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The impact of environmental factors in explaining exercise and eating behavior.

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Trondheim 2013

Acknowledgements

I have received assistance throughout the time I have worked with my master thesis, and I would like to take this opportunity to thank them.

First I would like to thank Mons Bendixen who was of great help in assisting the layout, language and professional tips the last couple of weeks. I would like to thank Kyrre Svarva for help on the questionnaire development for the online program select survey, and Dagfinn Refseth for the making the questionnaire accessible for students on Innsida.

My initial supervisor who moved to Germany, Ellen Matthies, also deserves appreciation for guiding me toward the right direction.

Lastly, my sincerest gratitude goes out to Idalill Udnes for helping me with SPSS and data analysis and my friends who helped to motivate me and proofread the final product.

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The effects of local environmental factors on exercise behavior and eating habits.

Abstract

The purpose of this overview was to determine which local environmental factors had the best predictive capabilities of exercise and eating behavior, and also which ones could be used for possible intervention programs and research. There are too many undefined factors which have made it hard for researchers to know which one to implement; in addition it is hard to interpret the studies that have been conducted. There are promising factors that appear, such as accessibility to supermarkets, convenience of facilities, aesthetics and beach access. Nonetheless, it is not possible to draw any causal relationship between the local environmental factors and exercise- or eating behavior because there has not been carried out any good longitudinal studies with good definitions of the local environmental factors that control for confounding variables. For future research, it is important to have good definitions of the local environmental factors in order to determine the actual effects they have on exercise- and eating behavior.

In recent decades, the population has changed in ways that makes it easier to use of vehicles to get around. In everyday life most of us are inactive far more than we are in activity. We sit on our way to work (drive or public transport), we sit at work, and some even sit while working out. This has become the norm as fewer jobs require manual labor and more jobs are performed in front of a computer or behind a service desk. These changes have reduced the average amount of energy expenditure in the population, while the energy intake has remained stable. The stable intake could perhaps be surprising in a time were the media are often reporting the negative effects of fast-food and finished products (Cutler, Glaeser & Shapiro, 2003). There is reason to believe that this also applies to Norway, as Norwegians have gained weight over the last decades (Statistisk sentralbyrå, 2009). We can however see that there was less candy among the youth of Norway in 2008 than 2005, so it seems we might be on our way to a healthier society.

The current requirements for physical activity is half an hour per day according to the Norwegian Institute of public health (Anderssen & Andersen, 2004). Unfortunately, large amounts of the Norwegian population do not meet the requirements of half an hour/day of exercise (Dillern, Pedersen & Jenssen, 2012). This is unfortunate as physical exercise is associated with several of positive health outcomes, ranging from mental to physical health (Casaburi, et al., 1997; Martinsen, 1990; Vanhees et al., 2012; Warburton, Nicol, & Bredin, 2006). Among the negative outcomes of not being physically active is obesity. Obesity is associated with considerable negative physical and mental health problems (Papas et. al., 2007). This article will focus on the local environment, and how this plays a role in physical activity.

Over 60 years ago, the first preventative program in the United States was initiated. In 1952 (Nestle & Jacobson, 2000) the American Heart Association tried an approach were they created guidelines for individuals on how to reduce energy intake and increase energy expenditure. While being an important step, we can't say that it hasn't had any effect, and the bottom line is that quite a lot of people are overweight and not physically active enough (Menifield, Doty & Fletcher, 2008).

Obesity is a complicated problem influenced by genetic, physiological, psychological, social and environmental factors (Popkin, Duffey & Gordon-Larsen, 2005). Among the main individual factors is energy intake, and the fact that a higher energy intake than output is likely to result in weightgain (Chirico & Stunkard, 1960; Douthwaite, 1936; Hoelzel, 1945; Turk et. al., 2009).

In order to prevent obesity, we can either focus on individuals, or on the population. It is impossible to point at one factor that is responsible for the obesity problem. The government should focus on a number of areas in actualizing a healthier society, these areas include pricing of healthy foods (Horgen & Brownell, 2002), media interventions (Nestle & Jacobson, 2000), educational system, behavioural interventions, and environment interventions (Popkin et al., 2005). I will give an overview over these different areas of research and look at intervention methods in society that are likely to bring positive health outcomes, arguing for the built environment and its possible positive effects.

Obesogenic environments

In order to be successful at preventing obesity, it is important to be able to point out the typical obesogenic environments, i.e. environment that promotes less physical activity and unhealthier eating (Swinburn, Egger & Raza, 1999), as well as find the important factors for determining physical activity. Studies of obesogenic environments have been conducted but there is so far no consensus on the defining elements. Therefore it is hard to define, this article however will use a definition provided earlier. More specifically, obesogenic environments are environments that are built up such that it promotes less physical activity and unhealthier eating (Swinburn et. al., 1999). This of course entails a whole lot of complex areas of research that are probably not the same within different cultures and may also even vary across countries and might even be seasonal in some countries. For this article, we will focus on the parts of the obesogenic environment that are likely to bring positive physical activity changes within the community.

Why population-focus?

In order to be successful at preventing obesity, it is logical to not only treat what we see, but also the reason for what we see. We know that the reasons are many (Popkin et al., 2005), and that some of these are more have a greater effect than others, but why should we try to focus populations rather than individuals when it comes to promoting physical activity?

Individually-based interventions are successful within a one-year period (Apfelbaum et. al., 1999); however after 5 years the effect seems to have had no effect (Wadden, Sternberg, Letizia, Stunkard & Foster, 1988). Even if they were successful at maintaining weight-loss for the rest of their life, we would still be treating only one

person. This is unfortunate, as it would be very time-consuming and costly to treat everyone individually; also, individual interventions are not likely to provide population-wide change (Sallis, Bauman & Pratt, 1998).

Population-based interventions

It should be much better to move the focus to a medium in which we can get change within a population. We already named these interventions, such as media interventions (Nestle & Jacobson, 2000), educational system, and environment intervention (Popkin et. al., 2005). All these are probably places where interventions could be successful if done correctly. These are all arguably part of an obesogenic environment.

Educational interventions. Several studies have indicated that educational interventions might have an effect on treating obesity (see Summerbell et. al., 2005). As Summberbell and colleagues points out, these seem to be very sensitive to how they are implemented, and the setup of the intervention. The results aren't quite convincing either, as there are quite a lot of research that are disagreeing with the effect that has been shown. Determining the long-term and population-wide effects of these types of interventions is difficult. Maybe if an intervention that was based on families in their homes,, it could have better effect. There are also studies showing no effect on an educational-based intervention (Shaya, Flores, Gbarayor & Wang, ~~(~~2008), and especially not on physical activity (Sahota et. al., 2001).

Media interventions. There are some measures that can be taken in the media in order to promote physical activity. Norway already has advertisements on the benefits of a healthy lifestyle and being physically active. There are certainly not many promoting an unhealthy lifestyle. Also, when it comes to physical activity, a review from 1998 concluded that there was no long-lasting effect in mass-media interventions (Marcus, Owen, Forsyth, Cavill & Fridinger, 1998). There must also be shown criticism towards those type of commercials, as they are likely to disturb the body image of the population, and especially youth (Derenne & Beresin, 2006).

Environment interventions. In order to produce a population-wide change, it is reasonable to look at the environment. There are several different ways to look at the environment, and an obesogenic environment consists of many factors, such as; supermarket accessibility, recreational facilities accessibility, pricing of food, etc. Interventions on this level have been shown to have positive effect (Kegler, Swan, Alcantara, Feldman & Glanz, 2013; Sallis et. al., 1998). However weaknesses in this

method are also apparent, as there is problem in defining different factors within environmental research (Kirk, Penney & McHugh, 2010). Nevertheless, this might be the area that has the most promise in bringing population-wide change without having unwanted negative effect on individuals. In this article, we're interested in the factors in the obesogenic environment that deals with physical activity and eating habits; these include access to exercise possibilities, opportunities, safety and aesthetics (Bauman et al, 2012; Humpel, Owen & Leslie, 2002).

Physical environment

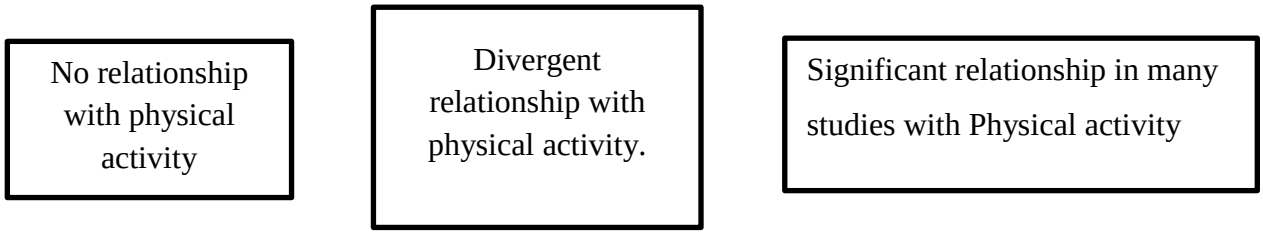
Physical activity

In finding determinants of physical activity and behavior, the physical environment is an interesting area of research. Earlier research has studied mostly individual factors or non-environmental factors, some with more success than others. There are a number of factors that are known to consistently predict physical activity level, these include age, health status, self-efficacy and previous physical activity (Bauman et. al., 2012; Rasmussen & Laumann, 2013). In recent decades environmental determinants have been included as well.

There are a lot of different environmental determinants that has been studied over the years, and a meta-analysis from 2005 assessed 138 different determinants (Duncan, Spence & Mummery, 2005). Depending on the definition of environmental factors, the number could be much higher or lower.This meta-analysis employed a liberal definition and included things such as unattended dogs and sidewalks. The environmental determinants that are related to the physical or built environment are the ones that are interesting for this article. It's reasonable to say that not all of the determinants are either good at predicting physical activity or not. The fact is that these determinants are too complex to only be classified as either having a relationship, or not. Therefore, I classified the physical environment determinants of physical activity in three groups based on their relationship to physical activity (Figure 1).

Figure 1

Physical environment for determining physical activity



These groups are fairly easy to understand. If an environmental determinant ends up in the "No relationship with PA"-box it means that I could not find any previous studies that showed a significant relationship between that environmental factor. If in the "Divergent relationship with PA", I found that some studies showed there was a significant relationship between this factor and physical activity. And lastly, if in the "Significant relationship" box, I found that a vast majority of studies show there is a significant relationship with physical activity. Out of all the determinants that has been studied on, the vast majority of studies end up in the "no relationship box (Duncan et al., 2005), however there are a number of factors that are in the other two boxes as well. The factors that are included in this study will only be related to the physical or built environment, or perceived physical or built environment. This of course rules out all social environment factors such as social support, having someone to talk to and self-efficacy. In addition, it rules out population-factors that might be considered as environmental, for example factors such as gymnastics at school and commercial in media.

Over the last years, there have been some systematic reviews and general overviews over the field of physical environmental factors to physical activity (Bauman, & Bull, 2007; Humpel et al., 2002; McCormack et al., 2004 Trost, Owen, Bauman, Sallis, & Brown, 2002; Wendel-Vos, Droomers, Kremers, Brug, & Van Lenthe, 2007). Some of them have defined the environmental factors more narrowly than others. For example Wendel-Vos et al., (2007) names the factors "traffic", "trip distance" and "hills" whereas Bauman & Bull (2007) defined those as one factor, defined as "Route related factors: Hilliness, traffic", naturally this makes it harder to compare and leads to some ambiguous results within studies., they did both however find a positive relationship with 5 factors. Table 2 gives an overview of the

environmental factors I have looked at in this article, as well as their relationship with physical activity.

Table 2

Summary of environmental factors with their relationship level to physical activity

Environmental factor	Significant relationship	Divergent relationship	No relationship
Accessibility of recreational facilities and equipment	X		
Convenience of recreational facilities (Distance, price)	X		
Access to the beach	X		
Aesthetics		X	
Accessibility of playgrounds and park		X	
Availability of sidewalks		X	
Safety/perceived safety		X	
Weather		X	
Perceived crime		X	
Crime rates			X
Traffic safety and volume			X
Streetlights			X
Public transport			X

Accessibility of recreational facilities. The definition of accessibility of recreational facilities differ across studies, some include parks, cycle paths or beaches, whereas some looked at the accessibility they had to gyms or facilities that had exercise equipment. Nonetheless, even the lack of obvious definition, a review of reviews article concluded that accessibility were reasonably consistent in determining physical activity (Bauman & Bull, 2007). They do not however differentiate between perceived accessibility and actual accessibility, which of course might give different results. Although most of the research is confident that accessibility of recreational facilities has a significant effect, it is hard to tell how much effect. Nevertheless, accessibility to recreational facilities as well as exercise equipment is one of the big

predictors of vigorous physical activity (Trost et al., 2002; Wendel-Vos et al., 2007). This is possibly one of the most important predictors for physical activity, and might be the one that is best suitable for intervention methods.

The constructs of accessibility have a long way to go before they are perfected, nonetheless a number of studies show that this construct does indeed have an effect on physical activity, albeit small. Also, interventions for this factor may be one of the easiest. Investing in outdoor training areas or subsidizing gym memberships might be two ways in order to improve the perceived accessibility of the population. Also, subsidizing gyms that want to start in rural areas can also be implemented. This is likely to make it easier for recreational gyms to start up in areas with less population, as well as brining the access of exercise equipment to the rural population. This could seem as an expensive investment in something that has not been shown to have causal effect on physical exercise. This is true, that is why it is important that good constructs are made which will hopefully find good relationships, as well as using objective measures for these constructs. Nonetheless, considering the vast amount of money that is being spent in treating diseases which are associated with not being physically active.

If future research however shows that it is the perceived accessibility measure that is able to predict exercise behavior, instead of actual accessibility, different intervention methods are needed. These should focus more on maybe giving the people the idea that recreational centers and equipment is nearby, and that it's a matter of knowing where they are, how to use them and that they are low threshold. This shows the importance of good measures, as the interventions methods that would actually work would be very different than what would actually work if the measures weren't clear in what would work.

Convenience of recreational facilities and accessibility to recreational facilities probably overlap each other a great deal. Convenience of recreational facilities shows a significant relationship with exercise behavior, and is often measured by looking at the price of the facilities, as well as pleasantness and distance. Accessibility also looks at distance and sometimes price, pleasantness and how the facilities look are more tested in convenience.

Playgrounds and parks. Having parks and playgrounds which are easy to get to or are in near vicinity have been shown to have some effect on the exercise behavior (Cunningham & Michael, 2004). This is also one that might be related to aesthetics or attractive neighborhood, it has however shown to have effect when standing alone.

This measure was not measured with objectively collected data, but perceived convenience of playgrounds and parks (Owen, Humpel, Leslie, Bauman, & Sallis, 2004). This is a variable that has an effect which is fairly small, and has used walking for exercise as the outcome. Hence, it has not tried to predict the exercise behavior that has been shown to have the most health benefits, namely moderate or vigorous physical activity. In addition, the effect that has been seen in this variable is most often seen in walking for exercise in women. It might be that the effect for this variable is greater in children.

Access to the beach. An interesting finding in some studies is that access to the beach, or coastal location acts as a determinant for physical activity (Wendel-Vos et al., 2007). Beach access may act as an incentive to exercise, because people may want to look fit for the beach life. This could be studied further by having a questionnaire that asks these types of questions. It would be interesting to see if there is a relationship with healthy eating habits, which it should be if they are more likely to want to look fit for the beach. It's however more likely that beach access/coastal region could act more as a variable for the construct of aesthetics. That this feature acts as a proxy for an attractive and pleasant neighborhood. People might be more likely to exercise when the environment around is more pleasing to look at, and the beach could be implemented an underlying variable in the bigger construct of aesthetics. Of course, the coastal variable is more likely to be used as a control for other models (Such as the TPB) of explaining physical activity, than to be used in order to bring intervention. There is no doubt that changing the environment so that more cities or inhabitants of a country has more coastal region is a very expensive and hard thing to do.

Aesthetics. Aesthetic features has been shown in some studies to be able to predict exercise behavior or walking behavior (Humpel et al., 2002; Wendel-Vos et al., 2007). More specifically, questions that was associated with perception of a friendly, pleasant and attractive neighborhood, also scenery, greenery, and cleanliness have been used as underlying variables in this factor. Aesthetics may be related to safety, pavements, weather and playgrounds. As we see in table 1, all these have an effect is some studies which could mean that these variables combined would bring a relatively considerable effect to exercise behavior. This is important for interventions on the population level. If these factors together show a good relationship with physical activity then we indeed have a good start for a possible intervention method.

Safety or Perceived safety. Safety or perceived safety is a fairly uncertain variable in determining physical activity (Bauman & Bull, 2007), however this might be because we lack a good definition of what is actually being measured. There are several elements of perceived safety that might be related to safety, such as crime rates, pavements, street lights and traffic volume. Studies have shown that safety or perceived safety does indeed play a role in determining physical activity (De Bourdeaudhuij, Sallis & Saelens, 2003; Lee & Moudon, 2004). It seems that within this variable it is especially important to implement good questions in order to provide a good construct for safety. Duncan et. al. (2005) showed that the presence of pavements increased the likelihood of being active by 29%, and the absence of heavy traffic increased the likelihood by 22%. McCormack et. al.(2004) also showed that pavement safety was a factor that was regularly associated with higher activity levels. This is interesting as pavements themselves have not necessarily shown to be a factor that has a relationship with physical activity levels (Trost et al., 2002).

Eating behavior

Physical activity has many potential environmental determinants, eating behavior on the other hand, doesn't seem to have that many. This might be because it has not been as widely studied, or because researchers doesn't think it will be able to predict eating behavior as good as it did physical activity. The ones that has been studied mostly are accessibility to healthy foods, accessibility to supermarkets and pricing. (Caspi, Sorensen, Subramanian, & Kawachi, 2012). Availability to vegetables and fruits (In the home) has been shown in adolescents to be positively associated with a higher consumption of those foods. If the same is true for adults, then making fruits and vegetable available and cheaper could be an option. Few studies differ from actual environment and perceived environment, it is however important to be aware that there might be a difference between people's perceptions of their environment and the actual environment. For example one review (Caspi et al., 2012) found that actual environment were less likely to be associated with eating habits than their perceived counterparts. It is important to determine which one actually has an effect (or which one has the biggest) on eating behavior, as the intervention methods might differ greatly between perceived and actual environment.

Accessibility of supermarkets. Accessibility to supermarkets has shown to have a positive association with fruit and vegetable consumption (Michimi & Wimberly, 2010). Hence people who live closer to supermarkets are more likely to eat

more vegetables and fruit, which is associated with a healthier diet. The authors even takes it further and inferring that the rural neighborhoods might be more obese due to the fact that they have longer travel distances to supermarkets, of course they do have a point, and it's not necessarily wrong. Nonetheless, even if there is an association between these factors it does not mean there's a causal relationship, and taking it to the step of actually saying that it explains why people are more obese in rural areas is optimistic at best. Nevertheless, this is one of the most consistent, not biggest, predictors for physical activity, and because of this it is probably the best place for intervening. As it is with physical activity, it is important to know which variables might go under this construct, and distinguish whether it's perceived accessibility or actual accessibility which is most important. As mentioned Caspi et. al. (2012) found that accessibility measured with geographic information systems (GIS) were less likely to be associated with eating behavior than perceived accessibility. GIS is a method used to assess geographical info, and thus making the accessibility measure an actual measure of accessibility, instead of perceived. In fact, they found this for more factors than just accessibility of supermarkets. An intervention example for actual accessibility of supermarkets could be to subsidize supermarkets in rural areas, and in areas that are deprived of them. But if the effect is actually in perceived accessibility, then it would have made more sense to focus on attitudes of the population, and to bring into light that there are in fact supermarkets nearby.

Affordability. The cost of foods, or the perception of food prices is often associated with eating behavior (Popkin et al., 2005), indicating higher prices of healthy foods results in less eating of the foods. This is a factor which is very concise and may be one of the promising factors in relating to eating behaviors. Affordability or pricing is much easier to measure than other environmental constructs showing a relationship to eating behavior. Hence, it is easier to work with. When they are easier to define, they are easier to measure as well. If the theories on which predictor will facilitate healthy eating are to come to life, it is crucial to find a good measure of the construct. Affordability is fairly easy. Nonetheless, also here comes the problem of knowing whether it's perceived affordability or actual affordability which is being measured. Again, there should be different intervention methods for these two. If perceived affordability was the one with the best predictive capabilities, we could maybe show the people in question that healthy foods are not necessarily more expensive than unhealthy foods. They are more expensive per calorie, but not for how much nutritional value is in them. Some people might just not know about what is

healthy, and have only heard of the healthy foods that are expensive. Enlightenment could help these people.

There have been some intervention studies done to see whether changing the price of healthy and unhealthy foods would have an effect on eating behavior (French, Jeffery, Story, Hannan & Snyder, 1997; French et al., 2001). The studies have been successful in finding that the actual pricing of foods did in fact change eating behavior, which suggest that actual affordability has an effect on food change. These interventions however were in small places such as cafeterias or vending machines. If these can be implemented on a larger scale, such as in supermarkets, the effects could be grave. If the government were willing to subsidize healthier foods, as well as keep the tax on unhealthy foods, the health benefits could largely outweigh the costs of the intervention.

Measurements, difficulties and future research.

There are some definite problems in both the outcome variables of this type of study, as well as the predictor variables (Tudor-Locke, & Myers, 2001).

Outcomes. Most studies within the field have used different measures for physical activity, for example some studies have used the International Physical Activity Questionnaire (IPAQ) to get the right measure of physical activity behavior, whereas some has used Godin Leisure-Time exercise Questionnaire. Although most of the ways measured have shown to have good validity and reliability, it is definitely a weakness and makes the studies much harder to compare studies. Also, they differentiate from using self-report studies to using actual measurements such as accelerometers or pedometers. It's hard to know which one is the best, but we do know that self-report often is biased. Perhaps future research could make a template for use in local environment studies. This would require them to find a good (The best possible) measure of physical activity and trying to reach out to other researchers in the field.

When measuring eating behaviors, there are mostly self-report measures that can be used, unless a participant is willing to let him or herself be videotaped in a 24-hour period for a week. One could tell them to take pictures of their foods and write down what they have eaten, but they could still "forget" something. Therefore it comes down to measuring them by self-report. This can either be done by specifying what type of foods people eat (Unhealthy, vegetables, fruit), or by measuring their food consumption, and actually ending up with a rating of their diet. Studies differ in

these mehods, as some measure who diet, some unhealthy, and some vegetables + fruit. Most research however seems to have measured vegetables and fruits. Also here, self-report is likely to be biased.

Predictors. As mentioned earlier, there are over 100 determinants for physical activity plus eating behavior, however only a handful have been shown to be a significant predictor over several studies. These included accessibility to recreational facilities, convencience of facilities, living in coastal regions, accessibility to healthy foods and accessibility to supermarkets. All of these face serious problems when it comes to measurements, in fact, no environmental measurements have been developed properly even though the field has been studied for two decades (Kirk et al., 2010).

First we must come up with a good measure for the constructs for the environmental factors. This means that more studies are needed to determine which factors fit in which constructs, and it will also be imperative that we know the relationship between the actual local environment characteristics and the perceived ones. As mentioned, misunderstanding if it's perceived local environment and actual local environment could have dire economic effects. It should also be a goal to find out what the best way is to actually measure environment. Whether it is using GIS-systems or sending an objective person in the field. Because objective measures of local environment have shown to have less effect for physical activity than their perceived counterparts, this is very important.

There is also lack of longitudinal interventions and data which makes it harder for us to draw actual causal relationship between different variables and their outcome (Bauman & Bull, 2007). These longitudinal studies could be hard to develop, as there are so many variables to control for, one would (should) be absolutely sure to know that what they are measuring is actually a causal effect of the intervention they made. The likelihood that interventions are different from urban to rural areas is big. It must be differentiated what impact the same interventions could have on another area, also there are cultural differences that must be taken into account. Another problem for the interventions is how their cost to benefit ratio can be determined.

Important factors that future research should consider

It is important to make it clear in any intervention, that it is not the victim that is the problem. It isn't uncommon for people to blame overweight or obese people for their own problems (Roberts & Coggan, 1994). This sends out the wrong signal, and might lead to overweight and obese people retracting from the society by not showing up to, or cancelling, general health services to avoid being stigmatized, discriminated,

and prejudiced against (O'Dea, 2005). Health services are likely to lecture them about their weight which might be uncomfortable. Research shows that external people are not the only ones who blame the individuals themselves for being obese (Ogden et. al., 2001). In fact, according to the research, obese people often attribute being fat to internal factors such as gland problem, slow metabolism, and stress. The general practitioners however, attributed it to eating too much. When it came to solving the problem of obesity, there was a misunderstanding in what the general practitioners thought, and what the patients though. The patients said that they would prefer a professional based approach, whereas the general practitioners preferred a patient-led approach. An intervention must take into consideration the beliefs and biases of the people, not only seeing the world from the outside in, but also inside out.

It is important to keep in mind that most of the research has been conducted in the United States and Australia, with the occasional Belgian or Canadian study. For Norway, this might create problems in generalizing the studies. It is possible that both the rural and the urban physical environment is quite different in rural areas of Norway than they are in Australia and the USA. For example, Norway might have good access to healthy foods almost anywhere if you live in the city, whereas in the USA one must maybe go out of the city Centre to the big supermarkets in order to get healthy foods. This is a possible problem that should be addressed for future research in Norway; these differences in physical environment could mean that for example accessibility to healthy foods would not be able to predict eating behavior. Perceived accessibility on the other hand, could still be a factor.

Conclusion

There are promising results for some of the local environment constructs, especially accessibility to supermarkets and healthy foods, pricing of healthy foods, accessibility and convenience of exercise facilities, accessibility to exercise equipment, aesthetics and residence in coastal regions. There has not been identified any causal relationship between any local environment factors and physical activity or eating behavior. The highest explained variance of the combined correlates of local environmental factors have been between 5-10% (Bauman & Bull, 2007), which is fairly low, however considering the problems in the measurements the real number might be considerably higher (Or lower). There is also quite a lot of overlap within the different physical environment factors that have been used. The problem is somewhat conceptual, as there hasn't been set a good template for measuring the different

constructs. This has led to some may have measured a construct they called convenience of facilities, or playgrounds and parks, when they in fact may have been measuring underlying variables to accessibility to exercise facilities.

Most of the research has been conducted in the United States and Australia, this is a weakness for generalizing the results to other countries. There is reason to believe that the physical environment is differently built in different countries. Differences in these environments could mean that we would see great differences in which physical environment factors that could predict eating and exercise behavior.

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Steffen Sæternes

The predictive capabilities of local environment factors on physical activity and eating habits - a study in the Norwegian student population

Abstract

The main goal of this paper was to explore the effects the local environment factors accessibility to supermarkets, accessibility to healthy foods, accessibility to exercise facilities and neighborhood safety would have on exercise and eating behavior. Theory of planned behavior (TPB) was implemented in the study to see the effects it would have on the predictive capabilities of the local environment factors. The TPB predictor Intention was able to significantly predict both exercise and eating behavior. Accessibility to exercise facilities and accessibility to healthy foods could explain some of the variance in exercise and eating behavior. When controlled for TPB-constructs, the local environment factors lost their effect. After the TPB-model was added to the regression analysis, the local environments' effect disappeared, it is important for future research to be sure that the environmental factors are in fact environmental and not personal factors such as perceived behavioral control.

Physical exercise and/or a dietary adjustment is associated with numerous positive outcomes such as decreased risk of cancer, physical and psychological benefits, type 2 diabetes and obesity (Fox, 1999; Gardner & Hausenblas, 2004; Paffenbarger et. al., 1993; Warburton, Nicol & Bredin, 2006). It is no wonder that the focus from both media and government is so vast when it comes to physical activity and healthy eating, although there might be negative outcomes to all that focus (O'Dea, 2005). Despite all this focus and a large amount of data showing the obvious connection between both physical activity and healthy eating, the Norwegian population has failed to meet the requirements of physical activity required for significant health benefits (Anderssen & Andersen, 2004; Dillern, Pedersen & Jenssen, 2012). A low level of physical activity combined with a calorie rich diet is associated with obesity (Witkos, Uttaburanont, Lang, & Arora, 2008).

In order to prevent the problem of obesity, interventions on the environmental and individual level that are likely to increase the physical activity of the population and should be implemented. These interventions along with actions that will facilitate the consumption of a healthier diet are likely to decrease the prevalence of obesity within the population. Before these interventions are set into action, it is important to have as much information as practically possible on which actions are most likely to bring the desired results. The obesity problem is a complex problem with several aspects, each with its own set of interventions that are likely to work, both individual-based and community-based (Apfelbaum et. al., 1999; Nestle & Jacobson, 2000; Popkin, Duffey & Gordon-Larsen, 2005). Community-based interventions are generally interventions that are used by community psychologists to change the behavior of the individual by shaping the environment around them.

In assessing the environmental predictors for exercise and eating behavior, there is an understanding that a number of the environmental determinants play a role in obesity via to exercise and eating behavior (Boehmer, Lovegreen, Haire-Joshu & Brownson, 2006; Booth et. al., 2001). Research on the relation between environmental factors and exercise and eating behavior has had a rise in popularity lately, however a consensus on which factors and elements should be included within environmental factors has not yet been reached (Kirk, Penney, & McHugh, 2010). In choosing which ones to implement in a study, it is important to see which ones are sufficient determinants for exercise and eating behavior. In the literature, there is a widespread range of determinants used, a meta-analysis from 2005 (Duncan, Spence & Mummery, 2005) analyzed 138 different factors for exercise behavior alone

including everything from street lighting to physical activity facilities in the neighborhood. . Fewer studies have been conducted on predicting healthy eating, however some factors such as availability and accessibility emerge when the studies that have been conducted as reviewed ((Brug, Kremers, Lenthe, Ball & Crawford, 2008; Popkin et. al., 2005; van der Horst,et al., 2007).

Out of the vast number of environmental determinants that have been studied some stand out as consistently having a relationship with physical activity and eating behavior. When evaluating research on eating behavior it is possible to infer that availability and accessibility are able to predict eating behavior significantly. In determining environmental influences on exercise behavior more factors have been studied. In this are accessibility and availability also plays a role, however here safety and aesthetics also come in as consistent factors (Bauman & Bull, 2007; Humpel, Owen & Leslie, 2002).

Research has shown that the theory of planned behavior (TPB)is able to predict both exercise and eating behavior (Blue, 1995; Bozionelos, & Bennett, 1999; Verbeke, & Vackier, 2005). The direct measures of the TPB consist of the following constructs: Intention, Attitude, Subjective norm and Perceived behavioral control. All the direct measures have shown to be able to predict different behaviors (Ajzen, 1991). However, only intention has shown to consistently be able to significantly predict exercise (Bozionelos, & Bennett, 1999; Armitage & Conner, 2001), while the others predict the intention to exercise (Blue, Marrero & Black, 2008). Nevertheless, there is research showing that other constructs besides intention are able to predict exercise (Murnaghan et. al., 2010). The same is true for eating behavior (Beaulieu & Godin, 2011; Blue & Marrero, 2006).

On the basis of previous research, the main research question of this paper will be to determine accessibility and availability's relation to eating behavior, as well as accessibility, availability and safety's relation to exercise behavior. Another goal is to see if there is a relationship between the local environment factors and exercise/eating habits even after they have been controlled for by the TPB.

Method

Participants

A total of 267 participants were included in the dataset. Out of these 253 were included in the analysis. 253 subjects answered the questions concerning physical activity behavior. 44 people only filled out the first page which resulted in 209 people

answering the next variable, and around the same amount of responses on the rest of the variables. This big drop is likely to have been because they first thought it was going to be one page, but soon noticed there was more to the questionnaire than the first page alone. The 58 people in total that were excluded from the dataset was because blank responses in the questionnaire. Select Survey registered any participants just opening the questionnaire web page as a respondent; this probably led to the above 20% total dropout-rate (Blank responses).

Procedure

The participants were recruited using Facebook and Norwegian University of Science and Technology's (NTNU) internal network "Innsida". The survey was available from June 22nd to July 10th 2012. The project was approved by Norsk samfunnsvitenskaplig datatjeneste (NSD). They were assured that all measures were taken to keep them anonymous, and that not any personal or demographical data could be linked to them personally. If they wanted, they were told that they could receive the results by sending an email to the author (See appendix 1).

Measurements

Theory of planned behavior for exercise and healthy eating. In recent years, several studies has shown that these have good predictive capabilities of exercise behavior (Blue, 1995; Hausenblas, Carron, & Mack, 1997; Bozionelos, & Bennett, 1999; Brickell, Chatzisarantis, & Pretty, 2006), as well as eating behavior (Sparks, Conner, James, Shepherd, & Povey, 2001; Conner, Norman, & Bell, 2002; Louis, Chan, & Greenbaum, 2009; Verbeke, & Vackier, 2005). In this article, theory of planned behavior is used to predict both exercise behavior and eating behavior. I used the direct measures of TPB to predict exercise and eating behavior, the questions were acquired from Carolyn Blue's diabetes research (Blue, & Marrero, 2006; Blue et. al., 2008). These consisted of "attitudes", "Subjective norms", "Perceived behavioral control" and "Intention".

In the questionnaire, physical exercise was defined as something moderately or hard that increased the heart rate considerably. For eating habits they were referred to the "5-a-day" (5 vegetables or fruits per day) principle and not eating too much processed meats (Consistent with the scoring on eating habits).

Each of the TBP-constructs consisted of questions followed by a likert scale from 1-5. For example "My getting at least 30 minutes of moderate or vigorous physically activity on most days of the week would be…." followed by the likert scale where 1 could be "very unpleasant" and 5 indicate "very pleasant". Each construct was measured with different amount of questions for both exercise and eating behavior. Attitude toward exercise had 6 questions, e.g. «At jeg får minst 30 minutter med moderat eller tung fysisk aktivitet de fleste dager i uken vil være…..» (My getting at least 30 minutes of moderate or vigorous physically activity on most days of the week would be…) followed by good or bad (α = .71). Subjective norm toward exercise had 4 questions, e.g. «Det er forventet av meg at jeg får moderat eller tung fysisk aktivitet minst 30 minutter de fleste dager i uka.» (It is expected of me that I get moderate or vigorous physical activity for at least 30 minutes on most days of the week.) (α = .70). Perceived behavioral control was measured with 3 questions, e.g. «Det er helt opp til meg hvorvidt jeg engasjerer meg selv i moderat eller tung fysisk aktivitet i minst 30 minutter de fleste dager i uken.» (It is completely up to me whether or not I engage in moderate or vigorous physical activity for at least 30 minutes on most days of the week.) (α = .47). Intention to exercise was measured with 3 questions, e.g. «Jeg har til hensikt å få moderat eller tung fysisk aktivitet i minst 30 minutter de fleste dager i uken.» (I intend to get moderate or vigorous physical activity for at least 30 minutes on most days of the week) (α = .90). Attitude toward eating habits had 5 questions, e.g. «at jeg spiser sunt vil være…» (My eating a healthy diet would be…) followed by good or bad (α = .71). Subjective norms toward eating habits was measured with 4 questions, e.g. "De fleste personene I livet mitt som er viktige for meg synes jeg skal spise sunt.» (Most people who are important to me think I should eat a healthy diet.) (α = .69). Perceived behavioral control was measured using 6 questions, e.g. «Om jeg spiser sunt eller ikke i fremtiden er helt opp til meg.» (For me to eat a healthy diet in the future would be…) (α = .80). Intention to eat healthy was measured with 2 questions, e.g. "Jeg har en intensjon å spise sunt i fremtiden." (I intend to eat a healthy diet each day in the future (α = .68). The reliability for the TPB-constructs was sufficient or close to, even though I had fewer questions for some of the constructs than the original questionnaire. Most of the TPB-constructs had a cronbach alpha coefficient between .68 and .90 One had Cronbach alpha of .47 (Perceived behavioral control for exercise). Although it is a weakness, considering that the cronbach alpha values are quite sensitive when few items are used (Pallant, 2010), it's sufficient.

Each construct's questions were combined using SPSS's compute variable, e.g. for attitude toward exercise the 6 questions were combined for a total score, and this was done on all TPB-constructs. The constructs were not cumulated together for a total TPB-score. All questions but one was scored so as higher scores indicated better attitude, higher perceived behavioral control, etc. A question for perceived behavioral control was reversed in SPSS, because higher score indicated less control. "Jeg ville likt å spise sunt men vet ikke egentlig om jeg kan.» (I would like to eat a healthy diet but don't really know if I can.) had a scoring where 1 was "Strongly disagree" and 5 was "Strongly agree" which meant it had to be reversed. The questions were translated to Norwegian.

Local environment. Local environment was assessed using five questions used earlier by the Norwegian Directorate for Health and Social Affairs (Norwegian: Sosial- og helsedirektoratet) (Anderssen & Andersen, 2004), one for food habits and four for physical activity. I also added one regarding healthy food choices: «Jeg har god tilgang på sunn mat til rimelig pris der jeg handler.». This was done because I concluded there was missing a good question regarding accessibility to healthy foods.

These were also scored on a 1-5 likert scale. For example the «Jeg har god tilgang på sunn mat til rimelig pris der jeg handler.»-question had 1 = Strongly disagree and 5 = Strongly agree (see Appendix 2 for item wording and content). Higher scores indicated better access to healthy food or exercise possibilities on all questions except from one which was reversed.

Physical activity. Exercise was measured using two questions from the Norwegian version of the International Physical Activity Questionnaire (IPAQ) (Anderssen & Andersen, 2004) which had been used to assess physical activity in Norway. The first questions regarded hard physical activity: «Tenk på all meget anstrengende aktivitet du har drevet med de siste 7 dagene. Meget anstrengende aktivitet er aktivitet som krever hard innsats og får deg til å puste mye mer enn vanlig» *(*Think about all the vigorous activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal), whereas the second question regarded moderately physical activity: «Tenk på all middels anstrengende aktivitet du har drevet med de siste 7 dagene. Middels anstrengende aktivitet er aktivitet som krever moderat innsats og får deg til å puste litt mer enn vanlig.» *(*Think about all the moderate activities that

you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal). They were asked to rate how much activity they had been in for the last 7 days, and could answer in three blocks, one block contained "Days" (How many days did they exercise during the week), the second was hours (How many hours did they train on average on each of those days) and the third was minutes.

I chose to remove the last question which regarded walking. This was because the word formulation of the "moderate activity"-question indicated that people were likely to fill walking in as moderate activity in addition to filling it in as walking, this would have made them write up the same exercise two times. They also told their participants not to think of any exercise that didn't last at least 10 minutes. I chose not to say this because quite a few recent articles has shown that high-intensity training for much less than 10 minutes has significant health effects (Burgomaster et. al., 2007; Burgomaster, Hughes, Heigenhauser, Bradwell, & Gibala, 2005; Rakobowchuk et. al., 2008 ;Rakobowchuk, Stuckey, Millar, Gurr, & MacDonald, 2009). The average score for each person was then assessed. In order to get a normally distributed selection and to deal with outliers (Tabachnick & Fidell, 2007; Field, 2009), the scores on physical activity was squared using Square root Transformation in SPSS.

Eating habits. Eating habits was assessed using a "rate your plate"-design which consisted of questions regarding different, foods, and scoring was given. The plate I used was retrieved from the Dana Farber cancer institute (http://www.dana-farber.org/uploadedFiles/Library/adult-care/treatment-and-support/support/nutrition-services/rate-your-plate.pdf) which had used a food-frequency questionnaire developed to assess whether or not it was possible to screen diet using a short food questionnaire (Rifas-Shiman et. al., 2001). The questionnaire consisted of 21 items in which there was an initial question: "How often do you eat.." followed by different food choices such as "Dark green leafy vegetables" and "Processed meats".

The scores were different for some of the questions as some indicated healthier eating and some indicated less healthy eating. All needed to be reversed or changed as they had values from 1-5 from the online questionnaire. Some were rated on a scale from 0-4 where 0 was "less than once a week" and 4 was "Twice or more per day". "Dark green leafy vegetables" and some other questions had scores 0- minus 4 where 0 was "less than once a week" and -4 was "Twice or more per day" (Processed meats). The scores were summed together, and higher scores indicated healthier food habits.

Analysis. Firstly, preliminary analysis was conducted to ensure that no assumptions were violated. Exercise behavior was positively skewed (1.73) and was therefore Square Root Transformed in order to get a more normally distributed variable. This was not done for eating habits, as the scores were normally distributed.

A correlation analysis was used to see the correlation between the variables, and to assess which of the variables correlated with the dependent variables (Exercise behavior and eating behavior). Only the variables that had significant correlations with the dependent variables were included in the hierarchical regression analysis. The significant local environment variables were put in the first block which was to be controlled for, while all the TPB-constructs were put in the next block.

Results

Table 1 shows the characteristics of the sample as well as all the variables used in the study. The final sample included 253 participants answering exercise behavior, however the participants in the other variables varied from 190 (eating habits) to 211 (PCB for exercise). The exercise behavior values given here are after the square root transformation. The mean before the transformation was 53.1; this means that the people in this study exercised an average of 53 minutes every day, which is fairly high.

Table 1

Means, standard deviations, range, and skewness.

Measure	Mean	SD	Minimum	Maximum	Skewness
Exercise behavior (SQRT)	6.56	3.17	0	15	.31
Eating habits	10.23	7.68	-13	28	-.20
Accessibility to exercise possibilities	3.88	1.21	1	5	-.89
Accessibility to healthy foods	3.81	1.14	1	5	-.74
Attitude exercise	26.80	3.30	13	30	1.27
SN exercise	13.73	3.19	4	20	-.22
PCB exercise	11.93	2.03	6	15	-.71
Intention exercise	11.51	3.40	3	15	-1.00
Attitude eating habits	23.18	2.17	15	25	-1.28
SN eating	13.52	2.83	5	20	-.07
PCB eating	24.50	4.09	11	30	-.75
Intention eating	8.60	1.55	2	10	-1.25
Pavement	4.02	1.30	1	5	-1.08
Bicycle possibilities	3.57	1.35	1	5	-.60
Supermarket accessibility	4.23	1.22	1	5	-1.52
Neighborhood safety	4.19	1.23	1	5	-1.45

Correlations

Table 2 shows the correlation between eating habits and exercise behavior as well as correlations for all the variables. There is a weak correlation between people's eating habits and exercise behavior; nevertheless it's still small enough so that the two variables can be used in separate regression analysis without running the risk of them being the same predictor.

It also shows that all the local environment factors have a fairly good correlation with each other. In fact, all these factors significantly correlate with each other on the 0.01 level. Safety is the only one which doesn't fit in, and only correlates with accessibility to exercise and bicycle possibilities.

Exercise behavior. All TPB-constructs had significant correlations to exercise. Intention was the one who correlated best with exercise ($r = .50$), while subjective norm had the second highest correlation ($r = .35$). Interestingly, none of the local environment variables correlated with exercise behavior, except from accessibility which showed a weak correlation ($r = .14$).

Eating habits. The TPB-construct subjective norm interestingly did not correlate with eating behavior. Intention again had the highest correlation ($r = .49$), with perceived behavioral having the second highest ($r = .47$). Also here only one local environment variable had a weak correlation with eating behavior, namely accessibility to healthy foods ($r = .20$).

Table 2

Correlation matrix for all variables.

Measures	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. EatingHabits	.19*	.20**	-.02	.06	.02	.10	-.01	.31**	.11	.21**	.34**	.37**	.05	.47**	.49**
2. Exercise habits	1	.05	.02	.14*	.01	.02	.04	.32**	.35**	.30**	.50**	.13	.06	.17*	.19**
3. Accessibility to healthy foods		1	.24**	.27**	.23**	.14*	.06	.17*	.11	.21**	.25**	.13	.15*	.18**	.12
4. Supermarket accessibility			1	.24**	.50**	.19**	.09	.12	.07	.04	.12	.06	.10	-.05	.05
5. Accessibility to exercise				1	.34**	.36**	.22**	.07	.08	.13	.12	.11	.11	.15*	.1
6. Pavement					1	.37**	.09	.09	-.02	.00	.17*	.12	.05	.03	.16*
7. Bicycle possibilities						1	.20**	.07	-.07	.08	.06	.16*	.04	.25**	.07
8. Neighborhood safety							1	.06	.04	.03	.05	.07	.13	.07	-.03
9. Attitude exercise habits								1	.29**	.36**	.49**	.36**	.11	.14	.29**
10. SN exercise									1	.28**	.46**	.14	.33**	.12	.15*
11. PCB exercise										1	.48**	.12	.06	.38**	.20**
12.Intention exercise					.						1	.15*	.02	.25**	.29**
13. Attitude eating habits												1	.22**	.34**	.58**
14. SN eating													1	.10	.19**
15. PCB eating	.													1	.53**
16. Intention eating	.														1

Note. * = p < 0.05

Note. ** = p < 0.01

Regression analysis

Predictions within the TPB. Not surprisingly, this finding show that for eating behavior perceived behavioral control, subjective norm, and attitude explained a high variance of the intention construct (R Square = .467, p < .001). Both attitude toward healthy eating and perceived behavioral control significantly predicted intention, with attitude being the strongest (beta = .445, p < .001) and perceived behavioral control being the second strongest (beta = .373, p < .001) (Table 3). Subjective norm did not predict intention significantly (beta = .057, p = .293).

Table 3

Regression analysis for theory of planned behavior constructs for eating behavior.

Measures	B	Std. Error	Beta	t
Attitude eating habits	.32	.04	.45	7.80**
SN eating	.03	.03	.06	1.06
PCB eating	.14	.02	.37	6.68**

Note. ** = p < 0.01

In the TPB constructs for exercise behavior, there were no surprising results. Attitude, subjective norm and perceived behavioral control explained 41.9% of the variance of intention (R Square adjusted). All had fairly similar beta value, attitude was the highest (beta = .299, p < .001), subjective norm the second highest (beta = .297, p < .001), and perceived behavioral control coming in a close third (beta = .286, p < .001) (Table 4).

Table 4

Regression analysis for theory of planned behavior for exercise behavior.

Measures	B	Std. Error	Beta	t
Attitude exercise	.31	.06	.30	4.94**
SN exercise	.32	.06	.30	5.04**
PCB exercise	.48	.10	.29	4.74**

Note. ** = $p < 0.01$

Eating Behavior. To assess the strength of the independent variables of accessibility for both exercise and eating habits, a hierarchical regression analysis was used. The first block included accessibility only, the second added the TPB-constructs attitude, subjective norm and perceived behavioral control. The third block added intention.

For predicting healthy eating, the "accessibility to healthy foods"- variable was entered in the first model, and explained 4% of the variance in eating behavior (R Square = .04, $p < .01$). In the second model, the significance of the accessibility variable disappeared, likely to have been taken over by the perceived behavioral control construct because of their relationship in the correlation matrix (Table 2). The second model explained 27% of the variance in eating behavior ($F (4, 177) = 17.52$, $p < .01$). The third model added all the TPB-constructs for eating behavior, the unique variance that intention brought was 4% (R Square change = .04, $p < .01$), the total adjusted variance for model as a whole was 31% (Adjusted R square = .31, $p < .01$).

In the total model, "Perceived behavioral control" and "intention" had the only statistical significance (Table 5), with Intention having a higher beta value (beta = .277, $p = .01$) than perceived behavioral control (beta = .264, $p < 0.01$). Accessibility to healthy foods was not a significant predictor in the total model, but it was close (Beta = .112, $p = 0.79$). Also, that the pattern of the beta values of the regression analyses is consistent with the correlations in the correlation matrix.

Table 5

Regression analysis for eating habits.

Measures	B	Std. Error	Beta	t
Accessibility to healthy foods	1.34	.49	.20**	2.73
Accessibility to healthy foods	.74	.44	.11	1.67
Attitude eating	.88	.24	.25**	3.62
SN eating	-.17	.18	-.06	-.92
PCB eating	.69	.13	.37**	5.40
Accessibility to healthy foods	.76	.43	.11	1.77
Attitude eating	.45	.27	.13	1.64
SN eating	-.21	.18	-.08	-1.20
PCB eating	.50	.14	.26**	3.59
Intention eating	1.37	.42	.28**	3.27

Note. ** = $p < 0.01$

Exercise behavior. For predicting exercise behavior, hierarchical regression analysis was used. The first model included accessibility only; the second added the TPB-constructs attitude, subjective norm and perceived behavioral control. The third model added intention.

In the first model, I entered the "accessibility to exercise possibilities"-variable. This explained 2% of the variance in exercise behavior (R Square = .02, $p = 0.05$). In the second model the significance for the accessibility disappeared. The second model explained 21% of the variance in exercise behavior ($F (4, 189) = 12.30$, $p < .01$).After entering all the TPB-constructs for exercise, the model's total variance was 28% ($F (5, 188) = 14.74$, $p < .001$). The TPB-constructs alone explained 26% of the variance in the model.

As we can see the total model "subjective norms" and "intention" was the only significant predictors ($p < 0.05$) (Table 6), with intention having the highest beta value (beta = .360, $p < .001$) compared to subjective norms (beta = .144, $p = .041$). Accessibility to exercise possibilities was no longer significant after entering the other variables ($p = .236$).

Table 6

Regression analysis for exercise behavior

Measures	B	Std. Error	Beta	T
Accessibility to exercise	.37	.19	.14*	1.98
Accessibility to exercise	.24	.17	.09	1.38
Attitude exercise	.18	.07	.19**	2.66
SN exercise	.25	.07	.25**	3.63
PCB exercise	.23	.11	.15*	2.10
Accessibility to exercise	.20	.16	.07	1.19
Attitude exercise	.080	.07	.08	1.13
SN exercise	.143	.07	.14*	2.06
PCB exercise	.08	.11	.05	.68
Intention exercise	.34	.08	.36**	4.43

Note. * = $p < 0.05$

Note. ** = $p < 0.01$

Discussion

This study was done to explore the predictive capabilities the local environment had on exercise and eating behavior, in addition, I looked at how the TPB-constructs were able to predict exercise and eating behavior. Furthermore, how the local environment constructs could hold up their possible predictive capabilities when controlled for the TPB-constructs was also investigated.

Out of the TPB-constructs, intention was the best predictor on both eating behavior and exercise behavior. This was expected as earlier research has shown intention to be the single best predictor for both (Beaulieu & Godin, 2011; Bozionelos & Bennett, 1999; Blue & Marrero, 2006). What was not expected but not necessarily surprising was that subjective norm was the second largest predictor for exercise, this

has been shown to be predictive along with the two other construct variables before (Murnaghan et. al., 2010).

Perceived behavioral control was the second largest predictor for eating behavior, which was not unexpected, as within the TPB, PBC is supposed to affect both intentions and behavior (Armitage & Conner, 2001). There is however research that shows it predicts behavior, and that it does not (Blue et. al., 2008; Murnaghan et. al., 2010).

Accessibility to both healthy foods and to exercise possibilities turned out to be significant predictors to eating and exercise behavior. This is as far as I know the first study in Norway that shows this relationship.

Correlations.

Correlation analysis showed that eating habits had weak or moderate correlation to all the TPB-constructs as well as accessibility to healthy foods. This was expected beforehand as TPB has shown to predict eating behavior. When it comes to availability to supermarkets there was no correlation to eating habits. However, there was a weak correlation between accessibility to healthy foods and eating habits, which is consistent with earlier research (French, Story & Jeffery, 2001). Exercise correlated moderately with all the TPB-constructs. It also had a weak correlation with access to exercise facilities, which is consistent with previous research (Popkin et. al., 2005). Earlier research has shown that safety also might have a relationship with exercise (Humpel et. al., 2002), however I did not find any significant relationship between safety and exercise in my research.

Interestingly, most of the local environmental factors correlate with each other. This suggests that they might be measuring the same thing. In fact, some of the constructs might actually be underlying variables for the other constructs. For example could pavements and bicycle-opportunities be an underlying variable used to measure accessibility to exercise possibilities.

Predicting exercise and eating behavior

Theory of planned behavior. As predicted, the TPB model was able to significantly predict a large part of the variance in both eating and exercise behavior. This was very much expected as earlier research has shown this several times (Blue, 1995; Blue et. al., 2008; Beaulieu & Godin, 2011; Bozionelos, & Bennett, 1999; Verbeke, & Vackier, 2005). Although not all of the constructs did predict the

behavior, this is not necessarily the point of the TPB. The perceived behavioral control, attitude and subjective norm constructs are supposed to predict intention, and then intention is supposed to predict the behavior, as was generally the case. Interestingly though, subjective norm did not significantly predict intention to eating healthy. The cronbach alpha for the subjective norm construct was 6.93, this slight deviation in reliability might have damaged the model, making it is hard to draw any conclusions as to why subjective norm couldn't predict intention to eat healthy. All the other constructs predicted intention to both eating behavior and exercise.

Predicting eating habits. The TPB-model as a whole was not surprisingly able to predict eating behavior, within the constructs only perceived behavioral control and intention was able too significantly predict the behavior. This is not a surprise as previous research has shown the same results, although perceived behavioral control not always is able to predict behavior (Bozionelos, & Bennett, 1999). According to Ajzen (1991), PBC and self-efficacy are undifferentiated and actually measure the same thing. Self-efficacy has also shown to be a good predictor of behavior, specifically eating habits (O'Leary, A. (1985).

The questionnaire from Norwegian Directorate for Health and Social Affairs consisted of one question regarding supermarket availability; however I concluded that they lacked a good question about accessibility to healthy foods. Consequently, in missing a good interpretation and explanation of local environmental constructs (Kirk et. al., 2010), I designed a question on my own that asked whether the participants believe they have good access to healthy foods for a reasonable price. This showed statistical significance in explaining 4% of the variance in healthy eating before controlling for the TPB-constructs. This is a finding that I believe has not been achieved in the Norwegian population before and shows an interesting relationship between healthy eating and accessibility.

This finding supports some earlier studies outside of Norway (Humpel, Owen & Leslie, 2002; Popkin et. al., 2005), and it's interesting to see that it might be applicable to Norway as well. Although it's a fairly small variance, it's still important when preventing obesity. It might be that people who eat healthier actively seek out supermarkets that have what they need. And that getting to those supermarkets is generally not a problem. It is also conceivable that people who eat healthier perceive the food as cheaper and easier to get. Meaning that people who believe healthy foods are less expensive are also more likely to eat healthier. Previous studies have also shown that when the price goes down, consumption of healthier alternatives goes up

(French et. al., 2001). People in Norway often believe that it is more expensive to eat healthier, and supermarkets often have offers on chocolate, soda, etc., if they instead had offers on vegetables and fruit maybe people would open their eyes and see that in fact, eating healthy is not that expensive. Also decreasing the general tax on healthy foods, and bringing it to all supermarkets should be considered from the government in order to decrease obesity by making people eat healthier. Based on this study, bringing healthier food to the people via supermarket accessibility, and reduce the cost might be effective in reducing the risk of obesity in Norway.

Predicting exercise. Also for exercise, the TPB-model was successful in predicting. Within the constructs however only intention and subjective norm was able to significantly predict the behavior. It is interesting to see that subjective norm is able to predict exercise, but not eating behavior, and that the difference is seen already in correlation analysis. Perhaps what peers think of you is more important when it comes to exercising than eating healthy. As stated earlier, Ajzen (1991) argued that the perceived behavioral control construct is similar to self-efficacy, and self-efficacy has shown to be able to predict exercise (McAuley, 1993), even when controlled for intention (Sniehotta, Scholz & Schwarzer, 2005). However, here we can see that perceived behavioral control was not able to do so even though it has been able to do so before (Blue, 1995). It might be because self-efficacy and perceived behavioral control is not as similar as Ajzen argues. There are several authors that have tried, successfully, to distinct from the self-efficacy construct and perceived behavioral control (Armitage & Conner, 1999; Bandura, 1992; Terry & O'Leary, 1995). Bandura (1986, 1992) argues that perceived behavioral control and self-efficacy are entirely different, saying that self-efficacy deals more with internal factors and cognitive perceptions of control, while perceived behavioral control deals with more general, external factors. Drawing conclusions however in this might be futile, as the internal reliability of the PCB-variable was low (4.70). This in itself isn't necessarily bad in a variable with that few items (Pallant, 2010), on the other hand in this study the other items with few items had good internal reliability. This is a weakness in the TPB-constructs that were used in this study.

Earlier Norwegian research on the influence of a few local environment variables on exercise (Anderssen & Andersen. 2004) has not shown that the local environment plays any role in exercise behavior. In this study an important finding was that accessibility to exercise possibilities such as reasonable priced or free gyms,

swimming institutions, bicycle roads etc. was able to explain 2% of the variance in exercise behavior. This is the first Norwegian study to show the relationship between exercise behavior and accessibility to exercise possibilities in the Norwegian population.

It's not a surprising result when we know that earlier research has shown the relationship before (Humpel et. al., 2002; Sallis, Bauman & Pratt, 1998). Nevertheless, since it has not been shown in a Norwegian population in shows that the government of Norway is likely to benefit from using interventions on the community level to its advantage when preventing obesity by increasing exercise levels. In a few cities in Norway, there has been implemented a few outdoors training areas, this research supports this intervention and believes it might lead to a slight increase in physical activity.

Value and limitation of this study.

Sample. Although the sample size for the analysis is not that big (N = 253), and the actual sample between the variables is even lower (N = 181 between accessibility to healthy foods and exercise behavior) this should be big enough. Some researchers (Tabachnick & Fidell, 2007, p. 123) suggest that the amount of subjects should be (50 + 8 x independent variables). In this study there were two dependent variables, and 14 independent variables in total. According to this equation, the participant count would need 50 + (8 x 14) participants, which comes to 162. This means that for every variable there was a sufficient sample size according to this rule. The two dependent variables (Exercise and Eating behavior) were even used separately in this study. Hence, each variable had only 6 (Eating) and 8 (Exercise) independent variables, which puts us in the safe zone. Even if they were used together, I would have the sufficient amount. According to Stevens (1996), there should be 15 participants per predictor. In this study, there were 6 predictors for eating behavior (Attitude, Perceived behavioral control, Subjective norm, intention, and 2 local environment predictors), and 8 for exercise behavior (TPB-constructs + 4 local environment predictors). This gives us that I should have 210 participants in total, which is slightly above what I have, however, the predictors and dependent variables were used separately, and accordingly I should have 90 for eating habits and 120 for exercise behavior, and this criterion was met. The sample size was probably sufficient, but as in every study, there could always a larger sample. This might also have helped to achieve significant results in local environment after adding the TPB-constructs. In

order to see the actual predicting value of the constructs it would be beneficial to measure the same sample on exercise and eating behavior later in life.

Considering the sample was mostly collected through NTNU's internal network "Innsida", most of the subjects are likely to have been students. Nonetheless, parts of the sample was not students and how many was not measured. I also chose not to include questions about sex or age, and although research has shown that environmental constructs don't differentiate to a great degreebetween men and women (De Bourdeaudhuij, Sallis & Saelens, 2003; Wendel-Vos, Droomers, Kremers, Brug & Van Lenthe, 2007), it's only for physical exercise and it's definitely a weakness in the study. It is also likely that people who chose to answer the questionnaire are interested in exercising or eating healthy, which might also explain the high mean score for physical activity. However, these problems aren't necessarily that detrimental to the study as the goal was to see whether or not is was possible to measure these constructs in the Norwegian population. Future research must however have better recruitment for participants.

Local environment questions. Most of the local environment variables were unable to predict both eating behavior, and exercise behavior. Only 2 out of 6 variables were able to significantly predict the behaviors before they were controlled for the TPB-constructs, in fact, after TPB-constructs were added, none were significant. This is troubling when we know that the government in investing more and more in these types of interventions, such as outdoor recreational parks. Nevertheless, we can't rule out the effect that was found saw here, and the effect that several other authors have found. Even though there were no relationship, only one question was used for each variable, although there were three questions that were related to safety.

It is safe to say that refining the questions and perhaps adding more questions would get better validity in the local environment measures. It is unlikely that these one-question variables are able to be specific enough to accurately measure the concept of safety, or accessibility. There are several other research papers that have found a relationship between factors such as aesthetics, safety, accessibility and availability, however very few have implemented the theory of planned behavior as a control. This might have led to them not receiving the results that they had hypothesized. I found that it was likely that perceived behavioral control took over the variance of accessibility to eating habit variable, which in turn might be that those types of questions actually measure a personal factor, instead of an environmental one. For exercise, it's difficult to infer which variable took over the effect of the

accessibility factor here, as there were no significant correlation between accessibility and the 4 TPB-constructs, we do however have to keep in mind the low reliability of the PCB-variable for exercise which might have influenced the model. The questions used to determine the local environment are probably not the best. There has however not been created any good questions or constructs in determining or measuring the local environment (Kirk et. al., 2010; Ferdinand, Sen, Rahurkar, Engler, & Menachemi, 2012). Nevertheless, significant results were achieved before adding TPB-constructs. Also, more questions for each construct (Safety, accessibility) could have been used, but in order to do this, they must first be tested and shown to be measuring the same construct. There should however been a question regarding the accessibility of unhealthy food as well. Nonetheless, the two questions in this study that did show a relationship between their dependent variables are conceivably good enough to be used in future research for creating good local environment constructs.

Conclusion and future research. According to this study, local environment does actually play a role, although a small one, in both eating behavior and exercise behavior. This small effect as stated earlier has been shown before in research, nevertheless it is the first study to show the relationship in the Norwegian student population. The effect is contradictory to what the Norwegian Directorate for Health and Social Affairs found in their research (Anderssen & Andersen, 2004), although their results are unclear as I could not find sufficient information about their results. In order to be successful at preventing further weight gain in the population, by the means of increasing healthy food consumption physical activity, one area of focus from the government should be to look at how the built environment of the society is. That means looking at where recreational centers (And other exercise possibilities) are built in relation to different populations (i.e. Rural or urban), and organize such that it's easier to sell cheap healthy foods which is accessible for the population. A small positive change on the individual level can lead to a considerable amount of change in the population. It is important however to underline that this study is merely a start. Absolute conclusions would be wrong to be drawn from this study; however it shows that there is groundwork enough for future researchers to study this field by using more controlled samples and better constructs.

To fully understand the effects of a community intervention, future research should focus on being experimental in nature, i.e. trying to implemented certain interventions and see the long-term effects that it might have. This has been done before with promising results (Andersen, Franckowiak, Snyder, Bartlett & Fontaine,

1998; Economos et. al., 2007; Sacher et. al., 2010), and also with less promising results (Jeffery et. al., 1995). The studies that are having no luck might be targeting the wrong community aspects. The reason for the bad targeting is possibly due to the researchers unawareness toward which community aspects that might have given more favorable results. It is also essential for future research to be sure that what is being measured is indeed an environmental factor, and not a personal one. This could be done by objectively measuring the environment around the people in the study, and in addition develop questions that have good validity to those concepts.

Future research that employs the TPB for predicting exercise might find that it is not a sufficient model. Take the intention factor, this is not necessarily a good measure for actual behavior, as Schwarzer (2008) points out, people often do not behave in unison with their intentions. For example one group of people might have the intention to exercise, but they just don't have the equipment to do so. Another group also has the intention to exercise, but they on the other hand have the possibility. This might lead to the same intention scores, but very different exercise scores. Schwarzer (2008) says that we need more factors that can help intention to predict behavior, good measures for accessibility and availability might act as contextual non-individual factors for the TPB that might help to discover factors that are involved in transferring intention to behavior.

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Appendix 1

Hei! Denne studien er den del av en masteroppgave på *Norges teknisk-naturvitenskapelige universitet (NTNU). Temaet er* sunt kosthold og treningsatferd, og hvordan dette påvirkes av ting som tilgjengelighet og planlegging. Dette er helt frivillig, og det er mulighet for å trekke seg når som helst i løpet av spørreskjemaet. Ingen personidentifiserende data som navn, adresse, eller lignende vil bli samlet inn slik at svarene i denne spørreundersøkelsen ikke skal kunne spores tilbake til respondenten. All data vil anonymiseres innen prosjektslutt 30. juli 2012, og slettes etter dets slutt. Vi takker for din samarbeidsvilje! Om det er noen spørsmål angående spørreskjemaet eller om du vil ha studiets resultater og konklusjoner når oppgaven er skrevet, ta kontakt med Steffesa@stud.ntnu.no.

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Appendix 2

Aktivitets- og treningsvaner

Tenk på all meget anstrengende aktivitet du har drevet med de siste 7 dagene. Meget anstrengende aktivitet er aktivitet som krever hard innsats og får deg til å puste mye mer enn vanlig (For eksempel styrketrening, jogging, aerobic, bodycombat, etc.). Ta bare med aktiviteter som varer minst 10 minutter i strekk.

Hvor mange dager i løpet av de siste 7 dagene har du drevet med meget anstrengende fysisk aktivitet (For eksempel tunge løft, gravearbeid, aerobics, løp, sykling, svømming, og lignende)?

___ Dag(er)

Hvor mange minutter brukte du i gjennomsnitt på den fysiske aktiviteten disse dagene?
___ Time(r) per dag

___ Minutt(er)

Tenk på all middels anstrengende aktivitet du har drevet med de siste 7 dagene. Middels anstrengende aktivitet er aktivitet som krever moderat innsats og får deg til å puste litt mer enn vanlig.

Hvor mange dager i løpet av de siste 7 dagene har du drevet med middels anstrengende fysisk aktivitet (For eksempel lette løft, rask gange og sport som er moderat anstrengende.)?

___ Dag(er)

Hvor mange minutter lang tid brukte du i gjennomsnitt på den fysiske aktiviteten disse dagene?
___ Time(r) per dag

___ Minutt(er)

Fysisk aktivitet er her definert som aktivitet som er moderat hardt eller tungt å utføre, eller som øker pulsen betraktelig. (For eksempel styrketrening, aerobic, rask gåing i oppoverbakke, aerobic, spinning, etc.)

At jeg får minst 30 minutter med moderat eller tung fysisk aktivitet de fleste dager i uken ville være

Svært ubehagelig	Noe ubehagelig	Verken ubehagelig eller behagelig	Noe behagelig	Svært behagelig
1	2	3	4	5
Svært kjedelig	Noe kjedelig	Verken kjedelig eller interessant	Noe interessant	Svært interessant
1	2	3	4	5
Svært dårlig	Noe dårlig	Verken bra eller dårli	Noe bra	Svært bra
1	2	3	4	5
Svært unyttig	Noe unyttig	Verken unyttig eller nyttig	Noe nyttig	Svært nyttig
1	2	3	4	5
Svært verdiløst	Noe verdiløst	Verken verdiløst eller verdifullt	Noe verdifullt	Svært verdifullt
1	2	3	4	5
Svært skadelig	Noe skadelig	Verken skadelig eller skadeforebyggende	Noe skadeforebyggende	Svært skadeforebyggende

1	2	3	4	5

Det er forventet av meg at jeg får moderat eller tung fysisk aktivitet minst 30 minutter de fleste dager i uka.

Helt uenig	Noe uenig	Vet ikke	Noe enig	Svært enig
1	2	3	4	5

Hva synes personer som har meninger du verdsetter om at du skal få moderat eller tung fysisk aktivitet i minst 30 minutter de fleste dager i uka

Helt avvisende	Noe	Vet ikke	Noe	Sterkt godkjennende
1	Avvisende	3	Godkjennende	5
	2		4	

De fleste personer som er viktig for meg får moderat eller tung fysisk aktivitet minst 30 minutter de fleste dager i uken.

Helt usant	Noe Usant	Vet ikke	Noe Sant	Helt sant
1	2	3	4	5

Personer som har meninger jeg setter verdsetter får moderat eller tung fysisk aktivitet minst 30 minutter de fleste dager i uken.

Helt usant	Noe Usant	Vet ikke	Noe Sant	Helt sant
1	2	3	4	5

Det er helt opp til meg hvorvidt jeg engasjerer meg selv i moderat eller tung fysisk aktivtet i minst 30 minutter de fleste dager i uken.

Helt uenig	Noe Uenig	Vet ikke	Noe Enig	Helt enig
1	2	3	4	5

For meg å få moderat eller tung fysisk aktivitet i minst 30 minutter de fleste dager i uken ville vært...

Svært vanskelig	Noe vanskelig	Vet ikke	Noe lett	Svært lett
1	2	3	4	5

Hvor mye kontroll har du over om du får moderat eller tung fysisk aktivitet i minst 30 minutter de fleste dager i uken?

Ingen kontroll	Noe kontroll	Vet ikke	Mye kontroll	Full kontroll
1	2	3	4	5

Jeg har til hensikt å få moderat eller tung fysisk aktivitet i minst 30 minutter de fleste dager i uken.

Helt usannsynlig	Noe	Vet ikke	Noe	Helt sannsynlig
1	Usannsynlig	3	Sannsynlig	5
	2		4	

Jeg prøver å få moderat eller tung fysisk aktivitet i minst 30 minutter de fleste dager i uka.

Definitivt usant	Usant	Vet ikke	Sant	Definitivt sant
1	2	3	4	5

Jeg planlegger å få moderat eller tung fysisk aktivitet i minst 30 minutter de fleste dager i uka.

Helt uenig	Uenig	Vet ikke	Noe enig	Helt enig
1	2	3	4	5

Et sunt kosthold er å spise variert med ivertfall anbefalt mengde grønnsaker og frukt (5 om dagen), og ikke for mye av bearbeidet kjøtt, kaker, sukker, salt, osv.

At jeg spiser sunt ville være…

Svært ubehagelig	Noe ubehagelig	Verken behagelig eller ubehagelig	Noe behagelig	Svært behagelig
1	2	3	4	5
Svært dumt	Noe dumt	Verken smart eller dumt	Noe smart	Svært smart
1	2	3	4	5
Svært dårlig	Noe dårlig	Verken bra eller dårlig	Noe bra	Svært bra
1	2	3	4	5
Svært unødvendig	Noe unødvendig	Verken nødvenig eller unødvendig	Noe nødvendig	Svært nødvendig
1	2	3	4	5
Svært skadelig	Noe skadelig	Verken skadelig eller skadeforebyggende	Noe skadeforebyggende	Svært skadeforebyggende
1	2	3	4	5

Det er forventet av meg at jeg skal spise sunt.

Helt uenig	Noe Uenig	Vet ikke	Noe Enig	Helt enig
1	2	3	4	5

De fleste personene i livet mitt som er viktige for meg synes jeg skal spise sunt.

Helt uenig	Noe Uenig	Vet ikke	Noe Enig	Helt enig
1	2	3	4	5

Når det kommer til å spise sunt, så vil jeg gjøre det de fleste som er viktige for meg vil at jeg skal gjøre.

Helt uenig	Noe Uenig	Vet ikke	Noe Enig	Helt enig
1	2	3	4	5

De personene som meninger jeg verdsetter spiser sunt.

Helt uenig	Noe uenig	Vet ikke	Noe enig	Svært enig
1	2	3	4	5

For meg å spise sunt ville vært…

Svært vanskelig	Noe vanskelig	Vet ikke	Noe lett	Svært lett
1	2	3	4	5

Jeg er trygg på at hvis jeg spiste sunt så kunne jeg fortsette med det.

Helt uenig	Noe uenig	Vet ikke	Noe enig	Svært enig
1	2	3	4	5

Om jeg spiser sunt eller ikke i fremtiden er helt opp til meg

Helt uenig	Uenig	Vet ikke	Enig	Svært enig
1	2	3	4	5

Hvor mye kontroll føler du at du har over det å spise sunt?

Ingen kontroll	Noe kontroll	Vet ikke	Mye kontroll	Full kontroll
1	2	3	4	5

Jeg ville likt å spise sunt men vet ikke egentlig om jeg kan.

Helt uenig	Uenig	Vet ikke	Enig	Svært enig
1	2	3	4	5

Jeg er trygg på at jeg kan spise sunt om jeg vil.

Helt uenig	Uenig	Vet ikke	Enig	Svært enig
1	2	3	4	5

Hvis folk trodde at å spise sunt ville forlenge livet deres, da ville de spist sunt.

Helt uenig	Uenig	Vet ikke	Enig	Svært enig
1	2	3	4	5

Om jeg hadde muligheten å ta et kurs for å lære om hvordan å spise sunt, så ville jeg vært interessert.

Helt uenig	Uenig	Vet ikke	Enig	Svært enig
1	2	3	4	5

Jeg har som intensjon å spise sunt i fremtiden

Ekstremt usannsynlig	Noe usannsynlig	Vet ikke	Noe sannsynlig	Ekstremt sannsynlig
1	2	3	4	5

Jeg vil prøve å spise sunt nesten hver dag framover.

Definitivt usant	Noe usant	Vet ikke	Noe sant	Definitivt sant
1	2	3	4	5

Miljømessige omgivelser

Tenk på de forskjellige mulighetene i og rundt nabolaget ditt. Med dette mener vi hele området rundt hjemmet ditt som du kan gå til på 10–15 minutter.

Mange butikker, butikksentra, markeder eller andre steder der jeg kan handle ting jeg trenger, er innen rimelig gangavstand fra hjemmet.

Sterkt uenig

Litt uenig

Vet ikke/usikker

Litt enig

Veldig enig

Jeg har god tilgang på sunn mat til rimelig pris der jeg handler.

Sterkt uenig

Litt uenig

Vet ikke/usikker

Litt enig

Veldig enig

De fleste gatene i nabolaget har fortau.

Sterk uenig

Litt uenig

Vet ikke/usikker

Litt enig

Veldig enig

Det er greit å sykle i nabolaget eller dit jeg trenger å komme meg (skole, jobb, etc). F.eks er det egne sykkelfelt, separate sykkelveier eller felles gang- og sykkelveier, og disse er i god stand (ikke sprekker og hindringer).

Sterkt uenig

Litt uenig

Vet ikke/usikker

Litt enig

Veldig enig

Jeg har lett tilgang på flere gratis eller rimelige rekreasjonsmuligheter, for eksempel treningssenter, svømmehaller, sykkelveier, gangveier og lignende.

Sterkt uenig

Litt uenig

Vet ikke/usikker

Litt enig

Veldig enig

Jeg anser det som utrygt å ferdes i gatene fordi det enten er mye kriminalitet, trafikk, eller lignende i nabolaget.

Sterkt uenig

Litt uenig

Vet ikke/usikker

Litt enig

Veldig enig

Denne seksjonen omhandler dine spisevaner den siste tiden.

Sett kryss bak det som best beskriver dine spisevaner de siste 6 månedene.

Hvor ofte spiser du…

1. Mørkegrønne bladgrønnsaker (Spinat, bladkål, kinakål, bladbete/sølvbete):
   - Mindre enn 1 gang pr uke
   - 1 gang per uke
   - 2-4 ganger i uken
   - Nesten daglig eller daglig
   - 2 eller flere ganger om dagen

2. Brokkoli, blomkål, kål, rosenkål:
   - Mindre enn 1 gang pr uke
   - 1 gang per uke
   - 2-4 ganger I uken
   - Nesten daglig eller daglig
   - 2 eller flere ganger om dagen

3. Gulrøtter:
   - Mindre enn 1 gang pr uke
   - 1 gang per uke
   - 2-4 ganger I uken
   - Nesten daglig eller daglig
   - 2 eller flere ganger om dagen

4. Andre grønnsaker (F.eks erter, mais, grønne bønner, tomater, squash):
   - Mindre enn 1 gang pr uke
   - 1 gang per uke
   - 2-4 ganger I uken
   - Nesten daglig eller daglig
   - 2 eller flere ganger om dagen

5. Tørkede bønner, gule erter, eller linser:
   - Mindre enn 1 gang pr uke
   - 1 gang per uke
   - 2-4 ganger I uken
   - Nesten daglig eller daglig
   - 2 eller flere ganger om dagen

6. Sitrusfrukter (F.eks appelsin, klementin og grapefrukt):
   - Mindre enn 1 gang pr uke
   - 1 gang per uke
   - 2-4 ganger I uken
   - Nesten daglig eller daglig
   - 2 eller flere ganger om dagen
   - Twice or more per day

7. Andre frukter (f.eks epler, pærer, banan, bær, druer og melon):
   - Mindre enn 1 gang pr uke
   - 1 gang per uke
   - 2-4 ganger I uken
   - Nesten daglig eller daglig
   - 2 eller flere ganger om dagen

8. Fettholdige meierprodukter (Helmelk, ost, smør, is):
   - Mindre enn 1 gang pr uke
   - 1 gang per uke
   - 2-4 ganger I uken
   - Nesten daglig eller daglig
   - 2 eller flere ganger om dagen

9. Lav-fetts meieriprodukter (Skummet/ekstra lett-melk, yoghurt, kesam eller cottage cheese:
   - Mindre enn 1 gang pr uke
   - 1 gang per uke
   - 2-4 ganger I uken
   - Nesten daglig eller daglig
   - 2 eller flere ganger om dagen

10. Egg:
    - Mindre enn 1 gang per uke
    - 1-2 ganger I uken
    - 3-4 ganger per uke
    - Daglig
    - 2 eller flere ganger om dagen

11. Oksekjøtt, svinekjøtt eller lammekjøtt:
    - Mindre enn 1 gang pr uke
    - 1 gang per uke
    - 2-4 ganger I uken
    - Nesten daglig eller daglig
    - 2 eller flere ganger om dagen

12. Bearbeidet kjøtt (Spekepølse, salami, pølse, bacon):
    - Mindre enn 1 gang pr uke
    - 1 gang per uke
    - 2-4 ganger I uken
    - Nesten daglig eller daglig
    - 2 eller flere ganger om dagen

13. Kalkun eller kylling:
    - Mindre enn 1 gang pr uke
    - 1 gang per uke
    - 2-4 ganger I uken
    - Nesten daglig eller daglig
    - 2 eller flere ganger om dagen

14. Fisk/sjømat (ikke fritert):
    - Mindre enn 1 gang pr uke
    - 1 gang per uke
    - 2-4 ganger I uken
    - Nesten daglig eller daglig
    - 2 eller flere ganger om dagen

15. Margarin:
    - Mindre enn 1 gang pr uke
    - 1 gang per uke
    - 2-4 ganger I uken
    - Nesten daglig eller daglig
    - 2 eller flere ganger om dagen

16. Raffinert korn (hvitt brød/loff, hvit ris):
    - Mindre enn 1 gang pr uke
    - 1 gang per uke
    - 2-4 ganger I uken
    - Nesten daglig eller daglig
    - 2 eller flere ganger om dagen

17. Fullkornsbrød og korn (Sammalt hvete, havregryn, brun ris,bygg):
    - Mindre enn 1 gang pr uke
    - 1 gang per uke
    - 2-4 ganger I uken
    - Nesten daglig eller daglig
    - 2 eller flere ganger om dagen

18. Bakte produkter (muffins, smultring, kjeks, kaker, osv):
    - Mindre enn 1 gang pr uke
    - 1 gang per uke
    - 2-4 ganger I uken
    - Nesten daglig eller daglig
    - 2 eller flere ganger om dagen

19. Kaloriholdige drikker (Vanlig brus, Kuli, Iste):

Mindre enn 1 gang pr uke
1 gang per uke
2-4 ganger I uken
Nesten daglig eller daglig
2 eller flere ganger om dagen

20. Fritert mat:

Mindre enn 1 gang pr uke
1 gang per uke
2-4 ganger I uken
Nesten daglig eller daglig
2 eller flere ganger om dagen

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Mindre enn 1 gang pr uke
1 gang per uke
2-4 ganger I uken
Nesten daglig eller daglig
2 eller flere ganger om dagen