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CHAPTER

1

General introduction

GENERAL INTRODUCTION

Physical inactivity is an important risk factor for many major chronic diseases such as cardiovascular disease, diabetes, and various types of cancer [1]. Worldwide, lack of physical activity (PA) has been estimated to cause 6-10% of the major chronic diseases and 9% of premature mortality [1]. To promote and maintain good health, current guidelines advise adults to engage in moderate-intensity PA for at least 30 minutes at five days of the week, or in vigorous-intensity PA for at least 20 minutes at three days of the week [2]. Worldwide, 31% of the adults do not meet these recommendations [3]. Physical inactivity is even more present in upper-middle and high income countries, where more than 40% of the adults are not physically active enough [3]. In these countries, technological advancements have reduced the amount of physical labour needed to accomplish many tasks in daily life. Transport has become more motorized, and manual labour has been replaced by machines. Therefore, in these countries, leisure-time physical activity (LTPA) has become increasingly more important to meet recommended levels of PA. However, only 39% of the adult European population engage in some or a lot of LTPA [4].

CORRELATES OF LEISURE-TIME PHYSICAL ACTIVITY

Understanding why some adults do and others do not engage in LTPA is essential for the development of effective public health interventions. Traditionally, research on determinants of health behaviours like LTPA has primarily focused on individual-level factors [5]. The most prominent individual-level theories come from the field of social psychology and include theories such as the Theory of Reasoned Action and its extended version Theory of Planned Behaviour [6], and the Health Belief Model [7]. These theories state that human behaviours like LTPA are influenced by a variety of psychosocial factors such as attitude, perceived social norm, perceived behavioural control, self-efficacy, perceived benefits and barriers, and perceived threat. However, LTPA promotion interventions that have employed such individual approaches have generally produced only small, short-term changes in LTPA [8].

In the past two decades, LTPA research has shown an increased interest in social-ecological models[8-12]. “Ecological” refers to peoples’ transactions with their physical and social environments. These models posit that health behaviours like LTPA are not only shaped by individual-level determinants, but also by various environmental-level determinants. Influences on LTPA may interact across these levels. Therefore, interventions that target both individuals and their environment are suggested to be most effective in producing long-term, population-wide LTPA

changes. The neighbourhood environment may be of particular interest, because this is the most frequently used setting for LTPA [13,14].

Since the introduction of the social-ecological model, a large number of studies have explored possible neighbourhood environmental correlates of LTPA. Several reviews have shown that it is important to study purpose-specific PA behaviours, as environmental correlates of LTPA are different from those of PA for transport reasons [15-19]. Most of the reviews have focused on leisure-time walking. These reviews have documented positive associations of leisure-time walking with neighbourhood aesthetics and with the presence, proximity, and quality of sidewalks and LTPA facilities [15,17,19]. Another review has found consistent associations of leisure-time sports with the availability of PA equipment and the amount of social support, and some evidence for associations with convenience of recreational facilities [16]. The majority of studies in these reviews originated from America or Australia. A recent review of European studies found evidence of associations of a composite recreational walking and cycling measure with traffic safety, and of total LTPA with quality of the neighbourhood environment [18]. In contrast with non-European reviews, there was no support for associations with neighbourhood aesthetics or recreational facilities.

NEIGHBOURHOOD SAFETY AND LEISURE-TIME PHYSICAL ACTIVITY

There is inconsistent empirical support for the role of neighbourhood safety in LTPA [15,16,17,19-21]. Poor neighbourhood safety may be perceived by residents as threatening and hence cause stress or fear [20-24]. To try and alleviate this fear, adults may minimize their exposure to potentially dangerous places by avoiding them. Hence, LTPA levels may decrease. Inconsistencies in the evidence on the role of neighbourhood safety in LTPA may be due to the complexity of the relation.

First, adults may not only engage in PA for different purposes (leisure or transport), but they may also engage in different types of LTPA. One might expect that the neighbourhood environment is most likely to affect LTPA that is performed in public spaces. This suggests that adults are less likely to be affected by neighbourhood safety when working out at the gym or when gardening, than when walking in the park, cycling on a trail, or jogging in the streets. Use of generic LTPA measures may obscure such differences. Research provides some support for the use of specific PA measures. Two reviews found more convincing evidence for an association between the neighbourhood environment and PA when looking at specific types of PA (e.g. sports, walking) rather than general PA [16,25].

Second, poor neighbourhood safety may have many causes. To be able to develop effective interventions, it is important to identify which issues are at the core of the problem. Studies on environmental determinants of LTPA usually distinguish between personal safety (also referred to as fear of crime) and traffic safety [15-17,19]. While traffic safety has one clear underlying cause (i.e. traffic), personal safety may have many underlying causes. Traditionally, research has focused on criminal victimization as the main underlying cause. However, personal safety concerns are far more widespread than crime, suggesting alternative causes [26-28]. The incivilities thesis posits that personal safety concerns are partly caused by physical (e.g. litter, graffiti) and social disorder (e.g. public drinking, drug use, youth gangs) [29]. Residents may interpret disorder as a sign that fellow residents and officials are unable or unwilling to preserve order, causing them to feel personally at risk of more serious crime. There is strong evidence for an association between disorder and personal safety concerns [30,31], but there is limited evidence on its relation with LTPA.

Studies on personal safety and PA have usually applied generic safety measures that make no explicit reference to the underlying cause, or composite safety measures that combine various causes into one overall measure [20,21]. These measures lack specificity and may obscure possible associations of LTPA with specific safety problems. Studies that have explored associations of specific safety problems with LTPA have most often focused on only one or two problems. Comparability of the results of these studies is limited due to differences in settings and in measurement of PA and safety. Only few studies have simultaneously explored associations of various specific safety problems on LTPA. For example, in Australia, traffic problems and social disorder were found to be significantly associated with lower levels of leisure-time walking, while there was no evidence for the role of crime and mixed evidence for the role of physical disorder [32]. In America, crime, physical disorder, social disorder, and traffic safety were all found to be significantly associated with lower levels of leisure-time walking [33]. More research is needed in countries other than America and Australia [16,21].

Third, neighbourhood safety may be more strongly related to LTPA behaviour in some socio-demographic groups than in others. Women, elderly, ethnic minorities, and individuals with lower socio-economic status more often report poor neighbourhood safety than their counterparts [20,21,23,34]. These groups are suggested to be more concerned about safety because of higher physical and social vulnerability, which causes them to feel more at risk of crime [21,23]. As a result, they may be more inclined than other groups to avoid potentially dangerous places and hence reduce their levels of LTPA. There is some evidence that poor neighbourhood safety may constrain PA, particularly among women and older adults, but more research is needed to corroborate these findings [20,21,34].

RESIDENTIAL SELF-SELECTION

Most of the evidence on the relation between neighbourhood safety and LTPA has been derived from cross-sectional studies [21,34]. This type of study is vulnerable to bias due to residential self-selection [35,36]. Self-selection entails that people who are active or who like to be active go live in neighbourhoods that facilitate PA. Thus, high levels of LTPA in safe neighbourhoods may not be the result of adults getting active because of good neighbourhood safety, but of active adults choosing to live in safe neighbourhoods. Cross-sectional studies that do not account for this self-selection bias may overestimate associations of neighbourhood safety with LTPA [35,36].

There is limited understanding of the role of residential self-selection in the relation between neighbourhood safety and LTPA. A handful of studies on neighbourhood safety and general PA have taken self-selection into account by looking at changes in neighbourhood safety over time in relation to PA. This study design minimizes the chance of self-selection bias by controlling for factors that remain stable over time, including residential preferences [37]. An Australian study by Humpel et al. [38] provided evidence for an association of traffic safety with PA beyond residential self-selection. They found that men who perceived traffic safety to have become less of a problem over a 10-week period of time, were less likely to have increased their walking, while women were more likely to have increased their walking in this time period. Two Dutch studies by Jongeneel-Grimen et al. [39,40] also provided evidence for an association of neighbourhood safety with PA beyond residential self-selection. They found that adults were more likely to participate in PA when living in neighbourhoods that showed more favourable changes in self-reported traffic safety, fear of crime, physical order, and social order over the past years. Additional research along the lines of Jongeneel-Grimen et al. [39,40] is needed with purpose-specific PA measures.

AREA-BASED INEQUALITIES IN LEISURE-TIME PHYSICAL ACTIVITY

Adults that live in deprived neighbourhoods report lower levels of LTPA than adults living in non-deprived neighbourhoods [41-43]. In Perth, Australia, 60.7% of the adults in deprived neighbourhoods participated in leisure-time walking and 40.7% participated in sports, compared to 76.8% and 53.6%, respectively, of adults in non-deprived neighbourhoods [41]. In Melbourne, Australia, 13.2% of the adults in the most deprived neighbourhoods cycled at least once a month for recreational purposes, compared to 18.7% in the least deprived neighbourhoods [43]. In Eindhoven, the Netherlands, 82.6% of the adults in the most deprived

neighbourhoods were found to walk, cycle, or garden in leisure time and 37.1% participated in sports, compared to 87.4% and 54.6%, respectively, of the adults living in the least deprived neighbourhoods [42].

These findings raise questions about the mechanisms responsible for area-based inequalities in LTPA. Inequalities cannot entirely be explained by individual-level factors, as associations between neighbourhood deprivation and LTPA have been found to persist even after taking differences in demographic and socio-economic characteristics into account [42,43]. It has been suggested that LTPA inequalities may partly be the result of differences in environmental conditions, such as neighbourhood safety [41-43]. Adults living in deprived neighbourhoods have reported more safety concerns, and more crime and disorder, as well as lower levels of neighbourhood attractiveness, less public recreational facilities, less social support, and lower levels of trust and social cohesion than adults living in non-deprived neighbourhoods [41,44-46]. There is some evidence to suggest that area-based LTPA inequalities can be explained by differences in environmental conditions. In the Netherlands, area-based inequalities in leisure-time walking, cycling, and gardening were found to be partly mediated by differences in general physical neighbourhood design, and inequalities in sports participation were partly mediated by differences in required police attention [42]. In Australia, area-based inequalities in leisure-time cycling were partly mediated by objectively measured neighbourhood aesthetics, but not by objectively measured neighbourhood design, safety, or destinations [43].

In the past two decades, numerous area-based initiatives (ABIs) have been implemented in deprived areas across Western-Europe, with the aim to improve the physical and social conditions in these areas as well as the socio-economic position of its residents [47-49]. ABIs take a vastly different approach than the urban renewal programmes that were popular in the 1960's, 70's, and 80's [47,48]. These urban renewal programmes primarily aimed to improve the physical appearance of deprived areas, without paying much attention to its residents and the social neighbourhood conditions. From the 1990's onwards, urban policies took on a more area-based and integral approach. Public-private partnerships were developed, residents were more involved in the approach, and areas were given the autonomy to develop a set of interventions tailored to their local situation.

Though they do not explicitly aim to improve LTPA, ABIs have the potential to stimulate LTPA in deprived areas by improving neighbourhood safety and other neighbourhood conditions known to be associated with LTPA, such as neighbourhood aesthetics, infrastructure, PA facilities, and social networks. ABIs may improve neighbourhood safety by tackling underlying safety problems such as crime and disorder [21,30,31]. Moreover, they may improve neighbourhood safety by improving physical and social neighbourhood conditions [21,30,31]. Improving the physical

design of the neighbourhood may improve opportunities for surveillance from fellow residents, which may cause people to feel less at risk of crime and disorder, and hence reduces fear and safety concerns. Alternatively, strengthening the social networks in the neighbourhood may safeguard against the fear resulting from poor physical neighbourhood conditions by making people feel less vulnerable to crime.

THE IMPACT OF AREA-BASED INITIATIVES

ABIs can be regarded as “natural experiments” and may be useful to generate more evidence for the impact of area-level policies on LTPA and neighbourhood conditions such as area safety in deprived areas [50,51]. Though many researchers have expressed the need for natural experimental studies, only very few ABIs have been scientifically evaluated for their impact on neighbourhood safety [52] or health, let alone LTPA [50,51,53]. Studies that have done so have generally evaluated smaller scale interventions, such as park upgrades, new cycling infrastructure, new greenway trail, or extra street lighting to enhance PA [36], and home security improvements, extra street lighting, or installation of closed-circuit television systems to improve neighbourhood safety [52]. Moreover, these interventions have generally not been specifically aimed at deprived areas.

Only two ABIs were identified that have been scientifically evaluated for their impact on PA and neighbourhood safety: the Single Regeneration Budget (SRB) and the New Deal for Communities (NDC). Both have been launched by the English government. In 1994, the SRB was launched with the aim to improve the economic, physical, and social conditions in local areas across England [54,55]. Between 1995 and 2001 a total of 1028 schemes were funded. Of the total SRB expenditure, 80% went to the 99 most deprived districts of England [54]. Because of the large amount of schemes, a case-study-based approach was adopted to evaluate the impact of the SRB. Cases were selected from the roughly 300 schemes that were funded in 1995 and 1996. In each case study area, change in outcome variables was traced using household surveys. A baseline was established in 1996. Cross-sectional follow-up measurements were performed in 1999 and 2001. Changes in the SRB areas were compared with those in England as a whole. At 5-year follow-up, SRB areas saw larger reductions in the number of residents feeling very unsafe than the rest of England [55]. However, differences were not tested for statistical significance. There were no effects on crime, vandalism, problems with dogs, and litter.

In 1998, the NDC was launched with the aim to reduce the gap between the 39 most deprived urban areas in England and the rest of the country with respect to health, education, unemployment, crime, community, and housing and the physical

environment [56,57]. Compared to the SRB, the NDC had a more area-based focus by targeting only the most deprived areas of the country. The impact of the NDC was measured using household surveys [56,57]. A common baseline was established in 2002. Cross-sectional follow-up measurements were taken in 2004, 2006, and 2008. Changes in outcome variables in NDC areas were compared with those in non-adjacent, similarly deprived areas. At 4-year and 6-year follow-up, PA levels did not improve in NDC areas, neither when looking at absolute change, nor when looking at the change relatively to that in comparator areas [56,57]. At 6-year follow-up, NDC areas saw significantly larger reductions in the number of residents reporting victimization, and lawlessness and dereliction than similarly deprived areas [58]. There were no effects on fear of crime or feeling unsafe after dark in general. However, positive effects on fear of crime were found in areas with greater safety problems at the start of the programme and with larger safety interventions [59,60]. These findings reinforce the earlier expressed need to take variations in programme delivery and contextual factors into account when evaluating ABIs [53].

More quasi-experimental research is needed to strengthen the evidence base on the impact of ABIs on LTPA and neighbourhood safety. Existing evidence has exclusively been derived from England. It is important to extend the research to other countries, as the impact of ABIs may depend on the context in which it is implemented. Moreover, to strengthen the causal inferences that can be drawn from natural experimental studies, the Medical Research Council guidance has advised researchers to include multiple pre and post measurements of the outcome (as in an interrupted time series design), multiple intervention and control groups, and potential confounders [51]. So far, none of the SRB and NDC evaluation studies have incorporated all advises.

UNDERLYING PATHWAYS

To be able to improve future ABIs, it is important to not only know whether an intervention was successful, but to also understand how it worked, why it was successful or not, and for whom. Several studies have expressed the need to know more about the pathways by which ABIs produce change [36,53]. The realist approach has been opted as a useful approach to uncover the inner workings of complex programmes like ABIs [61,62]. The key aim of this explanatory and theory driven evaluation approach is to uncover how a programme works, for whom, and in what conditions. The realist approach has already been applied in a wide range of fields, including sociology, psychology, and economics, but only few studies in the field of public health have adopted this approach [62].

Three concepts are central to the realist approach: mechanisms, contexts, and outcomes [61,62]. *Mechanisms* refer to the choices and capacities that are offered to a person by the programme. They answer the question of how a programme produces change. Mechanisms are only active when the programme is active. They are often hidden and should not be confused with programme components. Whether and how these mechanisms are acted upon by the person and what *outcomes* they produce, depends on the *context* in which they are implemented. The context will always exist, even if the programme is not active. The context consists of many layers, from the individual level to the interpersonal, institutional, and infra-structural systems surrounding the individual. They answer the question of for whom and in what conditions a programme produces change.

Realist approach posits that programmes are always based on underlying assumptions about how an intervention is assumed to work, in what conditions, and with what outcomes [61,62]. This is called the programme theory. A realist study starts by identifying the underlying programme theory. The programme theory can be identified using discussions with experts, or by searching the literature. Then, empirical evidence is gathered to test and refine this theory. This process differs between the two types of realist studies: realist review and realist evaluation. A realist review aims to explore the inner workings of a particular programme that may be implemented in a wide range of contexts, e.g. an ABI. Evidence to test and refine the programme theory is collected by means of a review of the peer-reviewed literature. In contrast with traditional systematic reviews, this type of review is interested in mechanisms rather than effect sizes and is purposive and iterative. A realist evaluation aims to explore the inner workings of a particular programme that has been implemented in a particular context, e.g. a specific intervention that has been implemented in a specific area. Evidence to test and refine the programme theory is gathered from interviews with practitioners, observations, reports, policy documents, etc.

THE NETHERLANDS

The Netherlands may be a particularly interesting country to assess associations of neighbourhood safety with LTPA, and the impact of ABIs on both aspects. Prevalence of LTPA in the Netherlands is among the highest in Europe, with 58% of all adults engaging in some or a lot of LTPA [4]. Moreover, the number of cyclists in the Netherlands is the largest around the world, offering the chance to explore this much less studied component of LTPA [63,64]. Though levels of LTPA are generally high in the Netherlands, prevalence rates differ between areas. In the most disadvantaged neighbourhoods of the city Eindhoven, 82.6% of the adults have been found to walk,

cycle, or garden in leisure-time and 37.1% engage in sports, compared to 87.4% and 54.6%, respectively, in the most advantaged neighbourhoods [42]. In the forty most deprived districts of the Netherlands, 64.7% of adults have been found to engage in moderate-intensity PA, compared to 68.9% in other districts within the same cities [65].

In 2007, the Dutch government launched an ABI called the District Approach [66]. The District Approach aimed to reduce problems related to employment, education, housing and the physical environment, safety, and social cohesion in the forty most deprived districts of the Netherlands. The forty districts are spread across 18 cities, of which most have a strong urban character. Districts were selected based on their accumulation of economic, physical, and social problems, judged on statistics and survey data. Each district was given the autonomy to develop a set of locally tailored interventions, as long as they addressed the five core problems mentioned above. As a result, there were large between-district variations in the interventions that were implemented [67]. Examples of interventions that aimed to improve the physical and social neighbourhood environment include housing renovations, demolition and building of housing estates, extra trees, upgrading of parks and playgrounds, upgrading of the walking and cycling infrastructure, more police surveillance, extra maintenance of public space, extra waste facilities, and extra leisure and sports activities and facilities [see Droomers et al. [67] for more detailed information on the content and scale of implemented interventions]. The District Approach provides the opportunity to extend the research on the impact of ABIs on neighbourhood safety and LTPA to countries other than England.

AIMS AND RESEARCH QUESTIONS OF THIS THESIS

The overall aim of this thesis is to assess the interplay of LTPA, self-reported neighbourhood safety, and ABIs in deprived areas. More specifically, this thesis aims to assess relations of neighbourhood safety with LTPA among Dutch adults, and the impact of ABIs like the Dutch District Approach on neighbourhood safety and LTPA among adults in deprived areas. Three specific research questions are addressed:

1. To what extent are general neighbourhood safety and specific safety problems associated with leisure-time walking, cycling, and sports in Dutch adults?
2. To what extent and how is the Dutch District Approach associated with changes in general neighbourhood safety and specific safety problems as reported by adult residents of deprived target districts?
3. To what extent and how is the Dutch District Approach associated with changes in leisure-time walking, cycling, and sports among adult residents of deprived target districts?

OUTLINE OF THIS THESIS

This thesis consists of three parts (figure 1). **Part I** consists of **chapters 2 to 4** and focuses on the first research question “To what extent are general neighbourhood safety and specific safety problems associated with leisure-time walking, cycling, and sports in Dutch adults?” **Chapter 2** reports on associations of self-reported general safety, physical order, social order, crime safety, and traffic safety with leisure-time walking and cycling. In addition, differences in association by age, gender, and educational level are described. **Chapter 3** reports on the associations of self-reported neighbourhood social safety with leisure-time sports at various locations. **Chapter 4** describes associations of levels of self-reported neighbourhood safety at one point in time as well as *changes* in self-reported neighbourhood safety over time with leisure-time walking, cycling, and sports.

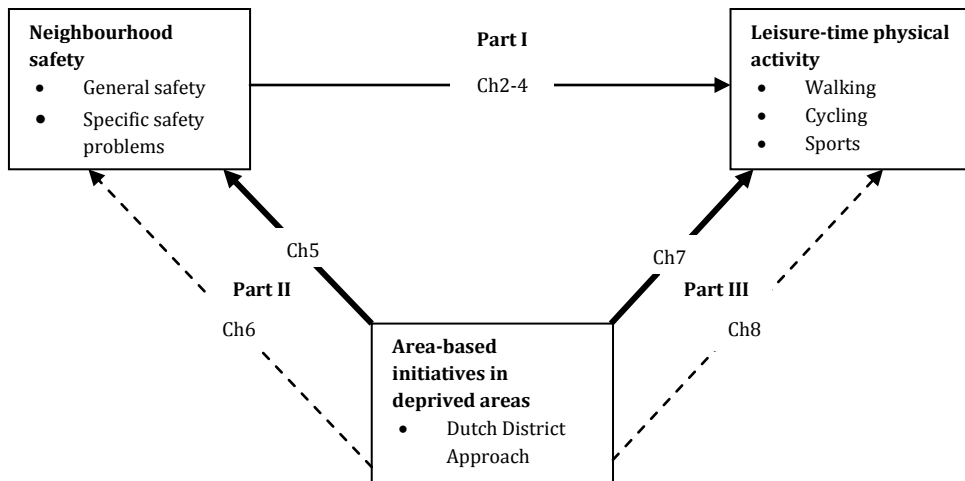


FIGURE 1. Framework of the research outlined in this thesis. → cross-sectional study design. → quasi-experimental design. - → realist design.

Part II consists of **chapters 5 and 6** and focuses on the second research question “To what extent and how is the Dutch District Approach associated with changes in general neighbourhood safety and specific safety problems as reported by adult residents of deprived target districts?” **Chapter 5** describes the results of a quasi-experimental study in which we explored to what extent the District Approach was associated with changes in trends of self-reported general safety, physical order, social order, and criminal non-victimization in deprived target districts. **Chapter 6** presents the results of a realist evaluation in which we explored how a specific

neighbour nuisance intervention had an impact on neighbourhood safety as reported by adults residents of four deprived districts in Arnhem.

Part III consists of **chapters 7 and 8** and focuses on the third research question “To what extent and how is the Dutch District Approach associated with changes in leisure-time walking, cycling, and sports among adult residents of deprived target districts?” **Chapter 7** describes the results of a quasi-experimental study in which we assessed to what extent the District Approach was associated with changes in leisure-time walking, cycling, and sports in deprived target districts. **Chapter 8** presents the results of a realist review in which we explored how the environmental interventions of ABIs may stimulate leisure-time walking in deprived areas.

Finally, in **chapter 9**, the main findings of part I to III are summarized and discussed in light of various methodological considerations and previous research. Furthermore, implications and recommendations for practice and research are described.

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