intake (e.g. (Hannestad, Rortveit, Daltveit, & Hunskaar, 2003; Knoops et al., 2004; Schuit, van Loon, Tijhuis, & Ocké, 2002; Sjöberg, Hallberg, Höglund, & Hulthen, 2003), while the environmental context is important as well, because it can influence individual choices and behaviour (Handy, Cao, & Mokhtarian, 2005).

Because of this gap in the literature, Mirowsky and Ross (2011) developed a new theoretical framework in the context of the United States that can be of importance in the ways in which lifestyles can be understood. It can also be helpful to gain insight in its influence on prevalence of overweight, obesity, and the related health risks. This concept, the default American lifestyle, consists of three elements. First, as the authors argue, human energy is displaced by mechanical energy. Second, the household food production is replaced by the industrial food production. Finally, there is a general pressure on individuals to take medicines for their health complaints instead of developing or maintaining a healthy lifestyle. This framework, Mirowsky and Ross (2011) argue, is default to the American lifestyle, as this society is designed to choose cars over bikes or walking, food is produced for convenience rather than nutrition, and it is an accepted custom to take medicines to control health issues (Mirowsky & Ross, 2015). The environment plays an important role in this, as factors such as noise pollution, safety, population density, and the quality of physical neighbourhood facilities influence physical activity levels. In addition, the density and proximity of fast food restaurants can influence one's dietary intake. The default lifestyle can only be overridden by actively resisting it with "knowledge, insight, ingenuity, effort, and nerve" (Mirowsky & Ross, 2015, p. 299), which can be obtained through education. They argue education creates health knowledge, resulting in the ability to make healthier choices. The higher educated would thus be better in recognising the societal structure that is essential in the default lifestyle.

Although this theoretical framework is established in view of the American context, it can be argued the concept can be broadened to the Western world. For instance, in Western countries there are similarities in diet, also called the Western diet. This is characterised by increased intake of saturated fats and refined carbohydrates, such as glucose (Cordain et al., 2005). Yet, because there are large differences in the prevalence of obesity and overweight (Ng et al., 2014) and in physical environments between the United States and Europe (Van Dyck et al., 2010), a new country-specific framework needs to be developed. This study specifically focuses on the Netherlands, which provides an interesting case as it can be argued that the Netherlands is, in some ways, becoming more similar to the United States, for instance when looking at the enlargement of portion sizes (Steenhuis, Leeuwis, & Vermeer, 2010), the number of fast food chains (Duijn & van de Scheur, 2018), and the increasing prevalence of sedentary behaviour (Milton, Gale, Stamatakis, & Bauman, 2015; Smith, Ng, & Popkin, 2013). Consequently, the country is on the same path with regard to obesity and overweight prevalence as the United States in earlier days. Therefore, the foundations of the default American lifestyle are used to create a new theoretical framework: the default Dutch lifestyle.

This study aims to dive into the default lifestyle applied to the context of the Netherlands. The three elements of the default lifestyle provide an interesting insight in the understanding of *globesity* by combining findings from different strands of literature, such as epidemiological, sociological, and environment-oriented literature, into one coherent framework. This framework takes into account the structure of society and the way in which this structure unconsciously results in health issues such as obesity. Educational level plays an important role in this, as it is hypothesised that it can override the default lifestyle.

As this default lifestyle has not been empirically studied before, I first examine how the three elements can be operationalised. In order to do so, indicators are constructed using the theory on the default American lifestyle. It is examined whether there are some factors that are of influence specifically on the Dutch context. Thus, a 'default Dutch lifestyle' is created based upon the default American lifestyle. The research questions are: "*How can the three elements of the default lifestyle be operationalised? To what extent does the default lifestyle relate to BMI in the context of the Netherlands? What role does educational level play in the default lifestyle?*". These questions will be studied in light of the entire population of the Netherlands, including all ages, both men and women, because this lifestyle is hypothesised to be the standard.

2. Theoretical framework

In this section, I first discuss the emergence of the default lifestyle in the literature. Next, I describe the several elements of the default lifestyle, starting with the displacement of human energy with mechanical energy, followed by the second element of the default lifestyle: displacing household food production with industrial food production. Then I go into detail on the last element: displacing health maintenance with medical dependency, followed by an exploration of the role of educational level in the default lifestyle. Finally, I compare the Netherlands and the United States and explain how the default lifestyle fits into the context of the Netherlands. Of these elements I first derive indicators and then compose hypotheses. At the end, an overview of the composed hypotheses is presented.

2.1.The development of the default lifestyle

The default lifestyle is a theoretical concept originally encountered in the literature in 2011 (Mirowsky & Ross, 2011). The authors argue that both the economic system and physical infrastructure set automatic routines in contemporary affluent societies, resulting in a lifestyle that is the 'default' (Mirowsky, 2011).

The development of the default lifestyle begun in the 20th century. During the ongoing expansion of the welfare state, public health programs were created that benefitted all citizens (Cutler & Miller, 2005; McKinlay & McKinlay, 1977; Stroebe, 2011). In addition, overall living conditions improved, such as increased water quality, the emergence of safety standards for buildings and mandatory vaccinations against all kinds of diseases. Also, working conditions were significantly better than in previous centuries. Because of these improved conditions, life expectancies went up and overall health increased among entire populations.

However, affluence has its downsides, as individuals cannot always see the dangers of unhealthy lifestyles. Together these downsides form the lifestyle that is the standard, unless overridden by the operator (Mirowsky, 2011; Mirowsky & Ross, 2015). This can only happen when the lifestyle is "deliberately reject[ed] and actively resist[ed]" (Mirowsky & Ross, 2015, p. 299). For this to happen, "insight, knowledge, critical analysis, long-range strategic thinking, and wilful self-design" is needed (Mirowsky & Ross, 2011, p. 235).

Mirowsky and Ross (2015) argue this lifestyle consists of three dimensions. First, human energy is displaced by mechanical energy. Both leisure- and work-related physical activity has declined, as machines increasingly take over manpower (Church et al., 2011). Physical activity has thus become optional instead of necessary. Second, household food production is displaced by industrial food production. This means that less time is spent on food preparation, because many ready-made food products can be bought in stores. Yet, ready-made food is not always as healthy as homemade meals, but it is less time-investing and thus seen as an easier option. The high supply of unhealthy foods, such as fast food outlets, also makes the temptation harder to resist. Mirowsky and Ross (2015) claim these two elements of the default lifestyle eventually result in the final element: the displacement of health maintenance with medical dependency. Because it can be argued that the (Western) context is structured as an obesogenic environment, compensation for unhealthy lifestyles can only be obtained through medical dependency instead of health maintenance.

2.2.Elements of the default lifestyle

2.2.1. Displacing human energy with mechanical energy

The first element of the default lifestyle is the observation that human energy is replaced by mechanical energy. Mirowsky and Ross (2011) argue that before industrialisation physical activity was necessary as there were no machines. In earlier times, "[h]igh levels of physical fitness . . . have probably been a necessary requirement for survival" (Erikssen, 2001). However, the number of jobs requiring moderate physical activity has decreased from 50 percent of all jobs in the 1960s to less than 20 percent nowadays. Even more, the work-related physical activity has decreased in this period of time with more than a hundred calories (Church et al., 2011). Consequently, overall physical activity has declined (Matthews et al., 2008; Nelson, Neumark-Stzainer, Hannan, Sirard, & Story, 2006; Ng, Norton, & Popkin, 2009), because it has become *optional* instead of *necessary.* Thus, the motives to be physically active have changed. Where one previously had no other choice but to walk, nowadays there are many other, less physically demanding, options. In addition, urban scale increased while urban density decreased (Mirowsky & Ross, 2015), which stimulates taking the car or bus.

Thus, Mirowsky and Ross (2011) focus on both work- and leisure-related physical activity. In both dimensions the environment is important in determining physical activity. Therefore, contextual determinants of physical activity should be taken into account when studying this element of the default lifestyle. Although environmental factors are often overlooked (Ståhl et al., 2001), they offer an interesting insight in the prevalence of lifestyles. In addition, when studying the assumed displacement of human energy with mechanical energy, it is important to consider the extent to which the environment is adapted to mechanical or human energy, for example by the availability of cycle or walking paths or street connectivity. The idea that the context is important in determining health is called the ecological model, in which “inter-relations between individuals and their social and physical environments are included” (Bauman et al., 2012, pp. 258-259). The environment can be either stimulating or discouraging to be physically active.

Several factors are important when determining physical activity, and consequently BMI. First, noise pollution due to traffic can gain insight in the traffic density of a specific area. It can be argued that a higher traffic density results in overall higher noise pollution. When high traffic density is experienced as problematic, people reported lower physical activity levels than those who did not find it problematic (Duncan, Spence, & Mummery, 2005). The underlying argument is that high experienced traffic density, and thus high noise pollution, decreases the likeability of the environment, making people less prone to be physically active. Thus, the amount of noise pollution can decrease physical activity levels (Hanibuchi, Nakaya, Yonejima, & Honjo, 2015; King & Clarke, 2014; Wilcox, Bopp, Oberrecht, Kammermann, & McElmurray, 2003). Despite the existence of guidelines on the maximum amount of noise pollution allowed (European Environment Agency, 2009), these guidelines are not always met, resulting in various health complaints, such as sleeping issues, psychological issues, increased blood pressure, hearing problems or eventually cardiovascular diseases (Chepesiuk, 2005; Geravandi et al., 2015; Griefahn, 2000; Stansfeld & Matheson, 2003). Although the causal direction of physical activity and noise pollution can be contested, studies have shown that exposure to stressors such as noise are the preceding factors of, for example, residential social support (Appleyard, 1980) and increased sense of fatigue and locus of control (Cohen, Evans, Stokols, & Krantz, 2013; Evans, 1999; Lazarus, 1966). Therefore, in this study, it is theorised that increased noise pollution reduces physical activity levels, eventually leading to a higher BMI.

Second, overall safety of a neighbourhood is also important when determining physical activity levels. Both one's confidence in the ability to be physically active and one's actual physical activity levels decrease if perceived safety is low (Bennett et al., 2007; Catlin, Simoes, & Brownson, 2003; Foster & Giles-Corti, 2008). This is the case because neighbourhoods that appear unsafe or unappealing, for example due to graffiti or demolished roadside objects, can be a barrier to physical activity (Bennett et al., 2007; Ross & Mirowsky, 2001). Also a high crime rate is a barrier for being less physically active (Chad et al., 2005; Shores, West, Theriault, & Davison, 2009).

Third, it can be theorised that in neighbourhoods with higher population density there are more facilities nearby, stimulating walking or cycling to destinations, i.e. active transportation, rather than taking the car (Lopez, 2007). Accordingly, a higher population density is related to a lower prevalence of obesity and overweight (Lopez, 2007; Rundle et al., 2007). It can thus be expected that population density is associated with higher levels of physical activity, which, in turn, leads to a lower BMI (Blair & Brodney, 1999; Ferro-Luzzi & Martino, 1996; Kelley & Goodpaster, 1999; Rissanen, Heliövaara, Knekt, Reunanen, & Aromaa, 1991).

Fourth, physical activity can be stimulated when the environment is designed to have prominent features for cyclists and pedestrians. In this case, overall walkability increases. This index, that links neighbourhood designs to the pedestrian-friendliness (Frank, Engelke, Schmid, & 2003), is found to stimulate the choice of walking or cycling over other forms of transport, thus stimulates physical activity (Frank et al., 2010; Frank, Schmid, Sallis, Chapman, & Saelens, 2005; King et al., 2005; Owen et al., 2007; Rodriguez, Khattak, & Evenson, 2006; Saelens, Sallis, Black, & Chen, 2003; Sallis, Frank, Saelens, & Kraft, 2004; Sallis et al., 2009;

Van Dyck et al., 2010). The quality of physical neighbourhood facilities, such as maintenance of roads, parks, outdoor lighting, and playgrounds, can enhance overall walkability, as the environment has become more attractive to walk or cycle. The above theoretical findings lead to the following four hypotheses:

1. Individuals living in areas with lower noise pollution due to traffic have higher levels of physical activity, resulting in a lower BMI.
2. Individuals living in areas with higher experienced overall safety have higher levels of physical activity, resulting in lower BMI.
3. Individuals living in a densely populated area experience higher levels of physical activity, resulting in a lower BMI.
4. The higher the quality of physical neighbourhood facilities, the higher the physical activity levels, resulting in a lower BMI.

2.2.2. Displacing household food production with industrial food production

The second element of the default lifestyle is the replacement of household food production with industrial food production. In earlier days, people used to home-grow their foods more often or spend more time on food preparation. As Mirowsky and Ross (2015) note, food has become less time-investing as some of the work has already been done when buying it in the supermarket. For example, a food product such as chicken used to be slaughtered, plucked and boned before it could be consumed. Nowadays, readymade chicken fillets can be bought. In addition, there are cheaper, and easier ways of getting food, such as packaged foods, home deliveries, take-away foods, and fast food outlets. This has resulted in less time spent on food preparation (Monsivais, Aggarwal, & Drewnowski, 2014). Yet, these cheaper and easier options for food are often also unhealthier. In other words, to achieve a healthier diet more time and money needs to be spent on food preparation (Michaud et al., 1998; Sharpe & Abdel-

Ghany, 1999; Sooman, Macintyre, & Anderson, 1993). At least among young adults, the more time spent on food preparation, the better quality of diet one has (Larson, Perry, Story, & Neumark-Sztainer, 2006; Laska, Larson, Neumark-Sztainer, & Story, 2012). When eating out or buying ready-made food a lot, no time is spent on food preparation and thus this is seen as an easy option to eat.

Therefore, fast food outlets also play an important role in the extent to which household food production is displaced by industrial food production. Fast food outlets are characterised by “a relatively limited menu and food preparation options, quick service, paying for meals before they are received, no wait staff, and the option to consume the meal at the restaurant or take it out” (Jeffery, Baxter, McGuire, & Linde, 2006, p. 324). In the Netherlands the density of fast food outlets is lower than in the United States (Rabobank, 2017; United States Department of Agriculture, 2017). Consequently, the *availability* of fast food outlets is more heterogeneous in the Netherlands, resulting in a higher relation between physical access and the number of visits to such outlets.

Related to this, supermarkets also play an important role in assessing the food environment. There are different theoretical viewpoints on whether living closer to supermarkets is related to a higher or lower BMI. Supermarkets have a wide range of foods available, which means one can be triggered by the sight of healthy foods. In fact, it has often been found that fruit and vegetable intake was higher when people lived closer to supermarkets (Laraia, Siega-Riz, Kaufman, & Jones, 2004; Moore, Diez Roux, Nettleton, & Jacobs Jr, 2008; Morland, Wing, & Roux, 2002). Yet, one can also turn this argument around by arguing that seeing, or being close to, unhealthy foods can generally trigger the stimulus to consume them (Inman, Winer, & Ferraro, 2009). Therefore, in this study it is tested which of these viewpoints is actually true in the context of the Netherlands.

The increasing popularity of meal delivery services (Hirschberg, Rajko, Schumacher, & Wrulich, 2016) could indicate that the proximity of fast food outlets or supermarkets will become less important in assessing one's dietary patterns over time. Nevertheless, the density of fast food outlets can be an indicator for the number of meal delivery services in a municipality. The higher the density of fast food outlets, the higher the likelihood that these outlets are joint in meal delivery services such as Takeaway.com. Following Say's law (1836), when there is a supply of a certain good, there will be demand. In other words, the more fast food outlets provide meal delivery services, the higher the demand will be in a municipality. This leads to hypothesis 5 and 6:

5. The closer the proximity to fast food outlets, the higher the BMI.
6. The a) closer, or b) further the proximity to supermarkets, the higher the BMI.

2.2.3. Displacing health maintenance with medical dependency

The final element of the default lifestyle is the increasing dependency on medicines instead of on maintaining a healthy lifestyle. Medical dependency can be defined as the reliance on "*specialised equipment, medications, or caregivers in order to sustain life, minimise deterioration in health status, and/or retain some degree of personal independence in performing activities of daily living*" (Risoe, Schlegelmilch, & Paturas, 2013). This third element of the default lifestyle can be described as the consequence of the two previously described elements: little to no physical activity in combination with an unhealthy dietary pattern can lead to medical dependency.

During the 1960s, the idea of 'medicalisation' arose, in which natural processes of life (i.e. childbirth, menopause, homosexuality) are treated and defined as medical problems (Conrad, 1992). In later eras this concept transformed into a "medicalisation of lifestyle" (Arney & Bergen, 1984; Crawford, 1980), where areas of everyday life such as patterns of exercise, rest, and dietary patterns become medicalised (Lowenberg & Davis, 1994). For example, physical activity is now seen as a necessary activity in order to remain healthy.

Some suggest capitalism is the underlying cause of medicalisation, as it gains from the process in two ways (Navarro, 1975; Waitzkin, 1979, 1984). First, the increasing dominance of the individualistic model stimulates the embracing of personalised solutions for socially caused problems (Ballard & Elston, 2005). Second, increased medical intake results in increased profits for companies. Some express concerns on the influence of capitalism in medicalisation, particularly on the way the pharmaceutical industry operates. A few scholars suggest medicines are not always created and produced in view of general health needs, but of potential profitability (Gilbert, Walley, & New, 2000). This is not just the case for medicines, but also vitamins. Vitamin supplementation is often used to compensate for an unhealthy lifestyle (Haenen & Bast, 2002). Yet, vitamins can only capture deficits to a certain maximum (Merlino et al., 2004; Zandi et al., 2004) and can thus not be seen as a true compensation of an unhealthy lifestyle.

Some go even further and compare the pharmaceutical industry to the mafia: Gøtzsche (2013) reasons that illnesses are 'invented' so that one should spend money on medicines, and that doctors rely too much on the industry and take too little note on side-effects of medicines. Yet, a side note should be made because not just the health industry influence citizens, but also the other way around: sometimes patients put pressure on doctors in order to come to diagnoses (Broom & Woodward, 1996).

Thus, although the increasing engagement with health among citizens is not necessarily a negative development, it does contribute to the (questionable) influence of the pharmaceutical industry. Mirowsky and Ross (2015) even worry that it might soon become reality that individuals have taken medicines since childhood. However, it is doubtful to what extent this is plausible for several reasons. First, some scholars argue there has been put too much emphasis on “medical imperialism” (Fox, 1977; Strong, 1979), and too little attention has gone to the notion of free will and choice (Riessman, 1983). In other words, it is argued that medicalisation is not just a result of capitalism, but also of rationalism (Conrad, 1980; Zola, 1972). If this is the case, then individuals can make a deliberate choice between taking medicines or maintaining a healthy lifestyle. Second, if it is indeed the case that medicalisation as a societal trend is related to modernity (Conrad, 1992), then one can expect a process of de-medicalisation in this post-modern era (Elston, Gabe, Denney, Lee, & O'beirne, 2002; Lowenberg & Davis, 1994). Still, there is no consensus among scholars whether and to what extent this de-medicalisation process has already begun, as market interests still influence the pharmaceutical industry (Conrad, 2005; Moynihan & Henry, 2006).

The displacement of health maintenance with medical dependency is most difficult to operationalise for several reasons. First, it cannot be measured in the conceptual model as used in this study. Although Mirowsky and Ross (2015) argue the displacement of human energy with mechanical energy and the displacement of household food production with industrial food production eventually result in medical dependency, it is more difficult to substantiate the link with medical dependency and BMI. This link is ambiguous due to causality issues and problems such as side-effects of medicines. Besides, including medicine use into the theoretical model does not fully capture the macro-point of view Mirowsky and Ross (2015) describe. As medicalisation concerns a societal pressure, this indicates that each person in the same society (unconsciously) experiences the same pressure. Therefore, it cannot be measured in the same context, but only when comparing different countries. Thus, in this study, this element of the default lifestyle is not operationalised.

2.3.The role of education

As mentioned earlier, Mirowsky and Ross (2015) claim education can override the default lifestyle. The authors argue that those with higher education experience better health by almost every measure. This is the case because education “helps individuals use income more efficiently to meet household needs and maintain personal and family health” (Mirowsky & Ross, 2015, p. 298). In addition, higher education leads to more creative and fulfilling jobs (Mirowsky & Ross, 2007) opposed to low-educated jobs. Furthermore, education develops human capital, so they claim, as education is a resource itself which can help generating other resources. Mirowsky and Ross (2015) thus theorise that education generates health knowledge, resulting in the ability to make healthier choices. Due to this knowledge, the higher educated are better able to recognise the societal structure present that is essential in the default lifestyle. Education thus creates a higher notion of agency, the capacity to act independently and to generate change (Sen, 1999). While education generates choices the lower educated do not have because of their fewer knowledge, education also creates possibilities. In general, a higher education is related to a higher income (Cutler & Lleras-Muney, 2006), leading to actual financial possibilities to make a choice. Yet, income also affects BMI independently. For instance, energy-dense, high-sugar and high-fat foods are known to be cheaper than healthy foods, such as fruits and vegetables (Darmon, Briend, & Drewnowski, 2004; Drewnowski, 2004; Mul, Waterlander, Steenhuis, & Seidell, 2009). In other words, the environmental effects for health are not as strong for higher educated as for lower educated. Thus, hypothesis 7 is:

7. The positive effect of the default lifestyle on BMI is weaker for higher educated compared to lower educated.

2.4. The Netherlands versus the United States

In this section, I dive into a comparison of the context of the Netherlands versus the United States. Although the original theory is created with an eye on the American context, I think it can also be of relevance to other Western countries, specifically the Netherlands.

There are some similarities that show the same pathways in the Netherlands as in the United States. With regard to the first element of the default lifestyle, in all industrialised Western countries it can be argued that human energy is replaced by mechanical energy. The extent to which this happened, however, differs between countries, although in both the United States and the Netherlands physical activity rates have declined (Church et al., 2011; Hallal et al., 2012) and sedentary behaviour is more prevalent (Milton et al., 2015; Ng & Popkin, 2012). Concerning the second element of the default lifestyle, replacing household food production with industrial food production, in both countries fewer time is spent on food preparation. In the United States, the majority of daily energy is still consumed from home preparation, but since 1965 one spends fewer time on cooking (Smith et al., 2013). Likewise, in the Netherlands, a decrease is visible in the amount of time spent cooking from 1975 onwards, with an increase in 'outsourcing', going out for dinner and take-out (Mandemakers & Roeters, 2015). Also in the United States, the number of fast food outlets has grown substantially (Jeffery et al., 2006), leading to a higher exposure to unhealthy foods, and thus, a higher prevalence of obesity—even among the highest in the world (Afshin et al., 2017). Because these elements of the default lifestyle are detectable in both the United States and the Netherlands, it can be reasoned the third element is prevalent as well. Mirowsky and Ross (2015) argue that the first two elements eventually lead to medical dependency. Because in both countries the prevalence of obesity is increasing (Afshin et al., 2017) and both countries are capitalistic, it can be expected medicine use is driven by market interests (Conrad, 2005). This way, taking medicines is promoted at the expense of a healthy lifestyle.

These similarities carry some consequences, as it can indicate that the Netherlands eventually will be on the same path with regard to obesity and overweight epidemic as in the United States at some point. To some extent, this process has already started. The prevalence of overweight among men reached the same heights in the Netherlands in 1997 as had already occurred in the United States in 1960 (about 40%). The same holds for the prevalence of obesity: in 2005 for men (10%) and 2015 for women (15%) it reached the same heights as in the United States in 1960 (The State of Obesity; Volksgezondheidenzorg.info).

However, one cannot simply make the claim that the Netherlands will have the same high occurrences of obesity and overweight as in the United States without taking into account the different structures and cultures between the countries. The Netherlands is more ‘compact’, with smaller distances between facilities and more space for walkers or cyclers, resulting in more participants of labour-intensive traffic. While the way the environment is designed is important in determining physical activity, one can still make the deliberate choice between less or more physically demanding options, such as transportation via bus, car, or bicycle. External factors, such as the weather, of course also influence the choice between labour-intensive or non-intensive traffic. Also, in the United States it can be argued it is more common than in the Netherlands to use vitamins to supplement one’s diet.

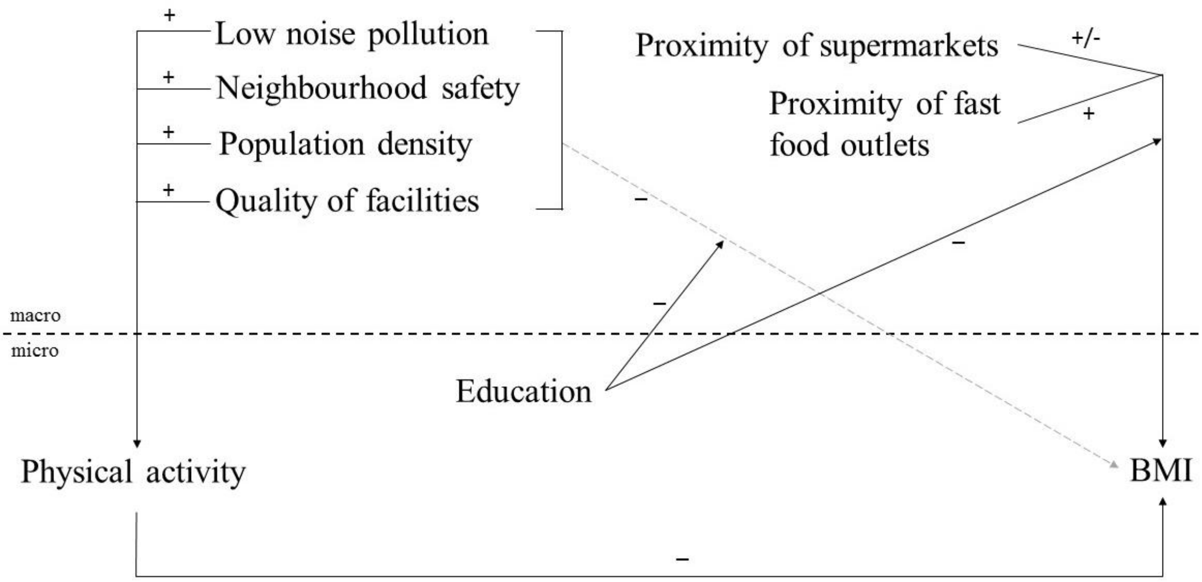
Because of these important differences it is not possible to simply apply the default American lifestyle to the Dutch context; therefore, a new ‘default lifestyle’ needs to be created using factors that are of influence in the Netherlands but not (or to lesser extent) in the United States. The proximity of fast food outlets is an example of such a factor. As described above, therefore, several environmental factors that influence BMI are considered, although they have not been explicitly mentioned in the theoretical foundations of the default American lifestyle, such as noise pollution or neighbourhood safety. In table 1, an overview of the hypothesis can be seen. Figure 1 visualises the hypothesised relationships in a conceptual model.

Table 1 Overview of hypotheses

Element of default lifestyle	Hypothesis
Displacing human energy with mechanical energy	Individuals living in areas with lower noise pollution due to traffic have higher levels of physical activity, resulting in a lower BMI.
Displacing human energy with mechanical energy	Individuals living in areas with higher experienced overall safety have higher levels of physical activity, resulting in lower BMI.
Displacing human energy with mechanical energy	Individuals living in a densely populated area experience higher levels of physical activity, resulting in a lower BMI.
Displacing human energy with mechanical energy	The higher the quality of physical neighbourhood facilities, the higher the physical activity levels, resulting in a lower BMI.
Displacing household food production with industrial food production	The closer the proximity to fast food outlets, the higher the BMI.
Displacing household food production with industrial food production	The a) closer, or b) further the proximity to supermarkets, the higher the BMI.
Overarching hypothesis	The positive effect of the default lifestyle on BMI is weaker for higher educated compared to lower educated.

In a conceptual model, the theory looks as follows.

Figure 1 Conceptual model[1]



3. Data and methods

3.1.Data description

In order to test the hypotheses, the Health Monitor will be used[2], provided by Statistics Netherlands, GGD Netherlands, and the National Institute for Public Health and the Environment [RIVM] (Statistics Netherlands, 2015). This dataset is used because it is one of the largest nationwide datasets to provide detailed information on many health-related topics, such as BMI, providing information on more than 457,000 adults aged 19 and older. Because of its size it is possible to make statements at municipality-level. It is a national file that came into existence by combining data from GGD, Statistics Netherlands, and RIVM. Specifically, GGD combined all known information over the country from the Adult Monitor (covering adults aged 19-64) and the Elderly Monitor (adults aged 65 or older). This way, the largest share

[1] This figure is a visualisation of the hypotheses as formulated above. Above the line the main macro factors are situated, below the line the main micro factors. An arrow with + means that a positive effect is to be expected; an arrow with – means a negative effect is to be expected. When +/- is depicted, no direction of the effect is to be expected. The dotted grey line indicates I expect no direct effect of the environmental factors on BMI. Instead, educational level interacts the relation between the environmental factors of the default lifestyle and BMI.

[2] Results based on calculations from Telos using non-public microdata from Statistics Netherlands.

of the population as possible is covered. Then, information from the Statistics Netherlands and RIVM Health Survey was added to that. Because information from different sources is combined, the sampling is somewhat different across the different files. For instance, some GGDs sampled on (sub)regional level, while others included municipalities and neighbourhoods. Yet, because I focus on municipalities this is not seen as problematic. In addition, there were some discrepancies in methods and questionings. The Adult and Elderly Monitor as well as the Health Survey deployed a 'mixed-methods' approach, meaning respondents had the opportunity to fill out the questionnaire online, fill out a paper questionnaire, or conduct a telephone or personal interview (Statistics Netherlands, 2015). Beforehand, it was agreed upon that each GGD would spread online questionnaires and choose one other form of surveying. However, in only less than 0.5 percent questionnaires were conducted personally or via telephone. The Health Survey was only conducted on paper or online.

Through a harmonisation process these inconsistencies were taken care of as much as possible. For instance, the variables sex and year of birth served as 'check-variables', indicating that with these factors one could check whether the right person—as approached for sampling—had filled in the questionnaire. Furthermore, methods and questionings were harmonised as much as possible. Through these processes the merged data is thought to be as similar as possible, and therefore more useful.

The Health Monitor data from 2016 will be supplemented with several other open-source data. First, Statistics Netherlands has made data available through StatLine (http://statline.cbs.nl) on population density, proximity and density of fast food outlets and supermarkets, noise pollution, and average municipality income. Furthermore, data on objective noise pollution is derived from RIVM (2016); data on subjective noise pollution from an earlier wave of the Health Monitor (2012).

3.2.Sample overview

In total, more than 457.000 respondents have filled in the Health Monitor in the Netherlands. I did not set any limitations to my target population with regard to age or education for example, as the environment affects the entire population. After deleting missing values or recoding it to the mean of the given variable, the final sample consists of 358.614 respondents.

3.3.Operationalisations

3.3.1. BMI

The dependent variable BMI is constructed by combining information about self-reported weight and height of respondents using information of the Health Monitor. First, weight was recoded to kilograms; height to meters. Next, BMI was constructed with the following formula: $BMI = \frac{(weight\ in\ kilograms)}{height\ in\ meters^2}$. The missing values and extreme values (BMI<14 and BMI>50) were deleted. Although BMI is contested as a useful measure of health and obesity (Burkhauser & Cawley, 2008; Rothman, 2008), I argue BMI can be valuable for several reasons. First, a frequently heard critique is the great deal of underreporting of weight and the overreporting of height when using self-reported data (Kuczmarski, Kuczmarski, & Najjar, 2001). Yet, the correlations between self-reported and clinical measures were found to be above 0.90 for all ethnic groups (Blacks, Mexican Americans, and Whites) and highly correlated with obesity-related disorders (McAdams, Dam, & Hu, 2007; Spencer, Appleby, Davey, & Key, 2002). Next, BMI functions as a proxy of percentage fat mass, but some argue the BMI cut-off values representing this percentage fat mass are not always reliable in detecting obesity (Wickramasinghe et al., 2005). Because of this critique, BMI in this study is treated as a continuous factor, where a higher score indicates a higher chance at obesity. BMI has been identified as a valid indicator, at least among adolescents (Malina & Katzmarzyk, 1999) and adults (Visscher, Viet, Kroesbergen, & Seidell, 2012). In addition, for practical matters, BMI is chosen as unfortunately no other indication of obesity, such as waist circumference or waist-hip ratio (World Health Organisation, 2000), is present in the given dataset.

3.3.2. Displacing human energy with mechanical energy

As the elements of the default lifestyle have not been operationalised before, several measurements are included to test which ones suit the data and theory best. For the first element, the displacement of human energy with mechanical energy, the operationalisations are described below. First, I discuss which municipality-level factors are included. Next, the measurements of physical activity are described.

Noise pollution is measured with two operationalisations. First, **subjective noise pollution** is measured with an earlier wave of Health Monitor (2012). The most recent data were not usable, as half of the respondents had not filled in questions about noise pollution. Respondents were asked to what extent they were hindered due to road, rail, or air traffic on a scale from 0 to 10. The highest scores were marked as ‘severely hindered’. Per municipality the percentage respondents that were severely hindered due to these sources are depicted. There were no missing values. Second, **objective noise pollution** per municipality is added. RIVM data is used to obtain information on this variable. Information from most recent years on noise by highways (2016), provincial roads (2011), rail traffic (2016), air traffic (2011), industry, and wind turbines (2015) are combined. Per municipality the average amount of noise pollution is taken into account. A higher score means there is more noise pollution, ranging from 45 dB or less to 65 dB or more. Also no missing values were reported.

Second, neighbourhood safety is measured with three factors. These variables are derived from the Safety Monitor of Statistics Netherlands (2017b) for the Netherlands. First, I added **physical decay**. Respondents could indicate to what extent they experienced nuisance due to garbage on the street, demolished roadside objects, graffiti, or dog faeces. Answers were given in average percentage of residents that often or sometimes experienced nuisance per municipality. Second, I added **social nuisance**, consisting of the average percentage per municipality that sometimes or often experienced nuisance from cafes or restaurants, from neighbourhood residents, drunk people on the streets, drug use or drug dealing, being harassed on the streets, or youths loitering. Lastly, respondents in this survey were asked to **rate crime** in their municipality on a scale from 0 to 10, where a higher score indicates higher crime rate. The average subjective crime rate per municipality is then taken into account. Because not all Dutch municipalities entered in the Safety Monitor, the missing values are recoded as the mean value in order to avoid loss of respondents.

Information on **population density** is provided by StatLine, the open-source databank of Statistics Netherlands, specifically, the study on key figures of neighbourhoods. The most recent information is used (Statistics Netherlands, 2017a). Population density is measured as the number of inhabitants per square kilometre. In order to gain more comprehensible results, the variable is divided by 1000. Yet, population density between older and newer built neighbourhoods could be comparable, but physical activity levels are likely to differ. In older neighbourhoods, facilities are mostly located on one central spot, while in new neighbourhoods, facilities are located all over the area. Therefore, a more precise indicator might be the **distance to all kinds of facilities** (i.e. distance to health facilities, shopping areas, restaurants, childcare, green spaces, train stations, libraries and sport facilities), as this is known to influence physical activity levels (Carlin et al., 2017). These facilities are expected to be often present in densely populated areas, but to a fewer extent in less dense (rural) areas. In addition, as the Netherlands is an overall densely populated area, the distance to facilities is a complementary measure for population density. A scale is constructed using the average distance per municipality to the nearest hospital, childcare facility, restaurant, library, cinema, swimming pool, and train station. These amenities are all related to municipality size, as they are thought to be present more often in larger compared to smaller municipalities. The average distance is calculated over paved roads for all residents in an area to the closest facility using the most recent information (Statistics Netherlands, 2017c). A higher score indicates a further distance. A factor analysis reveals these variables measure one scale. For these two measurements of population density, no missing values were present.

The subjective **quality of physical neighbourhood facilities** comprises the average grade on the quality of the maintenance of roads, paths and squares; parks and green spaces; outdoor lighting; playgrounds for children and playgrounds for youths. For this variable holds that the higher the grade, the higher the subjective quality, where 10 is the highest possible grade. This variable is also derived from Statistics Netherlands (2017b), specifically, the Safety Monitor. The missing values were handled similarly as the safety factors as mentioned above, thus recoded to the mean value in order to lose as less respondents as possible.

Physical activity functions as the mediating factor between population density and BMI and noise pollution and BMI. Two measurements for this variable are taken into account. Information on these variables comes from the Health Monitor, which includes several indicators for physical activity. First, a **physical activity** variable is constructed using different indicators, to make sure all motives to be physically active are captured: being physically active during commuting traffic, sporting, gardening, leisure time cycling or walking, household activities, or activities at school or work, all measured in total hours per week. The missing values (5% of all respondents) are recoded to the mean value. Second, because the health effects of physical activity cannot be regarded as endlessly positive (as too much physical activity also can have negative health consequences, for example in professional sports), I also include another measure of physical activity. In the Netherlands, citizens are advised to be intensively active for at least twenty minutes at least three days per week (Gezondheidsraad, 2017). The **score on this fit norm** is taken into account through three categories: (0) “Inactive (0 days per week intensely physically active)", (1) "Semi-active (1 or 2 days per week intensely physically active)", and (2) "Norm-active (at least three days per week intensely physically active)". The missing values are grouped into a fourth category.

3.3.3. Displacing household food production with industrial food production

The second element of the default lifestyle will be operationalised first as the **proximity to fast food outlets**. Data on this element comes from the study of 'proximity statistics', also provided by the open-source bank of Statistics Netherlands (Statistics Netherlands, 2017d). These figures are updated once a year, the most recent ones are used (2017). The proximity is measured as the average distance to cafeterias per municipality. This is the average distance from homes in a specific area to the nearest cafeteria. Therefore, the nearest cafeteria does not have to be in the same municipality.

Second, the **average distance to the closest large supermarket** is used as a measure. The most recent data from 2016 is used. This operationalisation measures the average distance of all inhabitants in an area to the closest large supermarket, calculated by road. Because this data is at neighbourhood level (and not at individual level), the average distance is included when information is known about at least ten inhabitants of that area. A large supermarket is defined by a shopping area of a minimum surface area of 150 m^2 where daily groceries can be bought. For these two variables, no missing values are present.

Lastly, as mentioned earlier, it is not sufficient to only look at the proximity of facilities, because also the frequency of cooking, frequency of meal deliveries, and fruit and vegetable consumption can be important indicators. The Dutch National Food Consumption Survey (2013) provides information on these variables. However, because there are only 220 respondents nationwide, I think this is insufficient to draw meaningful conclusions. Yet, in my opinion, these variables capture well the meaning of the second element of the default lifestyle, which is why these variables should be taken into account in future research using sufficient respondents. Instead, **density of fast food outlets** can function as a proxy for the amount of fast food outlets in a municipality, where it is expected that the higher the number of fast food outlets, the higher the amount of outlets that is joint in meal delivery services. I look at the density of fast food outlets within one kilometre with use of data from Statistics Netherlands (2017c). The density is calculated by looking at the average amount of fast food outlets per municipality within one kilometre. No missing values are present.

3.3.4. Educational level

Educational level is tested by focusing on formal education, meaning knowledge generated at school. For this variable, respondents were asked to indicate their highest completed educational level. Several answer categories are taken together in order to generate four main categories of educational level. The first category consists of having completed no education at all or lower education and is coded as “low educational level”. The second category consists of the Dutch educational levels lbo and mavo, which can be seen as slightly below intermediate vocational education. This category will be named “middle 1”. Thirdly, “middle 2” consists of the Dutch educational levels of mbo, havo and vwo, which are slightly above intermediate vocational education. The last category called “high educational level” consists of tertiary education generated through a university study (wo) or applied university study (hbo). The category “Other” is recoded as missing and were deleted. The choice for four categories instead of the traditional three (low, middle, high) has been made so that the answers from both respondents of Statistics Netherlands and GGD can be merged together better.

3.3.5. Control variables

Several control variables will be included. First, **age** is measured by the respondent's self-reported age, which ranges from 19 to 100. **Sex** is measured by self-reported sex, in which women are categorised as 0 and men as 1. **Marital status** is constructed from the variable "What is your marital status?". Category 1 consists of those who are married or are registered partners, category 2 of those who are living together. Category 3 consists of the unmarried (and never have been); the divorced make up category 4. Lastly, category 5 consists of widow(er)s.

Ethnicity is measured by self-reported ethnicity, in which several categories are taken together. Natives consist of category 0. Non-natives comprise category 1 and consist of Western non-natives from Germany, Belgium, Poland, former Yugoslavia, Indonesia, or other Western countries, and non-Western non-natives from Turkey, Morocco, Suriname, Antilles or other non-Western countries.

Main activity is constructed by combining several variables. The first category consists of those who work, ranging from 1 to 40 hours. Category 2 is the retired. Category 3 consists of individuals who are not working, such as the unemployed, disabled, social assistance claimants, or housewives/husbands. Lastly, category 4, "students" are those studying.

Mental health is also included as control variable. It is found to be related to weight (Herpertz, Kielmann, Wolf, Hebebrand, & Senf, 2004; Scott et al., 2008). Also, because I include several subjective measures of environmental factors into the analysis, mental health is important to include as well because those with worse mental health could be more prone to answer more negatively to subjective answers compared to those with better mental health. Mental health is measured by combining several questions on one's mental state. With a factor analysis it is assessed that these questions all form one dimension. Eventually, all factor loadings were high enough and Cronbach's alpha is 0,910. The final scale on mental health is thus constructed using the following questions: "How often do you feel fatigue without a clear reason?”, “How often do you feel hopeless?”, “How often do you feel restless?”, “How often do you feel so restless you cannot sit anymore?”, “How often do you feel miserable or depressive?”, “How often do you feel as if everything takes a lot of effort?”, “How often do you feel so miserable nothing helps to cheer you up?”, and “How often do you feel reprehensible, inferior, or worthless?”. The answer categories for all these questions range from (1) “Always” to (5) “Never”. These questions are added and divided by eight. A higher score on the mental health scale thus indicates a better mental health. For these control variables no missing values are present.

Next, smoking and alcohol drinking behaviour are included in the model, because they are known to influence BMI (Kuchler & Lin, 2002; Lin, Huang, & French, 2004; Lukasiewicz et al., 2005) and are part of one’s lifestyle. When performed outside of the house, they can both influence the overall sense of safety or likeness of neighbourhoods due to littering or social nuisance. **Smoking** is constructed using several variables. Respondents were asked “Do you smoke?” and “Have you smoked in the past?” and could answer yes or no. A new variable is constructed with the answer categories (0) “Never smoked”, (1) “Ex-smoker”, and (2) “Current smoker”. No missing values are present. **Alcohol drinking behaviour** is constructed by adding the following questions “How many glasses of alcohol do you usually drink during weekdays?” and “How many glasses of alcohol do you usually drink during weekends?”. Consequently, the higher the score, the more glasses of alcohol is consumed. Because this variable concerns an interval one, the missing values (6,9% of all respondents) are recoded as the mean value.

Lastly, I take into account income for several reasons. First, by taking into account income I am able to control for the price of foods, as those with higher incomes experience fewer financial constraints when making the choice between healthy or unhealthy foods. Unhealthy foods, such as energy-dense, high-sugar and high-fat foods are namely known to be cheaper than healthy foods, such as vegetables and fruits (Darmon et al., 2004; Drewnowski, 2004). This relationship is also shown to be present in the Netherlands (Mul et al., 2009), where the authors found that low-income groups more often maintain an unhealthy pattern. Price is thus an important method to influence consumers (Han, Gupta, & Lehmann, 2001), especially low-income groups (Cassady, Jetter, & Culp, 2007; Glanz, Basil, Maibach, Goldberg, & Snyder, 1998). In addition, income has strong independent effects on BMI (Schmeiser, 2009), as those with higher income more often maintain a sedentary lifestyle and maintain a diet consisting of excessive caloric intake (Drewnowski, 2000; Popkin, 2001). In addition, average income per area is important to take into account when assessing BMI because more impoverished areas namely experience lower levels of community social capital, which leads to worse health outcomes (Wilkinson, 2005). Therefore, two measures of income will be included. First, **household income** in quintiles is taken into account, using information from the Health Monitor (2016). Respondents were asked to give their income. Next, these incomes were standardised and categorised into one of the five response categories: (1) "0-20% (max. 16.100 euros)", (2) "20-40% (max 21.300 euros)", (3) "40-60% (max 27.200 euros"), (4) "60-80% (max. 35.100 euros)", or (5) "80-100% (more than 35.100 euros)". These quintiles are included in the analysis as dummies. Second, **average municipality income**, defined by the average standardised household income x1.000 euros is included. This data is gathered from Statistics Netherlands (2017), in which the average standardised income per municipality is taken into account. There were no missing values.

4. Analysis

4.1.Analytical procedure

In order to test the hypotheses, I performed a multilevel regression analysis where the two levels are individuals and municipalities. Although within municipalities there can be variation in higher-level factors such as population density or neighbourhood safety, with this type of analysis I am able to control for the fact that individuals live in a certain place. In other words, because individuals are nested into different municipalities within the Netherlands it is important not to neglect this. With this type of analysis, I do not violate any assumptions on the hierarchical structure of the data and on the normal distribution of the residuals.

Several models are constructed in which the hypotheses will be tested. Following hypothesis 1, first, the variables measuring noise pollution are included in model 1. Model 2 consists of neighbourhood safety measurements to test hypothesis 2. In model 3, measurements of population density are included. Hypothesis 4 will be tested in model 4, where quality of facilities is entered. In model 5, physical activity is included. Model 6 adds to that density and proximity of fast food outlets and supermarkets. Finally, in model 7, educational level is added to the model to test whether and how it affects the default lifestyle and BMI. In the appendix in table A2 the results can be found for the regression containing the interaction effect of educational level on the default lifestyle.

As measure for overall fit I look at -2 log-likelihood. When comparing nested models, this can best be done by looking at the deviance. For this measurement it is true that the smaller the deviance, the better the fit. In addition, I calculated the Pseudo-R^2 at individual level in order to assess how much of the variance is explained per model. In table 2 the descriptive statistics of the dependent and independent variables are shown. In table A1 the correlations of all municipality-level variables can be seen.

Table 2 Descriptive statistics of (in)dependent variables at municipality-level (N=358.614)

	Min	Max	Mean	Std.Dev.	Data sources
BMI	14.01	49.96	25.89	4.23	Health Monitor (2016)
Educational level	1	4	2.87	0.92	Health Monitor (2016)
Element 1: Displacing human energy with mechanical energy					
Subjective noise pollution	1.85	19.78	19.78	4.19	Health Monitor (2012)
Objective noise pollution	1	6.49	2.84	0.90	RIVM (2017)
Physical decay	21.50	88.20	82.82	4.99	Statistics Netherlands (2017)
Social nuisance	11.80	73.90	60.49	5.61	Statistics Netherlands (2017)
Crime rate	6.50	7.70	7.13	0.15	Statistics Netherlands (2017)
Population density	25	6347	1282.68	1419.73	Statistics Netherlands (2017)
Distance to facilities	1.36	30.17	4.04	2.25	Statistics Netherlands (2017)
Quality of facilities	5.60	7	6.29	0.16	Statistics Netherlands (2017)
Physical activity	0	112	40.07	23.04	Health Monitor (2016)
Score on fit norm	0	3	1.03	0.962	Health Monitor (2016)
Element 2: Displacing household food production with industrial food production					
Proximity to fast food outlets	0.40	4.60	0.90	0.44	Statistics Netherlands (2017)
Proximity to large supermarkets	0.40	2.60	0.96	0.37	Statistics Netherlands (2017)
Density of fast food outlets	0.10	47	4.52	3.55	Statistics Netherlands (2016)
Control variables					
Age	18	107	59.06	16.99	Health Monitor (2016)
Sex	0	1	0.47	0.50	Health Monitor (2016)
Marital status	1	5	1.90	1.38	Health Monitor (2016)
Ethnicity	0	1	0.12	0.33	Health Monitor (2016)
Main activity	1	4	1.96	0.88	Health Monitor (2016)
Mental health	1	5	4.42	0.64	Health Monitor (2016)
Smoking behaviour	0	2	0.76	0.71	Health Monitor (2016)
Alcohol drinking behaviour	0	105	6.80	8.97	Health Monitor (2016)
Household income	1	5	3.47	1.27	Health Monitor (2016)
Municipality income	20.10	44	26.14	2.88	Statistics Netherlands (2017)

Source: Dutch National Food Consumption Survey (2013); Health Monitor (2016); RIVM (2017); Statistics Netherlands (2016; 2017).

4.1.1. **Results**

First, I examine whether those living in municipalities with higher experienced or objective noise pollution have a higher BMI. As the first model in table 3 shows, those living in areas with higher levels of objective noise pollution have a lower BMI. Subjective noise pollution does not explain BMI. Second, it is expected that higher experienced overall unsafety in a municipality is related to a higher BMI. With regard to physical decay this is confirmed: the higher the average physical decay in a neighbourhoods, the higher BMI. Concerning social nuisance and crime rates the opposite is true: respondents living in municipalities with higher crime rates or social nuisance in general have a lower BMI. In model 3 population density and distance to facilities are added to the analysis. As can be seen, the higher the distance to facilities, the higher BMI. As a higher distance is a proxy for a lower population density, this finding is in line with the expectation. As can be seen in model 4, the quality of neighbourhood facilities in a municipality is inversely related to BMI. In other words: the higher the quality of facilities, the lower BMI, which is according to the expectation.

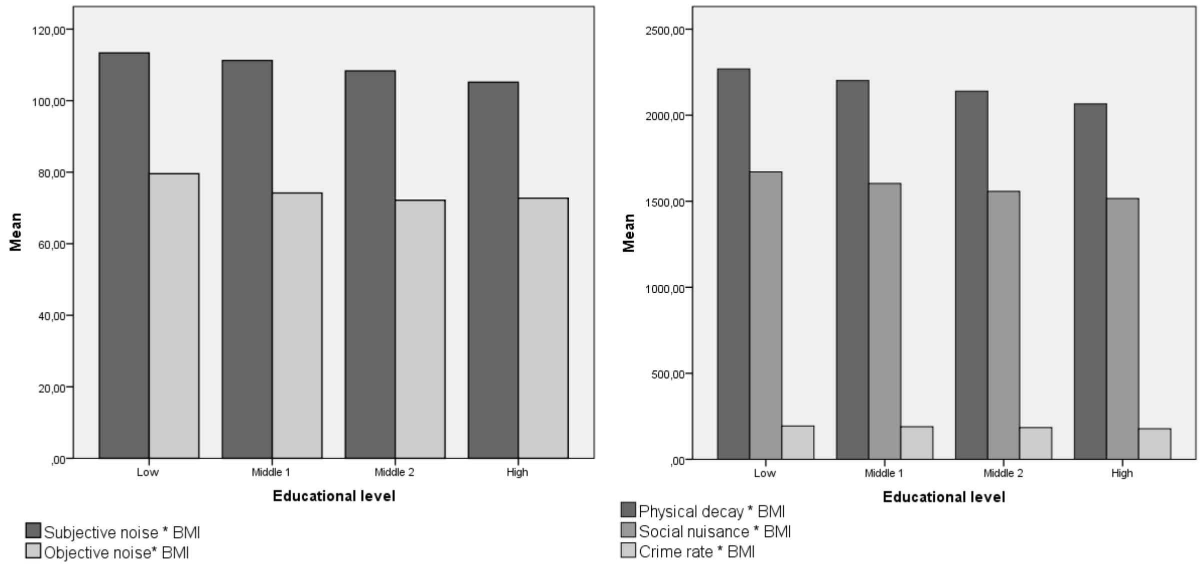
In hypotheses 1 to 4 I expected physical activity to serve as explaining factor between noise pollution, safety, population density, and quality of facilities. In model 5 physical activity is added to the model. As can be seen, the more physical activity, the lower BMI. Those who are most active ('norm-actives') have the lowest BMI compared to those who are not active. This is in line with my expectation. Yet, the b-coefficients of safety factors, population density, and quality of facilities do not decrease substantially compared to the previous model, which is why hypotheses 1 to 4 cannot be confirmed.

In model 6 it is tested whether proximity to fast food outlets and supermarkets influence BMI. As can be seen, the higher the distance to fast food outlets, the lower the BMI. This is in line with hypothesis 5. Furthermore, the higher the density of fast food outlets, the lower the average BMI. This is not according to the expectation, as a higher density indicates a greater supply of meal delivery services. Hypothesis 6a or 6b cannot be confirmed, as proximity to supermarkets does not predict BMI.

Finally, educational level is added to the model in order to see its difference on the factors of the default lifestyle and BMI. It appears to be an important factor in explaining BMI. As all factors of the default lifestyle decrease in power and as some lose significance, I can conclude that educational level can override the default lifestyle. Furthermore, it can be seen that the low and middle educational levels have a higher BMI compared to the reference category, the highest educational level. This is in line with Mirowsky and Ross's (2015) expectation on higher educated being less often obese. In addition, the difference between the lowest and highest educational level is highest compared to the middle educational levels. Furthermore, an interesting finding is that in models 1 to 6, I found that those who are not working have a higher BMI in general than those who are working. Yet, when educational level is added to the model, there is no difference between those two groups anymore.

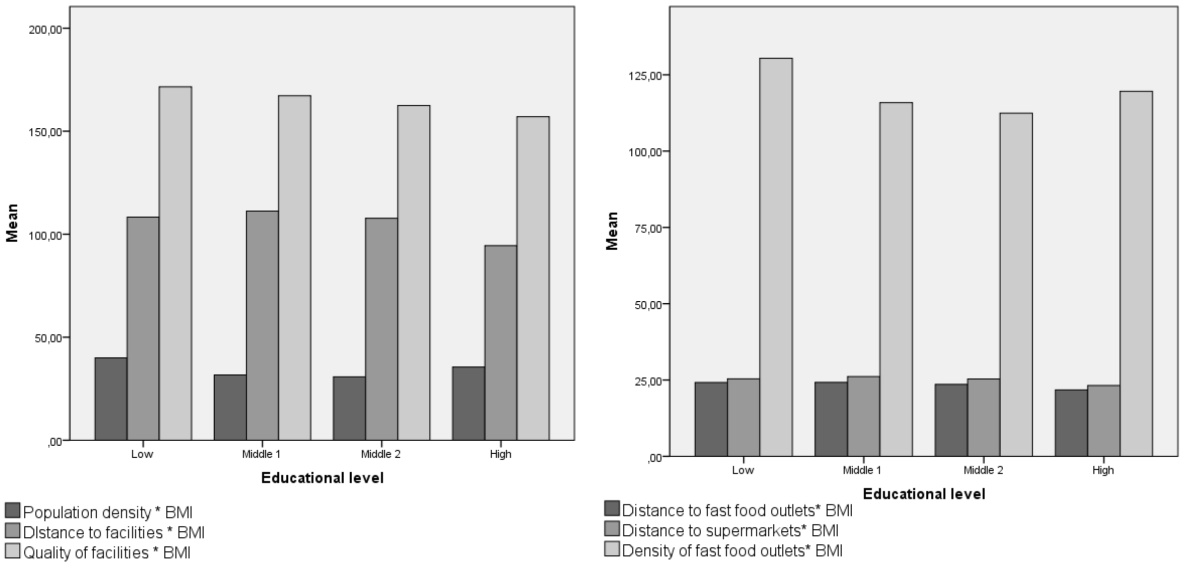
In the appendix the results of the linear multilevel regression analysis containing the interacting effect of educational level can be seen. In the figures below I show the interaction between education and the default lifestyle visually. Four figures are constructed corresponding the different themes as described in the theoretical framework. First, with regard to noise pollution, figure 2 shows that the combined effect of both subjective noise pollution and BMI and objective noise pollution and BMI decrease when educational level increases. In other words, the positive effect of noise pollution on BMI decreases when educational level increases. Yet, these are no significant differences; only objective noise in the middle 1 educational level differs significantly from the highest educational level combined with BMI. In figure 3, the safety measures are taken into account. It can be seen that as educational level goes up, the effect of physical decay on BMI decreases, which are all significant effects. This is also true for social nuisance. Yet, for crime rates no clear educational gradient can be seen. Only the lowest educational level combined with BMI is significantly different from the reference category.

Figures 2-3 Interaction effects of educational level and BMI



In figure 4 the effects of population density and quality of facilities are seen. Both population density as distance to facilities show a similar relationship to BMI and educational level, as the former is expected to be negatively related to BMI, while the latter is expected to be positively related to BMI. Yet, these differences are not significant. Furthermore, it can be seen that the combined effect of quality of facilities and BMI relates negatively to educational level. Or, in other words, the relationship between quality of facilities and BMI decreases as educational level increases. Only the lowest educational level differs significantly with the highest educational level. Lastly, in figure 5, the factors as measured in element 2 are shown visually. For distance to fast food outlets and supermarkets, no clear pattern can be seen across the educational levels. For density of fast food outlets, an curvilinear pattern is shown. None of these relationships are significant.

Figures 4-5 Interaction effects of educational level and BMI



When comparing the -2 log-likelihood values in the models of table 3, it can be seen that each subsequent model provides a better fit. In other words, each model in which new variables are added provide a better fit of the data. The final model is the best model when looking at the -2 log-likelihood values, as it holds that the smaller the value, the better the fit. Yet, when comparing the individual Pseudo-R^2 values, fewer changes are detectable across the different models. This can be due to the fact that mostly contextual factors are added to the model. The final model provides the highest Pseudo-R^2: for this model holds that 8% of the individual-level deviance in BMI is explained by all variables as included. In table 3 it can furthermore be seen that the variance of the constant, the municipality-level variance, decreases in each subsequent model, indicating that municipalities are less different when more higher-level factors are taken into account. In other words, the between-country differences decrease. The residual variance also decreases in the successive models, indicating that more individual-level variance is explained when more factors are added to the model.

In summary, hypothesis 5 and 7 are confirmed. Safety, distance to facilities, and quality of neighbourhood facilities are important in determining BMI, but including physical activity into the model does not highly impact these relationships to BMI. Educational level, however, impacts BMI and the factors of the default lifestyle strongly.

Table 3 Linear multilevel regression analysis of BMI on individual-level and municipality-level variables (N=358.614)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	B (Std.Dev)	B (Std.Dev)	B (Std.Dev)	B (Std.Dev)	B (Std.Dev)	B (Std.Dev)	B (Std.Dev)
Constant	27.876*** (0.154)	34.835*** (1.449)	33.364*** (1.481)	34.302*** (1.411)	33.852*** (1.359)	33.552*** (1.335)	32.221*** (1.208)
Educational level[a]							
Low level							1.468*** (0.033)
Middle 1 level							1.157*** (0.020)
Middle 2 level							0.795*** (0.018)
Element 1: Displacing human energy with mechanical energy							
Subjective noise pollution	0.014 (0.009)	0.014 (0.009)	0.010 (0.009)	0.010 (0.009)	0.009 (0.008)	0.008 (0.008)	0.009 (0.008)
Objective noise pollution	-0.054* (0.020)	-0.048** (0.019)	0.032 (0.031)	0.034 (0.031)	0.031 (0.029)	0.020 (0.030)	0.011 (0.027)
Physical decay		0.031*** (0.007)	0.028*** (0.007)	0.025** (0.007)	0.022** (0.007)	0.020** (0.007)	0.016* (0.006)
Social nuisance		-0.045*** (0.009)	-0.041*** (0.009)	-0.036*** (0.009)	-0.032*** (0.009)	-0.028** (0.009)	-0.022** (0.008)
Crime rates		-0.953*** (0.188)	-0.909*** (0.184)	-0.685** (0.214)	-0.595** (0.205)	-0.524** (0.202)	-0.453* (0.183)
Population density			-0.015 (0.022)	-0.030 (0.023)	-0.038 (0.022)	-0.031 (0.022)	-0.023 (0.020)
Distance facilities			0.024** (0.007)	0.025** (0.007)	0.025** (0.007)	0.026*** (0.007)	0.017* (0.007)
Quality of facilities				-0.278* (0.137)	-0.280* (0.132)	-0.283* (0.133)	-0.226 (0.118)
Physical activity					-0.005*** (0.000)	-0.005*** (0.000)	-0.005*** (0.000)
Score on fit norm[b]							
Semi-active					-0.526*** (0.190)	-0.526*** (0.019)	-0.481*** (0.019)
Norm-active					-0.667*** (0.017)	-0.667*** (0.017)	-0.620*** (0.017)
Element 2: Displacing household food production with industrial food production							
Proximity to fast food outlets						-0.101* (0.040)	-0.086* (0.037)
Proximity to large supermarkets						0.009 (0.060)	0.006 (0.056)
Density of fast food outlets						-0.014** (0.005)	-0.011* (0.004)
Control variables							
Age	0.022*** (0.001)	0.022*** (0.001)	0.013*** (0.001)	0.022*** (0.001)	0.023*** (0.001)	0.023*** (0.001)	0.016*** (0.001)
Sex[c]	0.615*** (0.015)	0.615*** (0.015)	0.615*** (0.015)	0.615*** (0.015)	0.617*** (0.015)	0.616*** (0.015)	0.656*** (0.015)

Continuation of table 3: Linear multilevel regression analysis of BMI on individual-level and municipality-level variables (N=358.614)							
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	B (Std.Dev)	B (Std.Dev)	B (Std.Dev)	B (Std.Dev)	B (Std.Dev)	B (Std.Dev)	B (Std.Dev)
Marital status[d]							
Living together	-0.507*** (0.027)	-0.507*** (0.027)	-0.506*** (0.027)	-0.506*** (0.027)	-0.537*** (0.026)	-0.537*** (0.026)	-0.474*** (0.026)
Unmarried	-0.699*** (0.028)	-0.698*** (0.027)	-0.697*** (0.027)	-0.697*** (0.027)	-0.742*** (0.027)	-0.741*** (0.027)	-0.754*** (0.026)
Divorced	-0.165*** (0.028)	-0.165*** (0.028)	-0.164*** (0.028)	-0.164*** (0.028)	-0.161*** (0.028)	-0.160*** (0.028)	-0.074** (0.028)
Widow	-0.239*** (0.025)	-0.239*** (0.025)	-0.238*** (0.025)	-0.239*** (0.025)	-0.323*** (0.025)	-0.323*** (0.025)	-0.355*** (0.025)
Ethnicity[e]	0.065** (0.022)	0.065** (0.022)	0.067** (0.022)	0.067** (0.022)	0.028 (0.022)	0.027 (0.022)	0.054* (0.022)
Main activity[f]							
Retired	-0.228*** (0.022)	-0.228*** (0.022)	-0.228*** (0.022)	-0.228*** (0.022)	-0.204*** (0.023)	-0.204*** (0.023)	-0.183*** (0.023)
Not working	0.157*** (0.022)	0.156*** (0.022)	0.156*** (0.022)	0.156*** (0.022)	0.150*** (0.022)	0.150*** (0.022)	-0.026 (0.022)
Student	-1.251*** (0.040)	-1.251*** (0.040)	-1.250*** (0.040)	-1.250*** (0.040)	-1.240*** (0.040)	-1.241*** (0.040)	-1.286*** (0.040)
Mental health	-0.497*** (0.011)	-0.497*** (0.011)	-0.498*** (0.011)	-0.498*** (0.011)	-0.413*** (0.011)	-0.413*** (0.011)	-0.374*** (0.011)
Smoking[g]							
Ex-smoker	0.599*** (0.016)	0.599*** (0.016)	0.599*** (0.016)	0.599*** (0.016)	0.615*** (0.016)	0.615*** (0.016)	0.574*** (0.016)
Current smoker	-0.295*** (0.021)	-0.295*** (0.021)	-0.295*** (0.021)	-0.295*** (0.021)	-0.348*** (0.021)	-0.347*** (0.021)	-0.453*** (0.021)
Alcohol drinking behaviour	-0.007*** (0.001)	-0.007*** (0.001)	-0.007*** (0.001)	-0.007*** (0.001)	-0.005*** (0.001)	-0.005*** (0.001)	-0.003*** (0.001)
Household income[h]							
0-20%	0.900*** (0.030)	0.901*** (0.030)	0.900*** (0.030)	0.901*** (0.030)	0.805*** (0.030)	0.805*** (0.030)	0.414*** (0.030)
20-40%	1.036*** (0.022)	1.036*** (0.022)	1.036*** (0.022)	1.036*** (0.022)	0.941*** (0.022)	0.942*** (0.022)	0.494*** (0.023)
40-60%	0.657*** (0.020)	0.656*** (0.020)	0.656*** (0.020)	0.656*** (0.020)	0.604*** (0.020)	0.604*** (0.020)	0.264*** (0.021)
60-80%	0.372*** (0.019)	0.372*** (0.019)	0.372*** (0.019)	0.372*** (0.019)	0.344*** (0.019)	0.344*** (0.019)	0.162*** (0.019)
Municipality income	-0.065*** (0.005)	-0.066*** (0.005)	-0.067*** (0.005)	-0.066*** (0.005)	-0.065*** (0.005)	-0.068*** (0.005)	-0.060*** (0.005)
Pseudo R^2 (individual)	0.064	0.064	0.064	0.064	0.069	0.069	0.080
-2LL	2029394.466	2029362.459	2029347.747	2029343.687	2027280.974	2027266.628	2023295.497
Residual variance	16.770	16.770	16.770	16.770	16.675	16.675	16.494
Variance of the constant	0.068	0.060	0.056	0.055	0.050	0.048	0.037

*=p<0.05, **=p<0.005, ***=p<0.001

[a] The reference category represents the highest educational level; [b] The reference category represents those who are inactive; [c] The reference category represents women; [d] The reference category represents married individuals; [e] The reference category represents native Dutch individuals; [f] The reference category represents individuals who work part-time or fulltime; [g] The reference category represents individuals who have never smoked; [h] The reference category represents individuals in the richest 80 to 100% of the Netherlands.

4.1.2. Robustness of the results

In order to test the robustness of the hypotheses, they were also addressed in terms of geography. The Netherlands is a densely populated area, but not uniformly. By performing separate analyses concerning geographical distinctions, I can distinguish between more or less densely populated areas in the country. In addition, because the default lifestyle is mostly constructed at country-level, and because of its emphasis on the environment, it is interesting to take this a step further and to differentiate between municipality size. In table A3 to A6 the results of the regression analyses can be seen.

First, I made the distinction between centre (Randstad) and 'periphery', as the Randstad takes up only twenty percent of the Dutch territory, while almost half of the Dutch lives and works in this area (Nijmeijer, 2000). Physical decay and social nuisance do influence BMI significantly in Randstad (resp. b=0.046, p<0.05; b= -0.035, p<0.005), but not in the rest of the Netherlands. Furthermore, distance to facilities (b=0.017, p<0.05) and distance to fast food outlets (b= -0.083, p<0.05) are positively related to BMI for periphery, but not for Randstad. Also, only in periphery and not in Randstad crime rates (b= -0.576, p<0.05) and distance to facilities (b=0.017, p<0.05) are related to BMI.

Second, I differed between size of municipalities; of those higher or below 100.000 residents. For municipalities with more than 100.000 residents, higher crime rates (b= -0.751, p<0.05) and higher quality of facilities (b= -0.519, p<0.005) relate to a lower BMI. In smaller municipalities the distance to facilities is associated with a higher BMI (b=0.016, p<0.05).

Besides the influence of population density, the differences between Randstad and periphery and between municipalities with more or less than 100.000 residents can be accounted for by agglomeration effects. In densely populated areas, such as Randstad and municipalities with over 100.000 residents, other factors can also be influenced due to the increased population density, such as social nuisance or physical decay. This knowledge can explain why these factors are found to be significantly related to BMI in Randstad but not in periphery; the same holds for noise pollution in municipalities with more than 100.000 residents.

In conclusion, differentiating the analysis by geography did provide some interesting results. As expected, the environmental factors showed altered relations to BMI when distinguishing between either Randstad and periphery or municipalities with more or less than 100.000 inhabitants. Yet, because the direction of the assessed relationships does not vary in the full model or when performing these robustness tests, I argue the results can be considered robust. In table 4 another overview of the hypotheses is presented, this time containing an overview whether they have been confirmed or rejected.

Table 4 Overview of hypotheses

Element of default lifestyle	Hypothesis	Confirmed/rejected
Displacing human energy with mechanical energy	1. Individuals living in areas with lower noise pollution due to traffic have higher levels of physical activity, resulting in a lower BMI.	Rejected
Displacing human energy with mechanical energy	2. Individuals living in areas with higher experienced overall safety have higher levels of physical activity, resulting in lower BMI.	Rejected
Displacing human energy with mechanical energy	3. Individuals living in a densely populated area experience higher levels of physical activity, resulting in a lower BMI.	Rejected
Displacing human energy with mechanical energy	4. The higher the quality of physical neighbourhood facilities, the higher the physical activity levels, resulting in a lower BMI.	Rejected
Displacing household food production with industrial food production	5. The closer the proximity to fast food outlets, the higher the BMI.	Confirmed
Displacing household food production with industrial food production	6. The a) closer, or b) further the proximity to supermarkets, the higher the BMI.	Rejected
Overarching hypothesis	7. The negative effect of the default lifestyle is weaker for higher educated compared to lower educated.	Confirmed

5. Discussion

The default American lifestyle is a theoretical concept created in order to get a grip on the large prevalence of overweight and obesity in the United States (Mirowsky & Ross, 2011). This lifestyle consists of three elements: displacing human energy with mechanical energy, displacing household food production with industrial food production, and displacing health maintenance with medical dependency. It is the default, as Mirowsky and Ross (2011) argue that the American society is designed to choose cars over bikes or walking, food is produced for convenience rather than nutrition, and it is the norm to take medicines to control health issues. Yet, the same holds also for other Western countries, specifically the Netherlands. It can be argued the Netherlands is at the same position nowadays with regard to the prevalence of a high BMI compared to the United States a few decades earlier. In addition, the influence of the United States on European countries is prevalent in the enlargement of portion sizes, the number of fast food chains, and the increasing prevalence of sedentary behaviour. Therefore, the foundations of the default American lifestyle are used to create a new theoretical framework: the default Dutch lifestyle.

As I argued, there are at least four important factors to take into account in studying the displacement of human energy with mechanical energy: noise pollution, safety, population density, and quality of physical activity-related facilities. Using a multilevel regression analysis I tested to what extent these factors are related to BMI. Although the inclusion of physical activity did not provide major changes in the strength of these factors, there are some interesting other findings regarding these factors. For instance, the higher the physical decay in a neighbourhood, the higher the average BMI. Social nuisance and crime rates, on the other hand, are related to a lower BMI. This is not consistent with earlier research (Brown, Werner, Smith, Tribby, & Miller, 2014; Fish, Ettner, Ang, & Brown, 2010; Foster & Giles-Corti, 2008). Future research should point out whether this is a robust finding or whether causality issues are at hand here. Next, as somewhat expected, population density does not predict BMI, yet, distance to facilities does: the higher the distance, the higher the BMI. As a higher distance is a proxy for a lower population density. From theoretical point of view, it can be expected that a high distance to facilities increases the tendency to take the car instead of using a form of active transportation. Furthermore, I found that the higher the distance to fast food outlets, the lower the BMI, while distance to supermarkets does not predict BMI.

As Mirowsky and Ross (2015) put a lot of emphasis on the role of educational level in the default lifestyle, I hypothesised that education can override the default lifestyle. It can be claimed that in a way, the concept of temptation is the main underlying factor in the default lifestyle. Mirowsky and Ross (2015) assume lower educated individuals are more likely to choose the easier option and are thus not successful in resisting temptation. With increasing educational level, as they argue, the ability to resist this temptation increases. And indeed, all factors of the default lifestyle decrease in power when educational level is added to the model.

Interestingly, those who are not working have a higher BMI than those who are; but this effect disappears when educational level is added to the model. This discovery could be explained by the finding that, at least among women, obesity prevalence is higher among housewives compared to working women, while it is lower among the higher educated (Salici et al., 2017). In other words, when educational level is included in the analysis, the positive effect of not working versus working and the negative effect of educational level on BMI are neutralised, causing an insignificant result.

With a robustness test I checked the sturdiness of the claims. Differentiating between Randstad and periphery and in municipality size yielded some interesting results. The municipality-level factors of physical decay and social nuisance did influence BMI significantly in Randstad, but not in the rest of the Netherlands. Also, crime rates, distance to facilities and distance to fast food outlets did yield significant results in periphery, but not in Randstad. This could be the case because neighbourhoods are more densely populated in Randstad than in the rest of the Netherlands, while the differences in population density are higher, and thus more visible, in the rest of the Netherlands. When differentiating to size of municipalities, crime rate and quality of facilities do predict BMI for residents in municipalities with 100.000 or more residents, but not for residents of smaller municipalities. For those smaller municipalities holds that a higher distance to facilities is related to a higher BMI. These robustness tests show that population density is perhaps high in the Netherlands overall, but there are differences visible when using different measurements and tests of population density. In addition, it shows that geographic factors are important in assessing BMI, and that even in a small country as highly populated as the Netherlands making geographical differentiations is useful.

This study shows how the default American lifestyle can be applied and modified into a default Dutch lifestyle. However, this study has some limitations. First, as mentioned earlier, the reliability of BMI is often questioned. In order to capture its shortfalls I treated BMI as a continuous variable without strong cut-off values. Future research, however, can do the analysis on other measures besides BMI, such as waist circumference. Second, I was not able to make any claims on the causal direction of the relationships I found. Yet, it could be the case that people actively choose to live in neighbourhoods that support their dietary or physical activity preferences (Zick et al., 2013). In addition, I could not assess any potential differences in time between the strength of relationships. Longitudinal data is necessary to assess causality or differences in time. Third, this study has shown it is difficult to operationalise the default (American) lifestyle in general. Therefore, it is possible that the indicators as used do not fully capture the theoretical concept as originally described by Mirowsky and Ross (2011). In this study, the third element of the default lifestyle, the displacement of health maintenance with medical dependency, is even thought to be impossible to operationalise. Future research could take it into account when a cross-country study design is used to measure the societal pressure as described in this element. Fourth, future research should take into account objective measurements of safety. In this study, only subjective measurements were available which can generate different results. Those individuals causing most nuisance in neighbourhoods perhaps do not view their neighbourhood as unsafe, as they themselves are its cause. Future research should take into account objective measurements of neighbourhood or municipality safety levels. Lastly, I was not able to measure more dietary factors, such as fruit and vegetable consumption, frequency of cooking, and frequency of takeaway meals at individual level due to data limitations.

In addition, the theoretical foundations of the default lifestyle can also be questioned to some extent. Mirowsky and Ross (2011) argue that society is structured in such a way that citizens are unconsciously unhealthy regarding their physical activity levels and dietary patterns. Yet, it does not mean individuals cannot choose otherwise. The authors argue that education leads to knowledge about healthy behaviours and healthy living. However, the obesity epidemic went together with educational expansion. Thus, people have knowledge, but this does not necessarily mean people *choose* the healthier option. However, as the analysis have shown, educational level does function as an interacting variable in the default lifestyle. Future research should thus always include educational level when assessing lifestyles.

Despite these limitations, this study has contributed to scientific knowledge by being able to measure and test indicators of the default lifestyle, a concept that has not been operationalised or empirically tested before. Besides, I have constructed a new theoretical concept in order to apply the default lifestyle to the context of the Netherlands. The empirical tests of this concepts is performed on a high-quality dataset containing over 350.000 respondents. Therefore, I was able to make claims at municipality-level while having enough statistical power. In addition, this study has shown that contexts are important when measuring theoretical concepts such as the default lifestyle. Population density is an important factor that should be taken into account via multiple measurements, as the robustness tests have revealed that geography is influential in assessing BMI. I have shown it is not possible to simply apply the default American lifestyle to the Netherlands, as there are context-specific factors that are expected to be of influence in the United States, but not in the Netherlands, such as population density. Perhaps future research can further explore the idea of a more general 'Western' default lifestyle. Now, I only focused on the Netherlands, but because of the similarities between Western countries it can be interesting to see to what extent the default lifestyle fits into other countries. This way, more general patterns in Western society in explaining *globesity* can be unravelled.

One question remains. Is the default lifestyle actually the default in the Netherlands? Theoretically, Mirowsky and Ross (2011) argued how the displacement of human energy with mechanical energy and the displacement of household food production with industrial food production eventually result in the displacement of health maintenance with medical dependency. These elements taken together, thus the default lifestyle, can explain *globesity*. Also in the Netherlands, theoretically, the default lifestyle can be argued to be present, while empirically, not all factors are as important as expected. Yet, this is a primary exploration in operationalising the default lifestyle. Of both the first and second element of the lifestyle at least several factors are significantly associated with BMI. Therefore, it can be reasoned that the default Dutch lifestyle, as created in this thesis, actually is the default in the Netherlands.

6. Literature

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7. Appendix

Table A1. Correlation matrix of municipality-level variables

	Subjective noise pollution	Objective noise pollution	Physical decay	Social nuisance	Crime rates	Population density	Distance to facilities	Quality of facilities	Proximity to fast food outlets	Proximity to supermarket	Density of fast food outlets
Subjective noise pollution	1										
Objective noise pollution	0.320***	1									
Physical decay	-0.029***	0.160***	1								
Social nuisance	-0.015***	0.353***	0.845***	1							
Crime rates	0.014***	-0.327***	-0.448***	-0.654***	1						
Population density	-0.001	0.716***	0.212***	0.478***	-0.351***	1					
Distance to facilities	-0.165***	-0.672***	-0.125***	-0.244***	0.202***	-0.577***	1				
Quality of facilities	0.017***	0.125***	-0.103***	-0.041***	0.372***	0.227***	-0.070***	1			
Proximity to fast food outlets	-0.143***	-0.468***	-0.037***	-0.107***	0.109***	-0.367***	0.508***	0.017***	1		
Proximity to supermarket	-0.110***	-0.676***	-0.152***	-0.306***	-0.280***	-0.626***	0.654***	-0.053***	0.721***	1	
Density of fast food outlets	-0.004***	0.376***	0.121***	0.282***	-0.126***	0.492***	-0.405***	0.062***	-0.437***	-0.462	1

Table A2. Linear multilevel regression analysis of BMI on individual-level and municipality-level variables (N=358.614)

Variable	B (Std.Dev.)
Intercept	27.461*** (0.146)
Educational level[a]	
Low level	1.937 (2.113)
Middle 1 level	-0.2192 (1.207)
Middle 2 level	2.928* (1.217)
Subjective noise pollution * educational level	
Subjective noise pollution * low level	-0.0167 (0.019)
Subjective noise pollution * middle 1 level	0.0082 (0.010)
Subjective noise pollution * middle 2 level	0.001 (0.010)
Objective noise pollution * educational level	
Objective noise pollution * low level	-0.05 (0.060)
Objective noise pollution * middle 1 level	-0.075* (0.031)
Objective noise pollution * middle 2 level	0.021 (0.031)
Physical decay * educational level	
Physical decay * low level	-0.033* (0.013)
Physical decay * middle 1 level	-0.033*** (0.007)
Physical decay * middle 2 level	-0.022** (0.007)
Social nuisance * educational level	
Social nuisance * low level	0.045* (0.014)
Social nuisance * middle 1 level	0.051*** (0.008)
Social nuisance * middle 2 level	0.027** (0.008
Crime rate * educational level	
Crime rate * low level	-0.699* (0.316)
Crime rate * middle 1 level	0.242 (0.179)
Crime rate * middle 2 level	-0.056 (0.179)
Population density * educational level	
Population density * low level	0.0194 (0.035)
Population density * middle 1 level	0.019 (0.021)
Population density * middle 2 level	0.007 (0.020)
Distance to facilities * educational level	
Distance to facilities * low level	-0.007 (0.019)
Distance to facilities * middle 1 level	0.0125 (0.009)
Distance to facilities * middle 2 level	0.002 (0.009)
Quality of facilities * educational level	
Quality of facilities * low level	0.723** (0.223)
Quality of facilities * middle 1 level	-0.087 (0.121)
Quality of facilities * middle 2 level	-0.267 (0.121)
Distance to fast food outlets * educational level	
Distance to fast food outlets * low level	0.001 (0.000)
Distance to fast food outlets * middle 1 level	0.041 (0.019)
Distance to fast food outlets * middle 2 level	0.042 (0.017)

Continuation of table A2: Linear multilevel regression analysis of BMI on individual-level and municipality-level variables (N=358.614)	
Distance to large supermarkets * educational level	
Distance to large supermarkets * low level	0.219 (0.034)
Distance to large supermarkets * middle 1 level	-0.143 (0.100)
Distance to large supermarkets * middle 2 level	-0.059 (0.050)
Density of fast food outlets * educational level	
Density of fast food outlets * low level	-0.003 (0.049)
Density of fast food outlets * middle 1 level	0.005 (0.149)
Density of fast food outlets * middle 2 level	-0.001 (0.073)
Physical activity	-0.005 (0.073)
Score on fit norm[b]	
Semi-active	-0.478 (0.010)
Norm-active	-0.617 (0.005)
Age	0.016*** (0.005)
Sex[c]	0.653*** (0.001)
Marital status[d]	
Living together	-0.47 (0.015)
Unmarried	-0.751 (0.026)
Divorced	-0.08 (0.026)
Widow	-0.355 (0.028)
Ethnicity[e]	0.044* (0.025)
Main activity[f]	
Retired	-0.186 (0.022)
Not working	0.026 (0.023)
Student	-1.287*** (0.022)
Mental health	-0.371 (0.040)
Smoking[g]	
Ex-smoker	0.576*** (0.011)
Current smoker	-0.454 (0.016)
Alcohol drinking behaviour	-0.003 (0.021)
Household income[h]	
0-20%	0.408*** (0.001)
20-40%	0.493*** (0.030)
40-60%	0.267*** (0.023)
60-80%	0.164*** (0.021)
Municipality income	-0.055*** (0.019)

*=p<0.05, **=p<0.005, ***=p<0.001

[a] The reference category represents the highest educational level; [b] The reference category represents those who are inactive; [c] The reference category represents women; [d] The reference category represents married individuals; [e] The reference category represents native Dutch individuals; [f] The reference category represents individuals who work part-time or fulltime; [g] The reference category represents individuals who have never smoked; [h] The reference category represents individuals in the richest 80 to 100% of the Netherlands.

Table A3. Linear multilevel regression analysis of BMI on individual-level and municipality-level variables; performed in periphery (N=358.614)

Variable	B (Std.Dev.)
Intercept	33.219*** (1.970)
Educational level[a]	
Low level	1.403*** (0.039)
Middle 1 level	1.094*** (0.023)
Middle 2 level	0.696*** (0.021)
Element 1: Displacing human energy with mechanical energy	
Subjective noise pollution	0.010 (0.008)
Objective noise pollution	0.017 (0.036)
Physical decay	0.010 (0.009)
Social nuisance	-0.015 (0.013)
Crime rates	-0.576* (0.286)
Population density	-0.040 (0.038)
Distance facilities	0.017* (0.007)
Quality of facilities	-0.183 (0.152)
Physical activity	-0.004*** (0.000)
Score on fit norm[b]	
Semi-active	-0.503*** (0.022)
Norm-active	-0.624*** (0.020)
Element 2: Displacing household food production with industrial food production	
Proximity to fast food outlets	-0.083* (0.039)
Proximity to large supermarkets	-0.003 (0.062)
Density of fast food outlets	-0.010* (0.004)
Control variables	
Age	0.017*** (0.000)
Sex[c]	0.680*** (0.017)
Marital status[d]	
Living together	-0.428*** (0.031)
Unmarried	-0.754*** (0.032)
Divorced	-0.136*** (0.034)
Widow	-0.298*** (0.029)
Ethnicity[e]	0.016 (0.027)
Main activity[f]	
Retired	-0.215*** (0.026)
Not working	0.011 (0.025)
Student	-1.225*** (0.048)
Mental health	-0.391*** (0.013)
Smoking[g]	
Ex-smoker	0.578*** (0.018)
Current smoker	-0.434*** (0.024)
Alcohol drinking behaviour	-0.003* (0.000)

Continuation of table A3: Linear multilevel regression analysis of BMI on individual-level and municipality-level variables; performed in periphery (N=358.614)	
Household income[h]	
0-20%	0.405*** (0.036)
20-40%	0.521*** (0.027)
40-60%	0.270*** (0.024)
60-80%	0.152*** (0.022)
Municipality income	-0.067*** (0.005)

*=p<0.05, **=p<0.005, ***=p<0.001

[a] The reference category represents the highest educational level; [b] The reference category represents those who are inactive; [c] The reference category represents women; [d] The reference category represents married individuals; [e] The reference category represents native Dutch individuals; [f] The reference category represents individuals who work part-time or fulltime; [g] The reference category represents individuals who have never smoked; [h] The reference category represents individuals in the richest 80 to 100% of the Netherlands.

Table A4. Linear multilevel regression analysis of BMI on individual-level and municipality-level variables; performed in Randstad (N=103.967)

Variable	B (Std.Dev.)
Intercept	29.069*** (1.880)
Educational level[a]	
Low level	1.589*** (0.060)
Middle 1 level	1.293*** (0.037)
Middle 2 level	0.921*** (0.033)
Element 1: Displacing human energy with mechanical energy	
Subjective noise pollution	0.005 (0.013)
Objective noise pollution	0.027 (0.045)
Physical decay	0.046* (0.017)
Social nuisance	-0.035** (0.010)
Crime rates	-0.299 (0.207)
Population density	-0.023 (0.022)
Distance facilities	0.031 (0.022)
Quality of facilities	-0.261 (0.166)
Physical activity	-0.005*** (0.000)
Score on fit norm[b]	
Semi-active	-0.418*** (0.036)
Norm-active	-0.606*** (0.032)
Element 2: Displacing household food production with industrial food production	
Proximity to fast food outlets	0.214 (0.160)
Proximity to large supermarkets	-0.088 (0.134)
Density of fast food outlets	-0.001 (0.009)

Continuation of table A4: Linear multilevel regression analysis of BMI on individual-level and municipality-level variables; performed in Randstad (N=103.967)	
Control variables	
Age	0.015*** (0.001)
Sex[c]	0.592*** (0.028)
Marital status[d]	
Living together	-0.573*** (0.049)
Unmarried	-0.760*** (0.045)
Divorced	0.016 (0.047)
Widow	-0.486*** (0.046)
Ethnicity[e]	0.111** (0.035)
Main activity[f]	
Retired	-0.115* (0.043)
Not working	0.066 (0.042)
Student	-1.395*** (0.068)
Mental health	-0.333*** (0.020)
Smoking[g]	
Ex-smoker	0.572*** (0.030)
Current smoker	-0.491*** (0.038)
Alcohol drinking behaviour	-0.005** (0.001)
Household income[h]	
0-20%	0.423*** (0.054)
20-40%	0.425*** (0.043)
40-60%	0.248*** (0.040)
60-80%	0.183*** (0.036)
Municipality income	-0.055*** (0.007)

*=p<0.05, **=p<0.005, ***=p<0.001

[a] The reference category represents the highest educational level; [b] The reference category represents those who are inactive; [c] The reference category represents women; [d] The reference category represents married individuals; [e] The reference category represents native Dutch individuals; [f] The reference category represents individuals who work part-time or fulltime; [g] The reference category represents individuals who have never smoked; [h] The reference category represents individuals in the richest 80 to 100% of the Netherlands.

Table A5. Linear multilevel regression analysis of BMI on individual-level and municipality-level variables; performed on municipalities larger than 100.000 residents (N=83.823)

Variable	B (Std.Dev.)
Intercept	38.385*** (3.056)
Educational level[a]	
Low level	1.770*** (0.066)
Middle 1 level	1.408*** (0.042)
Middle 2 level	0.962*** (0.038)
Element 1: Displacing human energy with mechanical energy	
Subjective noise pollution	0.068 (0.033)
Objective noise pollution	-0.047 (0.073)
Physical decay	-0.024 (0.016)
Social nuisance	-0.015 (0.010)
Crime rates	-0.751* (0.282)
Population density	-0.001 (0.031)
Distance facilities	-0.176 (0.117)
Quality of facilities	-0.519** (0.141)
Physical activity	-0.005*** (0.000)
Score on fit norm[b]	
Semi-active	-0.503*** (0.041)
Norm-active	-0.605*** (0.036)
Element 2: Displacing household food production with industrial food production	
Proximity to fast food outlets	0.010 (0.281)
Proximity to large supermarkets	0.037 (0.442)
Density of fast food outlets	-0.012 (0.015)
Control variables	
Age	0.016*** (0.001)
Sex[c]	0.590*** (0.031)
Marital status[d]	
Living together	-0.648*** (0.054)
Unmarried	-0.698*** (0.049)
Divorced	-0.008 (0.052)
Widow	-0.466*** (0.053)
Ethnicity[e]	0.126** (0.038)
Main activity[f]	
Retired	-0.108* (0.049)
Not working	0.120* (0.048)
Student	-1.281*** (0.074)
Mental health	-0.338*** (0.022)
Smoking[g]	
Ex-smoker	0.587*** (0.034)
Current smoker	-0.546*** (0.042)
Alcohol drinking behaviour	-0.005** (0.001)

Continuation of table A5: Linear multilevel regression analysis of BMI on individual-level and municipality-level variables; performed on municipalities larger than 100.000 residents (N=83.823)	
Household income[h]	
0-20%	0.323*** (0.058)
20-40%	0.370*** (0.049)
40-60%	0.235*** (0.046)
60-80%	0.177*** (0.043)
Municipality income	-0.031 (0.022)

*=p<0.05, **=p<0.005, ***=p<0.001

[a] The reference category represents the highest educational level; [b] The reference category represents those who are inactive; [c] The reference category represents women; [d] The reference category represents married individuals; [e] The reference category represents native Dutch individuals; [f] The reference category represents individuals who work part-time or fulltime; [g] The reference category represents individuals who have never smoked; [h] The reference category represents individuals in the richest 80 to 100% of the Netherlands.

Table A6. Linear multilevel regression analysis of BMI on individual-level and municipality-level variables; performed on municipalities smaller than 100.000 residents (N=274.791)

Variable	B (Std.Dev.)
Intercept	30.329*** (2.038)
Educational level[a]	
Low level	1.353*** (0.038)
Middle 1 level	1.075*** (0.022)
Middle 2 level	0.695*** (0.020)
Element 1: Displacing human energy with mechanical energy	
Subjective noise pollution	0.007 (0.007)
Objective noise pollution	0.015 (0.030)
Physical decay	0.016 (0.012)
Social nuisance	-0.020 (0.016)
Crime rates	-0.350 (0.303)
Population density	-0.025 (0.026)
Distance facilities	0.016* (0.007)
Quality of facilities	-0.024 (0.175)
Physical activity	-0.005*** (0.000)
Score on fit norm[b]	
Semi-active	-0.470*** (0.021)
Norm-active	-0.618*** (0.019)
Element 2: Displacing household food production with industrial food production	
Proximity to fast food outlets	-0.081* (0.037)
Proximity to large supermarkets	-0.009 (0.057)
Density of fast food outlets	-0.008 (0.004)

Continuation of table A6: Linear multilevel regression analysis of BMI on individual-level and municipality-level variables; performed on municipalities smaller than 100.000 residents (N=274.791)	
Control variables	
Age	0.016*** (0.000)
Sex[c]	0.675*** (0.017)
Marital status[d]	
Living together	-0.401*** (0.030)
Unmarried	-0.777*** (0.031)
Divorced	-0.116** (0.033)
Widow	-0.318*** (0.028)
Ethnicity[e]	0.010 (0.026)
Main activity[f]	
Retired	-0.207*** (0.025)
Not working	0.003 (0.024)
Student	-1.269*** (0.047)
Mental health	-0.385*** (0.013)
Smoking[g]	
Ex-smoker	0.572*** (0.017)
Current smoker	-0.418*** (0.023)
Alcohol drinking behaviour	-0.003** (0.000)
Household income[h]	
0-20%	0.441*** (0.035)
20-40%	0.533*** (0.026)
40-60%	0.275*** (0.023)
60-80%	0.158*** (0.021)
Municipality income	-0.065*** (0.004)

*=p<0.05, **=p<0.005, ***=p<0.001

[a] The reference category represents the highest educational level; [b] The reference category represents those who are inactive; [c] The reference category represents women; [d] The reference category represents married individuals; [e] The reference category represents native Dutch individuals; [f] The reference category represents individuals who work part-time or fulltime; [g] The reference category represents individuals who have never smoked; [h] The reference category represents individuals in the richest 80 to 100% of the Netherlands.