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Promoting physical activity: The role of neighbourhood safety and renewal of deprived areas

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CHAPTER 9

General discussion

GENERAL DISCUSSION

The overall aim of this thesis was to assess the interplay of leisure-time physical activity (LTPA), neighbourhood safety, and area-based initiatives (ABIs) in deprived areas. More specifically, this thesis aimed to assess associations of neighbourhood safety with LTPA among Dutch adults, and the impact of ABIs like the Dutch District Approach on neighbourhood safety and LTPA among Dutch adults in deprived areas. This chapter provides a discussion of the key findings of this thesis. First, main findings are summarized. Then, the main findings are discussed in light of several methodological considerations and prior research. Finally, implications of this thesis for practice and research are presented.

MAIN FINDINGS

The following sections discuss the main findings for each of the three research questions that were posed in the introduction of this thesis (chapter 1).

To what extent are general neighbourhood safety and specific safety problems associated with leisure-time walking, cycling, and sports in Dutch adults?

In **chapter 2** we explored associations of self-reported general safety, physical order, social order, crime safety, and traffic safety with leisure-time walking and cycling. We also explored effect-modification by age, gender, and educational level. None of the safety indicators were associated with leisure-time walking in the general adult population. However, general safety was negatively associated with leisure-time walking among younger men, older men, and lower educated adults. All neighbourhood safety indicators were found to be positively associated with leisure-time cycling. Associations were strongest for general safety and among older women. In **chapter 3** we explored associations of self-reported social neighbourhood safety (a composite measure of social order and crime safety) with leisure-time sports at various locations. Sports at indoor sports clubs were found to be far more popular than sports at outdoor sports clubs or on streets. Social safety was positively associated with sports at indoor sports clubs, but not with sports at outdoor sports clubs or sports on streets. In **chapter 4** we explored associations 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. Leisure-time walking was found to be negatively associated with levels of social order and non-victimization, but not with levels of general safety and physical order. Similar results were obtained when looking at changes in neighbourhood safety over time. Leisure-time cycling was positively associated with levels of all neighbourhood safety

indicators and with changes therein over time, though these latter associations were weaker. Leisure-time sports was positively associated with levels of all neighbourhood safety indicators, but only with changes in social order and non-victimization over time. Thus, leisure-time cycling and sports were less strongly related with changes in neighbourhood safety than with levels of neighbourhood safety.

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 presented the results of a quasi-experimental study in which we explored *to what extent* the District Approach was associated with changes in trends of neighbourhood safety in the forty deprived target districts. The implementation of the District Approach was found to be associated with a somewhat more positive change in non-victimization trend in deprived target districts than in the rest of the Netherlands or in other deprived areas. This between-district difference in trend change of non-victimization was only significant in women, older adults, and lower educated adults. There were no between-district differences in trend changes of general safety, physical order, and social order. **Chapter 6** described the results of a realist evaluation in which we explored *how* safety perceptions changed as a result of a neighbour nuisance intervention that was implemented in four deprived districts in Arnhem. The implementation of the intervention was found to be associated with change at three different levels. At the organizational level, the coordinated partnership strategy enabled role alignment, communication, and leadership, which resulted in a more efficient approach of nuisance households. At the level of nuisance households, the joint assistance and enforcement strategy enabled the removal of the various underlying reasons for nuisance, which resulted in less neighbor nuisance. At the district level, perceptions of social control improved, which resulted in better perceived neighbourhood safety, but only in one district. Key district level conditions included a wider safety approach, central location, and dense population.

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 presented the results of a quasi-experimental study in which we explored *to what extent* the District Approach was associated with changes in LTPA in the deprived target districts. The implementation of the District Approach was found to be associated with a more positive change in leisure-time walking trend in deprived target districts than in the rest of the Netherlands or other deprived districts. There were no significant between-district differences in trend changes of leisure-time

cycling and sports. Trend changes were not related to the intensity of environmental interventions for any of the LTPA outcomes. **Chapter 8** described the results of a realist review in which we explored *how* ABIs like the District Approach might be able to promote leisure-time walking in deprived areas. A synthesis of 13 peer-reviewed articles revealed that ABIs may stimulate leisure-time walking in deprived areas in three main ways: less safety problems and better physical neighbourhood design may reduce the fear to use existing leisure-time walking facilities, better infrastructure may increase the convenience of existing leisure-time walking facilities, and better neighbourhood aesthetics may make leisure-time walking facilities more relaxing and stress releasing. Three additional, less well supported pathways were identified: more leisure-time walking facilities may create more settings for leisure-time walking, more social capital may improve social support for leisure-time walking, and more social capital may improve opportunities for social interaction while walking.

METHODOLOGICAL CONSIDERATIONS

Results of this thesis should be interpreted in light of several methodological considerations. The following sections discuss several issues regarding the various study designs that were used throughout this thesis, the measurement of LTPA, the measurement of neighbourhood safety, and the generalisability of our results.

Study design

Various study designs have been used throughout this thesis. Major advantages and disadvantages of each of the designs are discussed in the following sections.

Cross-sectional study design

We started out with a series of traditional cross-sectional studies, in which we explored to what extent neighbourhood safety at one point in time was associated with LTPA at that same point in time (chapters 2 and 3). This type of study enables researchers to obtain data from a large amount of individuals with relatively little cost and effort. Therefore, they are useful to answer more specific research questions. For example, in this thesis we used it to gain more insight into associations of specific neighbourhood safety indicators with specific physical activity (PA) behaviours among specific population groups. Various studies have expressed the need for such specificity [1-4]. However, a major drawback of traditional cross-sectional studies is that they are unable to establish the causality of the relations between neighbourhood safety and LTPA. Relations may be biased by issues such as residential self-selection, which entails that adults who are active or who like to be active move into neighbourhoods that are most suitable for LTPA [5-9]. Cross-sectional studies that do

not take this bias into account may possibly overestimate associations of neighbourhood safety with PA [6,8,10].

To gain more insight into the role of residential self-selection in safety-LTPA, we explored to what extent neighbourhood safety at one point in time as well as *changes* in neighbourhood safety over time were associated with LTPA afterwards (chapter 4). A major advantage of looking at changes in neighbourhood safety over time is that it minimizes the impact of confounders that are assumed to remain stable over time, such as residential preferences. By comparing results of this more sophisticated analysis with those of the more traditional cross-sectional one, we were able to shed more light on the role of residential self-selection. However, some issues remain. First, we were unable to take possible neighbourhood-level confounders into account. The mechanisms underlying changes in neighbourhood safety are complex. We may have overestimated the causality of the safety-LTPA relation if changes in neighbourhood safety were caused by neighbourhood changes that were also related to LTPA. Second, we were only able to relate changes in neighbourhood safety to levels of LTPA afterwards, rather than to *changes* in LTPA. Again, we may have overestimated the causality of the safety-LTPA relation if changes in neighbourhood safety occurred in neighbourhoods where LTPA levels were already higher at baseline.

Quasi-experimental study design

To deal with some of the biases associated with cross-sectional studies, we performed a series of quasi-experimental studies, in which we explored to what extent the Dutch ABI District Approach was associated with *changes* in neighbourhood safety over time (chapter 5) and with *changes* in LTPA over time (chapter 7) in deprived target districts. These studies may help draw more robust conclusions about the causality of relations between the neighbourhood environment and LTPA. Moreover, it provides insight into whether area-based policies are able to change peoples' behaviour and their neighbourhood perceptions. However, this type of study also has some limitations. Due to the use of repeated cross-sectional data, changes in outcomes may have been the result of selective migration rather than of the initiative itself. Residents of deprived target districts may have acquired new skills that allow access to better jobs, causing them to move out. Alternatively, improved conditions in the target districts may have attracted residents from more affluent areas. This may have biased our results if self-reported neighbourhood safety and LTPA differed between in-movers, out-movers, and stayers. However, there were no indications of such bias. Adjustment for socio-economic factors did not substantially alter our results. Moreover, the District Approach was not associated with an increase in the number of people moving up the socio-economic ladder and the amount of those moving out of the target districts [11]. Finally, evaluation studies of other ABIs found no relation between residential mobility and change in safety concerns or PA [12,13].

Another limitation inherent to quasi-experimental studies is that the intervention and control group may be dissimilar at baseline in ways related to the study outcome, because of a lack of randomization [14,15]. However, by looking at changes in outcome over time, fixed differences between groups are taken into account. Moreover, we tried to increase comparability between groups by including control groups that were similarly deprived and geographically located as the deprived target districts. A limitation of the use of such control groups is that they may not have been intervention-free or may have experienced spill-over effects of the District Approach. This may have caused us to underestimate the impact of the District Approach. Therefore, we also included a national control group.

Realist approach

To gain more insight into the process by which ABIs have an impact on neighbourhood safety and on LTPA, we performed a series of realist studies in which we explored how, for whom, and in what conditions the District Approach had an impact on self-reported neighbourhood safety (chapter 6) and leisure-time walking (chapter 8). This type of study enables researchers to better understand the results of quantitative quasi-experimental studies by showing how ABIs are able to produce change and in what conditions they are and are not able to produce such change. Moreover, it may help policy makers develop more effective ABIs in the future. Though this type of study is very useful to understand the inner workings of complex programmes like ABIs, they are very time-consuming. Moreover, while it helped us to gain more insight into the pathways by which the District Approach had an impact on neighbourhood safety and leisure-time walking, we had difficulties identifying information on the conditions that determined programme success and failure.

Measurement of LTPA

In all studies displayed in this thesis, we used self-reported measures of LTPA. Surveys typically ask respondents to list the amount and type of PA they engaged in during the past month or in a regular week. A major advantage of surveys is that they are less costly and intrusive than more objective measurement devices such as pedometers or accelerometers, making them more suitable for large population studies like ours [16,17]. Moreover, they are able to provide information about the type (e.g. walking, gardening, jogging) and purpose (i.e. leisure, transport) of the activity [16,17]. While the purpose of PA is irrelevant for its impact on health, it is important when exploring environmental correlates, as environmental correlates of LTPA have been found to differ from those of PA for transport reasons [2,9,18-20]. A major drawback of survey data is the chance of information bias [21,22]. Respondents may have difficulties remembering what types of PA they have participated in, and for how long. Moreover, they may be inclined to give socially desirable answers. These

biases may explain why self-reported PA levels are generally higher than those objectively observed by accelerometers and pedometers [17]. However, information bias would have only substantially affected our results if the bias differed systematically between safe and unsafe neighbourhoods or if it differed systematically over time, which we do not perceive to be very likely.

A limitation specific to the survey that we used to measure LTPA is that it does not provide information about the location where people have been active. Adults may have been active within their own neighbourhood, or for example in the area around their workplace or a friend's home. Research has repeatedly expressed the need to use location-specific LTPA measures, as the neighbourhood environment is most likely to affect LTPA that is performed within the neighbourhood [1,3,4,19]. By including LTPA that is performed within the neighbourhood of residence as well as that performed in other neighbourhoods, we may have failed to identify some of the effects of neighbourhood safety and the District Approach on LTPA.

Measurement of neighbourhood safety

The vast majority of neighbourhood safety indicators that we used in this thesis represented adults' perceptions of safety. Perceptions and objective measures of neighbourhood safety and other neighbourhood features have been found to be poorly correlated [23-27]. While objective indicators may more accurately represent the true neighbourhood safety situation, we chose to focus on perceptions of neighbourhood safety as there is evidence to suggest that they are more strongly associated with PA [27]. Even if the neighbourhood is safe or has become safer as a result of an ABI, as long as people do not perceive their neighbourhood to be safe, they will remain fearful and keep constraining their PA accordingly. A limitation of the use of safety perceptions is the possibility that those who are active may perceive their environment differently than those who are not active, leading to spurious relations [2,9,28]. To minimize this source of bias, we measured neighbourhood-wide safety perceptions instead of individual-level perceptions, and used different surveys to measure neighbourhood safety and LTPA.

There is much debate about the appropriate neighbourhood size when assessing environmental characteristics [3]. We defined a neighbourhood as the area within one postal zip code. Within the Netherlands, a postal zip code is on average 8.4 km² large and has a mean population of 4 155 residents [29,30]. When cycling or working out at the gym, adults may very well exceed neighbourhood boundaries. Hence, characteristics of the final destination and neighbourhoods along the route may also be relevant for these type of activities. We were unable to take these influences into account in our studies, causing us to potentially underestimate associations of neighbourhood safety with leisure-time cycling and sports. When walking, adults are

more likely to stay within their neighbourhood of residence, at least if departed from home. As a result, characteristics of the neighbourhood of residence may be most important for walking. However, the area within one postal zip code may even be too large to capture environmental influences on walking, causing us to potentially underestimate associations of neighbourhood safety with leisure-time walking.

While we have extensively controlled our analyses for individual-level confounders, we were unable to control for all potential neighbourhood-level confounders. On the one hand, safe neighbourhoods may have certain other features that stimulate LTPA. For example, studies have found that safer neighbourhoods also tend to have better neighbourhood aesthetics and higher levels of social capital [31,32]. If levels of LTPA are high in these neighbourhoods, it is hard to identify whether this is the result of good neighbourhood safety or of other neighbourhood features. This may result in an overestimation of associations between neighbourhood safety and LTPA. On the other hand, safe neighbourhoods may have certain features that hinder LTPA. For example, studies have found that safer neighbourhoods tend to be less walkable, which means that street connectivity is lower and there are fewer destinations nearby (including sports facilities and parks) [31,33,34]. This may result in an underestimation of the relation between neighbourhood safety and LTPA.

However, we have reason to believe that this residual neighbourhood-level confounding had only limited impact on our findings. First, adjustment for population density had negligible effects on associations of neighbourhood safety with leisure-time walking and cycling, and even slightly strengthened associations with leisure-time sports (chapters 2 and 3). Population density was used as an indicator of various potential environmental influences. Second, adjustment for social capital had an impact on associations of neighbourhood safety with outdoor sports, but had no impact on associations with indoor sports, which made up the major share of total sports participation (chapter 3). Third, other studies have found that associations of various neighbourhood safety indicators with leisure-time walking and cycling did not substantially alter or even strengthened after taking into account other neighbourhood features such as social capital, walkability, PA facilities, and aesthetics [35-39]. The only exception being that associations of crime safety with leisure-time cycling attenuated after taking into account other neighbourhood features [36]. None of the studies explored the role of residual neighbourhood-level confounding in associations of neighbourhood safety with leisure-time sports.

Generalisability

Results of the cross-sectional studies described in chapters 2 to 4 of this thesis are believed to be largely generalisable to the entire Dutch population, as they were based on large, nationwide surveys. While many other studies only obtained data from

adults living in one specific city or area, we obtained data from adults across the Netherlands. However, to obtain reliable measures of neighbourhood-wide safety perceptions and changes therein, neighbourhoods were required to have a minimum amount of valid safety observations. Therefore, very small neighbourhoods may have been excluded from our analyses, which may limit the generalisability of our results. Results of the quasi-experimental studies described in chapters 5 and 7 of this thesis are also thought to be largely generalisable to the entire population of the Netherlands' most deprived areas, as all most deprived areas were included in the analyses.

It is unclear to what extent results of the abovementioned studies are generalisable to other countries. On the one hand, the Netherlands is very conducive of LTPA. It has a mild climate and flat topography. Moreover, it has a high population density, which increases the chance of having facilities such as gyms and parks nearby. Finally, it has a strong cycling infrastructure and cycling culture, in which many adults own a bicycle and know how to ride it. In countries with a hot climate, many hills, low residential density, and weak cycling infrastructure and culture, adults may not be able to participate in LTPA. Hence, neighbourhood safety may be less important. On the other hand, the Netherlands is a relatively safe country. Compared to other countries, relatively few Dutch adults feel unsafe or perceive themselves to be at risk of crime [40]. Self-reported criminal victimization rates are relatively high compared to other countries, but this is mostly due to high levels of bicycle theft [40]. In countries where adults feel less safe and crime is more prevalent, neighbourhood safety may be more important.

The generalisability of the results of our realist studies may be somewhat more complicated (chapters 6 and 8). Our realist evaluation focused on a subset of deprived areas within one particular Dutch city (chapter 6). Due to large variations between areas, generalisability of these results to other deprived areas in the Netherlands may be limited. However, inherent to the realist approach, we outlined the contextual factors at play and made context-dependent conclusions and recommendations. This may enlarge the transferability of results to other settings. Our realist review included studies from several countries across the world (chapter 8). No clear cross-country differences were present in the mechanisms that we identified. This indicates that mechanisms may well be transferable across countries. However, we only included a limited number of studies, and a larger amount of studies are needed to draw more robust inferences about the generalisability of our findings.

INTERPRETATION OF MAIN FINDINGS

The following sections reflect on the main findings of the studies presented in this thesis. First, we discuss whether neighbourhood safety appears to have an impact on LTPA among adults. Then, we discuss whether and how ABIs like the Dutch District Approach appear to be able to influence LTPA among adults in deprived areas.

Does neighbourhood safety have an impact on LTPA among adults?

The answer to this question appears to vary by type of LTPA. This supports earlier calls to use more specific PA measures when assessing environmental correlates [1-4]. The following sections discuss the answer to this question separately for leisure-time walking, and for leisure-time cycling and sports.

Leisure-time walking

For the *general adult population*, there is no evidence to suggest that neighbourhood safety may have an impact on leisure-time walking. We found no associations or in some cases even negative associations of self-reported neighbourhood safety with leisure-time walking among Dutch adults (chapters 2 and 4). These results are in line with the large body of research on this topic. Various reviews indicate that there is limited evidence for an association of neighbourhood safety with leisure-time walking [2,9,19] or with a composite measure of leisure-time walking and cycling [20] among adults.

However, among adults that live in *deprived neighbourhoods*, there is evidence to suggest that neighbourhood safety might have a positive impact on leisure-time walking. Our realist review indicated that poor neighbourhood safety was one of the key issues that kept adults in deprived neighbourhoods from walking in leisure time (chapter 8). These results are generally in line with those of the few quantitative studies that have been performed in deprived neighbourhoods. Self-reported general neighbourhood safety was positively associated with leisure-time walking in deprived neighbourhoods in Australia [33] and Scotland [41,42], and with general neighbourhood walking in deprived neighbourhoods in America [38]. Evidence regarding the role of social disorder is somewhat inconsistent, with some studies finding drunks and burglary to be associated with lower levels of walking [42] and others finding overall social disorder and drug dealing to be associated with higher levels of walking in deprived neighbourhoods [39,42].

There may be two possible explanations for the fact that we found evidence for an impact of neighbourhood safety on leisure-time walking among adults in deprived neighbourhoods, but not among the general adult population. First, we found that

safety problems and concerns were more prevalent in deprived than in non-deprived neighbourhoods (chapter 5). This is consistent with earlier research [23,43-45]. Perhaps, a certain threshold level of unsafety needs to be reached before it influences leisure-time walking. There is a dearth of evidence on whether such a threshold level exists, and if so, how high it is [46]. Second, we found that income levels were substantially lower in deprived compared to non-deprived neighbourhoods (chapter 7). This is consistent with earlier studies [23,45,47,48]. Research has suggested that individuals with a low socio-economic status may have less financial resources to safeguard against crime and to deal with the consequences of crime, thereby being more likely to restrict their walking when feeling unsafe [49]. However, we found no evidence to suggest that associations of neighbourhood safety with leisure-time walking differ by educational level (chapter 2 and 4).

Leisure-time cycling and sports

There is some evidence to suggest that neighbourhood safety may have a positive impact on leisure-time cycling and sports among the general adult population. We found that various self-reported neighbourhood safety indicators were positively associated with leisure-time cycling and sports (chapters 2 to 4). Prior research on this topic is somewhat inconsistent. Regarding leisure-time cycling, a Dutch study found no associations with personal safety indicators, but they did find associations with traffic safety [50]. Studies from Australia and the UK found some evidence of associations with crime safety and social order, but no evidence of associations with traffic safety [36,37]. Regarding leisure-time sports, prior Dutch research also found positive associations with general neighbourhood safety [51,52]. Studies from other countries found no evidence of a safety-sports association [53,54].

Interestingly, we found that associations of neighbourhood safety with leisure-time sports differed according to the sports location (chapter 3). Neighbourhood safety was positively associated with sports at indoor sports clubs, but not associated with sports at outdoor sports clubs or on streets. In line with suggestions made elsewhere [52], this implies that neighbourhood safety may not only be important during the exercise itself, but also during the journey to reach the sports facilities. A third of the Dutch adults use their bicycle to reach sports facilities, which makes them more vulnerable to crime and other safety problems [55]. Indoor sports clubs were by far the most popular location to practice sports in the Netherlands (chapter 3), which explains why we also found neighbourhood safety to be associated with overall sports participation (chapter 4).

We found that leisure-time cycling and sports were not only associated with levels of neighbourhood safety, but also with changes in neighbourhood safety over time, though these latter associations were substantially weaker (chapter 4). This is

consistent with earlier research on associations of overall PA with neighbourhood safety levels and changes therein [56,57]. Our results imply that part of the relation of neighbourhood safety with leisure-time cycling and especially sports may not be truly causal and may be due to residential self-selection bias. Nonetheless, neighbourhood safety appeared to be related with leisure-time cycling and somewhat with leisure-time sports beyond residential self-selection. Though more robust studies are needed to rule out other possible biases, we believe that there is at least some evidence to suggest that neighbourhood safety may have a positive impact on leisure-time cycling and sports.

To what extent and how are ABIs like the Dutch District Approach able to influence LTPA among adults in deprived areas?

There is evidence to suggest that ABIs like the District Approach can stimulate LTPA among adults in deprived areas, primarily by increasing levels of leisure-time walking. Results of our quasi-experimental evaluation showed that the District Approach was associated with increases in leisure-time walking in the most deprived areas of the Netherlands (chapter 7). There were no indications of an impact on leisure-time cycling or sports. Few other ABIs have been scientifically evaluated for their impact on PA. In England, deprived areas that were targeted by the ABI New Deal for Communities (NDC) saw no improvements in general PA levels [58,59]. Results of our study indicate that the use of such general PA outcomes may obscure effects visible for more purpose- and type-specific PA outcomes.

There may be several possible explanations as to why the District Approach appeared to have an impact on leisure-time walking, but not on leisure-time cycling and sports in deprived areas. First, leisure-time cycling and sports may be more likely to be influenced by characteristics of areas that have not been targeted by the District Approach, as these activities are likely to exceed neighbourhood boundaries. Second, leisure-time cycling and sports may be more likely to be influenced by factors that have not been addressed by the District Approach. For example, a large part of the population in deprived areas is of non-Dutch origin, who are less used to cycling or may not even know how to cycle.

Our realist synthesis of 13 peer-reviewed studies revealed three potential pathways by which ABIs like the District Approach might stimulate leisure-time walking in deprived areas (chapter 8). First, our realist review suggested that by improving the neighbourhood infrastructure, ABIs might make it more convenient for adults to use existing walking facilities in deprived areas (e.g. sidewalks, trails, and parks). This pathway received only limited support from evaluations of the District Approach and other ABIs. Only a limited number of deprived areas that were targeted by the District

Approach made investments in infrastructure [60]. The share of infrastructural investments as part of other ABIs like the NDC and the SRB are unknown.

The two other pathways received more support from evaluations of the District Approach and other ABIs. First, our realist review suggested that by reducing the amount of safety problems in the area and by improving the physical neighbourhood design, ABIs might reduce adults' fear to use existing walking facilities in deprived areas (chapter 8). There was some evidence to suggest that the District Approach was able to do so. Nearly all deprived target areas invested in neighbourhood safety at an intermediate or large scale [60]. We found that the District Approach was associated with a small reduction in levels of criminal victimization in deprived areas, though not with changes in perceptions of general safety, physical order, or social order (chapter 5). Another Dutch study found no indications of an impact of the District Approach on self-reported neighbourhood safety [11]. They may have underestimated the impact of the District Approach because they only made comparisons with similarly deprived areas, which may have experienced spill-over effects of the District Approach or may have received interventions of their own. Moreover, we found that the District Approach did appear to have a positive impact on safety perceptions, but only in areas that took on a wider neighbourhood improvement approach and that were densely populated (chapter 6). Given the large variation in programme content and area characteristics across the deprived target areas, some target areas may have seen improvements in safety perceptions and hence in fear and levels of walking, but this may have been overshadowed by a lack of changes in others [60]. Evaluations of ABIs other than the District Approach also provided some evidence to support the pathway of fear. The English NDC was associated with reductions in criminal victimization and improvements in perceptions of lawlessness and dereliction in deprived target areas [61]. There were no indications of changes in fear of crime or safety concerns. The English Single Regeneration Budget (SRB) was associated with a small reduction in safety concerns, though there were no indications of changes in crime, vandalism, problems with dogs, and litter [62].

Second, our realist review suggested that by improving neighbourhood aesthetics, ABIs might make walking more relaxing and stress releasing (chapter 8). There was inconsistent evidence whether the District Approach was able to do so. Two third of the deprived target areas invested in green on an intermediate or large scale [60]. They aimed to increase the amount and quality of green to be active in as well as that of green to look at. Unexpectedly, areas that invested in green did not see larger improvements in leisure-time walking than those without green investments [63]. However, the impact of green interventions on leisure-time walking may be more complicated to measure than that. Our realist review pointed out that green will not provide relaxation and stress release if not well maintained or not properly landscaped (chapter 8). Moreover, green space may attract youth gangs and drug

dealers, causing adults to be fearful (chapter 8). Therefore, a better way to explore the amount of support for the pathway of relaxation and stress release may be to look at changes in the appreciation of green space. Evaluations of ABIs other than the District Approach have done so and provided some evidence to support the pathway of relaxation. The SRB was associated with a slight increase in the appreciation of open space in deprived target areas, while the rest of England showed large decreases in appreciation [62].

IMPLICATIONS

For practice

Results of this thesis indicate that LTPA among adults in deprived areas can successfully be promoted by means of ABIs like the Dutch District Approach that aim to improve socio-economic as well as environmental conditions in these areas. These initiatives appeared to be able to stimulate leisure-time walking among adults within a relatively short period of time of only 3.5 years.

The multidisciplinary nature of ABIs like the District Approach seemed to be the key to success. Our literature review revealed that adults in deprived areas encountered many problems that kept them from walking in leisure time. Most of these problems were related to the quality of existing leisure-time walking facilities (e.g. sidewalks, trails, parks), rather than the quantity of these facilities or the amount of social stimuli to use them. Results of our thesis indicated that ABIs like the District Approach are able to promote leisure-time walking in deprived areas by making existing walking facilities less frightening and more relaxing, thereby increasing their quality. ABIs may do so by tackling various safety problems, improving the physical neighbourhood design, and improving neighbourhood aesthetics.

Multidisciplinary approaches can be hard to organise and maintain as many different organisations are involved that all have different interests. Based on our realist evaluation, we advise organisations that are involved in such a multidisciplinary approach to arrange periodic meetings, develop clear plans of actions, and appoint a coordinator to organise and keep track of the process. These actions may facilitate role alignment, communication, and leadership among the various organisations and hence increase the efficiency and effectiveness of their approach.

Results of this thesis indicated that perceptions of neighbourhood features like safety may be more difficult to change than actual neighbourhood features. Some interventions may successfully tackle actual neighbourhood safety problems but may have a negative impact on perceptions of neighbourhood safety. For example,

increased police surveillance may reduce levels of crime but may at the same time give off a signal to the residents that their neighbourhood is unsafe. Moreover, improvements in actual neighbourhood safety may not translate into improved perceptions of neighbourhood safety in certain types of areas, such as areas that are not very densely populated, so residents are less likely to be exposed to neighbourhood improvements. Practitioners need to be aware of such processes when implementing interventions.

For research

An extensive body of cross-sectional research has explored associations of neighbourhood safety with LTPA. Because of their ease to acquire large study populations, they are very much suited to answer specific research questions. In this thesis, we have successfully applied this study design to shed more light onto the role of specific neighbourhood safety problems in specific LTPA behaviours for specific population groups. This thesis highlights several questions that have not been answered yet and may very well be addressed in future cross-sectional research. Research may explore whether safety-LTPA associations differ between deprived and non-deprived neighbourhoods, whether there is a threshold level of neighbourhood safety after which it has an impact on LTPA, and what neighbourhood size is most appropriate to assess safety-LTPA associations. Research is advised to use specific LTPA outcomes, as our results indicate that neighbourhood safety may be differently related to leisure-time walking, cycling, and sports. Research is also advised to take into account neighbourhood factors other than safety to limit the possibility of residual neighbourhood-level confounding.

While cross-sectional studies may be valuable to explore new areas of interest, they are unable to make causal inferences. We have found evidence to suggest that cross-sectional studies are prone to residential self-selection bias (chapter 4). To acquire more robust evidence on the causality of neighbourhood-LTPA relations, it may be useful to perform quasi-experimental studies that look at changes in LTPA following an environmental modification. Only few quasi-experimental studies have been performed to explore the impact of large-scale ABIs on LTPA. A larger amount of studies with a longer follow-up time are needed to acquire more robust evidence. Research on the impact of ABIs on LTPA is advised to use type-specific LTPA measures, as we found the impact of the District Approach to differ by type of LTPA. Moreover, LTPA measures should make reference to where the activity has taken place, to make more accurate estimates of the impact of ABIs on LTPA. In addition, more research is needed to explore the underlying pathways by which ABIs may influence LTPA, by evaluating its impact on neighbourhood safety, aesthetics and pedestrian infrastructure. Finally, future studies should use longitudinal, individual-level data to deal with the possible bias caused by selective migration.

A disadvantage of quasi-experimental studies like the one we performed with the District Approach is that they are unable to shed light on the impact of ABIs in specific areas. Results of our thesis indicate that the impact of ABIs may be restricted to certain areas. By only looking at outcomes at the programme level, studies may underestimate the impact of ABIs. Besides the need to focus on specific areas, there is also a need to focus on specific interventions. Quasi-experimental studies like ours provide limited insight into what interventions are able to produce positive changes and which are not. Therefore, research is advised to combine quasi-experimental studies with case studies that focus on specific areas and specific interventions.

Moreover, quasi-experimental studies and case studies are advised to be accompanied with realist studies to uncover how ABIs in general and specific interventions in particular are able to produce change. We gained insight into the pathways by which ABIs can stimulate leisure-time walking in deprived areas. Additional research is needed to explore why ABIs may be unable to stimulate leisure-time cycling or sports. Moreover, realist studies may be useful to uncover the conditions under which ABIs do and don't work. This may help gain more insight into why ABIs and specific interventions work in one area, but not in the other. We explored these issues for one specific safety intervention implemented in one specific city, but additional research is needed on the contextual factors that influence the success of other specific interventions and of ABIs as a whole.

OVERALL CONCLUSIONS

Two main conclusions arose from this thesis. First, though residential self-selection seemed to explain a substantial part of the relation between neighbourhood safety and LTPA, we found evidence to suggest that good neighbourhood safety may promote leisure-time cycling and sports in the general adult population. There were no indications of an impact of neighbourhood safety on leisure-time walking among the general adults population. However, among adults in deprived areas, we did find evidence to suggest that good neighbourhood safety may promote leisure-time walking. Alternative explanations such as residual neighbourhood-level confounding should be ruled out to provide more robust evidence on the causality of these relations.

Second, we found evidence to suggest that ABIs that aim to improve socio-economic as well as environmental condition in deprived areas may promote LTPA among adults in deprived areas, primarily by increasing the amount of adults that walk in leisure time. ABIs appear to be able to increase leisure-time walking by means of investments meant to make existing walking facilities less frightening, more convenient, and more

relaxing. Results emphasize the need for large-scale, multidisciplinary approaches to solve neighbourhood problems and hence improve LTPA in deprived areas.

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