Development and evaluation of an intervention to promote sports participation and physical activity in children.

Judith de Meij
This thesis presents the stepwise development, effectiveness and feasibility of the JUMP-in intervention. The JUMP-in programme is financially supported by the Larger City Policy fund of Amsterdam. The pilot study was supported financially by the Public Health Fund (Fonds OGZ) and the Ministry of Health, Welfare and Sport. Part of the work for this thesis is part of the ENERGY project. The ENERGY project is funded by the Seventh Framework Programme (CORDIS FP7) of the European Commission, HEALTH (FP7-HEALTH-2007-B). In addition, part of the work for this thesis was financially supported by the Netherlands Organization for Health Research and Development (ZonMw) and the World Cancer Research Fund.

Financial support by the Dutch Heart Foundation for the publication of this thesis is gratefully acknowledged.
JUMP-in, development and evaluation of an intervention to promote sports participation and physical activity in children.

ACADEMISCH PROEFSCHRIFT

ter verkrijging van de graad Doctor aan de Vrije Universiteit Amsterdam,
op gezag van de rector magnificus prof.dr. F.A. van der Duyn Schouten,
in het openbaar te verdedigen ten overstaan van de promotiecommissie van de Faculteit der Geneeskunde
op dinsdag 3 september 2013 om 13.45 uur in de aula van de universiteit,
De Boelelaan 1105

door

Judith Sara Berbera de Meij

geboren te Amsterdam
promotor: prof.dr. W. van Mechelen

copromotoren: dr. M.J.M. Chin A Paw
dr. M.F. van der Wal
## CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>General introduction</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>Promoting physical activity in children: the stepwise development of the primary school-based JUMP-in intervention applying the RE-AIM evaluation framework.</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>Effectiveness of JUMP-in, a Dutch primary school-based intervention aimed at the promotion of physical activity.</td>
<td>33</td>
</tr>
<tr>
<td>4</td>
<td>Mediators of the effect of the JUMP-in intervention on physical activity and sedentary behaviour in Dutch primary schoolchildren from disadvantaged neighbourhoods.</td>
<td>49</td>
</tr>
<tr>
<td>5</td>
<td>Mediating effect of parental determinants on sport participation in the school-based JUMP-in intervention in Dutch children from deprived neighbourhoods.</td>
<td>73</td>
</tr>
<tr>
<td>6</td>
<td>Effects of a multi-level school-based intervention aimed at physical activity promotion - JUMP-in - on mental wellbeing in children.</td>
<td>93</td>
</tr>
<tr>
<td>7</td>
<td>A mixed methods process evaluation of the implementation of JUMP-in, a multilevel school-based intervention aimed at physical activity promotion.</td>
<td>107</td>
</tr>
<tr>
<td>8</td>
<td>General discussion</td>
<td>127</td>
</tr>
<tr>
<td></td>
<td>References</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>Summary</td>
<td>168</td>
</tr>
<tr>
<td></td>
<td>Samenvatting</td>
<td>171</td>
</tr>
<tr>
<td></td>
<td>Dankwoord</td>
<td>175</td>
</tr>
<tr>
<td></td>
<td>About the Author</td>
<td>178</td>
</tr>
</tbody>
</table>
Chapter 1

General introduction
RISKS OF CHILDHOOD PHYSICAL ACTIVITY AND SEDENTARY BEHAVIOUR

The benefits of regular physical activity (PA) for children are well documented. Research indicates that physically active children are less prone to develop cardiovascular risk factors (Andersen 2006; Kavey 2003), have better fitness (Ortega 2008; Dencker 2005), better motor skills (Shephard 1994) and enhanced bone health (MacKelvie 2003). Regular PA is also associated with better mental health (higher levels of self-esteem and lower levels of anxiety and stress) (Biddle 2011; Ekeland 2004; Parfitt 2005) and improved academic performance (Singh 2012). More specifically, sports participation in childhood and adolescence has been associated with lower levels of antisocial behaviour (Morris 2003; Harrison 2003), higher levels of positive emotional wellbeing, (Steptoe 1996) and greater participation in sport in adulthood (Tammelin 2003). Furthermore, on a community level, sports participation contributes to social cohesion and integration (Blair 2012).

Given this evidence, it is alarming to note that many children do not engage in sufficient PA to gain the above mentioned benefits. Moreover, as children move through adolescence, PA rates further decline (Kemper 2000; Zeijl 2005; van Mechelen 2000; Barnett 2008; Armstrong 2006). The public health guideline for children is to be physically active at moderate to vigorous intensity levels for at least 60 minutes every day. Zeijl et al (2005) reported that based on self-report only 29% of Dutch children aged 10-12 years met this recommendation. At the same time, participation in school-based physical education programs remains unacceptably low (Bergeron 2007) and the regular curriculum of school physical education does not provide the opportunity to reach the entire amount of recommended daily PA. Luepker et al. (1999) for example pointed out that primary school-aged children spend only 6% of their time in the physical education class in aerobic activities.

Participation in PA has a strong socio-economic and ethnic gradient, with children from a low socio-economic status (SES) or from ethnic minorities being less likely to participate in regular PA than their more advantageous counterparts (Brug 2012; Brug 2010; Delva 2006; Haug 2009; Sallis 2000; van der Horst 2009). Dutch children living in socioeconomically deprived areas seem to have the lowest levels of PA and the highest rates of overweight (De Vries 2005; Zeijl 2005). In a study using accelerometers De Vries and colleagues (2005) showed that in deprived city areas in the Netherlands only 3% of the children met the above mentioned PA recommendations.

While the trend of decreased PA behaviour in children continues, time spent in sedentary behaviours increases, compared to previous generations (Andersen 2006). Sedentary behaviour is defined as a distinct class of behaviours (e.g. sitting, watching TV, computer use) characterized by little physical movement and low energy expenditure (≤1.5 METs) (Pate 2008; Owen 2010). The increased time spent in sedentary behaviour has been attributed to developments in availability, accessibility and attractiveness of electronic media. Children spend more time with TV, videogames and Internet than any other activity, except for sleeping, and such media-related
activities are in general sedentary (Robinson 1999). In the lives of today’s 8- to 18-year olds, television viewing dominates media consumption, taking up about 4.5 h a day in young people’s lives (Rideout 2010). A recent review by Chinapaw et al. concluded that there is moderate evidence for a longitudinal inverse relationship between screen time and aerobic fitness during childhood (Chinapaw 2012). Excessive sedentary time may also induce negative effects on cellular processes in skeletal muscles or other tissues regulating risk factors like plasma triglycerides and HDL cholesterol (Hamilton 2004; Bey 2003; Zderic 2006).

Another important PA-related problem causing health risk is the dramatically increase of childhood overweight and obesity (Micheli 2011; Metallinos-Katsaras 2007; Biddle 2004; Ball 2001). One in five children in the WHO European Region is overweight and prevalence rates are still growing. Of these, one third is already obese, and numbers are increasing fast. (WHO charter 2006; WHO 2007). Dutch data from national growth surveys show a steep increase in the proportion of children who are overweight in the Netherlands as well (van den Hurk 2006; Schokker 2007; Hirasing 2001). In the period 1980 to 2010 the overweight prevalence among children increased from approximately 4% to 15% (CBS 2012). Certain areas in the Netherlands reached even more alarming levels: in ten districts of the larger cities in the Netherlands 28% (boys) and 33% (girls) of the 6-11 years old were overweight (De Vries 2005). In socially and economically deprived neighbourhoods these rates were even higher, up to 38% among 10-year olds (Amsterdam child health care monitoring data).

CHILD HEALTH PROMOTION

The above described health risks and prevalence rates of physical inactivity, overweight and obesity make clear that promotion of PA is an essential component of health promotion and obesity prevention. PA during childhood is a strong predictor for PA behaviour in adolescence and adulthood (Yang 2007) and because most habits are formed early in life, PA promotion in children is of utmost importance.

Targeting children in the school and extracurricular setting

The school environment provides various opportunities to promote PA in all school children, regardless of their socio-economic or cultural circumstances and irrespective of their parents’ behaviour and attitudes towards PA and health. Interventions to change lifestyle behaviours through the school environment have been found to be successful, especially if they take place early in life (Rosenbaum 1998). Further, it seems that the socioeconomically deprived have the lowest levels of PA and are also most difficult to reach by any preventive measure that is not included in the regular school curriculum (Zahner 2006). Major advantages of school-based interventions are the relatively easy access to all children in a collective setting and that changes in the school environment are relatively easy to implement and monitor (Zahner 2006). However, it
is possible that children who increase their PA during the school day may compensatory decrease their out-of-school PA (Donnelly 1996). If so, to stimulate children’s overall amounts of PA, the extracurricular setting should also be involved (Cleland 2005). Out-of-school PA programmes, collaboration with sports organizations and family involvement are therefore needed to ensure that children engage in adequate PA beyond the school day (Beets 2009).

Targeting children at risk
Children from low SES or ethnic minority families are less likely to participate in regular PA, spend more time being sedentary and are more likely to be overweight. Therefore, important health benefits can be achieved when regular PA in these children is promoted and sedentary time is limited. Findings show that for youth living in low-SES areas environmental factors (i.e., proximity, cost, facilities and safety) are very important to ensure participation in PA. Low-SES children may be just as interested in PA as their high-SES peers, but their financial and environmental circumstances may limit their opportunities to participate in PA. Intrapersonal (i.e. perceived skill, competence, time) and social factors (i.e. friends, adult support) must also be considered to improve PA participation rates among low-SES youth (Girolami 2006).

The governmental role in health promotion
Based on the Public Health Act (“Wet Publieke Gezondheid”) Dutch municipal authorities are responsible for the protection and promotion of public health. An example of active public health policy of governmental authorities is the municipal child health care (CHC). With regard to the prevention of childhood overweight CHC has five main municipal tasks: 1) to systematically track development in the local prevalence of childhood overweight; 2) to identify factors that promote or pose related risks; 3) to provide preventive interventions at individual level; 4) to provide preventive interventions at the population level, and: 5) if needed, to provide individual referral to health care providers (Jansen 2009).

Another role of municipal authorities concerns public policy regarding the social and physical environment, involving strategies that aim to reduce barriers or increase opportunities for healthy choices, e.g. by providing healthy options and by making healthy choices more accessible (De Gouw 2011).

JUMP-in

JUMP-in is an intervention to promote sports participation and PA behaviour among children in economically deprived areas (www.JUMP-in.nl). The development process of JUMP-in started in 2002, based on the Precede Proceed model (Green 1991). The Intervention Mapping protocol (Bartholomew 2001) was applied in order to systematically design the intervention. The JUMP-in framework (figure 1) was based on the initial version of the EnRG framework, including determinants of energy balance related behaviours (Kremers et al, published in 2006). According to
this framework environmental factors are hypothesized to influence children’s PA behaviour both indirectly and directly. The indirect causal mechanism reflects the mediating role of behaviour-specific cognitions in the influence of the environment on PA behaviour, including attitude, self-efficacy, social modelling, social pressure, social norm, social support, perceived planning skills, perceived environmental barriers and PA behavioural intention. The direct influence reflects the automatic, unconscious influence of the environment on PA behaviour. Environmental determinants can be in the physical, social or political domain. The framework also distinguishes factors that may moderate the relations of the environmental and cognitive determinants with PA behaviour. These possible moderators include demographic characteristics and body composition.

**Figure 1. JUMP-in framework**

The JUMP-in programme targeted children’s PA behaviour. Parents were a secondary target group, as well as the school staff and sports trainers. In the JUMP-in working model, these secondary target groups are part of the social environment and have their direct or indirect influence (via cognitive mediators) on children’s PA behaviour. Of course, a similar model can be applied to the behaviour of parents, school staff and sports trainers regarding children’s PA. This behaviour can be directly or indirectly influenced by environmental determinants in the physical, social or political domain.

**Theories underlying the JUMP-in framework**

A theory-based programme targeting hypothesised mediators increases the chances of success (Noar 2005; Baranowski 2003). However, childhood PA behaviour is a complex behaviour determined by many factors (Sallis 2000) and is not easily or completely described by any existing theory (Marcus 2003). Therefore, the JUMP-in conceptual working model was based on a number of theories; the Theory of Planned Behaviour (Ajzen 1988), the Model of Physical Exercise and Habit Formation (Aarts 1997), the Model of Dual Process View (Chaiken 1999) and Ecological models (Sallis 1997; Spence 2003; Kremers 2005). Below the significance of these theories for the development of JUMP-in is described briefly.
models (Sallis 1997; Spence 2003; Kremers 2005). Below the significance of these theories for the development of JUMP-in is described briefly.

**Theory of Planned Behaviour**
The theory of Planned Behaviour (TPB) (Ajzen 1988) assumes that PA behaviour is based on reasoned decision making: e.g. children are physically active because they experience more positive than negative consequences, they perceive having the opportunity and skills to be physically active and they perceive a positive norm in their social environment. Findings in longitudinal studies of Rhodes (2006), Craig (1996) and Hagger (2001) support the utility of the TPB as a framework to explain children’s PA behaviour. Overall, children’s PA intention, attitude and perceived behavioural control significantly predicted PA behaviour (Hagger 2001; Rhodes 2006). Subjective norm and perceived behavioural control were significant predictors of intention (Rhodes 2006).

**Model of Physical Exercise and Habit Formation**
The TPB seems to neglect an important aspect of PA behaviour, i.e. the automaticity as an underlying mechanism of behaviour. Especially children do not consider all the positive and negative consequences, social influences and perceived behavioural control of the behaviour thoroughly every time before they go out to play or play sports. The more automatic (non-reasoned) process that determines PA behaviour is described in the model of Physical Exercise and Habit Formation (Aarts 1997). Cognitions become less important and behaviour is likely to be automatically activated by specific environmental cues. Aarts stated that intervention programmes should pay attention to the promotion of habitual PA behaviour. For this purpose resources and opportunities need to be provided that enable children to perform the type of PA they like at any time they want to enjoy it.

**Model of Dual Process View**
The Dual Process View of Chaiken and Trope (1999) describes behaviour as a result of a simultaneous influence of conscious (reasoned) and unconscious (automatic) processes. The extent to which PA is a habit and the extent to which children are aware of their own PA level, may determine whether a more reasoned or a more automatic behaviour takes place. The JUMP-in pilot results appeared to underline the hypothesis that awareness as well as habits influence the explanatory value of cognitive determinants (Kremers 2008). Children who were unaware of their PA level and those with strong habits concerning PA were less likely to make well-considered behavioural choices.

**Ecological models**
Ecological models hypothesise a direct influence of the environment on behaviour, i.e. unmediated by cognitive factors (Sallis 1997; Spence 2003; Kremers 2005; Brug 2005). It has even been argued that reductions in levels of obesity and sedentary behaviour seem unlikely until the
current obesogenic environment is modified (Egger 1997). The results from the JUMP-in pilot study confirmed the hypothesis of a direct relationship between environmental and behavioural changes. Environmental changes (e.g. the creation of school sport clubs) resulted in behavioural changes, without influencing the related cognitions (Jurg 2006). Previous studies support this hypothesis as well (Welk 1999, Wind 2005; Eriksen 2003; Perry 2004).

**AIM AND OUTLINE OF THIS THESIS**

The main purpose of this thesis is to describe the development, effectiveness and feasibility of the JUMP-in intervention. We also describe the process evaluation which helps us to explain the effects found.

**Stepwise development**

*Chapter 2* of this thesis presents the description of the stepwise systematic development of the intervention. The lessons learned in the pilot period were translated into an improved programme, organisation and evaluation design. This translation process was conducted by application of the RE-AIM framework.

**Effectiveness of JUMP-in**

A controlled trial was carried out to investigate the effectiveness of JUMP-in. *Chapter 3* describes the study protocol, the objectives, the recruitment of participants and the effectiveness of JUMP-in on sports participation, overall PA, fitness and body composition.

**Mediating effects on changes in sport participation, outdoor play and screen behaviours.**

*Chapter 4* describes the effectiveness of JUMP-in on outdoor play and screen behaviour as well as the mediating effects of personal (e.g. attitude, self-efficacy, intention, perceived planning skills) and environmental determinants (e.g. social modelling, social pressure, social norm, social support, perceived environmental barriers) on changes in sport participation, outdoor play and screen behaviours.

**Parents**

*Chapter 5* presents the effect of the JUMP-in programme on parents’ cognitions towards children’s sports participation and whether parents’ cognitions mediated the JUMP-in intervention effect on sports participation.

**JUMP-in sports participation and mental wellbeing**

The effect of JUMP-in on mental wellbeing in schoolchildren is described in *Chapter 6*. In addition, results are presented of the investigated longitudinal relationship between sport participation and indices of mental wellbeing.
Factors influencing the implementation process

Chapter 7 describes the process evaluation of JUMP-in. Factors influencing the adoption, implementation and institutionalisation process of JUMP-in were investigated, in order to optimise the dissemination of the intervention and improve its effectiveness. The process evaluation concerned the constraints and the success and failure factors at socio-political, organisational, user and intervention level. We used a mixed methods technique combining quantitative and qualitative research strategies.

Main findings and implications for practice, policy and research

The final chapter – chapter 8 – summarises the main findings of this thesis and discusses theoretical, practical and methodological issues derived from this thesis. In addition, implications for the JUMP-in intervention, public health policy and future research are presented.
Promoting physical activity in children: the stepwise development of the primary school-based JUMP-in intervention applying the re-aim evaluation framework.

Judith de Meij
Mai Chin A Paw
Stef Kremers
Marcel van der Wal
Merlin Jurg
Willem van Mechelen

Published in Br J Sports Med 2010;44:879-887.
ABSTRACT

Background: There is a lack of effective intervention strategies that promote physical activity (PA) in school children. Furthermore, there is a gap between PA intervention research and the delivery of programmes in practice. Evaluation studies seldom lead to adaptations in interventions that are subsequently evaluated by implementation on a wider scale. The stepwise development and study of JUMP-in aims to add knowledge to better understand how, when and for whom intervention effects (or lack of effects) occur.


The process and effect outcomes of a pilot study were translated into an improved programme and intervention organisation, using the RE-AIM framework (Reach, Efficacy, Adoption, Implementation and Maintenance). This paper presents the process and results of the application of this framework, which resulted in a widescale implementation of JUMP-in.

Results: The application of the RE-AIM framework resulted in challenges and remedies for an improved JUMP-in intervention. The remedies required changes at three different levels: (1) the content of the programme components; (2) the organisation and programme management; and (3) the evaluation design.

Conclusions: Considering factors that determine the impact of PA interventions in ‘real life’ is of great importance. The RE-AIM framework appeared to be a useful guide by which process and effect outcomes could be translated into an improved programme content and organisation.
BACKGROUND

Strong evidence supports the need for urgent action to increase physical activity (PA) among youth (Branca 2007; Edwards 2006). The benefits of regular PA in children are well documented. PA is important in maintaining physical and mental well-being and can prevent overweight and obesity (Branca 2007; Edwards 2006; Ekelund 2004; Kavey 2003; MacKelvie 2003; Trost 2001; Ball 2001; Janssen 2005). Many children however, do not engage in sufficient PA to gain health benefits, also in the Netherlands (Kemper 2000; Zeijl 2005). De Vries and colleagues (2005) showed that in deprived city areas in the Netherlands only 3% of the children met the PA Public Health recommendation. Promoting PA among children is a complex challenge. Studies that incorporated whole-of-school approaches, including curriculum, policy and environmental strategies, appeared to be more effective than those that incorporated curriculum-only approaches (Yin 2005; Kahn 2002; Timperio 2004). In 2002 the Municipal Health Service and the Municipal Sports Service of the city of Amsterdam started the development and implementation of JUMP-in, a Dutch intervention that aims to prevent overweight by stimulating PA in school-aged children in socially and economically deprived areas in Amsterdam. The intervention incorporates policy, environmental, and individual components and involves municipal authorities and agencies, primary schools, local sport services, sports clubs and youth health care.

The stepwise development of JUMP-in, a school-based multi-strategy approach.

The development process of JUMP-in started in 2002, based on the Precede Proceed model (Green 1991). The Intervention Mapping protocol (Bartholomew 2001) was applied in order to systematically design the intervention. A complete description of the development of the pilot programme can be found in Jurg (2005). The pilot programme entailed six components: (1) Extracurricular school sports activities; (2) a Pupil Follow-up System, monitoring children’s PA behaviour; (3) Regular breaks for PA by means of calendars with in-class exercises (“The class moves!”); (4) Game cards with assignments, aiming at increasing awareness and self-efficacy with regard to PA (“Choose your card!”); (5) Parental information services aimed at increasing knowledge, awareness with regard to children’s PA; and (6) an activity week with a variety of sports for children and parents, demonstrations, a sports market, etc. The feasibility and quality of the JUMP-in intervention components were tested in a pilot study in the period 2002-2004. This pilot study provided information about the effects on PA and the social cognitive determinants in a population of school children aged 9-12 years from six primary schools. The pilot evaluation also provided process measurements, which were used to illuminate the effect evaluation. The results of the pilot evaluation have been reported previously (Jurg 2005; Jurg 2006; Jurg 2008).

Step II. (2005): Translation of pilot outcomes into an adapted programme.
The process- and effect outcomes of the pilot study were translated into an adapted programme and organisation, using the RE-AIM framework (Reach, Efficacy, Adoption, Implementation and Maintenance; table 1) (Glasgow 1999; Glasgow 2006; Glasgow 2002).
Table 1. RE-AIM dimensions and definitions

<table>
<thead>
<tr>
<th>Level</th>
<th>Dimension</th>
<th>Definition</th>
</tr>
</thead>
</table>
| Individual | Reach | 1  Participation rate among eligible individuals  
2  Representativeness of participants |
| Individual | Efficacy/ Effectiveness | 1  Effects on primary outcome measures  
2  Impact on quality of life and negative outcomes |
| Setting | Adoption | 1  Representativeness of settings participating  
2  Participation rate among possible settings |
| Setting | Implementation | 1  Extent to which intervention delivered as intended  
2  Time and costs of intervention |
| Both | Maintenance | 1  (Individual) Long-term effects of intervention (> 6 months)  
2  (Individual) Impact of attrition on outcomes  
3  (Setting) Extent of institutionalization, continuation or modification of treatment |

**Step III. (2006-2009): wide scale implementation.**

In 2006 the implementation of the revised JUMP-in programme started in 60 schools in deprived city areas in Amsterdam, including a detailed formative, process and effect evaluation. This paper presents the results of the translation of the pilot outcomes into an adapted programme, conducted in step II.

**METHODS STEP II: THE APPLICATION OF RE-AIM**

This paragraph describes the translation of the pilot evaluation outcomes into an adapted programme and organisation. The RE-AIM framework provides a tool to evaluate the impact of interventions not solely by its efficacy, but also by the process of delivery, and by its institutionalisation (Glasgow 2006; Glasgow 2001; Glasgow 2002; www.RE-AIM.org). Successful delivery, high implementation fidelity and incorporation of the intervention method into the daily routine, contribute to the effectiveness of interventions. The RE-AIM framework operationalizes this process in the dimensions Reach, Adoption, Implementation and Maintenance. The integration of these dimensions is important in the translation of research into practice (Rogers 1995; Abrams 1996; Oldenburg 1999; Armstrong 2007). By considering effect and process outcomes across the RE-AIM dimensions, the effectiveness of intervention methods, delivery strategies and planning procedures can be increased. Below the JUMP-in pilot results are addressed across the five RE-AIM dimensions. In addition, a summary of the encountered key challenges and remedies for an increased overall impact of the programme is provided (table 2).
RESULTS

Results on the dimension Reach
The primary target group of JUMP-in are children aged 6-12 years (1). Important intermediate target groups are (2) parents, (3) schools - school directors, school staff and physical education (PE) teachers -, (4) local municipalities - city districts’ policy makers, sports coordinators - and (5) local sports club.
Ad (1). Children.
A major advantage of the JUMP-in intervention is the relatively easy access to children through the school. However, the number of children reached differed for the several programme components. All children were reached by the programme components that were part of the in-school curriculum. But after-school sports activities reached mainly children who were already active. Based on qualitative data it can be concluded that children who would benefit the most from participating - because of their overweight, physical inactivity or motor disabilities -, were the hardest to reach.
Ad (2). Parents.
Parents were relatively easy to reach through the school as well; written information reached in principle all parents. Nonetheless, information meetings organised at school reached predominantly parents who were already aware of the importance of PA for their children and who were ready to support their children. Again, the parents who needed information the most - because of their lack of knowledge and their own unhealthy lifestyle - proved to be the hardest to reach.
Ad (3-5) Schools, local municipalities, sports clubs.
It was not difficult to reach the schools and the local municipalities, because they are part of existing networks and easy to approach. Sports clubs are part of existing networks too, but not all were easy to reach, because some trainers are volunteers. Furthermore, in most of the deprived city areas there is a lack of sports clubs. Instead, city districts organise a variety of easy accessible sports offers for the local youth, organised after school time in public playgrounds and local sports locations. These activities however, mainly consist of short term sports courses, sports competitions and PA games, all without further engagement. Because the coordinators and trainers of these local sports activities are employed by the city districts, they were easy to approach.

Results on the dimension Efficacy
The pilot JUMP-in succeeded in influencing PA among children; for children of control schools the level of PA decreased considerably, corresponding with the trends in this age group (Kohl 1998; van Mechelen 2000), whereas the children of intervention schools became only marginally less active. After one school year JUMP-in appeared to have succeeded in preventing children from becoming less active. A common weakness in the assessment of effectiveness regarding PA behaviour in youth is the lack of adequate assessment procedures to measure PA among
youth (Campbell 2001; Summerbell 2005; Brug 2005). A gold standard is not available, which hampers the assessment of changes in PA, or in hypothesized causal determinants. In the pilot study, data on PA were based on self-report by questionnaires. Self-report data suffer from memory bias, problems with concentration and comprehensibility. Furthermore, the cognitive requirements for completion of a questionnaire about PA are high for young children, which influences reliability and validity of the results (Sallis 1999). Therefore, in the evaluation study of the pilot, only the older groups (age 10-12) participated.

The pilot success of preventing children of intervention schools to become less active could not be explained by changes in the hypothesized determinants. Only in Grade 4 some effects on potential determinants were identified (i.e. attitude and habit strength). Previous studies have shown that, in contrast to hypotheses derived from various social cognitive theories (Ajzen 1991; de Vries 1998), changes in behaviour can be realized without first changing the underlying cognitive determinants. These findings suggest that environmental changes (e.g. in-class exercises and school sport activities) may suffice for behavioural change in children (Brug 2005; Eriksen 2003; Perry 2004; Wind 2005; Kremers 2006).

Results on the dimension Adoption

The willingness to participate among school directors, PE teachers, city districts’ policy makers and sports clubs was high. All the city districts, and almost all the eligible schools that were offered participation, were willing to participate. Encouraging the school staff to implement the program components, however, was rather difficult and had to be repeated for every new component. One aim of the process evaluation was to ascertain how teachers PE and the school staff perceived the programme, in terms of characteristics that were hypothesized to influence adoption and implementation, such as outcome beliefs, subjective norms and self-efficacy (Jurg 2005; Jurg 2008; Paulussen 1994; Paulussen 1994). In the pilot, linkage systems were used as an interactive dissemination approach, to improve the fit between programme planners and users (Bartolomew 2001). This linkage systems, in which programme leaders and the programme implementers (at school, city district and sport level) participated, created a means to exchange information and ideas. This joint involvement supported the development of needs-based, tailored programmes and implementation strategies. Nevertheless, there were factors hampering adoption among the school staff in the pilot, mainly related to three factors. First, inefficient and insufficient communication about the project led to differences in expectations and lack of clarity about tasks and responsibilities. Second, the school teachers felt to have had insufficient preparation time, which led to resistance to join the project. Finally, during the pilot period the programme developed continuously and new networks were built. Despite the linkage systems, the lack of formal guidelines about how to fulfill new tasks were found to hamper the cooperation of participants from time to time.
Results on the dimension Implementation
The pilot schools implemented most of the components of the programme. The effort and commitment of the city districts, PE teachers and school directors appeared to be important factors in the prediction of successful implementation. Nonetheless, there were some impeding factors that hampered the implementation process (Jurg 2006).

- The content of some new components, such as the Pupil Follow-up System, and ‘Choose Your Card!’ was still in a developmental phase.
- Differences in and lack of clarity with regard to outcome expectations, responsibilities and sets of tasks;
- The lack of behavioural capabilities of PE teachers and the school staff, especially regarding components that required relatively new skills such as the Pupil Follow-up system, Parental information, ‘Choose Your Card!’ and ‘The Class Moves!’;
- The lack of skills among PE teachers to coordinate the implementation and to coach sports trainers;
- The cooperation between the city districts, schools and sports clubs was not always facilitated by existing networks or past contacts;
- Practical factors sometimes hampered the implementation (e.g. a fully booked school year, the work load of teachers).

Results on the dimension Maintenance
The pilot scored positive at the maintenance level; all schools and city districts decided to continue the programme and to embed JUMP-in into their policy. City districts allocated money and manpower to ascertain continuation of JUMP-in, by structural finances for sports facilities and by structural employment of PA managers in the city district and PE teachers, to fulfil the management and coordination tasks connected with JUMP-in. Moreover, the city districts extended the programme to many other schools in their local area. Examples of factors that facilitated embedding were the effort and commitment of project members and project targets that were in line with the policy of the involved organisation.

The process evaluation showed that two years were needed to achieve full embedding of JUMP-in into policy. Factors that hampered embedding the most were absence of guidelines about the tasks of the implementers and the lack of formalized contracts and agreements before the programme started. Furthermore, it can be concluded that to reach continuity, professionalism (quality) and uniformity, effective formalized partnerships in the field of sports, health care and education have to be build, with shared vision, clear strategic and operational objectives and a whole-system approach to tackle overweight and physical inactivity.
Table 2: Challenges and remedies for JUMP-in with regard to the five RE-AIM dimensions

<table>
<thead>
<tr>
<th></th>
<th>Challenges</th>
<th>Remedies</th>
</tr>
</thead>
</table>
| **Reach**| 1. To identify and select the target groups (children at risk: overweight, inactivity, motor disabilities)  
2. To increase the reach among children at risk.  
3. To increase the reach of parents of children at risk. | 1. Use of smart risk profiles in the JUMP-in pupil follow up system (Pupil Follow up System; for description, see part 4);  
2. Personal approach with tailored solutions (see part 4 extra care);  
3. Focus on parents of children at risk:  
   - Involve parents when a child is at risk. If necessary, parents receive an invitation from the youth health care or hospital.  
   - Parental information service is embedded in the entire JUMP-in programme and contains multi-medial alternatives for tailor-made information and advice. |
| **Efficacy**| 1. To quantify the reach, especially of the groups at risk  
2. To increase the focus on high risk groups.  
3. To increase the focus on the role of environmental factors.  
4. Adequate assessment of PA.  
5. To gain insight in the working mechanism of the programme and effects on PA behaviour and determinants. | 1. Registration of school sport- and club extra participation and registration of referrals.  
2. Tailored solutions aimed at risk reduction, such as adapted sports offers, tailored information and courses for parents of children at risk.  
3. The evaluation study includes self-reported- and objective measures of the environment.  
4. Objective PA measurement with an accelerometer.  
5. The evaluation study includes:  
   - Measurements among parents;  
   - Measures of potential mediating variables as well as process measures, that can help to understand how intervention effects (or lack of effect) occur;  
   - Objective secondary outcome measurements; body composition and fitness;  
   - Registration of the progress and quality of the implementation. |
| **Adoption**| 1. Commitment of all implementers, including the school staff.  
2. To overcome impeding factors that hamper participation among implemeters. | 1. Besides school directors and PE teachers, the school staff is explicitly required to commit and support the decision to participate.  
   - For the adoption a ‘flow diagram’ is used, which is divided in phases. Each phase needs to be successfully finished before proceeding to the next phase.  
2. Factors that support adoption:  
   - Efficient and sufficient communication about the project, starting in the adaptation phase;  
   - Equal and clear expectations about tasks and responsibilities;  
   - Sufficient preparation time for all implementers;  
   - Introduction of contracts for school directors and city districts concerning the implementation aims, costs, tasks, efforts and responsibilities.  
   - The preparation period is divided in phases and each phase needs to be successfully finished before proceeding to the next phase. |
### Challenges

<table>
<thead>
<tr>
<th>Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Implementers have sufficient skills to fulfil their tasks.</td>
</tr>
<tr>
<td>2. More attention for communication and information:</td>
</tr>
<tr>
<td>• To improve the clarity of programme components, instruments and protocols and to reduce the level of complexity in content and delivery.</td>
</tr>
<tr>
<td>• To reduce the types and levels of resources necessary to effectively deliver the intervention.</td>
</tr>
<tr>
<td>3. To make the implementation measurable in terms of evaluation criteria.</td>
</tr>
<tr>
<td>4. Sufficient sports clubs in terms of distance, availability and sufficient qualified sports trainers.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Structural embedding of the programme in practice and policy of schools, city districts and programme partners at local and even national level.</td>
</tr>
<tr>
<td>2. Community coalitions aiming at effective local planning and action.</td>
</tr>
</tbody>
</table>

### Remedies

<table>
<thead>
<tr>
<th>Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Tailored implementation training and instructional presentations for PE teachers, sports trainers and school staff, carried out by professionals, with contents in line with the teachers’ jargon, goals and needs.</td>
</tr>
<tr>
<td>2. More attention for communication and information:</td>
</tr>
<tr>
<td>• For the implementation phase a ‘flow diagram’ is used, which is divided in phases. Each phase needs to be successfully finished before proceeding to the next phase.</td>
</tr>
<tr>
<td>• Well defined and protocolized programme components; clearly described and evaluable objectives, applications and criteria for use.</td>
</tr>
<tr>
<td>• Formal guidelines about how to fulfill all sets of tasks.</td>
</tr>
<tr>
<td>• Information services and technical assistance at a central location; instruments and tools available on the JUMP-in website. Availability of required materials, tools and information less complex and less time consuming.</td>
</tr>
<tr>
<td>3. Registration of implementation progresses at organisation level in order to control progress of implementation and quality.</td>
</tr>
<tr>
<td>4. Practical solutions such as building dependences in the school, and influence the local sports policy.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Structural embedding by:</td>
</tr>
<tr>
<td>• Structural employment of PE teachers and coordinators to fulfill the tasks.</td>
</tr>
<tr>
<td>• Participation in the public health policy debate on a local and national level in order to generate attention and finances for structural implementation.</td>
</tr>
<tr>
<td>• Structural professional centralized service centre for the provision of technical assistance, information, instruments, tools, cues, reinforcement and training.</td>
</tr>
<tr>
<td>2. Highly structured cooperation with clearly described and evaluable objectives and sets of tasks between municipal authorities, schools, youth health care, dieticians, school supervisory services, local sport services and sports clubs.</td>
</tr>
</tbody>
</table>
Towards an improved JUMP-in programme

The application of the RE-AIM framework on the results of the pilot evaluation resulted in challenges and remedies for an improved JUMP-in programme (see table 2). The remedies required changes at three different levels. First the content level of the programme components; the methods and strategies selected to achieve an increase in PA behaviour. Second, remedies were needed at the level of organisation and programme management. This second level is crucial for the quality of putting together effective local planning and action. Third, the evaluation design, which was adapted regarding key internal and external validity factors (Glasgow 2004; Dzewaltowski 2004).

A. Programme components

The most important weaknesses concerning the pilot components were: (1) the uni-dimensional focus on sports-participation, instead of daily PA behaviour; (2) the lack of attention to hampering factors at individual level, such as overweight and being behind in the motor development; (3) the fact that school sports clubs especially reached already active children; and that (4) the game approach of “Choose your card” did not reach parents and did not affect the awareness among children. Furthermore; (5) the information meetings did not reach all parents; (6) the messages were not tailored to the individual child/family and; (7) the activity week ended up in an arbitrary set of unstructured fun-activities, due to a lack of specified goals.

While the complete programme is implemented for all children, certain programme components specifically target inactive and overweight children and parents, such as Parental Information services and Extra care and Club Extra. Other programme components give priority to inactive and overweight children, such as School sport clubs. Table 3 presents an overview of the revised JUMP-in programme components, after the application of the RE-AIM framework, including the aims, change objectives and underlying theories.
Table 3. Aims, change objectives, theory, methods and strategies (programme components) of the revised JUMP-in programme, after the application of the RE-AIM framework.

<table>
<thead>
<tr>
<th>RE-AIMS</th>
<th>Change objectives</th>
<th>Theory</th>
<th>Methods</th>
<th>Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Detection and monitoring of overweight children, inactive children or children with arrears in their motor development, in order to support them in a structured way*</td>
<td>At individual level: n.a. At environmental level: Risk awareness Social Support Environment (availability + accessibility of adapted PA, information and care)</td>
<td>Coping strategy, Relapse prevention theory, Precaution Adoption Process model.</td>
<td>PFS is the base for tailored approaches of groups at risk and adapting the programme to the needs of the specific groups. Methods: Monitoring, Targeting, Planning, Building networks, Mobilizing social support and care, Consciousness raising, Self-evaluation, Problem solving, Tailored solutions.</td>
<td>Pupil Follow up System *</td>
</tr>
<tr>
<td>• Sport participation as a habit • Increase of perceived sport competence • Healthy sensor-motor development • Positive self esteem.</td>
<td>Attitude Perceived beh. control Habit strength Perceived sport competence Environment (availability + accessibility of PA)</td>
<td>Learning theory, Task Experience theory, Motivational construction, the model of physical exercise and habit formation, Reinforcement theory, Ecological model.</td>
<td>Create opportunities, Direct experience, Active learning, Skill training with guided practice and feedback, Attitude change through reinforcement, Modelling, Facilitation, Repeating positive experiences, Altering physical environments to include more PA options, Building networks, Tailored offers.</td>
<td>School sport clubs</td>
</tr>
<tr>
<td>• Awareness of own PA behaviour, talents and opportunities to be daily physically active. • Awareness of the importance of daily PA behaviour. • Positive intention and skills to plan and control daily PA behaviour. • Increased habit strength.</td>
<td>Attitude Perceived beh. control Perceived sport competence Intention Habit strength Planning skills Social norm Social support Modelling (Perceived) environment</td>
<td>Social-Cognitive Theories, Theory of Planned Behaviour, Attribution Theory, Relapse prevention theory, Goal-setting theory, Cognitive dissonance theory, Learning theory, Task experience theory, Motivational construction, Social comparison, social inoculation, The model of physical exercise and habit formation, Trans theoretical model.</td>
<td>Consciousness raising, Self-evaluation, Environmental re-evaluation, Attitude change through learning, reinforcement and congruity. Direct experience, Mobilizing social support.</td>
<td>Personal workbook “This is your way you Move!”</td>
</tr>
<tr>
<td>RE-AIMS</td>
<td>Change objectives</td>
<td>Theory</td>
<td>Methods</td>
<td>Strategies</td>
</tr>
<tr>
<td>---------</td>
<td>-------------------</td>
<td>--------</td>
<td>---------</td>
<td>------------</td>
</tr>
<tr>
<td>Parents are aware of the importance of daily PA, Parents are motivated and ready to support and stimulate daily PA behaviour of their children.</td>
<td>Parental: Attitude Perceived beh. control Intention Social norm Social support Modelling (Perceived) environment</td>
<td>Theory of Planned Behaviour, Theory of reasoned action, Learning theory, Information processing, Persuasive communication, Elaboration-Likelihood model, Social comparison, social inoculation. Coping strategy, Trans theoretical model.</td>
<td>Attention and comprehension, Demonstration, Consciousness raising, Tailoring, Providing information, Receiving, hearing, accepting new opinions. Modelling, Direct experience, Skill training Self-evaluation, Environmental re-evaluation, tailored offers.</td>
<td>Parental information services</td>
</tr>
<tr>
<td>Make PA, relaxation and posture exercises a habit in the daily school routine. A healthy sensor-motor development.</td>
<td>Perceived sport competence Habit strength</td>
<td>Task Experience theory, Reinforcement theory, The model of physical exercise and habit formation.</td>
<td>Direct experience, Guided learning and feedback, skill training, repeating positive experiences</td>
<td>“The Class Moves!”</td>
</tr>
<tr>
<td>Healthy sensor-motor development. To stimulate and support children at risk, in order to increase the (perceived) sport competence. Give children at risk the opportunity to participate in regular school sport activities.</td>
<td>Attitude Perceived beh. control Social support Perceived Sport competence</td>
<td>Trans theoretical model, Relapse prevention theory, Reinforcement theory, Task Experience theory, Goal-setting theory.</td>
<td>Targeting, Direct experience, tailored offers, Consciousness raising, Increase self esteem, modelling, Demonstration, Tailoring, Individualization, Skill training with guided practice and feedback, Tailored support.</td>
<td>Club Extra, MRT, extra care</td>
</tr>
</tbody>
</table>

* The Pupil Follow up System creates the opportunity of tailored approaches and adapting JUMP-in programme components to the needs of individuals and groups at risk.
I. The Pupil Follow-up System (PFS).
The PFS is a monitoring instrument that identifies (changes in) risk factors and care needs by assessing and registering yearly children’s level of PA, BMI and motor skills. The PFS also contains an attendance list that registers the presence of children at after-school activities. PFS facilitates tailored solutions for individuals in a structured way, e.g. motor remedial teaching, physiotherapy, referral to youth health care. In cases in which additional support or care is required, existing school network channels are used. Furthermore, the PFS creates the opportunity to tailor the other programme components to the characteristics of the school and environment. The PE teacher is trained to use the system via a password protected area on the JUMP-in website.

II. Daily exercises with “The Class Moves!”
This programme offers recurrent breaks for PA, relaxation and posture exercises, during regular lessons, by means of calendars. For each grade the materials are adapted to the level of sensor-motor development. An instruction book for the school teacher is available. The aim is to make PA a daily habit, to increase enjoyment in PA and to contribute to a healthy sensor-motor development. Although the materials were not revised after the pilot, the refined instruction for the school staff and the implementation is professionalized by certified implementation supervisors from a school advisory service. In future implementation, agreements are made with the director and school staff about the extent to which the programme will be used and the implementation is accompanied by a process evaluation and follow up instructions if needed.

III. Personal workbook: “This is the way you move!”
The game approach “Choose your Card!” carried out in the pilot period, is replaced by the method “This is the way you move!” This method consists of personal workbooks for children and their parents, with assignments to perform in class and at home, and an instruction-book for the school staff. The method is especially aimed at raising awareness of the importance of PA for health and one’s own PA behaviour and at improving self-efficacy, social support, self regulation and planning skills, of both children and parents. The assignments vary from “design and perform your own favourite exercise for inside the house /with the family” to “make a plan for a week schedule for daily PA”. The children regularly bring the book home to make assignments together with the parents. Informational messages for parents are embedded in the workbook. The instruction for the school staff is provided by the School Supervisory Service.

IV. School sports activities
In or near to the school premises, continuously easily accessible school sports activities are offered on a daily basis. During school hours children will get acquainted with a variety of sports. Subsequently they can join the club during out of school hours. Existing local offers of physical activities and sports clubs are involved. In case of waiting lists for a school sport club, priority is given to children not yet participating in organised sports. Children who are not yet ready to participate in regular school sports, such as children with overweight, a low self esteem or
low (perceived) sport competence, receive adapted sports. These adapted sports provide a safe social environment that allows children to enjoy physical activity and become competent in sport-related skills.

V. Parental Information Service
Parents are important and responsible for the PA behaviour of children and therefore the parental information service in JUMP-in is intensified (Golan 2004). The adjusted instruments are embedded in the entire JUMP-in programme and contain several options for tailor-made information (e.g. information meetings, personal consults, courses, sports activities for parents). To reach parents, multi-medial instruments and a JUMP-in information film for parents is developed, because written information reaches only marginal groups of parents. Parents are asked to support sports activities for children and for themselves and they are involved in the assignments in “This is the way you move!”. This workbook also includes informational messages for parents. Parents are also contacted by school when their child has deficits in its motor development, has overweight or needs stimulation in sports. Financial support is provided for sports activities and materials, if needed. The parental information service is carried out by professional information officers. Information can be given in the parents’ own language if necessary.

VI. Club Extra and extra care
Children are monitored by the PFS and those who are delayed in their motor development or who experience hampering factors in their PA behaviour (such as overweight), receive additional physical education lessons (Club Extra) or motor remedial teaching (MRT). These lessons start in small groups during school hours, given by a qualified MRT or PE teacher. After several weeks the lessons are continued after school time, if needed. If necessary, parents are involved as well. Parents are referred to the school nurse, who carries out a consult or refers to the hospital or a dietician.

B. Organisation and programme management
Our experience confirms that a complex intervention such as JUMP-in, demands a coordinated response across a number of different sectors. Organisational innovations, like formalized agreements between schools, sports and health care are needed, both in the preparation and adoption phase, as well as in the implementation and maintenance phase.

Tools to optimise the preparation and adoption phase
A thorough adoption and preparation is needed, before implementation can take place. Such implementation should be tailored to the characteristics of the school and the environment. To optimize the adoption-, preparation and implementation phases, a ‘flow diagram’ is developed, which is divided in steps. Each step needs to be successfully completed before proceeding to the next step. A school scan and environment scan are carried out, which provide information about:

• Policy and practice with regard to the local sports infrastructure;
• School- and city district policy with regard to sports, education, extra curricular education programmes, after school child care centres and youth health care;
• Existing local programmes targeting overweight and inactivity among youth, including primary and secondary prevention;
• Practice and policy with regard to parental participation at school;
• - Lack of - existing networks in the field of sports, extra curricular education, prevention programmes and youth health care.

A city district officer - usually the sports coordinator -, school directors and PE teachers perform the scans. Subsequently, networks are created and practice and policy with regard to sports, health care and education are prepared, in order to implement the JUMP-in programme.

Keys to optimise the implementation and maintenance phase
It is clear that, to implement and embed the programme in daily practice and in policy, highly structured cooperation is required between municipal authorities, local city districts, schools, youth health care, welfare organisations, school supervisory services, local municipal sport services and local sports clubs, aiming at effective local planning and action. However, as Tones and Green (2004) noted, “a rational planning process can not tackle all organisation and coordination problems.” There is no single organisation, controlling and coordinating all facets of the whole system approach such as JUMP-in. Nonetheless four main keys have been identified that improve programme management and organisation: (1) good communication; (2) clear strategic planning; (3) realistic operational objectives; and (4) the building of effective partnerships. To achieve long term maintenance of the programme, participation is also needed in the public health policy debate (both at a local and at a national level), in order to generate attention and finances for the intervention.

C. Research design.
The revised JUMP-in evaluation framework (presented in figure 1), is adapted from the Environmental Research framework for weight Gain prevention (EnRG) (Kremers 2006). An important factor that influenced the development of the framework is the recent increased attention for social-ecological theories, which highlight the importance of environmental influences (Brug 2005; Kremers 2005; Spence 2003). Ecological models are distinct from most social cognitive theories by hypothesising a direct influence of the environment on behaviour, i.e. unmediated by cognitive factors (Kremers 2005; Spence 2003; Sallis 2002). It has even been argued that reductions in levels of obesity and sedentary behaviour seem unlikely without modifying the environment (Egger 1997). The results from the pilot study JUMP-in and previous studies (Eriksen 2003; Perry 2004; Wind 2005; Welk 1999) appear to underline this hypothesis. Environmental changes (e.g. the creation of school sport clubs) appear to have led to behavioural changes, without influencing the related cognitions (Jurg 2006). Only few papers report analyses of potential moderators, mediators and differential environment-behaviour relationships in distinct subgroups (Wendel-Vos 2007). Evaluation of the revised JUMP-in intervention gains insight into the causal mechanisms by which PA behavioural change is likely to occur.
The evaluation study assessing the effectiveness of the revised JUMP-in intervention is a quasi-experimental controlled trial. The study is carried out in 19 primary schools among 2700 boys and girls in group 3-8 (aged 6-12 years) and their parents. The population mainly consists of people from socially and economically deprived areas. Baseline measurements were conducted in Autumn 2006 (T0). In Spring 2007 the first post-test (T1) was carried out and in Spring 2008 the second post-test (T2).

Primary outcome measures include:
1. Total daily PA (a subgroup of 349 children), measured by Actigraph AM-7164 accelerometers, Fort Walton Beach Florida, USA.
2. Sports participation by interview (all children) and questionnaires (9-12 years, all parents).

Secondary outcome measures include:
1. Anthropometrics: body weight, body height, waist and hip circumferences (all children);
2. Social environmental influences and cognitions of PA behaviour (i.e. attitude, perceived sport competence, habit strength, social influence, perceived behavioural control, planning skills), measured by questionnaire (9-12 years). The questionnaire is developed based on literature study (Dijkman 2003), social-cognitive theories (Ajzen 1991), social-ecological theories (Kremers 2005; Spence 2003; Brug 2005) and the model of physical exercise and habit formation (Aarts 1997). The items were also developed using existing validated questionnaires (Motl 2000; Sallis 2002; Saunders 1997; Veerman 1997) and were pre-tested.
3. Parental determinants of supporting children’s PA behaviour, by questionnaire (all parents). The parental questionnaire is developed based on literature study and focus group interviews (van der Veer 2005), social-cognitive theories (Ajzen 1991), social-ecological theories (Kremers 2005; Spence 2003; Brug 2005), and the model of physical exercise and habit formation (Aarts 1997). The questionnaire was also pre-tested.

The effect evaluation aims to determine the effect of the JUMP-in program on social cognitive determinants, as well as PA behaviour. A mediation analysis will be performed to assess the mediating effect of hypothesized mediators. In addition an analysis of moderators will be performed to analyse if effects are more prominent among or restricted to certain subgroups. The process evaluation concerns the constraints and the success and failure factors at all organisational and operational levels, linked to the implementation of JUMP-in. The process evaluation will also provide information on “health promotion outcomes”: (1) health literacy; (2) social action and influence; and (3) healthy public policy and organizational practice. (Nutbeam 1996; Nutbeam 2000; Saan 2004; Saan 2005). Insight in the health promotion outcomes will explain the relation between implementation, capacity and efficacy of JUMP-in. Process data will be collected during the first and second school year by semi-structured interviews, questionnaire and document analysis, minutes and documentation of program activities.
CONCLUSIONS

This paper aims to give an overview of the stepwise development of the JUMP-in intervention, using the application of the RE-AIM framework. The framework appeared to be a useful guide in combining process- and effect outcomes and translating them into an improved programme content and organisation. However, despite the concrete level of the RE-AIM dimensions, it is difficult to gain insight in mutual causal relationships between outcomes on the different RE-AIM dimensions: outcomes are strongly associated with each other. For example, the game approach of ‘Choose Your Card!’ had weak results on Adoption and Implementation and subsequently did not affect the awareness of children (Efficacy). Further, the results on the dimension Reach depended for an important part on the extent to which the programme was adopted by the implementers (Adoption). For example, the in-school programme ‘The Class Moves’ only reached children in classes where schoolteachers adopted the programme. However, the RE-AIM metrics provide a broad perspective of impact indices and issues important to develop evidence-based and practice-based interventions promoting PA (Glasgow 2006; Baranowski 2003; Bauman 2002).

There is a lack of knowledge about effective intervention strategies to increase PA among school children (Doak 2006). Furthermore, there is a gap between PA intervention research and the delivery of evidence-based programmes in practice. Evaluation studies seldomly report on external validity and they seldomly lead to adaptations in interventions implemented and evaluated on a wider scale (Rothwell 2005; Dzewaltowski 2004). Translating research evidence into programme change is challenging and the evidence around how to effectively promote and facilitate this process is still relatively limited (Armstrong 2007). A common problem is that it may take years to find improvements in PA, or even in causal determinants. It has also been recognized that creating collaboration and intensive participation may take years (Weijters 2003; Ronda 2004; Mercx 2002). Nevertheless, considering factors that will determine the ‘real life’ impact of evidence-based interventions is of great importance. The continuing study of JUMP-in aims to add knowledge about potential moderating and mediating variables as well as process measures, that can help to understand better how, when and for whom intervention effects (or lack of effect) occur.
Effectiveness of JUMP-in, a Dutch primary school-based community intervention aimed at the promotion of physical activity.

Judith de Meij
Mai Chin A Paw
Maartje van Stralen
Marcel van der Wal
Lotte van Dieren
Willem van Mechelen

ABSTRACT

Background: The aim of the present study was to investigate the effect of the JUMP-in programme on sports participation, overall physical activity (PA), aerobic fitness and body composition in 6 to 12-year-old children.

Methods: JUMP-in is a school-based strategy combining environmental - policy, neighbourhood, parents- and personal components. A controlled trial was carried out in nineteen primary schools including 2848 children (50% boys). Measures were performed at the beginning of the first school year (T0: 2006), and repeated at the end of the first (T1: 2007) and second school year (T2: 2008).

Results: A significant beneficial intervention effect was found on organised sports participation (OR 2.8 (2.2 to 3.6)). Effects were stronger for girls (OR 3.6 (2.3 to 5.6)), and for Moroccan (OR 4.2 (3.6 to 5.7)) and Turkish children (OR 3.2 (1.9 to 5.2)). Participation in organised sports was associated with increased shuttle run score. No significant intervention effects on overall daily PA rates and body composition were observed.

Conclusion: The present study proves that a school-based strategy combining environmental and personal interventions was successful in improving structural sports participation among children.
Effectiveness of JUMP-in, a Dutch primary school-based community intervention aimed at the promotion of physical activity.

BACKGROUND

Physical inactivity and overweight are two major public health issues with severe health consequences (Floriani 2008; Branca 2007; Edwards 2006). Dutch children living in socioeconomically deprived areas seem to have the lowest levels of physical activity (PA) and the highest rates of overweight (Zeijl 2005; de Vries 2005). The regular curriculum of school physical education (PE) does not provide the opportunity to reach the entire amount of recommended daily PA (Kemper 2000). Luepker, for example, pointed out that primary-school-aged children spend only 6% of their time in PE class in aerobic activities (Luepker 1999). Extracurricular programmes and family involvement are therefore needed to ensure that children engage in adequate amounts of PA. Nonetheless, the school environment provides various opportunities for intervention (Zahner 2006). Major advantages of school-based interventions are as follows: (1) the relatively easy access to children through the schools; (2) changes in the school environment are relatively easy to implement and monitored; and (3) school-based interventions reach all schoolchildren of all social classes.

JUMP-in is a primary-school based multilevel intervention primarily aimed at the promotion of PA and sports participation among children in socially and economically deprived areas in Amsterdam. JUMP-in incorporates policy, environmental and individual components, and involves primary schools, municipal authorities, local sport services, sports clubs and youth healthcare. Longer-term objectives are the prevention of overweight and improvement of physical fitness through increased PA levels. The development of JUMP-in started in 2002, based on the Precede-Proceed model (Green 1991; Jurg 2005). The Intervention Mapping protocol (Bartholomew 2001) was applied in order to systematically design the intervention. Results from a JUMP-in pilot study showed that JUMP-in prevented the decrease in PA normally seen with increasing age. Among the 12-year-old children in the pilot study, instead of a 30% decrease in PA in the control group, the intervention group showed a 2% decrease only (Jurg 2006). The outcomes of the pilot study were translated into an improved programme and intervention organisation. The stepwise development of JUMP-in has been described previously, including the pilot outcomes, the programme components and strategies, and hypothesised working mechanisms (de Meij 2010). Table 1 provides an overview of the improved JUMP-in components.

The aim of the present study was to evaluate the effectiveness of this improved JUMP-in programme on sports participation, overall PA, aerobic fitness and body composition in 6–12-year-old children. Further, we hypothesised that increased sports participation leads to an increase in aerobic fitness. Should we be able to confirm these hypotheses, implementation of the JUMP-in PA and sports promotion programme will help to improve the health and fitness of schoolchildren with the obvious potential to reduce direct healthcare costs and indirect costs later in life.
METHODS

Participants
The study is a controlled trial carried out in 19 primary schools among a total of 2848 boys and girls in grades 3–8 (aged 6–12 years, 50.4% boys). To be included in the trial, schools needed to have: (1) a certified PE teacher; (2) a majority of pupils with low socio-economic status; and (3) a gymnasium, either in the school or in the direct vicinity of the school. A passive informed consent procedure (Gortmaker 1999) was applied: all parents received a letter describing the study procedures, with the option to sign and return the form if they did not want their child or themselves to participate. The Medical Ethics Committee of VU University Medical Center approved the study protocol.

Table 1: Overview of the main JUMP-in components and responsible implementers.

<table>
<thead>
<tr>
<th>Components</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pupil Follow up System (PFS)</td>
<td>A monitoring instrument yearly assessing and registering children’s level of PA, BMI and motor skills. PFS facilitates referral to tailored interventions in a structured way e.g. motor remedial teaching, physiotherapy, and youth health care.</td>
</tr>
<tr>
<td>School sports</td>
<td>In or near the school premises, structural and easily accessible school sports activities are offered on a daily basis. During school hours children get acquainted with a variety of sports. Subsequently they can join the club during out of school hours. Existing local providers of physical activities and sports clubs are involved.</td>
</tr>
<tr>
<td>“The Class Moves!”</td>
<td>Method (calendars) offering recurrent breaks for PA, relaxation and posture exercises, during regular lessons. For each grade materials are adapted to the level of sensor-motor development. The aim is to make PA a daily habit, increase enjoyment of PA and contribute to a healthy sensor-motor development.</td>
</tr>
<tr>
<td>“This is the way you move!”</td>
<td>Personal workbooks for children and their parents, with assignments to perform in class and at home, and an instruction-book for the school staff. The method is especially aimed at raising awareness of the importance of PA for health and at improving self-efficacy, social support, self-regulation and planning skills, of both children and parents.</td>
</tr>
<tr>
<td>Parental information services</td>
<td>Contains several options: information meetings, courses, and sports activities for parents. To reach parents, multi-medial instruments and a JUMP-in information movie is developed. Personal approach of parents from high-risk children is facilitated by the PFS. Existing structures such as language-courses or coffee-meetings are used to maximise attendance.</td>
</tr>
<tr>
<td>Extra care for children at risk</td>
<td>Children detected by the PFS who have motor and movement disabilities (MMD) or who experience hampering factors in their PA behaviour (such as overweight), receive additional adapted PE lessons (Club Extra) or motor remedial teaching (MRT), given by a qualified teacher. If necessary, parents of overweight or obese children receive an invitation for consultation from the youth health care or hospital.</td>
</tr>
</tbody>
</table>
Effectiveness of JUMP-in, a Dutch primary school-based community intervention aimed at the promotion of physical activity.

**Recruitment of schools**

Nine intervention schools were recruited in two city districts that planned to start the implementation of JUMP-in. Random assignment of schools to a control or intervention group was not possible because of prolonged preparations needed for a successful adoption and implementation of JUMP-in: a school and environmental scan had to be carried out and commitment had to be built among school staff and local partners in sports, care and prevention. Further, networks had to be created among participating organisations, and organisational practices had to be prepared for the implementation of the programme and related protocols. Ten comparable control schools were recruited from geographically separated city districts to limit the possibility of contamination between intervention and control schools. The control schools were asked to continue their usual curriculum during the study period. Children and parents were unaware of the existence of intervention and control schools. They were told that the aim of the study was the assessment of sports and leisure time physical activities among children in Amsterdam. Regular contact with the management and educational personnel of the schools took place to promote their continued participation. The control school staff were offered the JUMP-in programme at the end of the study. The city districts in which control schools were located supported the study and declared to support the implementation afterwards.

**Measurements**

Measures were performed at the beginning of the first school year (T0: September to October 2006) and at the end of the first school year (T1: May to June 2007), and repeated at the end of the second school year (T2: May to June 2008). All measurements took place at school and were performed according to standardised procedures by trained testers. The intervention duration was 8 months in the first year (from November to June) and 9 months in the second year (September 2007 to May 2008). Figure 1 presents the flow diagram of subjects through the measurements. Since the children from the highest grade left school after 1 year, these children were not measured at T2.

**Demographics**

Demographics (gender, date of birth, country of birth for child, mother and father) were assessed by questionnaires completed by the children and parents. Age was calculated based on the self-reported birth date. Classification of ethnicity was based on the classification criteria of the Central Bureau of Statistics in The Netherlands (CBS 2000). If at least one parent or the child itself was born in Africa, Latin America, Asia (except Japan and Indonesia) or Turkey, a child was classified as non-Western. All other children were classified as Western. ‘Dutch,’ ‘Turkish,’ ‘Moroccan’ and ‘Surinamese’ were included in the analyses as separate groups, because those ethnicities were most prevalent in the sample. The remaining ethnicities were coded as ‘other western’ or ‘other non-Western.’
Primary outcome measures

Sports participation
Sports participation was assessed in a personal interview. Trained interviewers asked whether the child participated in organised sports activities at least once a week for a minimum of 3 months (yes or no). Following the results in the pilot evaluation, an interview was the most reliable way to classify sports participation, compared with questionnaires and attendance lists.

Daily PA
PA was measured in all children in grade 4 (n=351 mean age 7) using accelerometers. Two trained research assistants fitted the children with an Actigraph accelerometer (Actigraph 7164 or Actigraph GT1M). Participants received the accelerometer on a Tuesday afternoon during school hours, with actual registration starting Tuesday at midnight. The delay in registration was opted for, because research by De Vries et al. (2005) showed children to be significantly more active on the first day of wearing an accelerometer than on the second day. Children were instructed to wear the accelerometer during all waking hours, except when bathing, showering or swimming. An information brochure for parents was given to the children to take home. After 5 full days of registration, on the subsequent Monday, the accelerometers were reassembled, data were downloaded to a personal computer, and accelerometers were reinitialised for renewed distribution on Tuesday. The data were stored in 60 s epochs, which indicates a storage of the mean activity intensity every 60 s.

The mean number of counts per minute was used in the statistical analysis. Actigraph data were excluded if (1) less than 10 h a day were measured; or (2) when less than 3 days of complete data (>10 h/day) were available. Hours between 21:00 and 7:00 were excluded, as were periods of at least 20 consecutive minutes with output equal to zero, assuming the accelerometer was not being worn during these periods. Because of children’s sickness, loss of accelerometers, technical problems and incomplete data, a final sample of 158 subjects with on average 4 days of complete accelerometer data files was available at baseline. A sample of 154 and 186 subjects was available at T1 and T2, respectively (see figure 1).

Secondary outcome measures

Anthropometry
Weight and height were measured by trained research assistants using a standard measurement protocol. Children’s weights (in underwear) were measured with a calibrated balance (Care 2 Move Medical, Marsden MS-230; Marsden, the weighing company, Henley-on-Thames, Oxfordshire, UK ). Height was measured with a folding length yardstick with a pedestal (Care 2 Move Medical, Marsden MH-226; Marsden, the weighing company, Henley-on-Thames, Oxfordshire, UK ). The measurements were carried out in a private room, in underwear and bare feet. Body mass index (BMI) was calculated by dividing the weight (kg) by height (m) squared (kg/m²). Weight status was divided into normal weight, overweight and obesity based on internationally acknowledged
BMI cut-off points for children as defined by Cole et al. (2000). Waist and hip circumference were measured with a flexible band (Seca) to an accuracy of 0.5 cm. The anatomical landmark for the waist circumference was laterally midway between the lowest portion of the rib cage and the iliac crest.

**Aerobic fitness**

Aerobic fitness was measured by the shuttle run test (SRT). In this study, the distance between the two lines was set at 18 m instead of the usual 20 m, owing to the fact that most primary school gyms were too small for a 20 m SRT. The SRT was conducted in small groups of 10 children. Participants repeatedly ran from one fixed line to the opposite fixed line and had to arrive before they heard a beep. During the test, the time between the sound signals decreased every minute, thereby increasing the running speed. Every child was told that they could stop when feeling too tired to continue, and was ordered to stop by a member of the research team when they failed twice successively to reach the line before the beep. The test results were expressed as the number of laps at which a child stops. One lap is one way and back. According to Boreham et al (1990) and Van Mechelen et al (1986), the SRT is a valid test to assess aerobic fitness.

**Statistical analyses**

Descriptive statistics were used to describe participant characteristics for the intervention and control group at baseline. Independent t test or χ² tests were carried out to explore and quantify subgroup differences at baseline regarding gender, age, weight status, sports participation, fitness and daily PA.

Linear and logistic multilevel auto regression analyses were used to estimate the effect of the intervention. Using the multilevel technique with two levels (ie, individual and school), regression coefficients could be adjusted for the clustering of observations within one school and individual. The parameters of interest are the regression coefficients (b) indicating the difference between intervention and control group. In the crude model, the outcome value at 20 months was adjusted for baseline value and for the value at 8 months. Effect modification by gender, age, ethnicity and BMI was checked. All analyses were performed according to the intention-to-treat principle. Sample-size calculation was based on changes in daily PA and sports participation. A relative difference in daily PA of 10% between the intervention and control group after 21 months was considered to be clinically relevant. The study also focused on effects within subgroups for gender or ethnicity. Based on this, we needed 375 subjects per group to be able to detect a difference of 10% between conditions with a power of 90% and an α of 5%, taking into account the clustering within schools and a dropout rate of 10%. A sample size of 2000 subjects was required. We increased the sample size to allow for a higher dropout rate. Grade 8 subjects were lost at T2, because they left school.

The association between changes in sports participation and changes in shuttle run score were analysed using multilevel autoregressive analysis, in which the outcome variable shuttle run score was adjusted for its values at T0 and T1, gender, age, BMI and ethnicity. The independent
variable, sports participation, was recoded into three dummy variables, with children who were inactive at both T0 and T2 as reference group. Dummies were defined based on the change in sports participation; group (0) children inactive at T0 and T2; group (1) children inactive at T0 and active at T2; group (2) children active at T0 and inactive at T2; group (3) children active at T0 and active at T2.

RESULTS

Study population
A total group of 2848 children were available for the baseline measurements and were included in the study (T0). Of the included children, 2442 (86%) participated in the sports participation interview at baseline, 2363 (83%) after 8 months (T1) and 1824 (66%) after 20 months (T2). From responders excluded at baseline and T1, 14 (0.005%) refused to participate. The most common reasons for dropout were absence due to illness or transfer to another school.

At baseline, anthropometrics were obtained from 2457 children (87%). The follow-up rates at T1 and T2 follow-up were 83% and 72%, respectively. The dropout at T2 was mainly due to the highest grade leaving school to go to secondary school.

From all included subjects, 2134 participated in the SRT (75%). The follow-up rates were 73% and 62%, respectively. Accelerometer data were only available from grade 4 (mean age 7). At baseline, 351 subjects were included. Reasons for dropout were illness, moving to another school or moving to another class/grade. Figure 1 shows the flow of subjects through the trial and the available measurements at baseline (T0), after the first period and after the second period (T1+T2). Dropouts were not significantly different from participants regarding the outcome measures.

Table 2 presents the ethnicity of the intervention and control group, and table 3 the baseline characteristics for intervention and control schools. The mean age of the subjects was 8.6 years, and 50% (1435) were male. Analyses comparing baseline characteristics between control and intervention schools showed some statistically significant differences. Significantly more subjects in the control condition were participating in sports (for boys 50% vs 37% and for girls 25% vs 18%), and subjects in the intervention condition scored significantly higher at the SRT (boys 6.3 vs 5.8 and girls 5.1 vs 4.6).
Table 2. Ethnicity of the study population.

<table>
<thead>
<tr>
<th>Ethnicity (%)</th>
<th>Total</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I N=1378</td>
<td>C N=1451</td>
<td>I N= 706</td>
<td>C N= 698</td>
<td>I N= 672</td>
<td>C N= 753</td>
</tr>
<tr>
<td>Dutch</td>
<td>10.2</td>
<td>18.5</td>
<td>11.2</td>
<td>18.3</td>
<td>9.1</td>
<td>18.7</td>
</tr>
<tr>
<td>Moroccan</td>
<td>30.0</td>
<td>31.6</td>
<td>31.8</td>
<td>31.2</td>
<td>28.0</td>
<td>32.0</td>
</tr>
<tr>
<td>Turkish</td>
<td>23.3</td>
<td>14.3</td>
<td>24.3</td>
<td>14.1</td>
<td>22.3</td>
<td>14.5</td>
</tr>
<tr>
<td>Surinam</td>
<td>11.3</td>
<td>15.9</td>
<td>10.7</td>
<td>16.2</td>
<td>12.0</td>
<td>15.6</td>
</tr>
<tr>
<td>Western other</td>
<td>8.1</td>
<td>6.5</td>
<td>6.4</td>
<td>6.8</td>
<td>10.0</td>
<td>6.3</td>
</tr>
<tr>
<td>Non western other</td>
<td>17.0</td>
<td>13.2</td>
<td>15.5</td>
<td>13.4</td>
<td>18.6</td>
<td>13.0</td>
</tr>
</tbody>
</table>

I = intervention; C = control
Chapter 3

Subjects for analyses at T2:
- Sports participation data: n = 1827 (I: n = 841; C: n = 983, n = 3 missing)
- Anthopometrics: n = 2064 (I: n = 957; C: n = 1099, n = 8 missing)
- Shuttle run: n = 1765 (I: n = 899; C: n = 854, n = 12 missing)
- CSA data: n = 186 (I: n = 94; C: n = 90, n = 2 missing)

Subjects for analyses at T1:
- Sports participation data: n = 2373 (I: n = 1156; C: n = 1207, n = 10 missing)
- Anthopometrics: n = 2370 (I: n = 1159; C: n = 1211, n = 13 missing)
- Shuttle run: n = 2077 (I: n = 1087; C: n = 981, n = 9 missing)
- CSA data: n = 154 (I: n = 76; C: n = 76, n = 2 missing)

Subjects for analyses at Baseline (T0):
- Sports participation data: n = 2456 (I: n = 1197; C: n = 1246, n = 13 missing)
- Anthopometrics: n = 2470 (I: n = 1199; C: n = 1258, n = 13 missing)
- Shuttle run: n = 2148 (I: n = 1134; C: n = 1000, n = 14 missing)
- CSA data: n = 158 (I: n = 89; C: n = 68, n = 1 missing)

n = 2856 eligible children

n = 2848 children included at Baseline (T0)
- Intervention schools (9) n = 1378 (boys n = 672, girls n = 706)
- Control schools (10) n = 1451 (boys n = 753, girls n = 698, n = 19 missing)

No parental approval n = 8

Figure 1. Flow chart
Effectiveness of JUMP-in, a Dutch primary school-based community intervention aimed at the promotion of physical activity.

Table 3. Baseline characteristics in the intervention and control schools.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Boys</th>
<th>P value*</th>
<th>Girls</th>
<th>P value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>8.6 (1.9)</td>
<td>8.6 (1.8)</td>
<td>8.5 (1.9)</td>
<td>8.5 (1.8)</td>
</tr>
<tr>
<td>Sports participation (%)</td>
<td>37.3</td>
<td>49.8</td>
<td>&lt;0.001</td>
<td>18.3</td>
</tr>
<tr>
<td>PA (c/m)&lt;sup&gt;1&lt;/sup&gt;</td>
<td>801.8 (241.1)</td>
<td>831 (303.1)</td>
<td>619.3 (147.7)</td>
<td>663.7 (162.5)</td>
</tr>
<tr>
<td>Fitness&lt;sup&gt;2&lt;/sup&gt;</td>
<td>6.3 (2.6)</td>
<td>5.8 (2.5)</td>
<td>5.1 (2.0)</td>
<td>4.6 (2.0)</td>
</tr>
<tr>
<td>BMI (kg/m&lt;sup&gt;2&lt;/sup&gt;)</td>
<td>18.0 (3.1)</td>
<td>18.1 (3.4)</td>
<td>18.4 (3.6)</td>
<td>18.1 (3.4)</td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td>62.6 (8.8)</td>
<td>62.0 (9.2)</td>
<td>62.1 (9.4)</td>
<td>61.8 (5.0)</td>
</tr>
<tr>
<td>Hip circumference (cm)</td>
<td>72.3 (9.4)</td>
<td>72.3 (9.8)</td>
<td>74.3 (11.4)</td>
<td>73.5 (10.0)</td>
</tr>
</tbody>
</table>

* Comparing intervention and control schools at baseline, using the Student t test (age, body mass index, fitness, physical activity (counts per minutes measured by accelerometers)) and χ² test (sports participation, weight status).

<sup>1</sup> Measured in subgroup n=158.
<sup>2</sup> Shuttle run score expressed as the number of laps after which a child stops the shuttle run test.

Intervention effects

Table 4 shows the values (uncorrected means (SD’s) or percentages) for all outcome measures at baseline and the two follow-up measurements. A significant intervention effect was found on organised sports participation among the total study sample (OR 2.8 (95% CI 2.18 to 3.62)) (table 4). No intervention effect was observed on daily PA behaviour (b=40 CPM; (95% CI −27 to 106)), BMI (b=0.07 kg/m<sup>2</sup> (95% CI −0.02 to 0.16)), hip (b=0.1 cm (95% CI −0.32 to 0.42)), waist circumference (b=0.3 cm (95% CI −0.15 to 0.75)) and shuttle run score (b=0.02 laps (95% CI −0.26 to 0.29)).
Table 4. Means (SD) for outcome measures at baseline (T0), 8 months’ (T1) and 20 months’ follow-up (T2)

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>T0</th>
<th>I</th>
<th>T1</th>
<th>T2</th>
<th>C</th>
<th>T0</th>
<th>T1</th>
<th>T2</th>
<th>b/OR* (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sports participation (%)</td>
<td>27.4</td>
<td>51.6</td>
<td>65.8</td>
<td>37.7</td>
<td>42.8</td>
<td>43.0</td>
<td></td>
<td></td>
<td><strong>2.8 [2.18; 3.62]</strong></td>
</tr>
<tr>
<td>PA (counts/min)</td>
<td>707 (217)</td>
<td>715 (238)</td>
<td>715 (234)</td>
<td>742 (252)</td>
<td>771 (236)</td>
<td>695 (232)</td>
<td><strong>40 [-27; 106]</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fitness (laps)</td>
<td>5.7 (2.4)</td>
<td>6.3 (2.4)</td>
<td>6.4 (2.4)</td>
<td>5.2 (2.3)</td>
<td>6.1 (2.4)</td>
<td>6.3 (2.3)</td>
<td><strong>0.02 [-0.26; 0.29]</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>18.2 (3.4)</td>
<td>18.7 (3.6)</td>
<td>19.1 (3.7)</td>
<td>18.1 (3.4)</td>
<td>18.4 (3.5)</td>
<td>18.8 (3.7)</td>
<td><strong>0.07 [-0.02; 0.16]</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hip (cm)</td>
<td>73.3 (10.5)</td>
<td>75.9 (10.9)</td>
<td>78.1 (10.5)</td>
<td>72.9 (9.9)</td>
<td>75.4 (10.1)</td>
<td>77.8 (10.2)</td>
<td><strong>0.1 [-0.32; 0.42]</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waist (cm)</td>
<td>62.3 (9.1)</td>
<td>65.3 (10.7)</td>
<td>66.0 (10.0)</td>
<td>61.6 (8.9)</td>
<td>64.3 (9.7)</td>
<td>64.9 (9.5)</td>
<td><strong>0.3 [-0.15; 0.75]</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Bold text denotes changes in favour of the intervention group.
* Analysed using multilevel analysis, adjusted for values at T0 and T1, gender, age, BMI and ethnicity.

Subgroup analyses
Gender and ethnicity were found to be effect modifiers. The intervention effect on organised sports participation was found to be stronger in girls than in boys (OR 3.6 (95% CI 2.3 to 5.6) and 2.2 (95% CI 1.7 to 2.8), respectively) and stronger in Moroccan and Turkish children (OR 3.2 (95% CI 1.9 to 5.2) and 4.2 (95% CI 3.6 to 5.7), respectively (table 5)).

Relationship between sports participation and shuttle run score
Children who started participating in organised sports and children who maintained participating in organised sports between T0 and T2 had a significantly higher score on the SRT at the end of the intervention period (table 6).
The association between changes in sport participation and changes in shuttle run scores is analysed using multilevel autoregressive analysis, in which the outcome variable shuttle run score is adjusted for its values at T0 and T1, gender, age, BMI and ethnicity. The independent variable, sports participation, was recoded into three dummy variables, with children who were inactive at both T0 and T2 as a reference group.
Table 5. Intervention effects on organised sports participation per subgroup.

<table>
<thead>
<tr>
<th></th>
<th>Difference between groups after 20 months (OR (95% CI))</th>
</tr>
</thead>
<tbody>
<tr>
<td>girls</td>
<td>3.6 [2.29 – 5.57]</td>
</tr>
<tr>
<td>boys</td>
<td>2.2 [1.71 – 2.79]</td>
</tr>
<tr>
<td>Turkish</td>
<td>3.2 [1.91 – 5.21]</td>
</tr>
<tr>
<td>Moroccan</td>
<td>4.2 [3.63 – 5.7]</td>
</tr>
<tr>
<td>Dutch</td>
<td>1.1 [0.62 – 2.1]</td>
</tr>
</tbody>
</table>

Outcomes are analysed using a multilevel analysis, adjusted for values at T0 and T1, age and body mass index.

Table 6. Relationship between sports participation and aerobic fitness.

<table>
<thead>
<tr>
<th>Group</th>
<th>became active</th>
<th>b</th>
<th>(95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td></td>
<td>0.20</td>
<td>0.06 – 0.3</td>
</tr>
<tr>
<td>Group 2</td>
<td>remained active</td>
<td>0.38</td>
<td>0.2 – 0.5</td>
</tr>
<tr>
<td>Group 3</td>
<td>became inactive</td>
<td>0.18</td>
<td>-0.06 – 0.4</td>
</tr>
</tbody>
</table>

DISCUSSION

The purpose of the present study was to evaluate the intervention effects of JUMP-in on sports participation, daily PA, BMI, hip and waist circumference and shuttle run score. After 20 months, the intervention group showed a significant increase in structural sports participation, especially in girls and Turkish and Moroccan children. Within the JUMP-in intervention approach, these groups were specifically targeted as high-risk groups, because they show the lowest levels of sports participation, have the lowest socio-economic background and are usually most difficult to reach by any preventive intervention that is not included in the regular school curriculum (Rosenbaum 1998).

Schools have been identified as a key setting for health promotion (Naylor 2009). However, an overview of the literature shows that, generally, school-based interventions aimed at the promotion of PA had no effect on overall leisure-time PA rates. Further, extracurricular school-based interventions often had problems with low attendance (Jago 2004; Dobbins 2009; Kriemler 2010). Although evidence is sparse, environmental strategies (interventions that change policy and practice) appear to promote PA in elementary schools effectively (Naylor 2009; Jago 2004). The present study proves that our intervention was successful in improving sports participation through a school-based strategy combining environmental and personal interventions.
A strength of the present study is the fact that the intervention was implemented by the school staff, city district and local partners in healthcare and sports themselves. JUMP-in was integrated into existing local initiatives and proved to be feasible and applicable in real-world settings and ethnically diverse and socio-economically deprived schools. Another strength was the objective measurement of PA by accelerometers. Further, sports participation was assessed in personal interviews by trained testers. Previous experiences in the pilot study pointed out that this method is much more reliable and prevents response bias and over-reporting of PA levels.

Our trial also has also some limitations. First, randomisation of schools was not possible, as the adoption and organisation in the intervention schools had to be prepared several months before the intervention started. However, children and parents were not aware of the existence of the other condition, which could have biased the results. Second, we modified the SRT by setting the lines at 18 m instead of the usual 20 m, because most primary school gyms were too small for a 20 m SRT. However, this was the same in intervention and control schools. Third, the accelerometers for PA measurement were used in a very small portion of the sample. Fourth, not all testers could be blinded to group assignment of the children.

We hypothesised that increased sports participation would lead to increased shuttle run scores. Although the intervention did not significantly improve shuttle run scores, we observed that children who started organised sports participation and children who remained active in organised sports had a higher shuttle run score at the last follow-up measurement than children who did not participate in organised sports at both measurements.

We found no intervention effect on anthropometrics. This may be explained by the fact that JUMP-in was primarily aimed at PA behaviour and did not include dietary behaviour. However, to offer overweight children tailored care, JUMP-in uses the Amsterdam ‘Overbruggingsplan,’ an intervention for overweight children carried out by the municipal child healthcare (Bulk-Bunschoten 2005). For overweight children detected by the pupil follow-up system in JUMP-in schools, extra care is available; obese children in all grades are directly referred to youth obesity clinics, and overweight children in grade 4 of JUMP-in schools are invited by the school nurse for one or more extra ‘consultations.’ Results of the Amsterdam child healthcare monitor indicate that the prevalence of overweight has decreased over the period 2006–2009 (Booij 2010). These findings suggest that the Amsterdam child healthcare is successful in decreasing of overweight and obesity. Therefore, JUMP-in continued the intensive collaboration with this child healthcare intervention.

Based on the results of the present study and the process evaluation, we adapted the contents and organisation of JUMP-in in 2009. To be able to reach a decrease in the prevalence of overweight, the new JUMP-in programme was extended, including improving dietary habits of children, school policies regarding healthy nutrition, and promotion of fruit and vegetable intake. To enhance PA behaviour, we planned activities promoting active transport to school and adaptations of school playgrounds to promote active playing in lunch breaks. Further, collaborations between disciplines in sports, welfare and care are intensified and institutionalised, and selective prevention and care
for children at risk (overweight, inactive or motor deficiencies) is embedded in the organisational structures of local partners and local policy. The effects of JUMP-in on organised sports participation and the resulting improvement in fitness are of great importance for the combat against the complex problems of youth obesity and inactivity.
Mediators of the effect of the JUMP-in intervention on physical activity and sedentary behaviour in Dutch primary school children from disadvantaged neighbourhoods.

Maartje van Stralen
Judith de Meij
Saskia te Velde
Marcel van der Wal
Willem van Mechelen
Dirk Knol
Mai Chin A Paw

Published in International Journal of Behavioral Nutrition and Physical Activity 2012; 9(1): 131 [Epub ahead of print].
ABSTRACT

**Background:** Important health benefits can be achieved when physical activity in children from low socio-economic status is promoted and sedentariness is limited. By specifying the mediating mechanisms of existing interventions one can improve future physical activity interventions. This study explored potential mediators of the long-term effect of the school-based multicomponent JUMP-in intervention on sport participation, outdoor play and screen time in Dutch primary schoolchildren from disadvantaged neighbourhoods.

**Methods:** In total, 600 primary schoolchildren (aged 9.8 ± 0.7, 51% girls, 13% Dutch ethnicity, 35% overweight) from 9 intervention and 10 control schools were included in the analyses. JUMP-in was developed using Intervention Mapping, and targeted psychological and environmental determinants of physical activity. Outcome behaviours were self-reported sport participation, outdoor play, TV-viewing behaviour and computer use. Potential mediators were self-reported psychological, social and physical environmental factors.

**Results:** JUMP-in was effective in improving sport participation after 20 months, but not in improving outdoor play, or reducing TV-viewing or computer time. JUMP-in was not effective in changing hypothesized mediators so no significant mediated effects could be identified. However, changes in self-efficacy, social support and habit strength were positively associated with changes in sport participation, and changes in social support, self-efficacy, perceived planning skills, enjoyment and habit strength were positively associated with changes in outdoor play. Changes in enjoyment was positively associated with changes in TV-viewing while parental rules were negatively associated. Having a computer in the bedroom and enjoyment were positively associated with changes in computer use, while changes in parental rules were negatively associated.

**Conclusions:** Besides a significant positive effect on sports participation, no significant intervention effect on outdoor play, screen time or any of the potential mediators was found. This suggest that other (unmeasured) factors operated as mediating mechanisms of the intervention, that we used unsuccessful intervention strategies, that the strategies were inappropriately implemented, or that children are unable to accurately recall past activities and cognitions. Additionally, the school setting might not be the sole channel to influence leisure time activities. Still, several personal and environmental constructs were found to be relevant in predicting change in sport participation, outdoor play and screen behaviour and seem to be potential mediators. Future interventions are recommended including more effective strategies targeting these relevant constructs, addressing different constructs (e.g. pedagogic skills of parents), and focusing on different implementation settings.
Regular physical activity (PA) and low levels of sedentary behaviour (SB) have been associated with a decreased risk of physical and mental health problems (Biddle 2011; Fedewa 2011; Ortega 2008; Reilly 2005; Chinapaw 2011). Participation in physical and sedentary activities have a strong socio-economic and ethnic gradient, with children from a low socio-economic status or from an ethnic minority being less likely to participate in regular PA and more likely to be sedentary (Brug 2012; Brug 2010; Delva 2006; Gordon-Larsen 2003; Haug 2009; Lobstein 2003; Sallis 2000; van der Horst 2009). Important health benefits can be achieved when regular PA in children from low socio-economic status or ethnic minorities is promoted, initiation of activity of inactive children is encouraged and sedentary time is limited.

Schools have been identified as important arenas for PA promotion in young people. While school-based obesity prevention interventions were to some degree effective in changing PA, effect sizes were small (Summerbell 2005; Waters 2011). To increase their effectiveness knowledge of effective mechanisms underlying PA behaviour change is needed (Baranowski 1998). By conducting mediation analysis one can gain insight into which mechanisms are critical for influencing PA, e.g. insight into whether the intervention affected the potential mediator and whether this in turn affected the behaviour (Mackinnon 2007). This insight into what works and what does not work in interventions informs future intervention development and can improve their (cost)-effectiveness (Hafeman 2009). Even in the absence of a significant main effect on the behaviour, these so-called mediation analysis should be conducted as it unfolds why the intervention was ineffective in changing behaviours, and how the intervention should be adapted to increase its effectiveness. Consequently, mediation analyses will not only increase the effectiveness of future interventions, but they will also help to reduce their costs (Hafeman 2009) and will add to our understanding of behaviour change.

A systematic review found strong evidence for the mediating effect of self-efficacy on the effect of interventions on PA, while moderate evidence was found for the mediating effect of intention. The evidence with regard to mediators of intervention effects on sedentary behaviour is limited and inconclusive (van Stralen 2011). To date most overweight prevention intervention studies analyzed the mediating effect of personal determinants (e.g. self-efficacy, intention), whereas studies examining mediating effects of changes in the home and school environmental are largely lacking. In addition, all except one SB study (Robinson 2006) were conducted among secondary schoolchildren, limiting the generalizability of the findings to other age groups, such as primary schoolchildren. Therefore, more studies assessing mediators among primary schoolchildren are needed, especially on potential environmental mediators and potential mediators of sedentary behaviour interventions.
The JUMP-in intervention is a theory, practice and evidence based primary school-based intervention aimed at improving PA in primary schoolchildren living in disadvantaged areas in Amsterdam, the Netherlands (de Meij 2010). The intervention proved effective in changing the primary outcome organized sports participation (de Meij 2011). The aims of the present study were 1) to examine the JUMP-in intervention effects on outdoor play and screen behaviour; and 2) to conduct secondary data analysis to examine whether changes in personal (e.g. attitude, self-efficacy, intention, perceived planning skills) and environmental determinants (e.g. social modeling, social pressure, social norm, social support, perceived barriers) mediated the effect of the intervention on sport participation, outdoor play and screen behaviours (see Figure 1). The intervention was developed to target all of these underlying constructs, and it was hypothesized that these constructs would act as mediators in predicting changes in sport participation, outdoor play and screen behaviours.

Figure 1: Conceptual mediation model

METHODS

Procedure and participants.
This two-year controlled trial was carried out in nineteen primary schools situated in disadvantaged areas in Amsterdam, the Netherlands. A total of 708 boys and girls from grades 6 and 7 (aged 8–12) participated in the trial, and were interviewed about their sport participation and completed questionnaires on participation in outdoor play, screen behaviours and their potential mediators. Nine intervention schools were recruited in two city districts in Amsterdam, the Netherlands. Ten comparable control schools were recruited from geographically separated city districts to limit the possibility of contamination between intervention and control schools.
Random assignment of schools to a control or intervention group was not possible because of prolonged preparations needed for a successful adoption and implementation of JUMP-in: a school and environmental scan had to be carried out and commitment had to be built among school staff and local partners in sports, care and prevention. Further, networks had to be created among participating organizations, and organizational practices had to be prepared for the implementation of the program and related protocols. The control schools were asked to continue their usual curriculum during the study period.

**Intervention**

JUMP-in is a school-based intervention primarily aimed at the promotion of sports participation among children in socially and economically deprived areas in Amsterdam. The JUMP-in intervention, targeted sport participation, and outdoor play. The intervention did not directly target screen behaviours. However it was expected that by targeting daily PA, screen behaviours would be influenced as well. JUMP-in was found to be effective in changing organized sport participation (de Meij 2011). More detailed information concerning the systematic development and design of the intervention can be found elsewhere (de Meij 2010), and is briefly described below. The Intervention Mapping protocol (Bartholomew 2011), and RE-AIM framework (Glasgow 1999) were applied in order to systematically develop and design the intervention. The intervention was based on the Attitude- Social Influence- self-Efficacy (ASE) model (de Vries 1998), the Environmental Research framework for weight Gain prevention (EnRG) framework (Kremers 2006) and information collected in a pilot study (Jurg 2006; Jurg 2008). The EnRG framework is a dual process model that combines social cognitive theories (e.g. ASE model (de Vries 1998) and social-ecological theories (i.e. ANGELO framework (Swinburn 1999). In concordance with the EnRG framework, JUMP-in assumed that behaviour is influenced by the environment directly and indirectly, mediated by ASE determinants. The JUMP-in intervention therefore targeted primary schoolchildren’s PA by changing physical, social and political environmental determinants, and cognitive mediators, including social influences, attitude and self-efficacy (see table 1 for an overview of the potential mediators). The JUMP-in is a school-based multicomponent intervention, including 1. Pupil follow up system, a yearly monitoring instruments of PA, BMI and motor skills; 2. School sport activities, daily offer of structural and easily accessible school sport activities in or near the school premises; 3. Calendars offering recurrent breaks for PA, relaxation and posture exercises during regular lessons; 4. Personal workbooks for children and their parents with assignments to perform in class and at home and an instruction book for the school staff; 5. Parental information services including information meetings, courses and sport activities for parents; and 6. Extra care for children at risk, wherein children detected by the pupil follow-up system receive additional adapted physical education lessons or motor remedial teaching. Table 1 gives an overview of the hypothesized working mechanisms of the intervention including the potential mediators, intervention strategies, theoretical methods and tools used to change the potential mediators. The intervention duration was 8 months in the first year (from November 2006 to June 2007) and 9 months in the second year (September 2007 to June 2008).
Measures

Measures were performed at the beginning (T0: September-October 2006) and end of the first school year (T1: May–June 2007) and repeated at the end of the second school year (T2: May–June 2008). Since the implementation of the complete program took more than one school year this study reports on the T0 and T2 measurements. All measurements took place at school and were performed according to standardized procedures by trained testers. Sports participation was assessed in a personal interview. Trained interviewers asked whether the child had participated in organized sports activities at least once a week for a minimum of three months (yes or no) directly preceding the interview. Following the results of the pilot study, an interview was the most reliable way to classify sports participation, compared to questionnaires and attendance lists.

Unorganized outdoor play, screen behaviours and mediators were self-reported in a questionnaire completed in the classroom. Completion took about 45 minutes. The questions concerning outdoor play and screen behaviours were pre-tested and based on previous studies (Sallis 1991; Sallis 1996; Tremblay 2001; Welk 2000). For both variables only the frequency of activities was assessed since children this age are not able to accurately recall the duration of certain activities (Sirard 2001). Children reported their weekly unorganized outdoor play for both summer and winter: How often do you play outdoor? never or almost never [0], less than once a week [0.5], once a week [1], 14 times per week [3], every day or almost every day [6]. The mean value of winter and summer scores were averaged resulting in a total outdoor play score ranging from 0 to 6.

Leisure time screen behaviour was determined by assessing the frequency of both weekly TV viewing and computer usage (e.g. gaming, internet, playing “gameboy” etcetera). Since children are better able to recall their activities when a day is divided into parts (Tremblay 2001), both TV viewing and computer usage were assessed for three parts of the day: before school, after school and in the evening: How often do you watch TV in the evening? never or almost never [0], less than once a week [0.5], once a week [1], 14 times per week [3], every day or almost every day [6]. Before school, after school and in the evening, scores were summed resulting in a sum score ranging from 0 to 18.

Table 1 gives an overview of the hypothesized personal and environmental mediators per behaviour, including their scales and Chronbach’s alphas. Cronbach’s alphas ranged from 0.65 for cons towards sport participation at baseline to 0.96 for social pressure towards sport participation at 20 months follow-up.

Statistical analyses

We aim to examine the intervention effect on outdoor play and screen behaviours and to conduct secondary analysis by examining the mediators of the intervention effect on sport participation, outdoor play and screen behaviours. To accomplish our goals, descriptive statistics and t-tests were conducted to examine frequencies of the baseline characteristics and differences between the intervention and control group using SPSS (Version 15.0). The intervention effects on the behaviours were examined with regression analyses using robust maximum likelihood (MLR) estimator in Mplus wherein the behaviour was regressed on the intervention condition, controlling...
Mediators of the effect of the JUMP-in intervention on physical activity and sedentary behaviour in Dutch primary school children from disadvantaged neighbourhoods.

for baseline values, covariates and clustering within schools (Muthén and Muthén, Version 6.1). MLR is a maximum likelihood estimator with standard errors and chi-square statistics, that has been shown to be robust to non-normality and non-independence of observations (Muthén 2009).

To test the mediated effects, a multiple mediator path model using MLR estimator was conducted (see Figure 1) informed by the product-of-coefficient test (Mackinnon 2007), which consists of three steps: 1). Action theory test, which assesses the intervention effect on potential mediator at T2, controlled for the mediator at baseline (T0) (a-coefficient); 2). Conceptual theory, which assesses the association between potential mediators at T2 and outcome variable at T2, controlled for the intervention and baseline values of the mediator and outcome (b-coefficient); and 3). Mediated effect test, wherein the extent of the mediated effect is evaluated, by multiplying the a-coefficient and b-coefficient (a*b coefficient). The path model was developed in two steps. The first step involved testing the factor score of each mediating construct using confirmatory factor analysis, as described below in more detail. The second step involved testing the hypothesized mediators of the intervention on the outcome variable using path modeling. All analyses were adjusted for age, BMI and gender. TV watching and computer use were analyzed in the same model simultaneously. Since mediation can still occur without a significant intervention effect on the outcome (Cerin 2009), mediation analyses were also conducted in absence of a significant main effect.

Model specification
For all mediating variables measured with more than two items, factor scores were created by conducting confirmatory factor analysis by loading each item on a latent variable and requesting the f-scores. These factor scores are based on the factor loadings of each item and are therefore a kind of weighed sum scores. Factor scores were preferred above mean or sum scores since they control for measurement error. One item measures (e.g. screen behaviour mediators) and mean scores of two items measures (e.g. intention) were included as observed variables.

As seen in Figures 2, 3, and 4, the path models included (1) paths between the potential mediators at baseline (T0) and 20-months (T2) (not shown in figure); (2) paths from the potential mediators to the behaviour at baseline; (3) paths from the potential mediators at T2 to the outcome variable at T2 (b-coefficient of mediated effect); and (4) paths between the intervention and measures of the potential mediators at T2 (a-coefficient of mediated effect). The intervention was coded as control (0), or intervention (1) group. There were correlations allowed between the hypothesized mediators at time 0 and time 2 (not shown in figure).

Model fit
A combination of fit indices was used to determine model fit. A good model fit is indicated by p > .05 for the Chi-square test (Tabachnick 2007). Since the Chi-square test is influenced by the sample size, Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) were calculated to evaluate the model fit. A minimally acceptable fit is
obtained when RMSEA < .06, CFI > .95 and TLI > .95 (Hu 1999). Chi-square tests were conducted to test for differences between nested models. The fit of the sport participation model could not be calculated using MLR estimator due to the dichotomous outcome but was perceived as acceptable when the goodness of fit indexes using WLSMV estimator (i.e. Weighted Least Square parameter estimator using a diagonal weight matrix with standard errors and mean- and variance adjusted chi-square test statistic (Muthén 2009) were acceptable using the cut-offs presented above.
Table 1: Potential mediators, measurement scales, Cronbach’s alpha, theoretical methods and related intervention strategies.

<table>
<thead>
<tr>
<th>Potential mediator</th>
<th>Scale</th>
<th>Cronbach’s alpha</th>
<th>Theoretical method (theory)</th>
<th>Practical strategy/ Intervention strategy</th>
<th>Procedures, Material and Provider</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sport participation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pros - Cons</td>
<td>Seven items measuring pros of sports participation (e.g., if I participate in sports I will become stronger), and six items measuring cons of sports participation (e.g., if I participate in sports it will cost me too much time)</td>
<td>Pros: T0: 0.69 T2: 0.75 Cons: T0: 0.65 T2: 0.66</td>
<td>Theory of Planned Behavior Theory of reasoned action Persuasive communication</td>
<td>Make children aware of the importance of sports. Provide children direct positive experiences with sports. Attitude change through reinforcement, Repeat positive experiences. Facilitate sports participation. Alter physical environments to include more sports options. Design tailored offers in order to experience desired benefits.</td>
<td>Physical education (PE) teachers talk with children about the importance of sports. During lessons PE children get acquainted with a variety of attractive sports. City district and sports associations organize enjoyable after school sports activities and adapted sports offers (moderate intensity, non competitive etc). Work book-assignment for children to explicate why they do or do not participate in sports.</td>
</tr>
<tr>
<td>Social modeling</td>
<td>Five items on how much their father, mother, brother(s), sister(s), and friends participated in sports (e.g. My father participates in sports...) Scale: 0= never to 4= (almost) every day.</td>
<td>T0: 0.67 T2: 0.68</td>
<td>Social Cognitive Theory</td>
<td>Stimulate child through imitation Make parents aware of the importance of the parental role model. Notes for parents in the work book and parental information meetings: ‘Sports and PA behavior is important for your child. Join your child in their leisure time!’</td>
<td></td>
</tr>
<tr>
<td>Social norm</td>
<td>Five items on how important their father, mother, brother(s), sister(s) and friends perceived participation in sports (e.g. my father believes that participants in sport is important) Scale: 2= certainly not to +2= certainly yes</td>
<td>T0: 0.89 T2: 0.90</td>
<td>Theory of reasoned action Persuasive communication Social Cognitive Theory</td>
<td>Make children and parents aware of the importance of sports participation</td>
<td>Information in parental meetings and notes in the les book. Teachers PE motivate and stimulate inactive children to participate in sports.</td>
</tr>
<tr>
<td>Social pressure</td>
<td>Five items on whether their father, mother, brother(s), sister(s) and friends believe that (s)he must participate in sports (e.g. My father believes that I have to participate in sports) Scale: 2= certainly not to +2= certainly yes</td>
<td>T0: 0.94 T2: 0.96</td>
<td>Persuasive communication Social Cognitive Theory</td>
<td>Make children and parents aware of reasons to participate in sports / excuses not to sport. Assignment In the work book to collect all reasons children have regarding not participating in sports and all excuses parents may have to stimulate them (not) to sports.</td>
<td></td>
</tr>
<tr>
<td>Potential mediator</td>
<td>Scale</td>
<td>Cronbach's alpha</td>
<td>Theoretical method (theory)</td>
<td>Practical strategy/ Intervention strategy</td>
<td>Procedures, Material and Provider</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------</td>
<td>------------------</td>
<td>-----------------------------</td>
<td>------------------------------------------</td>
<td>----------------------------------</td>
</tr>
</tbody>
</table>
| Social support     | Six items on the support the child received from family and friends to participate in sports ("how often do your friends ask you to join them in participating in sports? Scale: 0= Never to 4= (almost) every day. | T0: 0.73  
T2: 0.74 | Reinforcement theory  
Social Cognitive Theory | Encourage parents to support their children in sports and provide them examples.  
Teachers motivate and stimulate children | Notes for parents in “This is the way you Move!” and parental information:  
‘Children need to listen to their body. They all want to learn new movements. Ask them what they want to learn and help them to train these skills.’  
‘Help your child in finding a sport that fits.’  
Schoolteachers motivate and stimulate children who started sports. |
| Self-efficacy      | Eight items measuring the perceived ability to participate in sports in a variety of difficult situations (e.g. do you think it is hard to participate in sports when there is a nice program on TV?)  
Scale: -2 = very difficult to +2= very easy | T0: 0.79  
T2: 0.84 | Theory of Planned Behavior  
Reinforcement theory  
Task Experience theory  
Active learning theory | Tackle barriers and create opportunities for sports participation.  
Repeat positive experiences with sports.  
Train skills with guided practice and feedback. | Children are offered easy accessible sports offers tailored to their preferences and skills.  
Teachers stimulate and support them to participate. |
| Perceived barriers | Nine items measuring whether the child perceived any situational or personal barriers regarding participating in sports (e.g. sport clubs are too far away from my home).  
Scale: -2= totally disagree to +2= totally agree. | T0: 0.86  
T2: 0.81 | Decision making theory  
Theory of reasoned action  
Model of physical exercise and habit formation  
The Dual Process view | Tackle barriers for sports participation and facilitate participation  
Make children aware of hampering factors, remedies and constraints for their personal sports behavior.  
Discover what elements/ motives attract children to sports and involve these in the strategies  
Inventory perceived hampering factors among children and parents. | Sports are offered:  
- Without costs or with very low costs.  
- directly after school hours  
- in or near the school premises  
- tailored to the target group.  
Parents are involved in the recruitment of children. |
| Perceived sport competence | Eight items on how much they perceived themselves to resemble the children mentioned in the examples (e.g. some children are very good in a variety of sports).  
Scale: -2= I certainly do not, +2= I certainly do too! | T0: 0.77  
T2: 0.80 | Reinforcement theory  
Active learning theory | Provide children positive experiences in order to increase perceived competence and self esteem.  
Tailor sports offers.  
Offer skill training with guided practice and feedback. | Children who are behind in their motor development are offered lessons motor remedial teaching.  
PE teachers and trainers in school sport clubs aim to increase perceived sport competence and self esteem. |
<table>
<thead>
<tr>
<th>Potential mediator</th>
<th>Scale</th>
<th>Cronbach's alpha</th>
<th>Theoretical method (theory)</th>
<th>Practical strategy/ Intervention strategy</th>
<th>Procedures, Material and Provider</th>
</tr>
</thead>
</table>
| Intention          | Two items measuring the intention of changing behavior in the next half year and within the next month respectively. Scale: -2 = certainly no to +2 = certainly yes. | T0: 0.73  
T2: 0.82 | Model of physical exercise and habit formation, Theory of Planned Behavior, Theory of reasoned action, Active learning theory, Decision making theory, Social Cognitive Theory | Create easy accessible opportunities for sports participation. Provide children positive experiences with sports. | Children are offered easy accessible sports offers tailored to their preferences and skills. Teachers stimulate and support children to participate. |
| Planning skills    | Nine items on whether the child finds it difficult or easy to plan sports activities (e.g., do you find it difficult or easy to ask your friend to participate in sports together). Scale: -2 = very difficult to +2 = very easy | T0: 0.85  
T2: 0.85 | Task Experience theory, Model of physical exercise and habit formation, Theory of reasoned action, Active learning theory | Make children aware of all things they have to organize/prepare for sports participation. Create opportunities to carry out plans and to evaluate experiences. | An assignment in the work book to write down what sport skills you want to learn, from who, where, what material is needed and how long it will take. The last chapter is directed to planning skills and self regulation with regard to leisure time sports behavior. Children are asked to fill in a day/week-calendar with all actions they have to plan and realize their own leisure time physical activities. Distinction is made between a school day and a weekend day. |
| Habit strength     | Six items on whether sports participation is a habit (e.g., I would find it hard not to participate in sports) Scale: -2 = certainly no to +2 = certainly yes | T0: 0.92  
T2: 0.88 | Model of Physical Exercise and Habit Formation, The Dual Process view | Make sports participation part of the weekly routine of the child. | Children are stimulated to participate in sports after school time. They are expected to follow the rules regarding presence etc. |
<p>| Preference/ Liking | One item on how much the child likes to participate in a range of activities (e.g., how much do you like the next activities: sports). Scale: 0 to 10 | - | Active learning theory | Provide children positive experiences with sports. | Children are offered easy accessible sports offers tailored to their preferences and skills. |</p>
<table>
<thead>
<tr>
<th>Potential mediator</th>
<th>Scale</th>
<th>Cronbach’s alpha</th>
<th>Theoretical method (theory)</th>
<th>Practical strategy/ Intervention strategy</th>
<th>Procedures, Material and Provider</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outdoor play</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pros - Cons</td>
<td>Six items measuring pros of outdoor play (e.g., if I play outdoors I will become stronger), and four items measuring cons of outdoor play (e.g., if I play outdoors do I get injured)</td>
<td>Pros T0: 0.73 T2: 0.76 Cons T0: 0.71 T2: 0.71</td>
<td>Theory of Planned Behavior Theory of reasoned action Persuasive communication</td>
<td>Make children aware of the importance of daily PA. Provide children positive experiences with PA.</td>
<td></td>
</tr>
<tr>
<td>Social pressure</td>
<td>One item on how often parents tell the child that he has to play outdoors</td>
<td>Social Cognitive Theory Persuasive communication</td>
<td>Provide parents knowledge regarding importance of daily PA. Motivate parents to stimulate daily PA behavior of their children.</td>
<td>Notes for parents in “This is the way you Move!” and in the JUMP-in Parental Information Service directed to the importance of the parental role in stimulating children to be daily physically active: “make agreements with your child and remind them to their plans” or “Make sure your child is physically active all days of the week; also on weekend days”. An assignment for children to note what they want to learn, from whom, where and how long it will take.</td>
<td></td>
</tr>
<tr>
<td>Social support</td>
<td>One item on how often parents take the child somewhere to play outdoors</td>
<td>Social Cognitive Theory Reinforcement theory</td>
<td>Motivate parents to support daily PA behavior of their children and provide examples.</td>
<td>Information for parents directed to what they can do to support their children in leisure time PA behavior. For example notes in the work book: “Discover the talents and preferences of your child”, “Help your child trying some of the PA ideas he/she has collected at school”, “Your child is proud of what it can do! Pay attention to that: give a compliment, take a photo and help him/her to get better” or “Your child learns about his /her body. Ask at home what he/she has learned”.</td>
<td></td>
</tr>
<tr>
<td>Potential mediator</td>
<td>Scale</td>
<td>Cronbach’s alpha</td>
<td>Theoretical method (theory)</td>
<td>Practical strategy/ Intervention strategy</td>
<td>Procedures, Material and Provider</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------</td>
<td>------------------</td>
<td>-----------------------------</td>
<td>------------------------------------------</td>
<td>----------------------------------</td>
</tr>
</tbody>
</table>
| **Self-efficacy**  | Eight items measuring the child’s perceived ability to play outdoors in a variety of difficult situations (e.g. do you think it is hard to play outdoors when there is a nice program on TV?) Scale: -2 = very difficult to +2 = very easy | T0: 0.82  
T2: 0.84 | Theory of Planned Behavior   
Reinforcement theory   
Task Experience theory   
Active learning theory | Tackle barriers and create opportunities for PA. Provide children positive experiences with PA. Train PA skills with guided practice and feedback. | Providing positive experiences with PA is a priority in lessons PE. Teachers PE and trainers in school sport clubs aim to decrease feelings of negative perceived sport competence. They encourage children to organize PA games, which they can play in their leisure time. In “This is the way you Move!” children are encouraged to expose their PA talents; “organize a theatre in which all children present their unique movement-trick make a collage from yourselves in your favorite movement”. |
| **Panning skills** | Six items on whether the child finds it difficult or easy to play outdoors (e.g. do you find it difficult or easy to ask your friend to play outdoors together). Scale: -2 = very difficult to +2 = very easy | T0: 0.79  
T2: 0.78 | Task Experience theory   
Model of physical exercise and habit formation   
Theory of reasoned action   
Active learning theory | Make children aware of all things they have to organize/ prepare for their daily PA. Create opportunities to carry out plans and to evaluate experiences. | In the les book the last chapter is directed to planning skills and self regulation with regard to leisure time PA behavior. Children are asked to fill in a day/week-calendar with all actions they have to plan and realize their own leisure time physical activities. Distinction is made between a school day and a weekend day. |
| **Perceived barriers** | Eight items regarding the availability and possibilities to play outdoors in the child’s neighborhood (e.g. In my neighborhood there is a place where I can play outdoor). Scale: -2 = certainly not to +2 = certainly yes. | T0: 0.82  
T2: 0.85 | Model of Physical Exercise and Habit Formation   
The Dual Process view   
Decision making theory | Make children aware of their social and physical environment (at school, at home and at the route between home and school). Make children aware of their preferences and wishes regarding environmental factors influencing outdoor play. Alter physical environments to create more PA options. | In les books attention is directed to awareness of the environment with assignments such as; Draw the playground at your school/home/ friends neighborhood (children can use stickers). Tell about your drawing: what is cool, what should be adapted to make it a better place for outdoor play? |
| **Habit strength** | Six items on whether outdoor play is a habit (e.g. I find it hard not to play outdoors every day) Scale: Scale: -2 = certainly no to +2 = certainly yes | T0:0.82  
T2:0.89 | Model of Physical Exercise and Habit Formation   
The Dual Process view | Make outdoor play part of the weekly routine of the child. | Children are stimulated to play outdoors after school time. In one chapter in the les book children fill in their personal favorite PA ideas for playing. |
<table>
<thead>
<tr>
<th>Potential mediator</th>
<th>Scale</th>
<th>Cronbach's alpha</th>
<th>Theoretical method (theory)</th>
<th>Practical strategy/ Intervention strategy</th>
<th>Procedures, Material and Provider</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preference/Liking</td>
<td>One item on how much the child likes to play outdoors (e.g. how much do you like the next activities: outdoor play). Scale: 0 to 10.</td>
<td></td>
<td>Active learning theory</td>
<td>Let children think and tell about their favorite PA activities in their leisure time. Stimulate them to try new PA experiences.</td>
<td>In one chapter in the les book children fill in their personal favorite PA ideas for playing: • in all seasons • outdoors • together with your parents • in-class • to make you feel strong</td>
</tr>
<tr>
<td>Screen behavior</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Availability TV in bedroom</td>
<td>One item on whether the child has a TV in bedroom (&quot;Do you have a TV in your bedroom?&quot;) Scale: 0= no 1= yes</td>
<td>-</td>
<td>Na</td>
<td>Na</td>
<td>None</td>
</tr>
<tr>
<td>Availability TV at home</td>
<td>One item on how many TVs the child has at home (&quot;How many TVs are available at your home?&quot;)</td>
<td>-</td>
<td>Na</td>
<td>Na</td>
<td>None</td>
</tr>
<tr>
<td>Perceived rules TV viewing</td>
<td>One item on rules at home on time the child is allowed to watch TV (&quot;Are there rules at home about how long you are allowed to watch TV?&quot;) Scale: 0= no 1= yes</td>
<td>-</td>
<td>Na</td>
<td>Na</td>
<td>None</td>
</tr>
<tr>
<td>Preference TV viewing</td>
<td>One item on how much the child likes to watch TV (e.g. how much do you like the next activities: TV watching). Scale: 0 to 10.</td>
<td>-</td>
<td>Na</td>
<td>Na</td>
<td>None</td>
</tr>
<tr>
<td>Availability computer in bedroom</td>
<td>One item on whether the child has a computer in bedroom (&quot;Do you have a computer (or playstation/x-box) in your bedroom?&quot; Scale: 0= no 1= yes</td>
<td>-</td>
<td>Na</td>
<td>Na</td>
<td>None</td>
</tr>
<tr>
<td>Preference computer use</td>
<td>One item on how much the child likes to use the computer (e.g. how much do you like the next activities: use computer). Scale: 0 to 10.</td>
<td>-</td>
<td>Na</td>
<td>Na</td>
<td>None</td>
</tr>
</tbody>
</table>
RESULTS

Table 2 shows the baseline values of children’s demographics, participation in behaviour and mediator values. In total 600 children had complete data on the outcome variables at baseline and T2 (aged 9.8 ± 0.7 years, 51% girls, 13% Dutch ethnicity). Mean BMI was 19.0±3.6, 35% was overweight and 13% obese. At baseline, 41% of the children reported to have participated in sports, and children had played on average 4 times/week (SD= 1.7) outdoors, had watched television (TV) 10 times/week (SD=5.2) and had used the computer 5 times/week (SD=5.1). In the intervention group significantly more children were from a Turkish background, and less children from a Dutch background. In addition, in the intervention group fewer children had participated in sports than in the control group (35 vs. 45%) at baseline.

Table 2. Baseline values (mean ± standard deviation or percentages) of demographics, participation in behaviour and mediator scores for the total sample, and the control and intervention group separately.

<table>
<thead>
<tr>
<th>Study characteristics baseline</th>
<th>Total</th>
<th>Control</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=600</td>
<td>N=341</td>
<td>N=259</td>
</tr>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>9.8±0.7</td>
<td>9.8±0.8</td>
<td>9.9±0.7</td>
</tr>
<tr>
<td>Gender (%girls)</td>
<td>51%</td>
<td>50%</td>
<td>53%</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dutch (%)</td>
<td>13%</td>
<td>16%</td>
<td>9%</td>
</tr>
<tr>
<td>Moroccan (%)</td>
<td>37%</td>
<td>36%</td>
<td>39%</td>
</tr>
<tr>
<td>Turkish (%)</td>
<td>19%</td>
<td>14%</td>
<td>25%</td>
</tr>
<tr>
<td>Surinam/ Antillean (%)</td>
<td>12%</td>
<td>15%</td>
<td>8%</td>
</tr>
<tr>
<td>Other, western (%)</td>
<td>6%</td>
<td>8%</td>
<td>5%</td>
</tr>
<tr>
<td>Other, non-western (%)</td>
<td>13%</td>
<td>12%</td>
<td>15%</td>
</tr>
<tr>
<td>BMI (mean ± SD)</td>
<td>19.0±3.6</td>
<td>18.8±3.6</td>
<td>19.2±3.6</td>
</tr>
<tr>
<td>% overweight</td>
<td>35%</td>
<td>34%</td>
<td>36%</td>
</tr>
<tr>
<td>% obese</td>
<td>13%</td>
<td>14%</td>
<td>11%</td>
</tr>
<tr>
<td><strong>Behaviours</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sports participation (% yes)</td>
<td>41%</td>
<td>45%</td>
<td>35%*</td>
</tr>
<tr>
<td>Outdoor play (times/week)</td>
<td>4.1±1.7</td>
<td>4.1±1.7</td>
<td>4.1±1.7</td>
</tr>
<tr>
<td>Screen behaviours</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TV viewing (times/week)</td>
<td>10.1±5.2</td>
<td>9.8±5.3</td>
<td>10.3±5.1</td>
</tr>
<tr>
<td>Computer use (times/week)</td>
<td>5.4±5.1</td>
<td>5.4±5.1</td>
<td>5.5±5.0</td>
</tr>
<tr>
<td><strong>Mediators- sports</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pros [-2,2]</td>
<td>1.2±0.5</td>
<td>0.2±0.5</td>
<td>1.2±0.5</td>
</tr>
<tr>
<td>Cons [-2,2]</td>
<td>-5±0.7</td>
<td>-0.5±0.7</td>
<td>-0.5±0.7</td>
</tr>
<tr>
<td>Social modelling [0,4]</td>
<td>2.3±1.1</td>
<td>2.2±1.1</td>
<td>2.3±1.2</td>
</tr>
<tr>
<td>Social pressure [-2,2]</td>
<td>0.8±1.1</td>
<td>0.9±1.1</td>
<td>0.8±1.2</td>
</tr>
<tr>
<td>Social norm [-2,2]</td>
<td>1.3±0.7</td>
<td>1.3±0.8</td>
<td>1.4±0.7</td>
</tr>
<tr>
<td>Social support [0,4]</td>
<td>1.8±1.0</td>
<td>1.8±1.1</td>
<td>1.9±1.0</td>
</tr>
<tr>
<td>Self-efficacy [-2,2]</td>
<td>0.0±0.8</td>
<td>-0.0±0.8</td>
<td>0.1±0.8</td>
</tr>
<tr>
<td>Sport competence [-2,2]</td>
<td>0.7±0.7</td>
<td>0.7±0.7</td>
<td>0.8±0.7</td>
</tr>
<tr>
<td>Perceived Barriers [-2,2]</td>
<td>-0.9±0.8</td>
<td>-0.8±0.8</td>
<td>-0.9±0.8</td>
</tr>
<tr>
<td>Intention [-2,2]</td>
<td>0.9±1.0</td>
<td>0.9±1.0</td>
<td>1.0±1.0</td>
</tr>
</tbody>
</table>
### Study characteristics baseline

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Control</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning skills [-2,2]</td>
<td>0.8±0.8</td>
<td>0.8±0.8</td>
<td>0.9±0.7</td>
</tr>
<tr>
<td>Habit strength [-2,2]</td>
<td>0.8±0.9</td>
<td>0.9±0.9</td>
<td>0.8±0.9</td>
</tr>
</tbody>
</table>

### Mediators outdoor play

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Control</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pros [-2,2]</td>
<td>1.2±0.7</td>
<td>1.2±0.7</td>
<td>1.2±0.7</td>
</tr>
<tr>
<td>Cons [-2,2]</td>
<td>-7±0.9</td>
<td>-7±0.9</td>
<td>-0.7±0.9</td>
</tr>
<tr>
<td>Social support [0,6]</td>
<td>2.5±2.5</td>
<td>2.5±2.5</td>
<td>2.5±2.4</td>
</tr>
<tr>
<td>Social modelling [0,6]</td>
<td>2.3±2.3</td>
<td>1.9±2.1</td>
<td>1.8±2.0</td>
</tr>
<tr>
<td>Self-efficacy [-2,2]</td>
<td>-0.0±0.9</td>
<td>-0.1±0.9</td>
<td>0.1±0.9*</td>
</tr>
<tr>
<td>Planning skills [-2,2]</td>
<td>0.9±0.8</td>
<td>0.9±0.8</td>
<td>1.0±0.8</td>
</tr>
<tr>
<td>Environmental barriers [-2,2]</td>
<td>1.1±0.8</td>
<td>1.1±0.8</td>
<td>1.1±0.8</td>
</tr>
<tr>
<td>Enjoyment [0,10]</td>
<td>9.0±1.9</td>
<td>9.0±1.9</td>
<td>9.0±1.9</td>
</tr>
<tr>
<td>Habit strength [-2,2]</td>
<td>0.9±0.8</td>
<td>0.9±0.8</td>
<td>0.9±0.9</td>
</tr>
</tbody>
</table>

### Mediators sedentary behaviour

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Control</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>TV in bedroom (%yes)</td>
<td>52%</td>
<td>50%</td>
<td>54%</td>
</tr>
<tr>
<td># TVs at home</td>
<td>2.3±1.3</td>
<td>2.3±1.3</td>
<td>2.3±1.3</td>
</tr>
<tr>
<td>Enjoyment watching TV</td>
<td>7.6±2.5</td>
<td>7.5±2.6</td>
<td>7.7±2.4</td>
</tr>
<tr>
<td>Having parental TV rules (%yes)</td>
<td>30%</td>
<td>31%</td>
<td>28%</td>
</tr>
<tr>
<td>Computer in bedroom (%yes)</td>
<td>68%</td>
<td>66%</td>
<td>70%</td>
</tr>
<tr>
<td>Enjoyment computer use</td>
<td>7.9±2.5</td>
<td>7.8±2.7</td>
<td>8.1±2.3</td>
</tr>
</tbody>
</table>

* p<0.05 intervention group significantly lower than control group.

### Intervention effect on sports participation, outdoor play and screen behaviour

Table 3 shows the baseline values, T2 values and adjusted intervention effect on sport participation, outdoor play and screen behaviours. A significant intervention effect on sport participation was found, as intervention children were 2.7 times more likely to participate in sport after the intervention than control children (unstandardized regression coefficient (b)= 0.98, Standard Error (SE)= 0.26; Odds Ratio (OR)=2.68, 95% confidence intervals (95%CI): 1.60, 4.46). No significant intervention effects were found on outdoor play or screen behaviours.

#### Table 3: Outcome variables at baseline and T2 (20 months after baseline) for control and intervention groups and intervention effect on sport participation, outdoor play and screen behaviours.

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>T2 (20 months)</th>
<th>Intervention effect (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Intervention</td>
<td>Control</td>
</tr>
</tbody>
</table>
| Sports participation (%) | 45%      | 35%*           | 48%                         | 62%***         | 2.68 (1.60, 4.46)##
| Outdoor play (times/week) | 4.1±1.7  | 4.1±1.7        | 4.1±1.5                     | 3.9±1.5        | -0.30 (-0.79, 0.19)##
| TV viewing (times/week)   | 9.8±5.3  | 10.3±5.1       | 9.5±4.9                     | 10.2±4.8       | 0.58 (-0.26, 1.43)##
| Computer use (times/week) | 5.4±5.1  | 5.5±5.0        | 5.5±4.5                     | 6.0±4.7        | 0.36 (0.35, 1.08)##

* p<0.05 **p<0.01; ***p<0.001 significant difference between intervention and control participants

## p<0.001 significant intervention effect.

# Odds Ratio; ## unstandardised regression coefficients

Analyses were adjusted for school, gender, age, ethnicity, BMI and baseline values.
Figure 2: Path model showing the psychological and environmental mediators of the effect of the JUMP-in intervention on sports participation.

Note: Numbers represent unstandardised regression coefficients. Dotted lines represent non-significant associations, full lines represent significant associations. For reasons of clarity, the model does not show correlations between mediators, the associations between potential mediators at T0 and T2 and the covariates.
**Figure 3:** Path model showing the psychological and environmental mediators of the effect of the JUMP-in intervention on outdoor play.

Note: Numbers represent unstandardised regression coefficients. Dotted lines represent non-significant associations, full lines represent significant associations. For reasons of clarity, the model does not show correlations between mediators, the associations between potential mediators at T0 and T2 and the covariates.
Figure 4: Path model showing the psychological and environmental mediators of the effect of the JUMP-in intervention on TV viewing and computer use.

Note: Numbers represent unstandardised regression coefficients. Dotted lines represent non-significant associations, full lines represent significant associations. For reasons of clarity, the model does not show correlations between mediators, the associations between potential mediators at T0 and T2 and the covariates. Model fit: X2 (102) = 187.811, RMSEA = 0.037 90% CI= 0.029–0.046), CFI= 0.941, TLI= 0.916
Mediated effects
The sports participation model depicted in Figure 2 had an acceptable fit ($\chi^2 (186) = 213.73; p=0.08; \text{RMSEA}: 0.016; \text{CFI}: 0.982; \text{TLI}: 0.960$; MLR was used to estimate path coefficients, WLSMV was used to estimate model fit). No significant intervention effect on any of the potential mediators at T2 was found ($a$-coefficient). Thus no mediators of the intervention effect on sport participation could be identified. However, significant positive associations between social support ($b=0.46; 95\%\text{CI}: .04, .88$), self-efficacy ($b=0.41; 95\%\text{CI}: .15, .66$), and habit strength ($b=0.50; 95\%\text{CI}: .14, .86$) with sport participation were found ($b$-coefficients). Changes in intention were negatively associated with sport participation ($b=−0.40; 95\%\text{CI}= −.65,−.15$).

The outdoor play model depicted in Figure 3 represented an acceptable fit ($\chi^2(163) =270.3$, $p$-value$<0.001$, $\text{RMSEA}= 0.033 90\%\text{CI}= 0.026–0.040$, $\text{CFI}=0.933$, $\text{TLI}=0.914$). We found no statistically significant intervention effects on potential mediators at T2 ($a$-coefficient). Thus no significant mediating effects were identified. However, significant positive associations were found between social support ($b=.04; 95\%\text{CI}: .01-.08$), self-efficacy ($b=.15; 95\%\text{CI}: .00-.30$), enjoyment ($b=.21; 95\%\text{CI}: .14-.28$) and habit strength ($b=.38; 95\%\text{CI}: .18-.58$) with outdoor play ($b$-coefficients).

In the screen behaviours model depicted in Figure 4, adding an association between perceived parental TV rules and computer use significantly improved the model ($\chi^2(2)=11.47; p=0.003$). As perceived parental TV rules probably are a proxy for parental rules in general, this association was added. This resulted in a good fit for the screen behaviour model ($\chi^2 (102) = 187.8$, RMSEA$= 0.037 90\%\text{CI}= 0.029–0.046$, $\text{CFI}= 0.941$, $\text{TLI}= 0.916$). For the screen behaviours model, no effects of the intervention on the potential mediators were found ($a$-coefficient). Consequently no mediated effects could be identified. However, a significant positive association of enjoying watching TV ($b=0.95; 95\%\text{CI}= 0.75, 1.14$) and a negative association of perceived parental TV rules ($b=−1.78; 95\%\text{CI}: -3.01, -.55$) with TV viewing were found. In addition, a positive association between enjoying using the computer ($b=0.77; 95\%\text{CI}: .56, .94$), and having a computer in the bedroom ($b=1.34; 95\%\text{CI}: .62, 2.06$) and a negative association from perceived parental TV rules ($b=−.70; 95\%\text{CI}: -1.36, .00$) with computer use was identified ($b$-coefficients).

DISCUSSION
The JUMP-in study showed a strong intervention effect on sports participation, which confirms previous findings (de Meij 2011). However, no intervention effect on their hypothesized mediators was found. In addition, no significant intervention effects on outdoor play and screen behaviours or their hypothesized mediators were found.

Despite our finding that none of these mediators were significantly impacted by the intervention, sport participation was positively affected by the intervention. As several hypothesized mediators based on social cognitive models (e.g. pros, cons, intention) were not associated with behaviour it suggests that our theoretical assumptions of the intervention were not entirely valid. Thus,
other (unmeasured) mechanisms by which the intervention impacted sport participation must be in place. The JUMP-in intervention was based on the EnRG-framework, a dual process model combining social cognitive and social-ecological theories (Kremers 2006). Based on the EnRG-framework we assumed that by changing the environment we would directly and indirectly (by changing children’s cognitions) change behaviour. We therefore targeted several environmental constructs (e.g. organize enjoyable after school sport activities and adapted sport offers) to facilitate participation in organized sport and positively change children’s cognitions towards PA. However, primary schoolchildren’s behaviour may be less planned than adults’ behaviour and other unconscious/unreasoned processes directly triggered by environmental cues (e.g. availability and parental influences) might influence their behaviour (Kremers 2006). Moreover, primary schoolchildren might have low autonomy, and many decisions regarding their acts are made by their parents. Consequently, the environment might primarily have a direct influence on primary schoolchildren’s behaviour instead of an indirect one via cognitive influences. Social cognitive models such as the theory of planned behaviour and ASE model as applied and measured in this study, may not fit well for predicting primary schoolchildren’s behaviour. As we did not measure the children’s perceived environment, we were not able to assess whether change in environmental constructs yielded by the intervention, directly affected children’s sport participation. Further research on the JUMP-in data, analyzing changes in potential environmental mediators reported by other sources (e.g. parents) should provide more insight into the working mechanisms of the intervention.

Other explanations for the limited intervention effect on any of the potential mediators might be due to unsuccessful intervention strategies. These intervention strategies might simply not have been effective or strong enough to be able to change the potential mediators; they could have mismatched the measured mediating variables, or they were not sufficiently implemented to bring about change in the mediators. Next, as primary schoolchildren have limitations in general cognitive competencies, especially in ability to think abstractly and perform detailed recall, children are less likely to make accurate self-report assessments of past activities and cognitions than adults (Sallis 1991; Sallis 1996; Tremblay 2001; Welk 2000). Other measures such as objective measures or interviews, or combining measures might be more reliable to better characterize primary schoolchildren’s activity levels and potential mediators.

The lack of intervention effect on outdoor play, screen behaviours and mediators might also be due to an insufficient implementation of the intervention. Results of the process evaluation (de Meij 2012) showed that JUMP-in is currently embedded in the Amsterdam policy as well as in the organizational structure and daily practices of all participating sectors. However, despite the successful embedding, process data showed some hampering factors of its implementation. An overall impeding factor was the complexity of the multilevel program involving collaborations between multidisciplinary organizations. Consequently, implementers needed more time than expected to synchronize and fine-tune organizational procedures. Further, the comprehensive study measurements took additional time. Two schools decided to postpone the implementation of the in-class lessons. In addition, implementers recommended a simplification of methods,
instruments, protocols and tasks of the program components (de Meij 2012). Lastly, as our a priori power calculation was based on detecting change in sport participation, and not on detecting changes in outdoor play, screen behaviours or any of the potential mediators, our study might have lacked power for detecting change in the other constructs.

The lack of effect on outdoor play and screen behaviours suggests that the school setting might not be the sole channel to influence leisure time activities. As these behaviours are typically performed after school hours, a combination of school-based and family-based intervention strategies may be needed to improve these behaviours, involving the social and physical home environment. JUMP-in did not directly target reducing screen time, but we expected that by targeting outdoor play and sports, screen behaviours would be targeted indirectly. Apparently, this was not the case. This confirms the findings of Biddle and colleagues (Biddle 2009), who examined the temporal patterns of activity and sedentary behaviours in children. They found that TV viewing and sports/exercise participation do not compete for similar time periods on a day but might be able to coexist. This supports the evidence that sedentary behaviours are not just the opposite of PA behaviours and therefore need specific strategies to be influenced.

Still, significant associations between changes in potential mediators (i.e. social support, self-efficacy, habit strength, enjoyment, parental rules, availability and perceived barriers) and changes in behaviours were identified. This confirms the relevance of these constructs in changing these specific behaviours, and that these constructs might be potential mediators. Future intervention studies should search for better or more intensive strategies to affect these potential mediators. The negative association found between intention and sport participation could be explained by the way we measured intention (“Do you intend to increase your sport participation within one month?”). We measured intention to change sport participation in stead of intention to participate in sports. Items measuring change are less appropriate measures for mediation analysis. Future studies should take their measures into account when planning to conduct a mediation analysis.

To our knowledge this is the first study examining the mediators of a PA intervention, and the second examining the mediators of screen behaviours in this age group. Importantly, few studies have used appropriate statistical tests to assess mediators in obesity prevention studies (van Stralen 2011). The need for well-conducted mediation analyses in obesity prevention studies has been noted in previous literature (van Stralen 2011; Cerin 2009; Lubans 2008). Our mediation analysis was based on theoretical models such as the EnRG framework and ASE model, providing the opportunity to test these models. In addition the intervention strategies were carefully matched to the targeted mediators, and were tested in a pilot study and adapted based on a process evaluation (de Meij 2010; Jurg 2008). A final strength was that our program was implemented by the local partners themselves and integrated into a real-world setting, which prevented overestimation of effects due to unrealistic controlled conditions.

Our study was however subject to some potential limitations. First, the measurement of mediators and outcomes relied on child-report. As discussed above, due to limited general cognitive competencies in children, our results may be biased. Future research is need that
focuses on the development of (a combination of) valid, reliable and sensitive mediator measures in primary schoolchildren (Brown 2009). Second, most of our mediator measures were translated and adapted from existing validated questionnaires because validated Dutch measures were not available, but were not tested for validity or sensitivity. Additionally, to limit participant burden some of the potential mediating variables were assessed by one item, which could have influenced the construct validity and reliability. Next, we assumed a causal association between the potential mediating variables and the outcome variables. We are however aware of the fact that a reciprocal association could exist, wherein changes in the behaviours could have influenced some of the potential mediators. Finally, the process evaluation presented information regarding hampering factors in the implementation and weaknesses in the program strategies. It is impossible to evaluate to what extend these elements were responsible for the lack of change in the mediators.

With these strengths and limitations in mind, future interventions are recommended examining how to effectively improve leisure time behaviour such as outdoor play and screen behaviours through school-based interventions. Effective intervention strategies targeting these behaviours should involve the family setting and the physical and social local environment. Other potential strategies include environmental adaptations such as attractive playgrounds, school policy and rules. Actually, these components have been integrated in the recently renewed JUMP-in program. Next, just motivating parents to stimulate and support their children to be physically active, as done in the JUMP-in program, seems not enough. More attention for parental skills is needed in addition to attractive and tailored information. In addition, as suggested by libertarian paternalism, more attention should be paid to the healthy choice as the easy choice in terms of availability, safety and attractiveness of public space to behave physically active (Thaler 2009). This new perspective has been recently integrated in a new integral healthy lifestyle intervention that focuses on the physical and social environment of primary schoolchildren.

Conclusions
The JUMP-in intervention was effective in improving sports participation, but not outdoor play, TV-viewing behaviour, computer use or any of the potential mediators. Our results show that it is possible to affect leisure time sport participation as part of a school based intervention. However, the lack of mediation findings imply that other (unmeasured) factors operated as mediating mechanisms of the intervention, that we used unsuccessful intervention strategies, that the strategies were inappropriately implemented, or that children are unable to accurately recall past activities and cognitions. Additionally, the school setting might not be the sole channel to influence leisure time activities. Still, several personal, social and physical environmental constructs (social support, self-efficacy, habit strength, enjoyment, parental rules, availability and perceived barriers) were found to be relevant in predicting change in the above mentioned behaviours and seem to be potential mediators. Future interventions are recommended including more effective strategies targeting these relevant constructs, addressing different constructs (e.g. pedagogic skills of parents), and focusing on different implementation settings.
Chapter 5

Mediating effect of parental determinants on sports participation in the school-based JUMP-in intervention in Dutch children from deprived neighbourhoods.

Judith de Meij
Maartje van Stralen
Marcel van der Wal
Willem van Mechelen
Mai Chin A Paw

Submitted for publication
ABSTRACT

Background: The aim of this study was to investigate in 6-12-year-old children from low socio-economic status the effect of the JUMP-in programme on parents’ cognitions towards children’s sports participation and whether parents’ cognitions mediated the JUMP-in intervention effect on sports participation.

Methods: JUMP-in is a school-based strategy combining environmental policy, neighbourhood, parents- and personal components. A controlled trial was carried out in 19 primary schools. Measures were performed at the beginning of the first school year (T0: 2006) and were repeated at the end of the first (T1: 2007) and second school year (T2: 2008). In total 1808 children had complete data on the parental outcome variables at baseline and follow-up.

Results: JUMP-in was effective in increasing parental social support and social pressure to encourage children to participate in sports. These determinants significantly mediated the intervention effect on sports participation. We found no significant intervention effect on parental perceived pros, self-efficacy, perceived sports competence, perceived barriers, planning skills and habit strength, while these hypothesised mediators were significantly associated with sports participation. Further, there was no intervention effect on intention, perceived cons, social modelling and social norm, but these constructs were not significantly associated with sports participation.

Conclusion: The present study showed that a school-based multicomponent strategy improved social support and social pressure among parents regarding their children’s sports participation. Additionally, several relevant parental factors could be identified but these were not significantly changed by the intervention. Future intervention studies should search for more effective intervention strategies targeting pedagogic skills of parents.
BACKGROUND

It is generally accepted that physical activity (PA) has numerous health benefits for all age groups such as lower risk of overweight and obesity, high blood pressure, and cardiovascular diseases and increased bone density and physical fitness ([Warburton 2006; Adkins 2004; Cleland; Dowda 2001; Vogels 2006; MacKelvie 2002]). PA in youth has been associated also with lower levels of antisocial behaviour (Morris 2003; Harrison 2003) and higher levels of positive emotional wellbeing (Steptoe 2000).

Inactive children are likely to have lower self-esteem, are more anxious and encounter higher levels of stress (van de Hurk 2007; Calfras 1994; Livingstone 2003; Rivis 2003). Physical inactivity is the fourth leading cause of death worldwide (Kohl 2012). According to the WHO, physical inactivity is worldwide responsible for 1.9 million deaths per year (Saebra 2008). Despite these findings, the majority of youth is not physically active enough to achieve health benefits. In deprived city areas in The Netherlands only 3% of the children met the PA Public Health recommendation of at least 60 minutes per day of moderate to vigorous intensity PA (De Vries 2005).

The consequences arising from physical inactivity among youth strongly imply a need to identify effective strategies to improve PA. A review on effective PA strategies among children concluded that interventions including contact with families generally appeared to be most effective (Timperio 2004). Parents influence children’s PA through a variety of mechanisms (Trost 2003; Baranowski 2003; Cleland 2005; Gustafson 2006; Brug 2005; Stubbe 2005). First, parents’ PA during pregnancy and early childhood has been associated with PA of children aged 11-12 years old, suggesting that active parents tend to raise active children (Mattocks 2008). In this regard, it may also be that a genetic predisposition to PA and sports behaviour exists (Gustafson 2006; Beunen 1999) concluded in a review that the heritability coefficients for sports participation ranged from 35% to 83%, and that children who had a parent active in sport had 1.2 to 5.8 times the odds of participating in sports compared to children whose parents were not active in sport. Stubbe et. al (2005) reported that environmental factors shared by children from the same family largely account for individual differences in sports participation (78-84%). Second, it is plausible that parents act as role models for children. When children observe that their parents are actively involved in and value sports, they may adopt these values and sports behaviours themselves. However, findings in previous studies regarding parental modelling are inconsistent (Lau 2007; Mattocks 2008; Cleland 2005; Trost 2003; Adkins 2004). Third, studies show a strong positive relationship between parental support in terms of encouragement, involvement and facilitation and children’s participation in PA and sports. (Krahnstoever 2003, Gustafson 2006, Sallis 1992, Sallis 2000; Cleland 2005). Parental support can directly or indirectly (e. g. through self-efficacy) predict a child’s PA level. Lastly, children whose parents have higher perceptions of their children’s PA competence are more likely to be physically active (Dempsey 1993).

However, evidence for an association between parental PA and sports behaviour, parental support and PA and sports behaviour of the offspring is not consistent and the mechanisms of
parental influence remain understudied and poorly understood (Gustafson 2006; Brug 2005). By far the most studies in this domain are cross-sectional. Such studies may show associations between presumed determinants and PA and sports behaviours, but do not allow conclusions about causality (Gustafson 2006; Brug 2005). There is a great need for experimental longitudinal study designs that explore possible mediating effects of potential parental determinants of PA and sports in youth. Further, there is a lack of studies in minority groups. Participants in the majority of studies were of higher socioeconomic status and not ethnically divers (Gustafson 2006).

The purpose of this study was to examine the effects of JUMP-in, a primary-school based intervention primarily aimed at the promotion of PA and sports participation, on parental cognitive determinants towards children’s sports behaviour. JUMP-in is a multilevel intervention primarily aimed at children in socially and economically deprived areas in Amsterdam and incorporates policy, environmental and individual components. Longer-term objectives are the prevention of overweight and improvement of physical fitness through increased PA levels. The stepwise development of JUMP-in has been described previously, including the programme components, strategies and hypothesised working mechanisms (de Meij 2008). The effectiveness study on sports participation and overall PA proved that JUMP-in was successful in improving children’s sports participation (de Meij 2011). No significant intervention effects on overall daily PA rates, body composition (de Meij 2011) or any of the potential hypothesised child-level mediators (van Stralen 2012) were observed. With the strong influence of parental determinants on child sports behaviour in mind, parental information services and parental involvement in child physical activities were important components in the JUMP-in intervention. The two key research questions of the present study were: 1) was the JUMP-in intervention effective in changing the parents’ cognitions towards sports?; and 2) did the parents’ cognitions mediate the JUMP-in intervention effect on sports participation?

METHODS

Procedure and Participants
The study is a controlled trial carried out in 19 primary schools including 2848 boys and girls in grades 3-8 (aged 6-12 years, 50% boys) and their parents. To be included in the trial schools needed to have: (1) a certified physical education (PE) teacher; (2) a majority of pupils with low socio-economic status; and (3) a gymnasium, either in the school or in the direct vicinity of the school. A passive informed consent procedure [15] was applied: all parents received a letter describing the study procedures, with the option to sign and return the form if they did not want their child or themselves to participate. The Medical Ethics Committee of VU University Medical Center had approved the study protocol.
Recruitment of schools
Nine intervention schools were recruited in two city districts that planned to start the implementation of JUMP-in. Random assignment of schools to a control or intervention group was not possible because of prolonged preparations needed for successful adoption and implementation of JUMP-in. Ten comparable control schools were recruited from geographically separated city districts to limit the possibility of contamination between intervention and control schools. The control schools were asked to continue their usual curriculum during the study period. Children and parents were unaware of the existence of intervention and control schools. They were asked to participate in a study assessing the sports and leisure time physical activities among children in Amsterdam. Regular contact with the management and educational personnel of the intervention and control schools took place to promote their continued participation. The control school staffs were offered the JUMP-in program at the end of the study. The city districts in which control schools were located supported the study and declared to support the implementation afterwards.

Intervention
During the study period the JUMP-in intervention consisted of six components: 1) Pupil Follow-up System (PFS), a monitoring instrument yearly assessing and registering children’s level of PA, BMI and motor skills. PFS facilitates referral to tailored interventions and child health care; 2) Structural and easily accessible school sport clubs during out of school hours, offered on a daily basis in or near the school premises; 3) “The Class Moves!” a method offering recurrent breaks for PA, relaxation and posture exercises during regular lessons; 4) “This is your way to Move!” workbooks for children with assignments to perform in class and at home, aimed at raising awareness and at improving self-efficacy, social support, self-regulation and planning skills, of both children and parents; 5) Parental information services containing options such as information meetings, workshops, courses and participation in child sports activities. Existing structures such as language-courses or coffee-meetings were used to maximise attendance and; 6) Extra care for children at risk with motor and movement disabilities and referral of overweight children. An overview of the methods and intervention strategies aimed at parents is provided in table 1.

Measures
Measures were performed at the beginning of the first school year (T0: September-October 2006), at the end of the first school year (T1: May–June 2007) and repeated at the end of the second school year (T2: May–June 2008). Since the implementation of the complete programme took 2 school years this paper reports on the T0 and T2 measurements. All child measurements took place at school and were performed according to standardised procedures by trained testers. The intervention duration was 8 months in the first year (from November 2006 to June 2007) and 9 months in the second year (September 2007 to May 2008). Parents from children from grade 3 to 8 (aged 6-12 yrs) filled in a questionnaire which took approximately 45 minutes
to complete. A member of the research team distributed the parent questionnaires in the class and children were asked to bring the questionnaire home, including an information letter with instructions. Parents were asked to fill in and let their child return the questionnaire in the class as soon as possible. Parents who had problems with the Dutch language were advised to ask a friend or family member to assist. Additionally, trained testers offered assistance to complete the questionnaire at school.

**Sports participation**
Children's sports participation was assessed in a personal interview. Trained interviewers asked the children whether they had participated in organised sports activities at least once a week for a minimum of the last three months (yes or no).

**Potential parental mediators**
Table 1 gives an overview of the hypothesised personal and environmental mediators, including their scales and reliability. For child sport participation, parental perceived pros (7 items), cons (5 items), perceived sport competence (8 items), social modelling (4 items), social pressure (1 item), social norm (1 item), social support (4 items), self-efficacy (8 items), perceived planning skills (6 items), perceived barriers (10 items), intention (2 items) and habit strength (6 items) were assessed. Scores were summed for each construct resulting in a sum score and Cronbach’s alphas ranging from 0.57 for cons towards sport participation at baseline to 0.92 for intention of changing behaviour (stimulating the child to participate in sports more often) at 8 months and 20 months follow-up. The questionnaires were derived from previous studies (Adkins 2004; Echeverria 2004; Trost 2003), but adapted to fit the specific research questions of this project. The questionnaires were pre-tested in a pilot sample of parents, which led to some small adjustments with respect to the formulation of the questions.

**Potential confounders and covariates**
Socio-demographic factors (gender, age, ethnicity) and BMI were regressed against the outcome variables and mediators to identify covariates and confounders. All subsequent analyses were adjusted for the significant covariates age and sex.

**Statistical analyses**
Descriptive statistics, t-tests and \( \chi^2 \) test were conducted to examine frequencies and differences between the intervention and control group at baseline and between children participating in sports and children not participating in sports at baseline using SPSS (Version 15.0).

**Mediation analyses**
The mediated effects were tested using latent variable structural equation modelling (SEM) using WLSMV estimator in Mplus, controlling for baseline values, and covariates (Muthen and Muthen, Version 6.1). SEM is a way to reduce the effect of measurement error by specifying a model for
how observed measures are related to a latent construct. A SEM model consists of two models, a measurement model specifying how the observed measures are related to a latent construct and a structural model, relating the independent, mediating and dependent variables. In the measurement model we loaded the observed factors (e.g. 7 items measuring pros) on one latent construct (e.g. pros). Factorial invariance was tested and factor loading and factor variances were constrained equally if invariant over time. The single item measures of social pressure and social norm were modelled as observed variables. Confirmatory Factor analysis showed that perceived barriers could best be divided into three latent variables: 1. financial barriers (2 items); 2. situational barriers (4 items); and 3. personal barriers (4 items) and perceived cons could be divided into two latent factors 1. cons- uncomfortable (2 items) and 2. cons awkwardness (3 items).

Next, a structural model was developed informed by the product-of-coefficient test (Mackinnon 2008), which basically consists of three steps: 1. the action theory test, in which the effect of the intervention on the potential mediator at follow-up is assessed, controlled for the mediator at baseline (a-coefficient); 2). The conceptual theory, in which the association between the potential mediator at follow-up and the outcome variable at follow-up is assessed, controlled for the treatment variable and baseline values of the mediator and outcome variable (b-coefficient); and 3). The mediated effect test: a simultaneous test of the action and conceptual theories, wherein the extent of the mediated effect on the intervention effect on behaviour is evaluated, by multiplying the a-coefficient with the b-coefficient (a*b coefficient). A bootstrapping method using 1,000 bootstrap samples was used to calculate the bias corrected confidence intervals (CI) around the mediated and direct associations (Mackinnon 2008). All analyses were adjusted for gender and age. First, a single mediator model was developed, testing the mediated effect of a single mediator, followed by a multiple mediator model including all significant mediators.

As seen in figure 1 the SEM model included (1) paths between the variables assessed at baseline (t0) and after 2 school years intervention (t2); (2) paths from the potential mediators at t2 to the outcome variable at t2 which equals the b-coefficient of the mediated effect; and (3) paths between the intervention and the potential mediators at t2 (a-coefficient) and outcome variables at t2 (c’-coefficient). The intervention was coded as control (0), and intervention (1) groups.
Figure 1. Latent variable mediator model for a single mediator measured with three items.

M1, M2, M3 = mediator items; Mt2 = latent mediator variable at time 2; Mt0 = latent mediator variable at time 0; Sport t2 = sport participation at time 2; Sport t0: sport participation at time 0. a = a-coefficient reflecting intervention effect on mediator; b = b-coefficient reflecting independent association between mediator and outcome; c' = c'-coefficient reflecting direct effect of intervention on outcome. For clarity issues correlations between the constructs and equality constraints over time are not shown.

Model fit
A combination of fit indices was used to determine model fit. Chi-square tests were conducted to test for differences between theoretical and observed models. A good model fit is indicated by p > .05 for the Chi-square test of model fit (Tabachnick 2007). Since Chi-square test is influenced by the sample size, additionally Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) were calculated to evaluate the model fit. A minimally acceptable fit is obtained when RMSEA < .06, CFI ≥ .90 and TLI ≥ .90 (Hu 1999).

RESULTS

Participant characteristics
Table 2 shows the baseline values of demographics, participation in sports and parental scores for the total sample and the control and intervention condition separately. In total 1808 children had data on the parental outcome variables at baseline and follow-up (mean age 8.2 ± 1.6, 51% girls, 15% Dutch ethnicity, 31% overweight/obese). In the intervention condition significantly more children were from a Turkish background, and less children from a Dutch background. In addition the following significant group differences were observed: in the control group more children participated in sports, but they were less physically fit than children in the intervention group; parents in the intervention group perceived more con’s regarding sports participation of their children and themselves, more barriers and intention regarding their child sport participation.
compared to parents of the control schools; mothers of children in the control group were more likely to participate in sports themselves.

**Differences in parental cognitions between active and inactive children**

Table 3 shows the descriptives and parental cognitions of active and inactive children separately. Active children were compared to inactive children significantly older, less likely to be a girl, more physically fit, and their parents perceived more pros, social modelling, support, self-efficacy, planning skills, habit strength and less cons, perceived barriers and intention regarding their child sport participation. Fathers and mothers of active children were more likely to participate in sports themselves. No differences were identified between active and inactive children in parental perceptions of social pressure and norm.

**Mediators**

Table 4 shows the model fit for each single mediator model. All models had a good fit based on the RMSEA <0.06, CFI > 0.90 and TFI>0.90.

Initially, we inspected the path coefficients to identify the effect of the intervention on the potential mediating variables. As shown in table 4, a significant positive intervention effect could be identified on social support (a= 0.18; 95%CI= 0.02-0.33), and social pressure (a= 0.24; 95%CI:0.02-0.46). No significant intervention effects were found for perceived barriers, habit strength, perceived planning skills, perceived pros and cons, sport competence, self-efficacy, intention, social norm and social modelling.

Next, we inspected the path coefficients for the relationships between theoretical parental mediators and child sport participation. Significant associations with sport participation were found for personal barriers (b=-.21; 95%CI: -.37; -.03); perceived pros (b= 0.29; 95%CI: .13; .43), sport competence (b=.15; 85%C1:.03; .26), self-efficacy (b= 0.32; 95%CI: 0.18; 0.44) habit strength (b=0.38 ; 95%CI: 0.29; 0.46), planning skills (b=0.39 ; 95%CI: 0.25; 0.53), social pressure (b= 0.16; 95%CI= 0.00-0.35), and social support (b=0.32; 95%CI=0.20-0.43) (see table 4). No significant association was found between a child’s sport participation and financial barriers, situational barriers, perceived cons, intention, social modelling and social norm. Social support (ab=0.06; 95%CI=.01-0.11), and social pressure (ab=0.04; 95%CI=0.00-0.12) significantly mediated the intervention effect on sport participation.

In the multiple mediation model, the significant single mediators social pressure and social support were included in one model. As shown in table 5, the model fit was good (X2(73)= 254; RMSEA= 0.037 (90%CI: 0.032; 0.042); CFI/TLI= 0.96/0.95). The intervention effect on social support (a= 0.23; 95%CI: 0.07; 0.39) and the association between social support and sport participation (b= 0.34; 95%CI: 0.20; 0.48) remained significant. The intervention effect on social pressure and the association between social pressure and sport participation were not significant in the multiple mediation model. As a result only a significant mediated effect of social support (ab= 0.08; 95%CI: 0.02; 0.15) was found in the multiple mediator model.
DISCUSSION

The multi-component JUMP-in program aimed to increase children’s sports participation. Parental involvement was one component of JUMP-in, including information about the importance of children’s sports participation and the parental role in supporting and encouraging children to be active, as well as involving parents in children’s sports activities and removing barriers such as distance and finances. JUMP-in was effective in increasing parental social support and social pressure to encourage their children to participate in sports in the future. Moreover, social support and social pressure significantly mediated the intervention effect on sports participation, explaining 9% and 6% of the intervention effect, respectively. We found no significant intervention effect on parental perceived pros, self-efficacy, sports competence, perceived barriers, planning skills and habit strength, while these hypothesised mediators were significantly associated with sports participation. Further, there was no intervention effect on intention, perceived cons, social modelling and social norm, but these constructs were not significantly associated with sports participation.

A number of parental factors were significantly associated with sports participation - pros, self-efficacy, sports competence, barriers, planning skills and habit strength – suggesting that these constructs are relevant when changing children’s sports behaviour. There are several explanations for the limited intervention effect on these hypothesised mediators. First, the lack of effect may be due to insufficient reach of parents or inappropriate programme strategies. During the implementation period we experienced difficulties in reaching parents through regular information meetings (de Meij 2012). Attendance increased in the second intervention year when information meetings were combined with children’s activities or embedded in existing structures such as parental language courses in the school setting. Inviting parents individually, based on results of the JUMP-in pupil follow up system, increased attendance as well. However, this demanded extra efforts and support of the implementation team. To increase attendance and to strengthen intervention effects in the future, we recommend using social marketing strategies to tailor strategies to the profile and needs of the population, making changes easier and popular (Borys 2011, van Koperen 2010).

Another explanation for the limited intervention effect on pros, planning skills, perceived barriers and self-efficacy, is that parents, whose children started participating in sports for the first time, may have been confronted with problems related to planning and organisation. School newsletters and information meetings were mainly focused on increasing knowledge and beliefs, while apparently, parents also needed confidence, capacity and tailored practical tools to support and plan their children’s PA behaviour. Future intervention studies should include effective intervention strategies targeting related pedagogic skills.

Recently, JUMP-in developed an innovative parental intervention strategy, based on Entertainment-Education principles (Bouwman 2005), involving interactive theatre as an educational tool to improve parental skills. Simple practical strategies are demonstrated about how parents can promote their children’s sports behaviour and how to deal with issues
faced by many parents, such as: “how to encourage desired behaviour”, “how to promote and support my children’s sports behaviour”, and “how to limit or manage sedentary behaviour”. A great deal of the performance is improvised in interplay with audience members and parents are asked to supply performance suggestions in order to help manage difficult parenting situations.

The lack of intervention effects on habit strength and perceived sports competence may be a matter of timing. Some children started participating in sports in the last months of the intervention. To strengthen habit and sport competence behaviour needs be performed for a longer period.

The lack of a significant association of parental modelling with sports participation is in line with previous studies in which findings regarding parental modelling as a possible mechanism for parent-child aggregation of sports participation are inconsistent. Parental modelling may have an insufficient effect on child sports participation, because parental sports participation alone does not remove important barriers (Cleland 2005; Trost 2003; Adkins 2004). Instrumental support, consisting of transporting the child, encouraging or observing sports, appeared to be necessary as well (Gustavson 2006; Cleland 2005). This is confirmed by our findings. Trost (2003) found that parental beliefs, support and stimulation are even stronger predictors than parental modelling, and that stimulating children to participate in sports strengthen the child’s attitude and self-efficacy. In addition, Adkins (2004) showed that parent’s self-efficacy for supporting their child to be active was positively correlated with the child’s PA. However, it may be possible that the encouragement of active parents might be more convincing, which should be studied in the future.

The lack of a significant association between intention and sports participation could be explained by the way we measured intention (“Do you intend to stimulate your child to participate in sports more often in the next half year and within the next month?”). We measured intention to change behaviour instead of intention to stimulate children to participate in sports. Items measuring change are less appropriate measures for mediation analysis. Future intervention studies should take their measures into account when planning to conduct a mediation analysis.

An explanation for the lack of significant associations between the parental mediators perceived cons, intention, social modeling, social norm, perceived barriers and children’s sports participation may be that our population exists predominantly of low SES families, living in socially and economically deprived areas. Members of the lower social classes tend to participate less in sports (Brug 2012). To some extent this behavioural difference is a derivative of the attitudes that distinguish higher and lower social classes, but they may also reflect social affiliations (Bradley 2002). Future research should investigate the role of SES in parenting mediators of child’s PA and sports participation.

To our knowledge this is the first study examining parental mediators of child’s PA, and few studies have used appropriate statistical tests to assess mediation in school-based obesity prevention.
studies (van Stralen 2011). The need for well-conducted mediation analyses in obesity prevention studies has been noted in previous literature (Cerin 2009; Lubans 2008; van Stralen 2011). By conducting structural equation modelling, measurement error could be taken into account. Strengths of this study include the controlled design with baseline and follow-up measurements over a two school year time period and the inclusion of different parental mediators. Another strength was that the intervention was conducted in a real world setting by non-researchers. Our study also has some limitations. First, the measurement of mediators relied on self-report. The results could therefore be biased by social desirability and misreporting. Second, most of our mediator measures were translated and adapted from existing validated questionnaires because validated Dutch measures were not available, but were not tested for validity. Additionally, to limit participant burden some of the potential mediating variables were assessed by one item, which could have influenced the construct validity and reliability. Next, we assumed a causal association between the potential mediating variables and the outcome variables. We are however aware of the fact that a reciprocal association could exist, wherein changes in the behaviours could have influenced some of the potential mediators.

This study is important from a public health perspective because it identified parental target variables for child sports promotion programmes, i.e. pros, self efficacy, sports competence, perceived barriers, planning skills and habit strength. JUMP-in succeeded to increase social support and social pressure, that mediated the intervention effect on children’s sports behaviour. Adapted strategies involving social marketing principles and additional research regarding related mediators in the social environment and family setting may further increase the effectiveness of the JUMP-in parental intervention components.
Potential mediators, measurement scales, Cronbach's alpha, theoretical methods and related intervention strategies.

<table>
<thead>
<tr>
<th>Potential mediator</th>
<th>Scale</th>
<th>Cronbach's alpha</th>
<th>Methods</th>
<th>Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pros</strong></td>
<td>Seven items measuring pros of child's sports participation (e.g., if my child participates in sports he/she will become stronger), and five items measuring cons of sports participation (e.g., if my child participates in sports he/she will be bullied). Scale: -2= totally disagree to +2= totally agree</td>
<td></td>
<td>Make parents aware of the importance of sports. Provide parents direct positive experiences with children's sports. Facilitate sports participation (regarding financial, practical and organisational issues) Invite parents to visit and participate in enjoyable child sports activities</td>
<td>Information meetings, written information and film for parents provide information about the importance of child sports participation and the benefits for their physical and psychological health. Parents are invited in lessons PE, tournaments and enjoyable after school sports activities for children to get acquainted with a variety of attractive sports and to see their children enjoy sports. Homework assignments for children explicate why they do or do not participate in sports. Notes for parents are included.</td>
</tr>
<tr>
<td><strong>Cons</strong></td>
<td>Five items measuring cons of sports participation Scale: -2= totally disagree to +2= totally agree. Exploratory Factor Analysis is distinguished 2 factors: - cons- uncomfortable: two items measuring uncomfortable feelings as a result of sport participation (e.g., if my child participates in sports he/she will get too tired). - cons- awkwardness: three items measuring awkwardness feelings as a result of sport participation (e.g., if my child participates in sports he/she will be bullied).</td>
<td></td>
<td>Make parents aware of the importance of the parental role model. Motivate and encourage parents to act as a role model for their children. Provide examples and stimulate parents to act as a role model.</td>
<td>In the homework book, newsletters and parental information meetings information is directed to the importance of the parental role model: ‘Sports and PA behaviour is important for your child. Join your child in their leisure time!’ Examples of parental role models are provided in the JUMP-in information film.</td>
</tr>
<tr>
<td>Social modelling</td>
<td>Four items on how much the father, mother, brother(s) and sister(s) participate in sports (e.g., “father participates in sports.”). Scale: 0= never to 4= (almost) every day.</td>
<td>T0: 0.84 T1: 0.87 T2: 0.89</td>
<td>Make parents aware of the importance of the parental role model. Motivate and encourage parents to act as a role model for their children. Provide examples and stimulate parents to act as a role model.</td>
<td></td>
</tr>
<tr>
<td>Social norm</td>
<td>One item on how important the parent perceives participation in sports (“I believe participation in sport is important”). Scale: -2= certainly not to +2= certainly yes</td>
<td></td>
<td>Make parents and children aware of the importance of sports participation.</td>
<td>Information in parental meetings, written information letters, school newspaper and notes in the homework lessons book is directed to the importance of sports and the PA Public Health recommendation for children. Teachers PE motivate and stimulate parents of inactive children to support them in sports.</td>
</tr>
<tr>
<td>Potential mediator</td>
<td>Scale</td>
<td>Cronbach's alpha</td>
<td>Methods</td>
<td>Strategies</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>------------------</td>
<td>------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Social pressure</td>
<td>One items on whether the parent believes that his/her child must participate in sports (e.g. “I believe that my child must participate in sports”). Scale: -2= certainly not to +2= certainly yes</td>
<td>-</td>
<td>Provide parents knowledge regarding importance of sports for children. Motivate and encourage parents to stimulate sports.</td>
<td>The homework book included the assignment to collect reasons children have regarding not participating in sports and excuses parents may have to stimulate them (not) to sport. Information in parental meetings, written information letters and school newspaper is directed to the importance of the parental role in stimulating children to participate in sports.</td>
</tr>
<tr>
<td>Social support</td>
<td>Four items on the support the parent provides to participate in sports (e.g. “how often do you or your partner ask your child to join participating in sports?”) Scale: 0= Never to 4= (almost) every day.</td>
<td>T0: 0.67, T1: 0.74, T2: 0.67</td>
<td>Motivate and encourage parents to support sports participation of their children. Stimulate parents to talk with their children about their preferences and perceived barriers regarding sports participation. Provide examples of parental supporting behaviour</td>
<td>In the homeworkbook, in the film and in parental information meetings information is provided about the strong positive relationship between parental support in terms of encouragement, involvement and facilitation and children's participation in PA and sports. Information for parents is directed to what they can do to support their children in sports: 'Ask what kind of sports your child likes', 'Help your child finding a sport that fits.' and 'motivate and stimulate your child who started sports'. Example of notes in the homework book are: ‘Discover the talents and preferences of your child’, ‘Help your child trying some of the sports ideas he/she has collected at school’, ‘Your child is proud of what it can do! Pay attention to that. give a compliment, take a photo and help him/her to get better’ or ‘Ask at home what he/she has learned’.</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>Eight items measuring the perceived ability of parents to stimulate their child in sports participation. in a variety of difficult situations (e.g. do you think it is hard to participate in sports when there is a nice program on TV?). Scale: -2= very difficult to +2= very easy</td>
<td>T0: 0.85, T1: 0.87, T2: 0.88</td>
<td>Tackle barriers and create opportunities for parents to support their children in sports participation. Encourage parents to support sports participation of their children</td>
<td>Parents are informed about easy accessible sports offers tailored to the preferences and skills of their child. Teachers stimulate parents to support their child in sports. Parents are invited in lessons PE, tournaments and enjoyable after school sports activities for children to get positive experiences and to decrease feelings of negative perceived sport competence. Children are encouraged to tell their parents about their sports wishes and to expose their talents.</td>
</tr>
<tr>
<td>Perceived barriers</td>
<td>Ten items measuring whether the parent perceived any barriers regarding participation in sports. Scale: -2= totally disagree to +2= totally agree. Exploratory factor analysis distinguished 3 factors: Financial barriers: Two items measuring whether the parents perceived any financial barriers regarding participation in sports (e.g. sport clubs for children are too expensive; sport equipment that are needed for a sport club are too expensive) Situational barriers: Four items measuring whether the parents perceived any situational barriers regarding participation in sports (e.g. sport clubs are too far away from my home). Personal barriers: Four items measuring whether the parents perceived any personal barriers regarding participation in sports (e.g. sport clubs are too far away from my home). Financial barriers: T0: 0.85, T1: 0.88, T2: 0.88. Situational barriers: T0: 0.70, T1: 0.72, T2: 0.72. Personal barriers: T0: 0.65, T1: 0.69, T2: 0.71.</td>
<td>Financial barriers: T0: 0.85, T1: 0.88, T2: 0.88. Situational barriers: T0: 0.70, T1: 0.72, T2: 0.72. Personal barriers: T0: 0.65, T1: 0.69, T2: 0.71.</td>
<td>Tackle barriers and create opportunities for sports participation. Support parents in the application of financial support by social sports fundings. Make parents aware of the social and physical environmental factors influencing their children's sports participation. Make parents aware of their own preferences and wishes regarding their children's sports participation. Alter physical environments to create more sports options. Provide a variety of sports offers.</td>
<td>In information meetings and homework books attention is directed to awareness of the influence of environmental factors in sports participation (financial, situational and personal). Parents are asked what should be adapted to make it easier for them to let their child participate in sports. Sports are offered without costs or with very low costs, directly after school hours, in or near the school premises and tailored to the target group.</td>
</tr>
</tbody>
</table>
Parents are informed about easy accessible sports offers tailored to the preferences and skills of their child. Teachers are encouraged to talk with their children about their preferences and perceived barriers regarding sports participation. Provide examples of parental supporting behaviour. Parents are asked what should be adapted to make it easier for them to let their child participate in sports. Sports are offered without costs or with very low costs, directly after school hours, in or near the school premises and tailored to the target group.

<table>
<thead>
<tr>
<th>Potential mediator</th>
<th>Scale</th>
<th>Cronbach’s alpha</th>
<th>Methods</th>
<th>Strategies</th>
</tr>
</thead>
</table>
| Perceived sport competence | Eight items on how much the parent perceive their child to resemble the children mentioned in the examples (e.g., some children are very good in a variety of sports). Scale: -2= my child certainly does not, +2= my child certainly does too! | T0: 0.77  
T1: 0.76  
T2: 0.81 | Show parents children’s joy and positive experiences in sports. Tailor sports offers. Offer skill training with guided practice and feedback and involve parents. Inform parents about improved sport competences of their child. | Parents are involved in the lessons motor remedial teaching for children who are behind in their motor development. PE teachers and trainers from school sport clubs involve parents in sport skills training and inform parents about progress in motor development of their children. Children are encouraged to expose their talents and what they have learned to their parents; |
| Intention | Two items measuring the intention of changing behaviour (stimulating the child to participate in sports more often) in the next half year and within the next month respectively. Scale: -2= certainly no to +2= certainly yes. | T0: 0.90  
T1: 0.92  
T2: 0.92 | Create easy accessible opportunities for sports participation. Provide parents positive experiences with children’s sports participation. | Children are offered easy accessible sports offers tailored to their preferences and skills. Teachers stimulate parents to support children to participate in sports. |
| Planning skills | Six items on whether the parent finds it difficult or easy to plan the support of child’s sports activities (e.g., “do you find it difficult or easy to bring your child to sports training?”). Scale: -2= very difficult to +2= very easy | T0: 0.84  
T1: 0.85  
T2: 0.85 | Make parents aware of all things they have to organise/prepare for their children’s sports participation. Create opportunities to carry out plans and to evaluate experiences. Create opportunities to carry out plans and to evaluate experiences | The last chapter of the homework book is directed to planning skills and self regulation with regard to sports behaviour. One assignment is to fill in a day/week-calendar with all sports activities. Distinction is made between a school day and a weekend day. |
| Habit strength | Six items on whether the parent perceives his/her child’s sports participation as a habit (e.g. I would find it hard when my child does not participate in sports). Scale: -2= certainly no to +2= certainly yes | T0: 0.79  
T1: 0.81  
T2: 0.85 | Make sports participation part of the weekly routine of the family. | Parents are stimulated to let their children participate in sports after school time. They are expected to follow the rules regarding presence etc. |

Perceived sport competence

Ten items measuring whether the parent perceived any barriers regarding participation in sports. Scale:-2= totally disagree to +2= totally agree. Exploratory factor analysis distinguished 3 factors:

- Financial barriers: Two items measuring whether the parents perceived any financial barriers regarding participation in sports (e.g. sport clubs for children are too expensive; sport equipment that are needed for a sport club are too expensive)
- Situational barriers: Four items measuring Tackle barriers and create opportunities for parents to support their children in sports participation. Encourage parents to support sports participation of their children situational barriers regarding participation in sports (e.g. sport clubs are too far away from my home).
- Personal barriers: Four items measuring whether the parents perceived any personal barriers regarding participation in sports (e.g. my child is not good enough to participate in sports).
Table 2. Baseline values (Mean ± standard deviation or percentages) of demographics, sports participation and hypothesised mediator scores for the total sample, and the control and intervention groups separately.

<table>
<thead>
<tr>
<th>Study characteristics baseline</th>
<th>Total</th>
<th>Control</th>
<th>Intervention</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>1808</td>
<td>969</td>
<td>839</td>
<td></td>
</tr>
<tr>
<td>Age (mean ± SD)</td>
<td>8.2±1.6</td>
<td>8.2±1.6</td>
<td>8.2±1.6</td>
<td>0.8</td>
</tr>
<tr>
<td>Gender (%girls)</td>
<td>50.9%</td>
<td>49.4%</td>
<td>52.7%</td>
<td>0.17</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dutch (%)</td>
<td>14.5%</td>
<td>19.1%</td>
<td>9.2%</td>
<td></td>
</tr>
<tr>
<td>Moroccan (%)</td>
<td>32.1%</td>
<td>32.2%</td>
<td>32.2%</td>
<td></td>
</tr>
<tr>
<td>Turkish (%)</td>
<td>19.1%</td>
<td>13.9%</td>
<td>24.9%</td>
<td></td>
</tr>
<tr>
<td>Surinam/Antillean (%)</td>
<td>12.8%</td>
<td>14.9%</td>
<td>10.5%</td>
<td></td>
</tr>
<tr>
<td>Other, western (%)</td>
<td>7.3%</td>
<td>7.1%</td>
<td>7.4%</td>
<td></td>
</tr>
<tr>
<td>Other, non-western (%)</td>
<td>14.2%</td>
<td>12.8%</td>
<td>15.8%</td>
<td></td>
</tr>
<tr>
<td>BMI (mean ± SD)</td>
<td>17.9±3.2</td>
<td>17.8±3.2</td>
<td>18.0±3.3</td>
<td>0.12</td>
</tr>
<tr>
<td>Overweight/obese (%)</td>
<td>31.6%</td>
<td>33.5%</td>
<td>29.3%</td>
<td>0.45</td>
</tr>
<tr>
<td>Sports participation child (% yes)</td>
<td>32.0%</td>
<td>38.0%</td>
<td>25.3%</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Physical fitness (Shuttle run test ‡)</td>
<td>5.3±2.3</td>
<td>5.1±2.3</td>
<td>5.5±2.3</td>
<td>0.002*</td>
</tr>
<tr>
<td><strong>Mediators</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pros [-2,2]</td>
<td>1.3±0.5</td>
<td>1.3±0.5</td>
<td>1.3±0.5</td>
<td>0.2</td>
</tr>
<tr>
<td>Cons – uncomfortable [-2,2]</td>
<td>-0.2±1.0</td>
<td>-0.3±1.0</td>
<td>-0.1±0.9</td>
<td>0.002*</td>
</tr>
<tr>
<td>Cons – awkwardness [-2,2]</td>
<td>-0.9±0.7</td>
<td>-1.0±0.7</td>
<td>-0.9±0.7</td>
<td>0.87</td>
</tr>
<tr>
<td>Social modelling [0,4]</td>
<td>1.6±1.0</td>
<td>1.7±1.0</td>
<td>1.6±1.0</td>
<td>0.1</td>
</tr>
<tr>
<td>Social pressure [-2,2]</td>
<td>1.5±0.7</td>
<td>1.4±0.7</td>
<td>1.5±0.7</td>
<td>0.38</td>
</tr>
<tr>
<td>Social norm [-2,2]</td>
<td>1.5±0.6</td>
<td>1.5±0.6</td>
<td>1.5±0.6</td>
<td>0.58</td>
</tr>
<tr>
<td>Social support [0,4]</td>
<td>1.4±0.9</td>
<td>1.4±0.9</td>
<td>1.4±0.9</td>
<td>0.42</td>
</tr>
<tr>
<td>Self-efficacy [-2,2]</td>
<td>-0.5±0.7</td>
<td>0.0±0.7</td>
<td>0.1±0.7</td>
<td>0.26</td>
</tr>
<tr>
<td>Perceived Sport competence [-2,2]</td>
<td>0.8±0.6</td>
<td>0.7±0.7</td>
<td>0.8±0.6</td>
<td>0.05</td>
</tr>
<tr>
<td>Perceived financial barriers [-2,2]</td>
<td>0.7±1.0</td>
<td>0.6±1.0</td>
<td>0.8±1.0</td>
<td>0.69</td>
</tr>
<tr>
<td>Perceived situational barriers [-2,2]</td>
<td>-0.4±0.8</td>
<td>-0.5±0.8</td>
<td>-0.3±0.9</td>
<td>0.004*</td>
</tr>
<tr>
<td>Perceived personal barriers [-2,2]</td>
<td>-0.9±0.7</td>
<td>-0.9±0.7</td>
<td>-0.8±0.7</td>
<td>0.4</td>
</tr>
<tr>
<td>Intention [-2,2]</td>
<td>0.9±1.0</td>
<td>0.8±1.0</td>
<td>1.0±1.0</td>
<td>0.004*</td>
</tr>
<tr>
<td>Planning skills [-2,2]</td>
<td>0.4±0.8</td>
<td>0.4±0.8</td>
<td>0.3±0.7</td>
<td>0.73</td>
</tr>
<tr>
<td>Habit strength [-2,2]</td>
<td>0.6±0.7</td>
<td>0.6±0.7</td>
<td>0.6±0.7</td>
<td>0.72</td>
</tr>
<tr>
<td>Pros parents [-2,2]</td>
<td>1.0±0.6</td>
<td>0.9±0.6</td>
<td>1.0±0.6</td>
<td>0.09</td>
</tr>
<tr>
<td>Cons Parents [-2,2]</td>
<td>-0.3±0.7</td>
<td>-0.4±0.7</td>
<td>-0.3±0.7</td>
<td>0.003*</td>
</tr>
<tr>
<td>Sports participation father (% yes)</td>
<td>20.3%</td>
<td>22.1%</td>
<td>17.9%</td>
<td>0.22</td>
</tr>
<tr>
<td>Sports participation mother (% yes)</td>
<td>26.6%</td>
<td>31.9%</td>
<td>19.5%</td>
<td>0.001*</td>
</tr>
</tbody>
</table>

Comparing intervention and control schools at baseline, using the Student t and χ² test (sports participation, gender).

‡Shuttle run score expressed as the number of laps after which a child stops the shuttle run test.

* p<0.05
Table 3. Baseline values (Mean ± standard deviation or percentages) of demographics and mediator scores for the total sample, and the active and inactive children separately.

<table>
<thead>
<tr>
<th>Study characteristics baseline</th>
<th>Total</th>
<th>Sports participation no</th>
<th>Sports participation yes</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>1808</td>
<td>969</td>
<td>839</td>
</tr>
<tr>
<td>Demographics</td>
<td>Age (mean ± SD)</td>
<td>8.2 ± 1.6</td>
<td>8.1 ± 1.6</td>
<td>8.5 ± 1.5</td>
</tr>
<tr>
<td></td>
<td>Gender (%girls)</td>
<td>50.9%</td>
<td>58.8%</td>
<td>34.2%</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Dutch (%)</td>
<td>14.5%</td>
<td>10.4%</td>
<td>22.8%</td>
</tr>
<tr>
<td></td>
<td>Moroccan (%)</td>
<td>32.1%</td>
<td>34.0%</td>
<td>28.6%</td>
</tr>
<tr>
<td></td>
<td>Turkish (%)</td>
<td>19.1%</td>
<td>22.6%</td>
<td>12.2%</td>
</tr>
<tr>
<td></td>
<td>Surinam/ Antillean (%)</td>
<td>12.8%</td>
<td>12.1%</td>
<td>14.3%</td>
</tr>
<tr>
<td></td>
<td>Other, western (%)</td>
<td>7.3%</td>
<td>6.7%</td>
<td>8.2%</td>
</tr>
<tr>
<td></td>
<td>Other, non-western (%)</td>
<td>14.2%</td>
<td>14.1%</td>
<td>13.9%</td>
</tr>
<tr>
<td></td>
<td>BMI (mean ± SD)</td>
<td>17.9±3.2</td>
<td>17.8±3.3</td>
<td>18.2±3.1</td>
</tr>
<tr>
<td></td>
<td>Overweight/obese (%)</td>
<td>31.6%</td>
<td>30.2%</td>
<td>34.0%</td>
</tr>
<tr>
<td></td>
<td>Shuttle run test ‡</td>
<td>5.3±2.3</td>
<td>4.9±2.1</td>
<td>6.1±2.5</td>
</tr>
<tr>
<td>Mediators</td>
<td>Pros [-2,2]</td>
<td>1.3±0.5</td>
<td>1.3±0.5</td>
<td>1.3±0.5</td>
</tr>
<tr>
<td></td>
<td>Cons – uncomfortable [-2,2]</td>
<td>-0.2±1.0</td>
<td>-0.04±0.9</td>
<td>-0.4±1.0</td>
</tr>
<tr>
<td></td>
<td>Cons – awkwardness [-2,2]</td>
<td>-0.9±0.7</td>
<td>-0.9±0.7</td>
<td>-1.0±0.6</td>
</tr>
<tr>
<td></td>
<td>Social modelling [0,4]</td>
<td>1.6±1.0</td>
<td>1.5±1.0</td>
<td>1.8±1.0</td>
</tr>
<tr>
<td></td>
<td>Social pressure [-2,2]</td>
<td>1.5±0.7</td>
<td>1.4±0.7</td>
<td>1.5±0.6</td>
</tr>
<tr>
<td></td>
<td>Social norm [-2,2]</td>
<td>1.5±0.6</td>
<td>1.5±0.6</td>
<td>1.6±0.5</td>
</tr>
<tr>
<td></td>
<td>Social support [0,4]</td>
<td>1.4±0.9</td>
<td>1.2±0.9</td>
<td>1.7±0.9</td>
</tr>
<tr>
<td></td>
<td>Self-efficacy [-2,2]</td>
<td>-0.5±0.7</td>
<td>-0.2±0.7</td>
<td>0.2±0.8</td>
</tr>
<tr>
<td></td>
<td>Perceived Sport competence [-2,2]</td>
<td>0.8±0.6</td>
<td>0.7±0.7</td>
<td>0.9±0.6</td>
</tr>
<tr>
<td></td>
<td>Perceived financial barriers [-2,2]</td>
<td>0.7±1.0</td>
<td>0.8±1.0</td>
<td>0.5±1.0</td>
</tr>
<tr>
<td></td>
<td>Perceived situational barriers [-2,2]</td>
<td>-0.4±0.8</td>
<td>-0.3±0.9</td>
<td>-0.6±0.7</td>
</tr>
<tr>
<td></td>
<td>Perceived personal barriers [-2,2]</td>
<td>-0.9±0.7</td>
<td>0.8±0.7</td>
<td>-1.1±0.6</td>
</tr>
<tr>
<td></td>
<td>Intention [-2,2]</td>
<td>0.9±1.0</td>
<td>1.0±0.9</td>
<td>0.8±1.0</td>
</tr>
<tr>
<td></td>
<td>Planning skills [-2,2]</td>
<td>0.4±0.8</td>
<td>0.2±0.8</td>
<td>0.6±0.7</td>
</tr>
<tr>
<td></td>
<td>Habit strength [-2,2]</td>
<td>0.6±0.7</td>
<td>0.4±0.7</td>
<td>0.9±0.7</td>
</tr>
<tr>
<td></td>
<td>Pros parents [-2,2]</td>
<td>1.0±0.6</td>
<td>1.0±0.6</td>
<td>0.9±0.6</td>
</tr>
<tr>
<td></td>
<td>Cons Parents [-2,2]</td>
<td>-0.3±0.7</td>
<td>-0.2±0.7</td>
<td>-0.5±0.7</td>
</tr>
<tr>
<td></td>
<td>Sports participation father (% yes)</td>
<td>20.3%</td>
<td>16.8%</td>
<td>21.8%</td>
</tr>
<tr>
<td></td>
<td>Sports participation mother (% yes)</td>
<td>26.6%</td>
<td>27.1%</td>
<td>35.2%</td>
</tr>
</tbody>
</table>

Comparing children who participate in sports and who don't participate in sports at baseline, using the Student t test and χ² test (gender).

‡Shuttle run score expressed as the number of laps after which a child stops the shuttle run test.

* p<0.05
### Table 4: Model fit, intervention effect on mediator, effect of mediator on sport participation, mediated effect and proportion mediation for each single mediation model

<table>
<thead>
<tr>
<th>Mediator</th>
<th>X2 (df)</th>
<th>RMSEA (90%CI)</th>
<th>CFI/ TLI</th>
<th>Intervention effect on mediator (a-path)</th>
<th>Effect mediator on outcome (b-path)</th>
<th>Mediated effect (a*b)</th>
<th>Direct intervention effect on sport (c’-path)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barriers</td>
<td>862 (305)</td>
<td>0.032 (0.029; 0.034)</td>
<td>0.97/0.97</td>
<td>.07 (-.09; .22)</td>
<td>-.10 (-.26; .04)</td>
<td>-.01 (-.04; .01)</td>
<td>.66 (.54; .77)</td>
</tr>
<tr>
<td>Financial</td>
<td>309 (145)</td>
<td>0.025 (0.021; 0.029)</td>
<td>0.97/0.97</td>
<td>-.09 (-.24; .04)</td>
<td>.29 (.13; .43)</td>
<td>-.03 (.09; .01)</td>
<td>.68 (.57; .80)</td>
</tr>
<tr>
<td>Situational</td>
<td>292 (76)</td>
<td>0.040 (0.035; 0.044)</td>
<td>0.95/0.93</td>
<td>.08 (-.08; .24)</td>
<td>-.17 (-.31; .03)</td>
<td>-.01 (-.06; .01)</td>
<td>.69 (.57; .80)</td>
</tr>
<tr>
<td>Personal</td>
<td></td>
<td></td>
<td></td>
<td>-.01 (-.15; .16)</td>
<td>-.21 (-.37; -.03)</td>
<td>.00 (-.03; .04)</td>
<td></td>
</tr>
<tr>
<td>Pros</td>
<td></td>
<td></td>
<td></td>
<td>.07 (-.09; .22)</td>
<td>-.10 (-.26; .04)</td>
<td>-.01 (-.04; .01)</td>
<td>.66 (.54; .77)</td>
</tr>
<tr>
<td>Cons</td>
<td>292 (76)</td>
<td>0.040 (0.035; 0.044)</td>
<td>0.95/0.93</td>
<td>-.01 (-.18; .16)</td>
<td>-.01 (-.16; .14)</td>
<td>.00 (-.01; .02)</td>
<td></td>
</tr>
<tr>
<td>Cons-uncomfortable</td>
<td></td>
<td></td>
<td></td>
<td>.08 (-.08; .24)</td>
<td>-.17 (-.31; .03)</td>
<td>-.01 (-.06; .01)</td>
<td></td>
</tr>
<tr>
<td>Cons-awkwardness</td>
<td></td>
<td></td>
<td></td>
<td>-.01 (-.18; .16)</td>
<td>-.01 (-.16; .14)</td>
<td>.00 (-.01; .02)</td>
<td></td>
</tr>
<tr>
<td>Habit</td>
<td>544 (116)</td>
<td>0.045 (0.041; 0.049)</td>
<td>0.97/0.97</td>
<td>-.02 (-.11; .07)</td>
<td>.38 (.29; .46)</td>
<td>-.01 (-.04; .03)</td>
<td>.61 (.49; .71)</td>
</tr>
<tr>
<td>Intention</td>
<td>45 (23)</td>
<td>0.023 (0.012; 0.033)</td>
<td>1.00/1.00</td>
<td>.13 (-.05; .28)</td>
<td>-.07 (-.17; .02)</td>
<td>-.01 (-.04; .00)</td>
<td>.67 (.56; .79)</td>
</tr>
<tr>
<td>Planning</td>
<td>453 (113)</td>
<td>0.041 (0.037; 0.045)</td>
<td>0.98/0.97</td>
<td>-.03 (-.13; .08)</td>
<td>.39 (.25; .53)</td>
<td>-.01 (-.06; .03)</td>
<td>.64 (.52; .75)</td>
</tr>
<tr>
<td>Sport competence</td>
<td>873 (189)</td>
<td>0.045 (0.042; 0.048)</td>
<td>0.94/0.93</td>
<td>.10 (-.04; .23)</td>
<td>.15 (.03; .26)</td>
<td>.02 (-.00; .05)</td>
<td>.58 (.45; .69)</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>550 (190)</td>
<td>0.032 (0.029; 0.035)</td>
<td>0.98/0.98</td>
<td>-.05 (-.16; .04)</td>
<td>.32 (.18; .44)</td>
<td>-.02 (-.06; .01)</td>
<td>.66 (.54; .78)</td>
</tr>
<tr>
<td>Social modeling</td>
<td>24 (21)</td>
<td>0.001 (0.000; 0.023)</td>
<td>1.00/1.00</td>
<td>.05 (-.06; .22)</td>
<td>.14 (-.07; .41)</td>
<td>.01 (-.01; .07)</td>
<td>.64 (.53; .75)</td>
</tr>
<tr>
<td>Social pressure</td>
<td>17 (8)</td>
<td>0.025 (0.007; 0.041)</td>
<td>0.99/0.97</td>
<td>.24 (.02; .46)</td>
<td>.16 (0.00; .35)</td>
<td>.04 (.00; .12)</td>
<td>.60 (.47; .72)</td>
</tr>
<tr>
<td>Social norm</td>
<td>29 (10)</td>
<td>0.032 (0.019; 0.046)</td>
<td>0.97/0.94</td>
<td>.12 (-.07; .30)</td>
<td>-.01 (-.06; .01)</td>
<td>-.00 (-.02; .00)</td>
<td>.66 (.55; .76)</td>
</tr>
<tr>
<td>Social support</td>
<td>216 (59)</td>
<td>0.038 (0.033; 0.044)</td>
<td>0.97/0.95</td>
<td>.18 (.02; .33)</td>
<td>.32 (.20; .43)</td>
<td>.06 (.01; .11)</td>
<td>.59 (.47; .70)</td>
</tr>
</tbody>
</table>

A good model fit is indicated by $p > .05$ for the Chi-square test of model fit (Tabachnick 2007). In addition, since Chi-square test is influenced by the sample size, Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) were calculated to evaluate the model fit. A minimally acceptable fit is obtained when RMSEA < .06, CFI ≥ .90 and TLI ≥ .90 (Hu 1999).
Table 5: Model fit, intervention effect on mediators, effect mediators on sport participation, mediated effects and proportion mediation for multiple mediation model.

<table>
<thead>
<tr>
<th>Mediator</th>
<th>Model fit</th>
<th>Mediation Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X² (df)</td>
<td>RMSEA (90% CI)</td>
</tr>
<tr>
<td>Total model</td>
<td>254 (73)</td>
<td>0.037 (0.032; 0.042)</td>
</tr>
<tr>
<td>Social pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social support</td>
<td></td>
<td>.23 (.07; .39)</td>
</tr>
</tbody>
</table>

A good model fit is indicated by $p > .05$ for the Chi-square test of model fit (Tabachnick 2007). In addition, since Chi-square test is influenced by the sample size, Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) were calculated to evaluate the model fit. A minimally acceptable fit is obtained when RMSEA < .06, CFI ≥ .90 and TLI ≥ .90 (Hu, 1999).
Chapter 6


Judith de Meij
Marcel van der Wal
Maartje van Stralen
Willem van Mechelen
Mai Chin A Paw

Submitted for publication
ABSTRACT

Background: JUMP-in is a multi-level school-based intervention aimed at physical activity promotion in primary schoolchildren, aged 9-12 years old, living in socially and economically deprived areas in Amsterdam. JUMP-in proved to be effective in improving sports participation. The aim of the present study was to examine the effect of JUMP-in on indices of mental wellbeing in schoolchildren. In addition, we investigated the longitudinal relationship between sport participation and indices of mental wellbeing.

Methods: A controlled trial was carried out in 19 primary schools including 1044 children. Measures were performed at the beginning of the first school year (T0: 2006), and repeated at the end of the first (T1: 2007) and second school year (T2: 2008). Outcome variables were child reported depressive feelings, quality of life and perceived sport competence.

Results: No significant intervention effect on indices of mental wellbeing was observed. Nevertheless, we observed that children who were active in sports at baseline and who maintained this during the intervention period had significantly lower depression scores and a significantly higher perceived sport competence, compared to children who did not participate in sports at both measurements.

Conclusions: The present study showed that a school-based strategy improving sports participation had no effect on mental wellbeing. The lack of effect may be due to unmeasured confounders. Therefore, future studies should account for factors such as the nature of the sports interventions in respect of frequency, intensity, duration and type of activity and the social climate in the sports settings.
**BACKGROUND**

The prevalence of depression among children and adolescents remains high (Birmaher 1996; Mesman 2001). Approximately 5% of 9- to 17- year-olds have been diagnosed as having a fully developed chronic depression, which is associated with extreme functional impairment (Shaffer 1996; Shaffer 1996). Children with a depression seem to be more often girls than boys (Rothon 2010; Green 2004) and more often belong to lower socio-economic and ethnic minority groups (Haastrecht 2005; Maas 2000; Verweij 2006). Depression not only has a negative impact on children’s current wellbeing (e.g. social relations, academic performance, and self-esteem), but also on children’s long-term development (Donovan 2000). Furthermore, diagnosed mood disorders significantly increase the risk of suicide (US department of Health and Human Services 2002).

The consequences arising from mental health disorders among youth strongly imply a need to identify strategies to reduce this public health problem (Brosnahan 2004). Early prevention may have health benefits and reduce societal costs (Donovan 2000). The advantages of physical activity (PA) are widely recognised both from a physiological and a psychological perspective (Biddle 2011; Landers 2001). Evidence has shown that a lack of PA has a negative impact on depression (Wendel-Vos 2008), whereas participation in PA has a positive association with positive mood (Brosnahan 2004; Williamson 2001) and greater self-esteem (Sonstroem 1984; Ferron 1999). Improvement of PA seems to have a beneficial effect on mental health problems (Donma 2010), feelings of sadness and suicidal behaviours (Brosnahan 2004).

In several large-scale epidemiological studies among children and adolescents a relationship was found between PA and mental well-being (Larun 2006). In these studies various measures of PA and mental well-being were used. Some small-scale intervention studies support a positive effect of PA on mental well-being in children. Several explanations for the psychological improvement related to PA and exercise have been put forward (Kirkcaldy 2002; Morgan 1997; Annessi 2004): First, PA could be associated with alterations in the physiological system-levels of endorphine and serotonine, two chemicals that help maintain a happy feeling. Second, according to behavioural theories, perceptions of mastery, self-efficacy, perception of capability, competence and self-worth that are associated with successfully participating in exercise can result in higher psychological wellbeing. Third, according to the “time out” theory, PA often removes individuals from there daily worries and stressors for a time, improving psychological states (Morgan 1982), and fourth, participation in PA and team sports activities may provide a social network that tends to support and protect from depression (Kirkcaldy 2002).

Thus, PA may be considered a strategy to improve mental health in children and adolescents (Brosnahan 2004). JUMP-in is a multi-level school-based intervention aimed at sports participation and PA promotion among children aged 9-12 years old in socially and economically deprived areas in Amsterdam (de Meij 2008). JUMP-in was found to be very effective in improving sport participation, especially among girls (de Meij 2011). The purpose of the present study was 1)
to investigate effects of JUMP-in on three indicators of mental wellbeing: depressive feelings, quality of life and perceived sport competence; and 2) to explore the longitudinal association between sports participation and wellbeing.

**METHODS**

**Recruitment of schools and participants**

Nine schools were recruited from two city districts that planned to start the implementation of JUMP-in. Random assignment of schools to a control or intervention group was not possible because of prolonged preparations needed for a successful adoption and implementation of JUMP-in. Therefore, we recruited 10 comparable control schools from geographically separated city districts to limit the possibility of contamination between intervention and control schools. The control schools were asked to continue their usual curriculum during the study period. Regular contact with the management and educational personnel of the schools took place to promote their continued participation. The control schools were offered the JUMP-in program at the end of the study. The city districts in which control schools were located supported the study and declared to support the implementation afterwards.

Sample size calculation was based on sports participation (de Meij 2011). A relative difference in sports participation of 10% between the intervention and control group after 21 months was considered clinically relevant. Based on this, we needed 375 subjects per group to be able to detect a difference of 10% between conditions with a power of 90% and an alpha of 5%, taking into account the clustering within schools and a dropout rate of 10%. We increased the sample size to allow for a higher drop out rate. Grade 8 was lost at T2, because they left school.

A total of 1044 boys and girls in grades 6-8 (aged 9-12 years, 50 % boys) from these 19 schools were enrolled in the study. Children and parents were unaware of the existence of intervention and control schools. They were told that the aim of the study was the assessment of sports and leisure time physical activities among children in Amsterdam. A passive informed consent procedure (Gortmaker 1999) was applied: all parents received a letter describing the study procedures, with the option to sign and return the form if they did not want their child or themselves to participate. The Medical Ethics Committee of VU University Medical Centre approved the study protocol.

**Measurements**

Measurements were performed at the beginning of the first school year (T0: September-October 2006), at the end of the first school year (T1: May–June 2007) and repeated at the end of the second school year (T2: May–June 2008). All measurements took place at school and were performed according to standardised procedures by trained testers. 794 boys and 796 girls
completed a classroom-administered questionnaire. The intervention duration was 8 months in the first year (from November to June) and 9 months in the second year (September 2007 to May 2008). For an overview of the flow diagram of subjects through all measurements see de Meij et al. (2011).

Mental wellbeing
Children self-reported their perceived sport competence, depressive symptoms and perceived quality of life as indices of their mental wellbeing.

Perceived Sport competence
Perceived Sport competence was assessed by a modified Dutch version of the Self-Perception Profile for Children (CBSK) (Harter 1985; Veerman 1997). The CBSK consists of 36 items from five subscales measuring aspects of perceived competence of children aged 8 to 12 years old. In this study, children were asked to fill in a modification of the sports competence scale. Based on a pilot test of the questionnaire, we simplified the questions into eight statements, for example ‘Some children think they are good in all kinds of sports’. Children were asked to score on a four points scale whether this item applies to them (4 ‘I certainly do too’; 3 ‘I do too’; 2 ‘I don’t’; 1 ‘I certainly don’t’). The 8 items were summed to calculate a sum score of perceived self reported sport competence with a high score representing high perceived sports competence and a low score representing low perceived sports competence. The internal consistency of this modified scale was good (Cronbach's alpha = .78).

Depressive symptoms
Depressive symptoms were assessed by the short version of the Depression Questionnaire for Children aged 9 to 12 years old (de Wit 1987; Evers 2000). This questionnaire is a widely used and well-validated Dutch-language screening tool for depressive symptoms, consisting of nine items designed to identify children with depressed mood. Examples are: ‘I often think other children don’t like me’, ‘In the past period I didn’t sleep well’. Answers are scored on a 2-point scale (not true, true). Total scores range from 0 to 9; scores above 3 are considered to be indicative of depression risk, and scores above 5 are in the clinical range (de Wit 1987). The dichotomous variable, clinical depression, was derived from the total depressive symptom score. The internal consistency of the Short Version Depression Questionnaire for Children in the present sample was good (Cronbach’s alpha = .79).

Perceived quality of life
Perceived quality of life was assessed by one question; “How did you feel in the last four weeks?”. Children were asked to answer using a score from 0 to 10 ranging from “very bad” to “very good” (Cantril 1965).
Sports participation
Sports participation was assessed in a personal interview. Trained interviewers asked whether the child participated in organised sports activities at least once a week for a minimum of three months (yes or no). Based on a pilot evaluation, an interview was the most reliable way to classify sports participation, compared to questionnaires and attendance lists (de Meij 2011).

Covariates
Covariates were gender, age, ethnicity and BMI. Age was calculated based on the self-reported birth date. Classification of ethnicity was based on the classification criteria of the Central Bureau of Statistics in The Netherlands (CBS 2000). If at least one parent or the child itself was born in Africa, Latin America, Asia (except Japan and Indonesia) or Turkey, a child was classified as non-Western. All other children were classified as Western. ‘Dutch,’ ‘Turkish,’ ‘Moroccan’ and ‘Surinamese’ were included in the analyses as separate groups, because those ethnicities were most prevalent in the sample. The remaining ethnicities were coded as ‘other western’ or ‘other non-Western. Body weight and height were measured by trained research assistants using a standard measurement protocol. Body weight of children (in underwear) was measured to the nearest 0,1 kg with a calibrated balance (Care 2 Move Medical; Marsden MS-230, UK). Body height was measured to the nearest cm with a folding length yardstick with a pedestal (Care 2 Move Medical; Marsden MH-226, UK). The measurements were carried out in a private room, in underwear and bare feet. Body Mass Index (BMI) was calculated by dividing weight (in kg) by height (in meters) squared (kg/m2).

Statistical analyses
Descriptive statistics were calculated to describe participant characteristics for the intervention and control group at baseline. Independent t-test or Chi-square-tests were carried out to explore and quantify subgroup differences at baseline regarding gender, age, ethnicity, BMI and sports participation.

Linear and logistic multilevel auto regression analyses were used to estimate the effect of the intervention on the mental wellbeing variables. Using the multilevel technique with two levels (i.e. individual and school), regression coefficients were adjusted for the clustering of observations within one school and individual. In the multilevel auto regression analyses the outcome variable at follow-up (T1 or T2) was regressed on treatment condition, outcome variable at a measurement one time point earlier (T0 or T1 respectively), adjusted for gender, age, BMI, ethnicity and clustering of schools.

The parameters of interest are the regression coefficients (b) and Odds Ratios (OR) indicating the difference between intervention and control group. Effect modification by gender, age, ethnicity and BMI was checked, by including an interaction term between the potential moderator and the treatment condition (e.g. gender*group). In case of a significant interaction term, subsequent subgroup analyses were conducted to test for differences in intervention effect between the subgroups. All analyses were performed according to the intention-to-treat principle.
The longitudinal association between changes in sport participation and changes in indices of mental wellbeing (depression score, clinical depression, perceived quality of life and perceived sports competence) was analysed using multilevel autoregressive analysis, in which the outcome variable mental wellbeing at follow-up (T1 or T2) was regressed on outcome variable at a measurement one time point earlier (T0 or T1, respectively), adjusted for gender, age, BMI, ethnicity and clustering of schools. The independent variable, sports participation, was recoded into 3 dummy variables, with children who were inactive at both T0 and T2 as reference group. Dummy group 1 were children who were inactive at T1 and became active at T2, dummy 2 children who were active at both T0 and T2 and dummy 3 were children who were active at T0 and became inactive at T2.

RESULTS

Study population
A total group of 1044 children was available for the baseline measurements and were included in the study. Figure 1 shows the flow of subjects through the trial and the available measurements at baseline (T0), after the first period (T1) and after the second period (T2). Dropouts were not significantly different from participants regarding baseline characteristics.

Complete sports participation data at baseline, T1 and T2 were obtained in 623 children (60%), complete measurements of anthropometrics in 605 children (58%) and complete questionnaire data in 536 children (51%). The most common reasons for dropout at T1 were absence due to illness or due to transfer to another school. The drop-out at T2 was mainly due to pupils of the highest grade moving to secondary school (316 pupils).

Table 1 presents the baseline characteristics for intervention and control schools, stratified for gender. The mean age of the subjects was 10.3 ± 1.0 years, 50% were boys, 13% was Dutch and the mean BMI was 19.0 ± 3.5. At baseline, 62% of the subjects reported that they did not participate in sports, the mean score on perceived sports competence was 3.0 ± 0.5 and the mean score on quality of life was 8.5 ± 1.9. Girls participated less in sports than boys (26 vs 51%) and girls reported more depressive symptoms than boys. Mean scores on depression symptoms (range 0 to 9) were 2.1 and 1.9 in girls versus 1.6 and 1.7 in boys from control and intervention schools, respectively. In boys 6.3% was clinically depressed, while in girls the prevalence of clinical depression was 9%. As shown in table 2, results from the linear regression analyses found that girls, younger children and the non-western group scored significantly higher on depressive symptoms. However, there were no specific child characteristics associated with clinical depression. Younger children reported a significantly lower quality of life (range 0 to 10), while Moroccan children scored higher compared to Dutch children. Regarding perceived sports competence (range 0 to 5), girls scored significantly lower than boys, as well as children with a higher BMI. Moroccan, Turkish and Surinam children scored higher on perceived sports competence than Dutch children.
**Intervention effects on mental wellbeing**

The mean scores for depression, perceived sports competence and perceived quality of life at baseline and follow-up for both the intervention and control groups are shown in table 3. There were no significant intervention effects on any of the mental well-being indicators. In addition, no significant interactions of group with ethnicity, age, BMI or gender were found.
Figure 1. Flow chart


- **No parental approval n = 5**

- **n = 1044 children included at Baseline (T0)**
  - Intervention schools (9) n = 501 (boys n = 248, girls n = 253)
  - Control schools (10) n = 543 (boys n = 262, girls n = 281)

- **n = 1049 eligible children**

- **Anthropometrics**
  - I: n = 536 C: n = 490 (n = 18 missing)

- **Sports participation interview**
  - I: n = 535 C: n = 489 (n = 20 missing)

- **Questionnaire**
  - I: n = 521 C: n = 470 (n = 53 missing)

**Baseline**

- **8-month follow-up**

- **20-month follow-up**

**Subjects for analyses at T1:**

- **Anthropometrics**
  - I: n = 500 C: n = 462 (n = 82 missing)

- **Sports participation interview**
  - I: n = 501 C: n = 462 (n = 81 missing)

- **Questionnaire**
  - I: n = 470 C: n = 437 (n = 137 missing)

**Subjects for analyses at T2:**

- **Anthropometrics**
  - I: n = 314 C: n = 329 (n = 401 missing)

- **Sports participation interview**
  - I: n = 297 C: n = 326 (n = 421 missing)

- **Questionnaire**
  - I: n = 312 C: n = 326 (n = 406 missing)

**Grade 6 left school (n = 316)**
Table 1. Baseline characteristics for intervention and control schools.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Boys</th>
<th>P *</th>
<th>Girls</th>
<th>P *</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I (n= 263)</td>
<td></td>
<td>I (n= 281)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C (n=247)</td>
<td></td>
<td>C (n= 253)</td>
<td></td>
</tr>
<tr>
<td>Age (y)</td>
<td>10.4 (1.0)</td>
<td>0.02</td>
<td>10.4 (1.0)</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>10.2 (1.0)</td>
<td></td>
<td>10.0 (1.0)</td>
<td></td>
</tr>
<tr>
<td>Ethnicity:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dutch</td>
<td>8.9</td>
<td></td>
<td>7.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>19.0</td>
<td></td>
<td>16.4</td>
<td></td>
</tr>
<tr>
<td>Moroccan</td>
<td>28.1</td>
<td></td>
<td>35.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>31.1</td>
<td></td>
<td>32.0</td>
<td></td>
</tr>
<tr>
<td>Turkish</td>
<td>23.4</td>
<td></td>
<td>24.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>13.8</td>
<td></td>
<td>15.2</td>
<td></td>
</tr>
<tr>
<td>Surinam</td>
<td>11.1</td>
<td></td>
<td>11.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16.2</td>
<td></td>
<td>16.1</td>
<td></td>
</tr>
<tr>
<td>Other Western</td>
<td>9.2</td>
<td></td>
<td>6.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.7</td>
<td></td>
<td>6.2</td>
<td></td>
</tr>
<tr>
<td>Other non Western</td>
<td>19.2</td>
<td></td>
<td>15.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>14.0</td>
<td></td>
<td>13.7</td>
<td></td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>19.2 (3.6)</td>
<td>0.8</td>
<td>19.8 (3.9)</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td>19.1 (3.3)</td>
<td></td>
<td>18.9 (3.5)</td>
<td></td>
</tr>
<tr>
<td>Weight status:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal weight (%)</td>
<td>68.3</td>
<td>0.9</td>
<td>62.1</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>69.4</td>
<td></td>
<td>67.7</td>
<td></td>
</tr>
<tr>
<td>Overweight (%)</td>
<td>23.9</td>
<td>0.6</td>
<td>26.7</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td>20.2</td>
<td></td>
<td>23.4</td>
<td></td>
</tr>
<tr>
<td>Obesity (%)</td>
<td>7.7</td>
<td>0.5</td>
<td>11.2</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>10.3</td>
<td></td>
<td>8.9</td>
<td></td>
</tr>
<tr>
<td>Sports participation (%)</td>
<td>48.3</td>
<td>0.2</td>
<td>21.7</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>54.5</td>
<td></td>
<td>28.3</td>
<td></td>
</tr>
<tr>
<td>Mean depression score (range 0 – 9)</td>
<td>1.7 (2.1)</td>
<td>0.5</td>
<td>1.9 (2.2)</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>1.6 (2.1)</td>
<td></td>
<td>2.1 (2.3)</td>
<td></td>
</tr>
<tr>
<td>Clinical depression (%)</td>
<td>6.5</td>
<td>0.91</td>
<td>8.2</td>
<td>0.91</td>
</tr>
<tr>
<td></td>
<td>6.2</td>
<td></td>
<td>9.9</td>
<td></td>
</tr>
<tr>
<td>Mean perceived sport competence (range 1-5)</td>
<td>3.2 (0.5)</td>
<td>0.4</td>
<td>2.9 (0.6)</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>3.1 (0.5)</td>
<td></td>
<td>2.9 (0.5)</td>
<td></td>
</tr>
<tr>
<td>Mean quality of life (range 1–10)</td>
<td>8.5 (2.0)</td>
<td>0.5</td>
<td>8.6 (1.8)</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>8.6 (1.9)</td>
<td></td>
<td>8.4 (1.9)</td>
<td></td>
</tr>
</tbody>
</table>

* Comparing intervention and control schools at baseline, using the Student’s T-test (age, BMI, weight status, depression score, sport competence, quality of life) and Chi square test (sports participation, clinical depression); I: intervention condition; C: control condition.

Table 2. Relationship (B/OR and 95% confidence intervals) of child characteristics with indicators for mental wellbeing measured at baseline.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Depr. symptoms</th>
<th>Clinical depression</th>
<th>Quality of life</th>
<th>Sports competence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender girls (ref boys)</td>
<td>0.43 [0.25 – 0.61]*</td>
<td>1.64 [-0.67 – 3.95]</td>
<td>-0.13 [-0.30 - 0.03]</td>
<td>-0.28 [-0.32 - -0.23]*</td>
</tr>
<tr>
<td>Age (y)</td>
<td>-0.12 [-0.22 - -0.02]*</td>
<td>0.87 [-1.27 - 3.01]</td>
<td>-0.15 [-0.24 - -0.06]*</td>
<td>-0.009 [-0.03 - 0.02]</td>
</tr>
<tr>
<td>Ethnicity (ref. Dutch):</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moroccan</td>
<td>0.08 [-0.25 – 0.41]</td>
<td>1.43 [-1.28 – 4.14]</td>
<td>0.60 [0.31 – 0.90]</td>
<td>0.13 [0.05 – 0.20]*</td>
</tr>
<tr>
<td>Turkish</td>
<td>0.33 [-0.03 – 0.70]</td>
<td>1.44 [-1.35 – 4.22]</td>
<td>0.30 [-0.03 – 0.62]</td>
<td>0.09 [0.002 – 0.17]*</td>
</tr>
<tr>
<td>Surinam</td>
<td>0.31 [0.07 – 0.68]</td>
<td>2.03 [-0.73 – 1.30]</td>
<td>0.18 [-0.15 – 0.5]</td>
<td>0.14 [0.05 – 0.22]*</td>
</tr>
<tr>
<td>Other Western</td>
<td>-0.14 [-0.59 – 0.31]</td>
<td>1.12 [-1.96 – 4.20]</td>
<td>0.15 [-0.25 – 0.5]</td>
<td>0.04 [-0.07 – 0.14]</td>
</tr>
<tr>
<td>Other non Western</td>
<td>0.5 [0.13 – 0.87]*</td>
<td>1.99 [-0.77 – 4.75]</td>
<td>0.10 [-0.23 – 0.42]</td>
<td>-0.004 [-0.09 – 0.08]</td>
</tr>
<tr>
<td>BMI</td>
<td>0.002 [-0.02 – 0.03]</td>
<td>0.99 [-1.02 – 2.99]</td>
<td>0.01 [-0.01 – 0.03]</td>
<td>-0.02 [-0.03 – -0.02]*</td>
</tr>
<tr>
<td>Sports participation</td>
<td>0.074 [-0.13 – 0.28]</td>
<td>1.0 [-1.35 – 3.34]</td>
<td>-0.01 [-0.19 – 0.18]</td>
<td>0.2 [0.13 – 0.27]*</td>
</tr>
</tbody>
</table>

Outcomes are analysed using multilevel linear and logistic analysis, adjusted for clustering of schools. * p<0.05

Table 3. Mean (SDs) scores for sports participation and mental wellbeing indices at baseline (T0), 8 months (T1) and 20 months follow-up (T2) and the mean differences between intervention and control schools (B/OR and 95% confidence intervals).

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>I</th>
<th>C</th>
<th>( \text{B/OR (95% CI)} )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T0</td>
<td>T1</td>
<td>T2</td>
</tr>
<tr>
<td>Sports participation (%)</td>
<td>33.0</td>
<td>59.5</td>
<td>64.0</td>
</tr>
<tr>
<td>Depression (score 0 to 9)</td>
<td>1.8 (2.1)</td>
<td>1.4 (1.9)</td>
<td>1.4 (2.0)</td>
</tr>
<tr>
<td>Clinical depression** %</td>
<td>7.3</td>
<td>5.9</td>
<td>6.4</td>
</tr>
<tr>
<td>Perceived sport comp.</td>
<td>3.0 (0.5)</td>
<td>3.1 (0.5)</td>
<td>3.1 (0.5)</td>
</tr>
<tr>
<td>(score 0 to 5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality of life</td>
<td>8.5 (1.9)</td>
<td>8.6 (1.8)</td>
<td>8.4 (1.8)</td>
</tr>
<tr>
<td>(score 0 to 10)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Outcomes were analysed using a multilevel analysis, adjusted for values at a measurement time point earlier (T0 and T1), age, ethnicity and body mass index.

* p<0.05

**Scores above 5 are in the clinical range.
Association between sports participation and mental wellbeing.
The longitudinal relationship between sport participation and depression scores, perceived
sport competence and perceived quality of life was analysed using multilevel autoregressive
analyses. Mental wellbeing scores in children who became active or who became inactive did
not change significantly over time, compared with children who did not participate in sports at
both measurements. However, children who maintained their PA status between T0 and T2 had
a significantly lower score in depression and a significantly higher perceived sports competence
(table 4).

Table 4. The relationship (B (95% CI)) between sports participation and depression score,
perceived Sports competence and quality of life.

<table>
<thead>
<tr>
<th>Group 1 became sport active</th>
<th>Group 2 remained sport active</th>
<th>Group 3 became sport inactive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression score</td>
<td>-0.04 [0.13] -0.28 – 0.21</td>
<td>-0.24 [0.12] -0.46 – -0.01*</td>
</tr>
<tr>
<td>Perceived sports competence</td>
<td>0.06 [0.03] - 0.0008 - 0.12</td>
<td>0.10 [0.03] 0.04 – 0.15*</td>
</tr>
<tr>
<td>Quality of Life</td>
<td>-0.05 [0.13] -0.31 – 0.17</td>
<td>0.09 [0.12] -0.14 – 0.32</td>
</tr>
</tbody>
</table>

Outcomes are analysed using a multilevel analysis, adjusted for values at a measurement time point earlier
(T0 and T1), age and body mass index. Children who were inactive at both T0 and T2 are the reference group.
* p<0.05.

DISCUSSION

The JUMP-in intervention had no significant intervention effect on depression, perceived quality
of life or perceived sports competence. Results of previous intervention studies are mixed. For
example, Annesi (2005) and Babiss (2009) found a positive relationship between changes in
sports participation and feelings of depression, but Rothon (2010) did not find a prospective
relationship. Biddle’s (2011) review of reviews reports potentially beneficial effects for reduced
depression, but the evidence base for a causal relation is limited; it was not possible to identify
research designs used, and intensity or duration of exercise and only 3 studies were on young
people Biddle 2011).
An explanation for the lack of effect in our study might be that we did not account for the exact
moment a child became physically active and for the nature of the sports interventions in respect of
frequency, intensity and type of activity. Some children started participating in sports in the
last month of the intervention, which might not have been long enough to show any effects at
the follow up measurement. This is confirmed by our finding that depression scores in children
who where active in sports at baseline and who remained being active during the intervention
period, were significantly lower. These children participated in sports for at least 20 months.
Further, their perceived sport competence was significantly higher compared to children who did not participate in sports at either measurement. Future interventions aimed at improving mental wellbeing in youth by means of promoting sport participation should therefore last for a longer period.

Another explanation for the lack of intervention effect on mental wellbeing is that mental health is influenced by a number of agents, often not easily affected by the individual (Rothon 2010). Our population exists of children of low SES and ethnic minority families living in socially and economically deprived areas. This setting obviously strongly affects mental health, since psychological climate and social interactions are crucial for mental wellbeing (Haggerty 1996). These effects may be stronger than the potential beneficial effect of PA. We found that children from non-western minorities were indeed more likely to report a lower mental well-being than children from Dutch ethnicity. However, the Moroccan children scored higher on perceived quality of life compared to the Dutch children and regarding perceived sports competence, Moroccan, Turkish and Surinam children scored higher on perceived sports competence than Dutch children.

Next to non-western minorities, we identified younger children and girls as more likely to report depressive feelings. Within the JUMP-in intervention approach, girls were specifically targeted as high risk groups, because they also show the lowest levels of sports participation. JUMP-in showed a significant increase in structural sports participation, especially in girls (OR 3.6 (2.3 to 5.6) (de Meij 2011). Future interventions aimed at improving mental wellbeing in youth should specifically target younger children, girls and children from ethnic minorities, since their mental wellbeing is generally lower.

Preventive action in the field of mental health and PA is much debated. However, in this regard there is reason to be cautious, because compulsory PA in the school setting may cause ominous experiences among children who suffer from, for example, overweight or motor problems (Lagerberg 2005). One may even argue that PA in school is sometimes counteractive, at least in some contexts. Anyhow, as Lagerberg states; forced and frightening activities should be avoided and the context should be one of enjoyment rather than of discipline and skill-dependent games where many children are apt to fail. Actually, JUMP-in provides adapted sports activities for children at risk (overweight, motor problems) in which enjoyment and increased self-esteem is a priority. These kind of sports might be suitable to prevent depressed feelings as well.

A strength of this study is the controlled design with baseline and follow-up measurements over a two school year time period and the inclusion of different indicators of mental wellbeing. Another strength was that the intervention was conducted in a real world setting by non-researchers. Our trial has also some limitations. First, randomisation of schools was not possible, as the adoption and organisation in the intervention schools had to be prepared several months before the intervention started. Second, comparison with other studies is difficult due to differences in outcome measures. Third, mental wellbeing measures were self-reported, suffering from social desirability bias. Fourth, the results might be influenced by the sample characteristics or other
unmeasured confounders. For example, Biddle found that higher levels of sedentary (sitting) behaviour are associated with worse mental health. Other factors such as differences in physical and social environments or outdoor play behaviour might have a negative or effects on mental wellbeing as well. Fifth, we did not specify the sports interventions with respect of frequency, intensity, duration and type of activity and we did not measure the exact moment a child started participating in sports. Many children started sports in the last six months and beneficial effects on mental wellbeing may need some more time to occur. Sixth, the validity and reliability of the adapted measurement instruments have not been verified in a predominantly low SES population. The combination of these weaknesses may have led to the lack of an intervention effect on mental wellbeing indicators.

Psychosocial disorders in youth are highly prevalent and early prevention and treatment is of utmost importance. However, our results do not support conclusions that sports promotion should be considered as part of an intervention strategy to improve child’s mental wellbeing. In literature it is suggested that effects of social interaction in sports interventions might have beneficial effect on mental wellbeing in their own right (Kirkcaldy 2002; Biddle 2011). Therefore, future studies should not only account for the intensity, duration and type of PA but also for the social climate in the sports settings.
A mixed methods process evaluation of the implementation of JUMP-in, a multilevel school-based intervention aimed at physical activity promotion.

Judith de Meij
Marcel van der Wal
Willem van Mechelen
Mai Chin A Paw

ABSTRACT

Background: The aim of the present study was to investigate factors influencing the adoption, implementation and institutionalisation process of JUMP-in – a multi-level school-based physical activity promotion programme-, to optimise the dissemination of the intervention and improve it’s effectiveness. The process evaluation concerned the constraints and success and failure factors at socio-political, organizational, user and intervention levels.

Methods: A mixed-methods approach including qualitative and quantitative data was conducted during two school years (2006–2008).

Results: JUMP-in was successfully embedded in the Amsterdam municipal policy and in the organizational structure and daily practices of the sectors involved. A general impeding factor was the complexity of the multilevel programme requiring multidisciplinary collaboration between organizations. In addition, there was a discrepancy between the recommendation to standardize and simplify the innovation and the need to tailor the strategies to local environmental, social, and cultural aspects.

Conclusions: This process evaluation provides challenges and remedies for managing discrepancies between prerequisites for an effective innovation and demands of daily implementation practice. The main recommendations are (a) standardized, simplified guidelines; (b) stepwise implementation; (c) formalized coalitions, integration of policy, and synchronization of tasks and protocols; and (d) smart planning and control by clear communication and feedback instruments. If these recommendations are incorporated into the JUMP-in intervention and organization, increased effectiveness and long-term effects can be expected.
BACKGROUND

In recent years, increased guidance has become available on how to translate theoretical ideas into systematically designed health promotion programs. However, little is known about the conditions for, or determinants of, successful implementation of such programs (Baranowski 2009). A careful process evaluation helps us find out what happened during implementation. This information is crucial to interpret the effects of the program and to improve the program design. To maximize the effectiveness and efficiency of a program, knowledge of determinants affecting the implementation process is needed.

In recent years, the scope and conduct of process evaluations has grown. Results from more than 500 studies offered strong empirical support to the conclusion that factors related to communities, providers, innovation characteristics, and aspects of the organizational functioning affect the outcomes obtained in prevention programs (Durlak 2008; Fixsen 2005; Greenhalgh 2005; Stith 2006). Process evaluations provide detailed information regarding these aspects and directions to improve the effectiveness and dissemination of innovations.

This article presents the process evaluation of JUMP-in, a primary school–based multilevel intervention that incorporates policy, environmental, and individual components to promote sports participation and daily physical activity (PA) among children from primary schools in deprived city areas of Amsterdam, the Netherlands. JUMP-in started in 2002 and after a pilot period an adapted and improved version of the intervention was disseminated across a larger area in Amsterdam at 60 primary schools, accompanied by continuous evaluation. The JUMP-in intervention is based on the EnRG model (Kremers 2006) and designed using the intervention mapping protocol (Bartholomew 2001), evaluated in a pilot study and improved using the RE-AIM framework (Glasgow 1999; Glasgow 2006; Eakin 2004; Glasgow 2001; Glasgow 2002; www.re-aim.org). The stepwise development of JUMP-in has been described previously (De Meij 2010; Jurg 2005; Jurg 2006; Jurg 2008). The program entails six components, and these are described in Frame 1.
Frame 1: Description of the components of the JUMP-in programme.

1. School sport clubs
   Structural, easily accessible school sports activities offered on a daily basis in or near the school premises. During school hours children get acquainted with a variety of sports and subsequently they can join clubs during out of school hours. Local providers of physical activities and sports are involved.

2. “The Class Moves!”
   A method (calendars) offering recurrent breaks for PA, relaxation and posture exercises during regular lessons. For each grade materials are adapted to the level of sensor-motor development. The aim is to make PA a daily habit and to contribute to a healthy sensor-motor development.

3. “This is the way you move!”
   Workbooks with assignments to perform in class and at home and an instruction-book for the school staff. The method is aimed at raising awareness of the importance of PA for health and at improving self-efficacy, social support, self-regulation and planning skills.

4. Parental information services
   Information meetings, newsletters, courses and sports activities, aimed at parental stimulation and support of children’s PA behaviour.

5. Pupil follow up system (PFS)
   A monitoring instrument yearly assessing and registering children’s sports participation, body mass index, and motor skills. The PFS facilitates referral to tailored interventions in a structured way.

6. Extra care for children at risk detected by the PFS
   Children with motor and movement disabilities (MMD) or who experience hampering factors in their PA behaviour (such as overweight) receive additional adapted PE lessons (Club Extra) or motor remedial teaching (MRT). If necessary, overweight children are referred to the youth health care or hospital.

The JUMP-in process evaluation is based on the theoretical framework of Fleuren et al. (2004), representing the main stages of the innovation process (adoption, implementation and institutionalization) and related determinants (Figure 1). The determinants can be divided into: (i) characteristics of the socio-political context, such as existing rules, regulations and legislation; (ii) characteristics of the organization, such as feasibility and compatibility of logistical procedures related to the innovation, inter-organizational linkages and commitment; (iii) characteristics of the professional adopting the innovations (user of the innovation), such as skills, beliefs and perceived support; and (iv) characteristics of the innovation, such as clearness of procedures, compatibility and complexity (Paulussen 1994; Fleuren 2004). Furthermore, the JUMP-in process-evaluation also incorporated the assessment of specific process measures for the various JUMP-in components, such as delivery and reach. Dose delivered means how much of the intended
A mixed methods process evaluation of the implementation of JUMP-in, a multilevel school-based intervention aimed at physical activity promotion.

intervention was delivered as planned. Reach is defined as the extent to which the intended target group participates in intervention components (Steckler 2002).

**Figure 1.** Framework representing the JUMP-in innovation process (adapted from Fleuren Determinants of process [23]).

In this study we investigated factors that are hypothesised to influence the implementation process: (a) delivery and reach of the programme and (b) characteristics of the socio-political context, the organization, the user and the innovation. We used a mixed methods technique combining quantitative and qualitative research strategies (Johnson 2007). Based on the results, we formulated recommendations to optimise, encourage and enhance successful widespread dissemination of the intervention and to optimize its effectiveness.

**METHODS**

**Recruitment, organization and participants**
The study was conducted among 9 primary schools in Amsterdam. The recruitment of schools was carried out in cooperation with policymakers of two city districts. Criteria for inclusion were that schools needed to have: (1) a trained PE teacher; (2) a majority of pupils from families with low socioeconomic status; and (3) a gymnasium, either in the school or in its vicinity. The districts were comparable in terms of availability and access to sports facilities. Sports clubs and local youth health care organizations located in the school areas were approached for participation. The PE teachers were responsible for the coordination of JUMP-in within schools. The city
districts sports coordinators were responsible for the coordination between the schools and assisted in the organization of school sports activities. The intervention team (consisting of two project leaders and the help desk staff) had meetings with the school director, PE teachers and sports coordinators about the planning and introduction of the programme components. The frequency of meetings depended on the phase of implementation and on encountered problems.

**Mixed methods design, data collection and measures**
The process evaluation was conducted during two school years (September 2006– June 2008). We used a convergent mixed method design, in which different research strategies were conducted and analysed separately yet concurrently and merged at the point of interpretation (Johnson 2007; Creswell 2011). Data collection involved a school- and environmental scan (filled in by PE teachers, school directors and city district’s sports coordinators), questionnaires (filled in by school staff, school directors, PE teachers and city district’s sports coordinators), structured in-depth interviews (with PE teachers and city district’s sports coordinators), a SWOT analysis (by the intervention team) and documentary analyses. Measured items were based on the theoretical framework of Fleuren (2004) and derived from the literature (Fleuren 2004; Paulussen 1994; Steckler 2002) and assessed with newly developed instruments. Most instruments included qualitative as well as quantitative questions. Table 1 outlines the elements of the mixed methods data collection, participants and key measures. Figure 2 presents a visualized overview of the convergent mixed methods data collection, analyses and integration of results in the interpretation.

**Measurement of delivery and reach**
To evaluate the actual implementation of the programme we investigated dose delivered and reach by quantitative measures in questionnaires, interviews and documentary analyses (e.g. planning schedules, registrations of activities, adherence ratings). Examples of qualitative questions were as follows: “How many workshops for the school staff took place?”, “How many school sports clubs were realised?” and “How many parental workshops and information meetings have been carried out and what was the participation grade?”. Other questions concerned level, intensity and duration of use of programme components, for example: “I teach the exercises of the calendar: ...” Seven answer categories ranged from “never” to “more than once a day”. Children’s sports participation was assessed in a personal interview at T0 (baseline, September 2006) and T2 (after two school years, June 2008). Trained interviewers asked whether the child participated in organized sports activities at least once a week for a minimum of three months (yes or no; de Meij 2011). An example of a qualitative question regarding dose delivered and reach was: “What has been changed in the planning and what was the reason?”

**Measurement of determinants of the innovation process**
To evaluate determinants that were hypothesized to affect the innovation process we investigated characteristics of the socio-political context, the organization, the user and the innovation
itself by questionnaires, interviews, a SWOT analysis and documentary analyses (e.g. policy documents, minutes of meetings, self-administered logs). In this regard, examples of qualitative questions were: “What is the school and city district’s policy regarding youth sports and children with deficiencies in their motor development?”, “How can communication between participating partners be optimized?”, “Which factors impeded or facilitated embedding of JUMP-in in your organization?”, “What is your opinion about the collaboration during the project?” and “What adaptations are needed to increase the feasibility of the programme implementation?”. Examples of quantitative questions were “I feel committed to the JUMP-in programme”, “I feel responsible for the implementation of The Class Moves” and “School sport related tasks are compatible with my daily set of tasks”. Six answer categories ranged from “I totally agree” to “I totally disagree”.

Data analyses
The SPSS 15.0 statistical package was used to obtain descriptive statistics (frequencies and means) from the quantitative questions. The semi-structured interviews were recorded and transcribed. Subsequently, the transcriptions of the interviews, the interview notes, the minutes of meetings, e-mails, logs, registrations of activities, evaluations of parental information meetings and workshops, planning schedules, school and environmental scans and other documents were organised by topic and analysed by MAXQDA 2007 (VERBI Software. Consult. GmbH, Berlin 2001). A code system was developed, ordered into a hierarchical structure, corresponding with the levels and determinants of the JUMP-in innovation framework. In all texts, codes were assigned to selected text segments. Subsequently, texts and codes were retrieved, analysed and finally described.

RESULTS
To develop a complete insight of factors that facilitated or impeded the JUMP-in innovation process, data collected using mixed methods were compared, related and integrated. Below, the main results in terms of delivery and reach are described as well as the factors affecting the JUMP-in innovation process. An overview of the results is presented in Table 2 and 3. In addition, a summary of the main implications of the newly encountered challenges and potential remedies to optimise the JUMP-in intervention is provided (table 4).

Results in terms of delivery and reach
Table 2 presents the results of JUMP-in in the study period 2006-2008 in terms of delivery and reach. Especially regarding the sports component, JUMP-in achieved positive results. At baseline there were no structural sports offers for youth in the intervention area. Within the period of 2 school years, a total of 63 school sports clubs were created at 9 schools and 7 official sports clubs were created in the local area. An important proportion of the target group was reached; after 2 school years 70% of the intervention children participated in sports on a structural basis,
compared to only 38% at baseline. Among girls the participation had increased even stronger: from 18% at baseline to 60% after 2 school years (De Meij et al. 2011). The positive results on sports participation in children could be achieved thanks to the effective cooperation between school, city district and sports clubs and the use of the PFS by which inactive children could be detected and motivated to participate. Other reasons for the successful implementation were intense motivation of the city district’s sports coordinator and PE teachers, and the compatibility of JUMP-in related tasks with their regular function.

However, not all components of the programme were implemented as planned. For example, attendance at parental information meetings was often disappointing. This may be because of a lack of perceived responsibility and motivation among schools and underestimation of the efforts needed to attract parents. In the second school year, attendance increased considerably thanks to extra support provided by the intervention team, connections that were made with existing structures, such as language courses or coffee meetings, and personal approach of parents of children at risk based on the PFS.

Regarding intensity of use of the in-class methods there was a large variation within and between schools. Differences were related to workload, compatibility with the curriculum and space to perform exercises. Variation between schools was mainly due to the amount of attention for the methods in staff meetings and perceived pressure and support from school directors.

Because of personnel turnover, two schools did not refer children to extra care in case of overweight or obesity. The other schools referred these children to child health care, resulting in capacity problems because of the large number of children and the lack of sufficient local treatment programs.

Determinants of the JUMP-in innovation process

Table 3 provides an overview of the main facilitating and hampering factors in the adoption, implementation and institutionalization phase of the JUMP-in innovation. The main determinants, grouped in categories, are described below.

Sociopolitical environment

In all phases of the innovation process political advocacy, lobbying, support and availability of resources had a positive impact. At the end of the study period JUMP-in was embedded in the Amsterdam city policy of sports and public health, in which integrative policy and ongoing financial means for JUMP-in was stated as a priority.

A hampering factor was the lack of existing local youth sports clubs and the lack of sports policy regarding risk groups at baseline. Further, the child health care and the paediatricians specialised in child obesity had insufficient capacity to manage all overweight and obese children detected and referred by JUMP-in. Moreover, there was a lack of evidence-based treatments.

Organization

The multi-disciplinary character of the innovation demanded increased collaboration between school, sports, city districts and child health care. There was strong commitment to comply with
A mixed methods process evaluation of the implementation of JUMP-in, a multilevel school-based intervention aimed at physical activity promotion.

Table 1. Elements of the mixed methods research strategy, participants, timing and key measures hypothesised to affect the innovation phases of JUMP-in.

<table>
<thead>
<tr>
<th>Method</th>
<th>Participants</th>
<th>Timing</th>
<th>Key measures (used method)</th>
</tr>
</thead>
</table>
| School scan             | School directors and PE teachers of 9 intervention schools                   | T0     | Socio-political environment (school and environmental scan, interview, SWOT and documentary analyses):  
Political commitment  
Political policies and priorities  
Resources (money and time)  
Availability, accessibility and convenience of local gymnasia, youth sports and health care  
Organization (school scan, questionnaire, interview, SWOT and documentary analyses):  
Organizational policies and priorities  
Organizational relationships  
Organizational functions  
Partnerships and networks  
Compatibility of innovation in organizational structures  
Policy and methods of physical education  
Plans for continuation JUMP-in in the future  
User characteristics (questionnaire, interview, SWOT and documentary analyses):  
Attitudes (pro’s and cons)  
Perceived importance of problem, goals and intervention  
Commitment and motivation  
Perceived responsibility  
Competences, skills and ability  
Appreciation of the components  
Outcome beliefs  
Perceived support and pressure  
Perceived fit in daily practice  
Qualification and expertise  
Intention to continue JUMP-in in the future  
Innovation characteristics (questionnaire, interview, SWOT and documentary analyses):  
Compatibility with regular tasks and curriculum  
Perceived clearness of tasks  
Communication & information  
User friendliness  
Coordination  
Programme management and leadership  
Visibility of results  
Intervention support and assistance  
Actual implementation (questionnaire, structured in-depth interviews, sports interview and documentary analyses):  
Dose delivered  
Reach and participation grade |
| Environmental scan      | Sports coordinators of 2 city district’s, PE teachers of 9 intervention schools | T0     |                                                                                              |
| Questionnaires          | School directors, PE teachers and school staff of 9 intervention schools, sports coordinators of 2 city district’s | T0 + T2 |                                                                                              |
| Structured in-depth interview | PE teachers of 9 intervention schools, sports coordinators of 2 city district’s, | T2     |                                                                                              |
| SWOT analyses           | JUMP-in intervention team                                                    | T3     |                                                                                              |
| Sports interview        | Children grade 3-8                                                           | T0 + T2 |                                                                                              |
| Documentary analyses²   | JUMP-in intervention team                                                    | T0 – T2 |                                                                                              |

Note: T0 = baseline, September 2006, T2 = after two school years, June 2008, T3 = Winter 2010

² We made use of planning schedules, registrations of activities, evaluations of parental information meetings and workshops, adherence ratings, minutes of meetings, policy documents, written agreements, self-administered logs and e-mails.
the JUMP-in goals among stakeholders of these organizations. However, more time was needed to synchronise organizational procedures in order to increase efficiency. Another hampering factor was the variety of providers involved in the planning and delivery of the programme. Components such as measurements as part of the PFS, the start of school sports clubs, MRT, referral to extra care and parental information were closely connected and there was a lack of coordination, planning and control regarding the overall programme. Involved participants complained about unclear communication lines. In addition, separate financial structures and lack of control over each other’s functioning among partners of different organizations turned out to be a hampering factor, as well as personnel turnover. In some cases the adoption process had to restart, agreements had to be reassured, knowledge and experience got lost and had to be rebuilt. However, at the end of the study period all participating organizations continued their collaboration and embedded the programme and goals in their policy and daily practices.

**Figure 2.** Overview of flowchart convergent mixed method design: data collection strategies, data analyses and cross data comparison and convergence.

[Diagram showing the flowchart convergent mixed method design: data collection strategies, data analyses and cross data comparison and convergence.]

**How can the effectiveness and dissemination of the JUMP-in intervention be optimised/ improved by knowledge about the factors influencing the implementation process?**
User characteristics
There was a strong willingness and aptitude to start JUMP-in. All participants considered physical inactivity and overweight as important health problems and the JUMP-in programme as an important intervention. However, commitment, motivation and readiness to conduct the intervention varied among users. Schoolteachers were the most critical participants; some had doubts regarding the feasibility of the in-class methods, the effectiveness of parental information services and the importance of extra care. Others complained about spending too much time on health issues; they perceived cognitive targets as their main priority and responsibility. However, during the implementation period the perceived importance of the goals related to the PFS, extra care

Table 2. Results in terms of delivery and reach (November 2006 - May 2008).

<table>
<thead>
<tr>
<th>Programme component</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>School 1</td>
</tr>
<tr>
<td>School sports clubs</td>
<td></td>
</tr>
<tr>
<td>Clubs T0 – T2(n) Participation T0 – T2 (%)</td>
<td>0-12</td>
</tr>
<tr>
<td>new official clubsa</td>
<td>32 - 64</td>
</tr>
<tr>
<td>Parental information services</td>
<td>6</td>
</tr>
<tr>
<td>Activities (n)</td>
<td>0-11</td>
</tr>
<tr>
<td>Reach parents (min-max) newsletter (+/-)</td>
<td>+</td>
</tr>
<tr>
<td>The class Moves!</td>
<td></td>
</tr>
<tr>
<td>Started (+/-)</td>
<td>+</td>
</tr>
<tr>
<td>Workshop d (+/-)</td>
<td>+</td>
</tr>
<tr>
<td>Follow-up d (+/-)</td>
<td>+</td>
</tr>
<tr>
<td>Intensity of use</td>
<td>+</td>
</tr>
<tr>
<td>This is the way you move!</td>
<td></td>
</tr>
<tr>
<td>Started (+/-)</td>
<td>+</td>
</tr>
<tr>
<td>Workshop(+/-)</td>
<td>-</td>
</tr>
<tr>
<td>Intensity of use</td>
<td>high</td>
</tr>
<tr>
<td>Follow up system</td>
<td>2</td>
</tr>
<tr>
<td>Measurements (n)</td>
<td>+</td>
</tr>
<tr>
<td>Referrals (+/-)</td>
<td>2</td>
</tr>
<tr>
<td>Club Extra/ MRT</td>
<td></td>
</tr>
<tr>
<td>Started (+/-)</td>
<td>+</td>
</tr>
<tr>
<td>Intensity of use</td>
<td>high</td>
</tr>
</tbody>
</table>

- = not implemented or n.a.  ? = activity took place but registration failed.
a = New realised official sports clubs at T2. A seventh sports club was created accessible for all children in the neighbourhood. b= The comprehensive study measurements caused time pressure to achieve goals. Two schools decided to postpone the implementation of ‘This is the way to Move!’ c = Due to turnover of PE teachers, two schools did not refer overweight children and did not implement MRT. d = Workshop and follow up for school staff about the use of the method, provided by trained members of the school supervisory service.
for groups at risk, parental information and the in-class lessons increased, compared to baseline. Teachers’ positive outcome beliefs and estimated feasibility increased as well, mainly because of observable JUMP-in successes and perceived advantages. Regarding the in-class methods teachers from younger age-groups generally performed better and reported more positive experiences than those of older age-groups. Differences were related to perceived workload, compatibility with the curriculum and space to perform exercises. The amount of attention for the methods in staff meetings and perceived pressure and support from school directors varied between schools.

**Innovation strategies**

Some components of JUMP-in were new (“This is the way you move!”) or adapted after the pilot evaluation (PFS, parental information services), but had not been tested in real world settings before implementation. Due to the innovative character it was not possible to catch all details in fine-tuned protocols. Further, some components demanded new structures within and new cooperation between organizations (school sports, parental information, PFS and referrals to extra care). This process took time and needed extra training and assistance by the intervention team. A hampering factor was the lack of an overall coordination for planning and control of all aspects of the intervention.

The opportunity to tailor the programme to aspects of the local setting – cultural, environmental - was appreciated, but also meant extra efforts and almost all participants recommended simplified guidelines and SMART planning schedules. Nonetheless, all participants stated that the programme should be continued. Moreover, some schools explicitly asked for additional components aimed at healthy nutrition. In 2008, the Dutch Centre for Healthy Living (CGL) certified JUMP-in as “in theory effective”. As a result JUMP-in generated a lot of national attention and the PFS was implemented in several Dutch municipalities.
Table 3. Main facilitating and hampering factors in the adoption, implementation and institutionalisation phase.

<table>
<thead>
<tr>
<th></th>
<th>Facilitating factors</th>
<th>Hampering factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adoption</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socio - political level</td>
<td>Political advocacy and support for the innovation.</td>
<td>Lack of policy regarding groups at risk.</td>
</tr>
<tr>
<td></td>
<td>High perceived fit of JUMP-in in policies.</td>
<td>Insufficient capacity of local health care for overweight and obese children.</td>
</tr>
<tr>
<td></td>
<td>Availability of financial resources.</td>
<td>Lack of evidence based treatment-programmes for overweight/obese children.</td>
</tr>
<tr>
<td>Organization level:</td>
<td>Strong commitment and motivation to comply to shared goals.</td>
<td>Lack of existing local youth sports clubs.</td>
</tr>
<tr>
<td></td>
<td>Clear information and communication strategies within organizations.</td>
<td>Lack of qualified trainers for lessons for children with MMD.</td>
</tr>
<tr>
<td>User level:</td>
<td>High perceived importance of innovation goals by director and PE teachers.</td>
<td>Moderate perceived importance of parental information and extra care by school staff.</td>
</tr>
<tr>
<td></td>
<td>Willingness and aptitude to collaborate in JUMP-in.</td>
<td></td>
</tr>
<tr>
<td>Innovation level:</td>
<td>Involvement of experts in tailoring the programme to the school characteristics.</td>
<td>Complexity of multilevel programme causing delay in the preparation period.</td>
</tr>
<tr>
<td><strong>Implementation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sociopolitical level</td>
<td>Positive attitude, subjective norm and beliefs among political stakeholders.</td>
<td>Incompatibility of JUMP-in PFS with existing health care monitoring instruments.</td>
</tr>
<tr>
<td></td>
<td>Positive attitude towards adaptations and changes in policies and practises.</td>
<td>Need for more time to synchronize and fine-tune organizational procedures in order to increase efficiency.</td>
</tr>
<tr>
<td>Organizational level</td>
<td>Facilitating factors</td>
<td>Hampering factors</td>
</tr>
<tr>
<td>----------------------</td>
<td>----------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td></td>
<td>Strong organizational commitment and motivation to comply to shared goals.</td>
<td>Lack of overall coordination hampered communication between organizations.</td>
</tr>
<tr>
<td></td>
<td>Goals, methods, procedures and tasks related to school sports were relatively easy to integrate in organizations.</td>
<td>Referrals of overweight/obese children were hampered by capacity problems in care institutes.</td>
</tr>
<tr>
<td></td>
<td>Effective communication strategies between partners in sports.</td>
<td>Poor availability &amp; accessibility of gymnasia.</td>
</tr>
<tr>
<td></td>
<td>Detection of children with overweight, inactivity and motor problems succeeded by the use of PFS.</td>
<td>Time pressure due to the timeline of the evaluation study.</td>
</tr>
<tr>
<td></td>
<td>Clear protocols, task descriptions and agreements within and between organizations.</td>
<td>Complex hierarchical lines and financial structures between collaborating organizations.</td>
</tr>
<tr>
<td></td>
<td>Clear hierarchical structures within organizations.</td>
<td>Personnel turnover among politicians, sports coordinators and PE teachers.</td>
</tr>
<tr>
<td></td>
<td>Satisfaction with quality and frequency of information regarding sports.</td>
<td>Poor availability of some gymnasia due to insurance-issues and cleaning agreements.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The competing position of some care providers within one district.</td>
</tr>
<tr>
<td>User level</td>
<td>Strong commitment and motivation to achieve goals, especially among PE teachers and sport coordinators.</td>
<td>Perceived workload among school staff</td>
</tr>
<tr>
<td></td>
<td>Involvement and support from experts in sports, health care and education.</td>
<td>Need for more information and clearness about tasks among the school staff.</td>
</tr>
<tr>
<td></td>
<td>Feasibility and compatibility of school sports related tasks with the regular task orientation.</td>
<td>Large variation in the amount of time teachers spent on the in-class interventions.</td>
</tr>
<tr>
<td></td>
<td>Observable results &amp; perceived advantages; increased PA among inactive children, referrals of children at risk and activity weeks for children and parents.</td>
<td>Lack of perceived responsibility for parental information among school participants.</td>
</tr>
<tr>
<td></td>
<td>Increase of positive outcome beliefs, estimated feasibility and perceived importance among participants.</td>
<td></td>
</tr>
</tbody>
</table>
A mixed methods process evaluation of the implementation of JUMP-in, a multilevel school-based intervention aimed at physical activity promotion.

<table>
<thead>
<tr>
<th>Innovation level</th>
<th>Facilitating factors</th>
<th>Hampering factors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Well defined and programme components.</td>
<td>A perceived lack of clearness about tasks</td>
</tr>
<tr>
<td></td>
<td>Potential for tailoring components to the local characteristics.</td>
<td>A lack of valid and reliable screening instruments to detect children with MMD</td>
</tr>
<tr>
<td></td>
<td>Tailored professional training and instructions for implementers.</td>
<td>Difficulties in reaching parents for information meetings and workshops.</td>
</tr>
<tr>
<td></td>
<td>Effective identification of children at risk.</td>
<td>Material of ‘This is the Way to Move!’ was perceived to be too valuable to take home.</td>
</tr>
<tr>
<td></td>
<td>Support from the intervention team and a centralised JUMP-in help desk.</td>
<td>School directors protect the staff against overload and did not oblige the implementation of in class programmes.</td>
</tr>
<tr>
<td></td>
<td>Daily PA with ‘The Class Moves’ was easy to integrate in the lessons for younger groups.</td>
<td>Daily PA with ‘The Class Moves’ was difficult to integrate in lessons for older groups.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Institutionalisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sociopolitical level</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Organizational level</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>User level</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Innovation level</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Implications of findings

The process evaluation provided lessons regarding programme strengths and areas in need of revision, which are presented as challenges and remedies in Table 4. These improvements might have positive implications for the programme effectiveness. The encountered lessons in the present process evaluation, however, exposed some discrepancies: the complexity of the problem of childhood physical inactivity and overweight demands for: (i) multi-component interventions; (ii) multi-disciplinary collaboration and; (iii) strategies tailored to the local profile and needs, combining bottom-up and top-down approaches. The JUMP-in process evaluation, however, indicates that successful implementation requires (i) a reduction of complexity in content and delivery; (ii) homogeneity in goals and policy; and (iii) standardised, evaluable and scalable programme components. The aforementioned discrepancies between prerequisites for an effective innovation and demands of daily implementation practices are not easy to solve. It may be clear that simplification of the programme and organization should not result in a decreased effectiveness. However, the recommendations in the present study are promising for the improvement of both effectiveness and implementation. In sum, we first need to develop simple standardized guidelines requiring minimum time for users, combined with improved information exchange strategies. Second, the complete programme requires a stepwise implementation during at least two school years. Third, organizations are advised to optimize their collaboration by formalized coalitions, integration of policy and synchronisation of tasks, planning schedules and protocols. This may increase stability and strengthen institutionalisation. Fourth, effective SMART planning and control of quality demands for clear communication- and feedback instruments and adequate programme management. The fifth advice is to provide schools with structural support during the implementation.

DISCUSSION

The present evaluation provides new insight regarding factors that affect the use and effectiveness of a multilevel school-based physical activity promotion program “JUMP-in”. The involvement of a wide variety of stakeholders in the multi-component intervention was one of the main challenges in the innovation process. Different authors have recognized that creating multidisciplinary collaboration and intensive participation in innovations may take years. Ideally, this collaborative process is characterized by nonhierarchical relationships, mutual trust and shared responsibilities for completing tasks (Mercx 2002; Weijters 2003; Ronda 2004). Moreover, data indicate that shared decision-making predicts programme sustainability (Hahn 2005). In this regard, JUMP-in was demonstrated to be successful in creating effective integral partnerships that have the potential to increase and optimize long-term effects after the improvements are incorporated. Qualitative measures of the JUMP-in innovation process can be used to explain the lack of quantitative intervention effect. Previous publications showed that JUMP-in was effective in
Table 4. Main challenges and remedies to optimize the JUMP-in intervention components.

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PFS: (monitoring &amp; detecting)</strong></td>
<td>Simplify PFS into separate modules: inactivity, overweight and MMD; adopt PFS to user needs and allocate monitoring of overweight to youth health care. Develop criteria for referrals of children at risk; synchronise existing health care monitoring systems; include the health care insurance in the collaboration; adapt the PFS to privacy legislation. Reach consensus regarding the definition of MMD; develop/select a valid and reliable instrument for screening and treatment of MMD.</td>
</tr>
<tr>
<td><strong>School Sports</strong></td>
<td>Overcome the lack of local sports trainers; Guarantee the quality of sports offers and improve accessibility of gymnasia after school hours. Create ‘combination-functionaries’ between school and sports clubs. Make agreements and task descriptions concerning the coaching of sports trainers, the accompaniment of children, security matters, and cleaning tasks; Describe formal guidelines how to fullfil tasks.</td>
</tr>
<tr>
<td><strong>Parental information services</strong></td>
<td>Improve efficacy of parental information services strategies. Increase reach and attendance of parents; Create fixed links between JUMP-in components and parental information; provide school structural support. Invite parents individually (based on outcomes PFS); increase use of community based strategies and social marketing principles; combine information with attractive activities;</td>
</tr>
<tr>
<td><strong>The Class Moves!</strong></td>
<td>Increase motivation to comply among the school staff; make method part of the daily routine. Tailor the method to capacity, competences, profile and needs of users. Joint planning and agreements about the use and regular attention for the method in school staff meetings. Distinguish between those who teach younger and older groups; Tailor the introduction; deliver a CD with songs to support the exercises and provide more examples.</td>
</tr>
<tr>
<td><strong>This is the way you move!</strong></td>
<td>Tailor the method to the capacity of implementers and the needs of daily practice. Increase the quality and intensity of programme delivering Simplify the handbook, limit preparation time; make the method useful for project activities; simplify the method to make it less expensive and easier to take home. Increase attention for the method in regular staff meetings in order to strengthen commitment and motivation; facilitate the exchange of user tips.</td>
</tr>
<tr>
<td><strong>Referrals to extra care for high risk groups</strong></td>
<td>Increase feasibility of tasks and improve the fit in the regular task orientations. Improve coordination of referrals; increase effectiveness of planning and action in multidisciplinary stepped care chains; create actual overview of local health care. Simplify procedures and tasks and embed them in existing chains of care and prevention. Strengthen collaboration, communication and gear actions between partners in the health care sector; include the health care insurance. make school youth health care responsible for coordination of care for overweight children; create a “menu” of evidence based prevention- and care programmes to refer to.</td>
</tr>
</tbody>
</table>
changing sports participation among children, but no intervention effect regarding hypothesized mediators (self-efficacy, social support and habit strength) was found. Furthermore, no intervention effect on daily PA behaviour or outdoor play was found (De Meij 2011; Van Stralen 2012). This lack of effects could be explained by ineffective intervention methods and strategies, an inappropriate intervention setting or insufficient implementation. The component “This is the way you move!” for example, was obviously not effective in changing PA, outdoor play and related mediators in children. However, inferior implementation might have been a reason for the lack of effect as well. The disappointing results on daily PA could also be explained by inappropriateness of the intervention setting, as leisure time activities, such as outdoor play, are typically performed during after school hours. To create the necessary conditions for increased daily PA and outdoor play, a combination of school-based and family-based strategies may be needed, involving the social and physical home environment (Spence 2003; Borys 2012). Moreover, this might reduce the tasks for the school staff. Other potential additional strategies include environmental adaptations such as attractive playgrounds. These components have, therefore, been integrated in the recently renewed JUMP-in programme and in the Amsterdam JOGG approach (Dutch acronym for Youth on a Healthy Weight), the Dutch translation of the Epode programme.

Regarding parents, JUMP-in succeeded in improving parental social pressure and social support to encourage children in sports participation. However, the intervention did not succeed in influencing other related potential mediators in parents such as parental self-efficacy, perceived environmental barriers, habit strength and planning skills (De Meij, submitted). Providing attractive and tailored information seems not enough to change these determinants. More attention for parental skills and involvement of the social and physical home environment is, therefore, recommended to improve parental self-efficacy, planning skills and habit strength. In addition, it is recommended to make use of social marketing principles in order to recognize specific barriers and opportunities for behaviour changes in parental mediators (Borys 2012). The core principle of social marketing is to tailor strategies to the profile and needs of the population. Motivation to change should be built on direct benefit for the target audience, based upon issues that touch their emotional perceptions. This will make changes easier and popular (Borys 2012). Actually, social marketing is an important pillar of the JOGG approach (van Koperen 2010) and is applied in the renewed JUMP-in intervention as well.

A strength of this study is the evaluation of JUMP-in in a real world setting. This avoided an overestimation of the level and quality of the implementation and promotes continued use of the program after the study. Other strengths were the collection of multi-level data at multiple time points and the use of mixed methods.

It is important to note some limitations as well, such as the use of questionnaires of unknown validity and reliability and the possibly selective response to questionnaires among school staff. Those who responded might be more committed and more positive towards the project or the project goals. However, questionnaire data were always combined with data from other methods. Furthermore, one can question whether measuring process variables and using them
as indicators for the extent of success of an intervention will do justice to the true impact of the intervention before the innovation is defined in detail and the implementation is sufficiently established (Durlak 2008).

The stepwise development of JUMP-in towards a practical, acceptable, sustainable and replicable intervention is an iterative process. At this moment, JUMP-in is disseminated across a larger area. The recommendations are incorporated into the intervention and organization and the dissemination will be accompanied by a continuous evaluation. With the improvements in mind, increased effectiveness and long-term effects can be expected.
Chapter 8

General discussion
This thesis describes the development, effectiveness and feasibility of JUMP-in, a primary school-based multi-level intervention aimed at sports and physical activity (PA) promotion among children in deprived city areas in Amsterdam. This chapter summarises and discusses the main findings and compares JUMP-in with similar school-based programmes. Additionally, methodological issues regarding the JUMP-in study are identified and discussed. Finally, implications and directions for further development of the JUMP-in intervention and the local public health practice are discussed, and policies and recommendations for future research are proposed.

**MAIN FINDINGS**

**Steps and instruments in the intervention development**

In 2002 we started the development of the school-based JUMP-in intervention using health promotion planning models and theories that explain PA behaviour and behaviour change. Programme objectives were directed at sports participation, daily physical activity (PA), hypothesised behavioural determinants and parental involvement. We transposed the objectives into a pilot version of JUMP-in, which was tested in 2002-2004. The RE-AIM framework (Reach, Efficacy, Adoption, Implementation and Maintenance) was used to transpose the pilot evaluation outcomes into an improved comprehensive intervention tailored to the needs of children attending schools in deprived city areas. The renewed programme consisted of afterschool sports, classroom programmes aimed at increasing daily PA, parental information services, and a pupil follow-up system aimed at detection and referral of children at risk. In 2006-2008, we evaluated the intervention alongside the wider introduction of JUMP-in at 60 schools. Based on the outcomes of the effect and process evaluation study, newly encountered challenges and remedies were transposed into a revised intervention. In 2012, JUMP-in became the school-based component of the Amsterdam integral approach “Children at a Healthy Weight” involving multiple sectors within the community.

During the entire development process, the health promotion planning models were extremely valuable. However, the problem turned out to be more complex than we had estimated a decade ago, and a sustainable, effective and efficient approach required far-reaching innovations, including intersectoral cooperation and involvement of the entire community. The necessary knowledge and expertise in community building, organisation development, communication and intersectoral cooperation are still inadequately integrated in the health promotion planning models.

**Summary of intervention effects**

A significant beneficial intervention effect was found on the main outcome: organised sports participation. Effects were stronger for girls and for Moroccan and Turkish children. No significant
intervention effects on overall daily PA levels, outdoor play, screen time, body composition and aerobic fitness were observed. Furthermore, no significant intervention effect on indices of mental wellbeing (depression, perceived quality of life and perceived sports competence) was found. However, children who were active in sports during the whole follow-up period had significantly higher aerobic fitness, significantly higher perceived sport competence and lower depression scores at follow-up compared to children who did not participate in sports at either time point.

Mediators
It was hypothesised that children's personal cognitions (i.e. attitude, self-efficacy, intention, perceived planning skills) and social and environmental determinants (i.e. social modelling, social pressure, social norm, social support, perceived barriers) would act as mediators in changing sport participation, outdoor play and screen behaviours. Thus, JUMP-in targeted all of these hypothesised mediators. However, mediation analyses showed that JUMP-in was not effective in changing the hypothesised mediators, so no significantly mediated effects could be identified. However, changes in self-efficacy, social support and habit strength were positively associated with changes in sports participation. Changes in social support, self-efficacy, perceived planning skills, enjoyment and habit strength were positively associated with changes in outdoor play. Enjoyment was positively associated with TV-time, while parental rules were negatively associated. Having a computer in the bedroom and enjoyment were positively associated with computer use, while parental rules were negatively associated.

Looking back at the working model of JUMP-in (Figure 1, Introduction), cognitive constructs thus appear to be important factors, and we must look for more effective strategies to influence these constructs. Despite the fact that JUMP-in did not influence cognition, sports behaviour was successfully influenced by a change in the setting. Offering an appropriate selection of sports is apparently sufficient to influence the sports participation of children. This finding is consistent with the outcomes of the JUMP-in pilot study. It is also consistent with the model of Physical Exercise and Habit Formation and with ecological models that assume a direct and independent influence of the setting on behaviour. The JUMP-in intervention effect will probably increase if effective strategies focusing on cognition are added.

Parents
Parents were an important target group in the JUMP-in intervention, and JUMP-in was indeed effective in improving social support and increasing social pressure among parents regarding their children’s sports participation. These determinants significantly mediated the intervention effect on sports participation. We found no significant intervention effects on parental perceived pros, self-efficacy, sports competence, perceived barriers, planning skills and habit strength, while these hypothesised mediators were significantly associated with sports participation. Furthermore, there was no intervention effect on intention, perceived cons, social modelling
and social norm, but these constructs were not significantly associated with sports participation. These findings provide helpful suggestions for designing a more effective parental component of the JUMP-in programme.

**Process findings**

The process evaluation indicated that JUMP-in was successfully embedded in Amsterdam policy and in organisational structures and daily practices of the sectors involved. The programme was generally delivered as planned, and its perceived importance and commitment among participants increased during the implementation. All participants planned to continue the programme in the future. A general impeding factor, however, was the complexity of the multilevel programme involving multidisciplinary collaboration between organisations. In addition, the JUMP-in process evaluation exposed some discrepancies between the prerequisites for effective innovation and the requirements for daily implementation. One example is the conflict between the need to tailor the intervention strategies to the local profile and local needs, and the recommendation to standardise and simplify the innovation.

The main recommendations for improving both effectiveness and implementation concerned enhanced information exchange strategies, a stepwise implementation, synchronisation of tasks, planning schedules and protocols between collaborating organisations, and structural intervention support. JUMP-in followed up on these recommendations, which resulted in increased stability, effective smart planning and control and strengthened institutionalisation.

**JUMP-in compared with similar school-based programmes**

**School-based PA promotion programmes**

Studies on school based programmes in the promotion of PA and sports are heterogeneous in design, participants, cultural setting, interventions and outcomes (Khambalia 2012). This complicates comparison of the JUMP-in results with findings of systematic reviews or meta-analyses. Most studies are carried out in the United States, raising questions about the generalisability of results due to differences in infrastructure, school systems, environments and cultures (van Sluijs 2007).

Another complicating factor in the comparison of JUMP-in results with findings of reviews is that most intervention studies are largely focused on a single setting within the school environment (Van Sluijs 2007), for example: 1) modified physical education classes (SPARK (Sallis 1997); 2) modified playground environments (Stratton 2005) or; 3) additional PA opportunities (Take10 (Steward 2004), PLAY (Pangraze 2003) and Energizers (Mahar 2006)). Van Sluijs et al (2007) conclude that there is a lack of evidence for effectiveness of interventions using educational activities only. Bases on these reviews comprehensive, whole school approaches with inclusion of after school PA programme components are recommended to increase effectiveness of school based interventions (Doak 2006; Khambalia 2012; van Sluijs 2007).
**Multi-component approaches**

Four studies evaluating a school based multi-component approach to promote PA comparable to the JUMP-in model are: the Swiss KISS (Kriemler 2010); the Canadian Action Schools BC (AS BC) (Naylor 2008); CATCH from the United States (Luepker 1996) and; the Dutch intervention Lekker Fit (Jansen 2008). These interventions focused on increasing the quality and amount of physical education lessons (KISS, AS BC, CATCH and Lekker Fit), additional PA in the classroom (KISS, AS BC), family involvement and PA homework (KISS, AS BC, CATCH), extracurricular PA (AS BC, Lekker Fit), classroom education (CATCH, Lekker Fit) and administration of the Eurofit test (Lekker Fit). CATCH and Lekker Fit targeted a combination of PA and healthy nutrition behaviour.

All interventions were evaluated by a controlled trial design. The KISS evaluation study showed significant benefits on body fat, aerobic fitness (measured by the 20 m shuttle run test) and PA in school (measured by accelerometry). Similar to JUMP-in, KISS was not effective in improving overall daily PA or quality of life (Kriemler 2010) and the level of adherence to the PA homework was disappointing. The AS BC results showed 10 additional minutes of PA per school day, in addition to PE. This increase translated into a positive effect on boys’ PA levels (assessed by pedometers). No intervention effect was found on BMI (Naylor 2008). The CATCH evaluation offered evidence of effects for decreasing fat consumption and increasing PA among children (Luepker 1996; Nader 1999; Coleman 2005). Child obesity prevalence significantly decreased for 4th grade students of CATCH schools (Hoelscher 2010). The Lekker Fit study (Jansen 2008) showed a significant intervention effect on aerobic fitness of children in grades 3-5 but not in children in grades 6-8. There were no measures of daily PA. The prevalence of overweight decreased among the younger children attending Lekker Fit schools. The effects of Lekker Fit and CATCH on overweight prevalence may be attributed by the components targeting healthy nutrition behaviour. This is in line with conclusions of reviews that for a significant reduction in overweight, interventions in the school setting should include combined diet and PA interventions (Harris 2009; Campbell 2001, Khabamlia 2012; Doak 2006).

As in JUMP-in, the above-mentioned programmes included a high level of implementation and a high degree of integration into the school system. However, they differed from JUMP-in in a number of critical components. First, KISS and AS BC teachers added PA “energisers” in the classroom while JUMP-in teachers used exercises of “The Class Moves”, i.e. PA breaks including relaxation and posture exercises. Further, the JUMP-in homework assignments mainly focussed on PA related cognitions such as knowledge, awareness and planning skills instead of PA behaviour. Another difference is that all interventions included additional PE lessons for all children, while JUMP-in primarily focused on increased participation in sports and physical activities after school hours among children who were not yet physically active. In addition, no other intervention introduced a monitoring system to detect inactive or overweight children or children with motor problems hampering sports and PA behaviour. This monitoring system facilitates tailoring the PA promoting strategies to the individual needs of children who need it most. Further, by using an integral environmental approach involving stakeholders in the local
area, JUMP-in provides opportunities for children to participate in sports and PA that are more likely to sustain on the long-term.

In sum, JUMP-in extends previous PA school interventions by introducing a model including a comprehensive prevention programme with adapted sports, physical activities and motor remedial teaching not only targeting the general population of school children but also the high risk children who are unlikely to participate in regular sports offers.

METHODOLOGICAL ISSUES

This part of the discussion addresses several methodological issues that should be considered when interpreting the findings presented in this thesis.

Study population
Although the intervention was effective in increasing sports participation among our study population, the extent to which these results can be generalised need to be taken into account.

Assignment to intervention and control group
Randomisation is the best method removing selection bias as it helps to ensure comparability between groups with respect to characteristics which may influence outcome. However, random assignment of schools to the control or intervention group was not possible for several reasons. Prolonged preparations were needed for a successful adoption and implementation of JUMP-in: a school and environmental scan had to be carried out, and commitment had to be built among school staff and local partners in sports, prevention and care. Furthermore, networks of participating organisations had to be established, and organisational practices had to be prepared for the implementation of the programme.

Before the trial started, the JUMP-in intervention had been implemented in 40 Amsterdam schools. For the trial, nine new intervention schools were recruited in two city districts that planned to start the implementation of JUMP-in. To be included in the trial, schools needed to have: (1) a certified PE teacher; (2) a majority of pupils with low socioeconomic status (SES) and; (3) a gymnasium in the school or in the immediate vicinity of the school. Ten comparable control schools were recruited from geographically separated city districts to limit the possibility of contamination between intervention and control schools.

At baseline intervention and control schools differed with respect to sports participation and aerobic shuttle run scores: in control schools sports participation was significantly higher (boys: 50% vs 37% and girls: 25% vs 18%) while in intervention schools aerobic fitness scores were significantly higher (boys: 6.3 vs 5.8 laps and girls: 5.1 vs 4.6 laps). Moreover, in the intervention schools significantly more children were from a Turkish background and less children from a Dutch background (Turkish 23% vs 14% and Dutch 10% vs 19%). The higher fitness scores may
be explained by the fact that more intervention schools had conducted the aerobic fitness test (shuttle run test) during regular PE lessons in the year before the trial. Children may have profited from this experience leading to a learning effect. Control and intervention schools were comparable regarding socioeconomic status of the school population, school policy, number of physical education lessons and environmental characteristics such as local sports infrastructure. All schools were concerned about the high prevalence of physical inactivity and overweight and all were motivated to start the intervention and participate in the study. The control schools were asked to continue their usual curriculum during the study period, and they were offered the JUMP-in programme at the end of the study. Some of the control schools however would rather have started the intervention immediately. The city districts in which control schools were located supported the study and declared their support for the implementation afterwards. This prospect may have influenced control schools and city districts in their policies and activities regarding the promotion of sports participation before the trial ended. Nine of the ten control school started the JUMP-in implementation after the trial.

**External validity**
A strength of our study was that the programme was implemented by the local partners themselves and was integrated into a real-world setting, which prevented overestimation of effects due to unrealistically controlled conditions. Nevertheless, the participants were children growing up in deprived city areas in low SES families, thus limiting the generalisability of our findings. The proportion of children with a foreign background ranged from 82% to 90%, compared to 23% in the general Dutch population (0-25 years old) (CBS 2008). The majority of our population was not acquainted with participation in organised sports, and parents might have perceived financial, personal and situational barriers regarding youth sports participation. Low SES youth and parents living in deprived city areas may differ from the general population in many other ways. These specific population characteristics may affect the generalisability of our study results. Furthermore, due to the high rates of overweight and physical inactivity, participating schools may have been more motivated for this type of intervention, more prepared for change and therefore not representative of all schools (Jansen 2008). Regarding environmental factors, the city districts involved in the JUMP-in intervention differed from general Dutch neighbourhoods as well. There was a lack of existing community sports clubs for youth and qualified sports trainers. Therefore, the present results may not be considered as representative for the Dutch population at large, and it is unknown whether the effects of JUMP-in can be replicated in other city areas or cities.

**Outcome measures**

**Objective measurements**
An important strength of our study is the objective measurement of PA by accelerometers and the assessment of sports participation in personal interviews by trained testers. Previous
experiences in the pilot study pointed out that these methods are much more reliable and that they prevent response bias and over-reporting of PA levels (Jurg 2006). Limitations were the costs and time available for accelerometer data collection. Therefore, accelerometers were only used in a subgroup of children in grade 4.

Anthropometric measures were performed by trained staff using standard protocols. Considering the sample size, financial and time constraints, BMI measurement was the only feasible measure for anthropometrics within JUMP-in. However, more research is needed on the best way to measure overweight and obesity in children, because BMI is not sensitive to small changes in body composition, especially in youth (Zimmerman 2004; Nooyens 2007). Moreover, BMI in children may represent body build rather than body fatness (Wright 2001). Being measured in underwear was a sensitive topic for schools, parents and children, especially for overweight children. Therefore, we paid special attention to privacy during measurements and told children that the aim was to assess growth. Moreover, measurement results were confidential to protect overweight children from uncomfortable situations.

**Self-report**

In our study, hypothesised mediators of PA and sports behaviour were assessed by questionnaires among children aged 9 to 12 years and parents of children aged 6 to 12 years old. These questions were based on existing questionnaires (Sallis 1991; Sallis 1996; Tremblay 2001; Welk 2000), but generally of unknown validity and reliability. Psychological wellbeing was assessed with a validated questionnaire among children aged 9 to 12 years (Harter 1985; Veerman 1997; de Wit 1987).

The self-reported data on determinants in this study are susceptible to reporting bias and social desirability bias (Livingstone 2004; Sallis 2000). Schoolchildren of this age may be less capable of adequately answering questions on behaviour, cognition and psychosocial constructs (Swinburn 1999; Tremblay 2001). Trained testers provided children verbal instructions on how to fill in the questionnaire and stayed in the classroom during completion. They tried to minimise social desirability by stressing the anonymity of respondents and by emphasising that there were no right or wrong answers. Questionnaires for the parents included a letter with instructions. Additionally, trained testers offered parents assistance to complete the questionnaire at school. With regard to respondent burden, one hampering factor was the length of the questionnaire: it took children and parents approximately 45 minutes to complete the questionnaire. To limit measurement error we used a minimum of four items for most constructs, and since we included many mediators both for sports participation and daily PA behaviour, the span of attention may have been insufficient to consider all questions properly for both behaviours separately. These limitations may also be an explanation for the lack of mediation effects found in this study. The negative association between intention and sport participation could be explained by the way we measured intention (“Do you intend to increase your sports participation within one month?”). We measured the intention to change sports participation instead of the intention
to start participating in sports. Items measuring change are less appropriate measures for mediation analysis. Future studies should pay attention to framing such questions when planning a mediation analysis.

**Process measures**

Data on the quality of the programme implementation provided indications for strengthening the content and organisation of JUMP-in. However, we were not able to examine to what extent the quality of implementation and related support system was related to intervention effects. Additional work is needed to better understand the most appropriate determinants of the implementation process and how to measure them. This will make it possible to determine the thresholds of implementation quality necessary for producing the intended effects and to define criteria for ‘high’ or ‘low’ implementation quality (Domitrovich 2008; Dusenbury 2005).
IMPLICATIONS FOR THE INTERVENTION

Below, we identify implications of our results for an improved intervention content and organisation. Some recommendations have meanwhile been incorporated into a renewed programme. Therefore, we also provide an overview of the JUMP-in programme development during the past decade (see Table 1).

JUMP-in sports: still room for improvement
A sports infrastructure surrounding JUMP-in schools in disadvantaged neighbourhoods was successfully established in which children could participate in appropriate sports at their own level. The pupil follow-up system made it possible to identify inactive children and to actively motivate them to participate in school sports clubs. This brings the target of “100% active pupils” continually nearer to realisation. However, the concept of school sports is still subject to improvement, especially in terms of cooperation and organisation:

Connect the sports policies for schools with those of city districts and the city
City districts have their own policies, targets and plans for promoting sports participation, which are not always compatible with JUMP-in. Moreover, because JUMP-in funding from the municipality is provided, city districts tend to cut their own budgets for promoting youth sports participation and after-school sports activities. It is therefore crucial that smart connections are sought between citywide and local interventions and policy, based on the concept of ‘one city – one organisation’.

How to aim for effective local implementation?
Because the local sports managers are employees of the city district, the citywide JUMP-in intervention team had difficulty controlling the organisation of the local JUMP-in sports activities. This can lead to problems, especially when the policy for encouraging sports participation of the city district differs from the central policy of the city. Furthermore, conditions such as available time and quality of the staff were not always adequate.
One option is to have the local sports managers seconded to the central municipal organisation that is responsible for the JUMP-in programme. However, the risk of this option is that it weakens the connection with the local sports organisations, and it is precisely this local relationship which is an important success factor for JUMP-in school sports. Here as well, the solution lies in coordinating the central policy of the city with that of the city districts. Clear agreements about aims and efforts will lead to even more effective organisation of school sports activities. This is also the route that JUMP-in has now chosen.

Enhance cooperation with community sports associations
The success of the JUMP-in school sports clubs is seen by some community sports associations as unfair competition. Offering sports activities for a low price, at convenient times and close to
schools can discourage parents from joining a community sports association, or even cause them to cancel an existing membership. Participants in the JUMP-in programme have been cooperating as much as possible with community sports associations. The current aim is to actively direct pupils – where possible – to the community sports associations. This takes place, for example, by training at the community sports association as time goes on, organising tournaments there, gradually raising the school sports club subscription fee and requesting the participation of parents at the community association. As a result, parents and children learn to participate in a structure that facilitates the transition to membership in a community sports association, which is important for the continuity of sports participation in the long-term. Children who are still unable to make the transition to the community sports association can permanently participate in the school sports club.

**Prevent dropouts, monitor attendance**
To prevent dropouts, it is important to monitor the attendance of pupils at school sports clubs. Attendance is now monitored at JUMP-in school sports clubs. Children who drop out are identified and encouraged by the teacher PE to continue participation, or are guided to a different, more suitable activity.

**Investing in motivational interviewing skills**
It is advisable for teachers PE at JUMP-in schools to be trained in motivational interviewing skills. During the regular training for teachers PE, there is still inadequate attention for dealing with the physically inactive target group. In the Amsterdam sport and exercise promotion programme for secondary education, teachers PE are trained in these skills; as a result, they are better able to encourage and support pupils in making a change towards a more physically active lifestyle. Teachers in primary schools would also benefit from such training, and there are now plans to organise continuing education programmes for JUMP-in PE teachers. For that matter, the standard education programme for PE teachers is also paying increased attention to encouraging the physically inactive target group to become more active.

**To increase daily PA, choose other strategies**
*Involve the larger community*
JUMP-in was not successful in improving outdoor play or screen behaviours. Consequently, the school setting may not be the sole setting to improve active leisure time behaviours. As these behaviours typically take place after school, a combination of school-based and community-based intervention strategies may be needed to improve these behaviours. These strategies would involve the social and physical home environment. This hypothesis is confirmed by previous studies showing that school-based intervention models involving environmental strategies are more effective in promoting PA in elementary schools (Naylor 2009).
Encourage active outdoor play during the school break

In order to get inactive children in motion, policy is required that focuses on encouraging active outdoor play during the school break (Nettlefold 2010; Beighle 2006; Janssen 2011). During the break, a small proportion of the children often take control of most of the schoolyard, and in many schoolyards there is a number of ‘hotspots’ where many children want to play. Observations of vulnerable, awkward and timid pupils have shown that their play behaviour is dependent on three environmental factors: the protective and supervising presence of the teacher, the design of the schoolyard (zoning) and the aspects of the environment (challenging) that invite children to play (van Hagen 2008). JUMP-in is now taking account of these factors by designing schoolyards for various types of activities, in which attention is paid to efficient use of the space and variation in types of play for all target groups (boys, girls; all primary school grades; physically challenging and less active game preferences). Teachers and staff who are responsible for pupil care during breaks and after school are trained in outdoor play supervision. The PE teacher integrates recess games into the curriculum. The activities/games are relatively simple, so children can play with little supervision or explanation, and the games are enjoyable for a majority of children. Transfer from PE lessons to the schoolyard is facilitated with a game-of-the-month or game cards. In addition, game materials are purchased, and an altered time management of recess time is implemented; as a result, groups use the schoolyard at different times and playground usage will be increased (Janssen 2011). Finally, parents are involved with outdoor play supervision in the schoolyard.

Include school components aimed at healthy nutrition

To stimulate a healthy weight it is advisable to combine strategies aimed at increasing sports participation and daily PA with components aimed at healthy nutrition (Khambalia 2012; Resnicow 1997). A healthy nutrition policy at school is an essential part of a comprehensive approach. In concrete terms, this means that agreements are made about: 1) snacks and drinks during the morning break; 2) birthday treats and; 3) lunch. Important reasons for implementing a healthy nutrition policy at school are the following:

- Children spend a major part of their day at school. What they eat and drink at school partly determines their health and bodyweight.
- The school is an important setting for acquiring a healthy eating pattern; children ‘learn’ to eat healthy products, observe each other’s eating behaviour and influence each other. The teacher is also a role model.
- Eating and drinking healthy products at school becomes a habit.
- It is likely that healthy nutrition contributes to improved learning performance of children (Rampersaud 2005; Bos 2010; Taras 2005; Hoyland 2009).
- Such a school policy supports parents who want healthy nutrition for their children: ‘the school does not allow junk food’.
- If there is no school-wide policy, individual teachers set the rules in their class. This can lead to different ‘rules’ for children in the same family. Moreover, if the teacher does not set any rules either, it is difficult for him/her to call children and parents to account for ‘unhealthy’ snacks.
Nutrition policy is now a basic component of the programme at JUMP-in schools. The intervention team supports the implementation process, which consists of the following: a) analysis of the baseline situation; b) creating support for change with the head teacher, school team and parents; d) establish policy; e) implement policy, and; f) safeguard policy within the school. Evaluation and recurrent attention are essential to prevent the policy from ‘staying in the drawer’.

Give priority to a healthy lunchbox from home.
From a practical and financial perspective, when children stay at school for lunch it is advisable to give priority to a healthy lunchbox from home. Moreover, this is highly compatible with the Dutch school system and the food culture in the Netherlands. Another advantage is that parents become actively involved in providing healthy food for their children. This increases the likelihood that healthy eating will become a habit at home as well.
Since 2009/2010, a number of primary schools in Amsterdam have been experimenting with various forms of healthy meal service at school. Pupils greatly enjoy the meals, even those who are sometimes ‘problem eaters’ at home. The schools have reported a number of positive effects from eating lunch together: an improved educational environment (tranquillity, social interaction), increased concentration in the class after lunch, introduction to food from other cultures and learning to appreciate healthy food. Generally speaking, the parents are also satisfied. However, this experience has shown that it is difficult to organise and finance healthy meals at school.

Train as role models
All JUMP-in sports trainers must be aware of their position as role models, so during sports activities they should eat only fruit and drink only water. They have a role in encouraging the children to do the same. Of course, it is desirable for all community sports associations to also implement a healthy nutrition policy. This can be achieved partly through the cooperation of the community sports associations with JUMP-in.

Focus on parental pedagogic skills
The JUMP-in intervention strategies for parents were mainly focused on their knowledge and beliefs, but parents apparently also need the capacity and practical tools to provide support and to plan their children’s PA behaviour. To provide these tools, we developed an innovative intervention strategy, based on the Entertainment-Education principles (Bouwman 1999), involving interactive theatre as an educational tool to improve the pedagogic skills of parents. Simple practical strategies are demonstrated showing parents how they can promote their children’s sports participation, improve their dietary habits and how to deal with issues faced by many parents, such as “how to encourage desired behaviour”, “how to promote and support my children’s outdoor play behaviour”, and “how to prevent or manage sedentary behaviour”. Much of the performance is improvised in interaction with the audience, and parents are asked to contribute performance suggestions regarding difficult parenting situations.
Influence cognitions in a theme-based approach
By adding effective strategies aimed at influencing cognitions, the JUMP-in intervention effect is expected to be enhanced, and made potentially permanent, when the environment of the children changes after they enter secondary education. The new JUMP-in programme, besides making sports and physical activities available, therefore focuses on influencing cognitions and implementing changes in policy and the environment. For this purpose, activities, lessons and information for children and their parents are provided on specific themes. Examples of such themes are outdoor play, biking or walking to school, drinking water instead of sweetened drinks, and eating fruit and vegetables, lunch and snacks. The JUMP-in schools focus on one annual theme, in which combined interventions are deployed simultaneously. For example, during the ‘drinking water’ theme, nutrition students from the Amsterdam University of Applied Sciences (HvA) provide guest lessons in the class about water and sweetened drinks, and dieticians hold interactive workshops for parents. Children ‘pimp’ a drinking bottle, and mothers decorate a water jug. A ‘water only’ policy for breaks and activities is implemented at the school. Parent contact-persons and teachers of afterschool activities are deployed as ‘water promoters’, and an education campaign for mothers is initiated: ’I make healthy choices, so my child drinks water!‘ In this way, besides implementing a policy on water as the preferred beverage, the programme also takes account of cognitive aspects, such as knowledge, attitude and social influence.

Social marketing for a better connection with the target group
As part of the development of new JUMP-in intervention components, parents, children and key figures are involved, and social marketing techniques are applied; as a result the content and form of the message connects more effectively with the experiential world of the target group. For example, it turned out that mothers have pleasant associations with outdoor play, such as enjoyment, releasing energy and staying in contact with their peers. The mothers reason that outdoor play results in a well-developed child, and this gives them a good feeling as a parent. Social marketing connects to this with key messages and with the development of tailored interventions and communication tools (Borys 2012; Gracia-Marco 2010).

Start intervention with youngest age group
Interventions at preschools (ages 2-4 years) and daycare facilities (ages 0-4 years) have also focussed out of necessity on healthy food and more PA. Indeed, overweight is becoming a problem with younger and younger children, and overweight preschool children tend to stay overweight as they grow (Freedman 2005; Dietz 1998). Food and exercise habits are formed very early in life, and once children become too heavy it becomes difficult for them to get back to a healthy weight (van der Hurk 2005; Seidell 2000; Jeffery 2000). Moreover, the efforts of JUMP-in should be continued into secondary education. A number of Amsterdam preschools and secondary schools have now implemented a comprehensive programme. Together with JUMP-in for primary education, this creates a continuous line with suitable interventions for all ages.
Provide on-going support to ensure fidelity

Our process evaluation results show that high quality and continuous support for schools is needed for successful implementation. Although this requires additional finances and planning, without such support, including training and consultation, it is unlikely that implementation fidelity will be maintained (Kam 2003).

Create clarity about commissioning practices

A sustainable and effective programme organisation requires clarity about the practices of contractors and clients, both administrative and managerial. The process evaluation showed that lack of clarity on these aspects impeded cooperation and implementation. Clarity about the organisational structure is crucial for safeguarding the programme over the longer term. Obviously, this applies not only to the control of the organisation, but also to the responsibilities for implementation.

IMPLICATIONS FOR PUBLIC POLICY

Maintain the balance between universal prevention and indicated prevention

It continues to be a challenge for JUMP-in to find the right balance between interventions focusing on the entire population and the high-risk group approach (Rose 1981; Rose 1985). Until 2005, JUMP-in was a prevention programme focusing on the entire population. However, at that time it primarily reached children and parents who already enjoyed relatively healthy and active lifestyles. To reach high-risk children, the JUMP-in pupil monitoring system was developed, and beginning in 2005 the BMI and sports participation of all children were monitored. Children who were inactive, or were classified as overweight or obese, were given a modified sports programme or they were referred to suitable care. However, the enormous size of the identified group of high-risk children resulted in long waiting lists at the Child Health Care centres and at paediatricians. Moreover, there was a lack of direction concerning care for individual children, there were no clear agreements about referrals and feedback between care partners, and there was a lack of available evidence-based treatment programmes.

Beginning in 2005: the magnitude of problem leads to shift to indicated prevention and care

Between 2005 and 2010, the above-mentioned factors led to a shift in the JUMP-in programme to indicated and care-related prevention. Parental activities were organised primarily for parents of high risk children, and schools paid substantial attention to identifying these children and directing them to care programmes, which were organised partly in school. During this period, JUMP-in initiated motoric remedial teaching (MRT) and modified sports clubs at school. In 2010, JUMP-in had this mode of operation reviewed according to the legal framework, specifically regarding the Personal Data Protection Act (Wbp). The work protocol in which the school had access to BMI data was found to be not in compliance with this privacy legislation.
However, the mode of operation concerning the collection, processing and use of information about sports participation and motor development of the children was found to be in accordance with the Wbp.

**Beginning in 2010: focus returns to prevention, additional activities offered where needed**

In 2010, the necessity to make the programme privacy-proof, as well as the undesirable trend whereby JUMP-in was becoming a “programme for fat kids”, resulted in another change of course. Beginning with the school year 2010/2011, JUMP-in schools were selected for participation based on low socioeconomic status and high average BMI scores, but the JUMP-in focus returned to prevention. With respect to the identification of overweight children: from that point JUMP-in has had only a facilitating role. There is still an additional weighing and measuring point for children grade 4 (aged 7-8 years), which is no longer implemented by JUMP-in but by the Child Health Care. As a result, another detection point was established in addition to the regular periodic health exams for 5 and 10-year-olds. Sports participation is still determined annually for all children, and inactive children are encouraged by their PE teacher to participate in suitable sports and physical activities.

**Towards a comprehensive healthcare chain**

An effective approach to obesity and physical inactivity requires a connection between prevention and appropriate care for high-risk groups. There must be a strong emphasis on effective coordination and cooperation between all partners in the chain. High-risk children must have immediate access to the appropriate activity or agency. In 2010, the National integrated health care standard for the diagnosis and management of obesity in children and adults (Nederlandse Zorgstandaard Obesitas) (Seidell 2012) was established; it describes the appropriate care that must be provided for overweight and obese children, how this care should be organised and the quality standards that apply to the care. Besides the implementation of the care standard, a top priority is to aim for a wider reach and higher participation in affordable and effective programmes for overweight children.

**Create coalition between cities and healthcare insurers**

Cooperation between cities, city districts and healthcare insurers provides opportunities for improved care and prevention in terms of nutrition, physical activity, parenting and overweight. Joint regional-oriented analyses and joint efforts will lead to an improved chain approach, greater participation of children in programmes, higher quality programmes and improved skills of the implementers. Through smarter use of resources and a more customised approach, local needs can be met more effectively.

**Involve politicians and multi-sector policymakers**

Childhood inactivity and obesity is a complex issue which requires multi-sector policies and multiple stakeholder involvement at all levels to foster healthier lifestyles in a sustainable
way. A plan that is supported by the entire city council is essential; it not only concerns the councillors for healthcare and sport, but also those for education, spatial planning and welfare. In the implementation plan of the Municipal Health Policy Memorandum and the Sports Plan, comprehensive health policy is a central focus. Tackling obesity has become a top priority in both policy documents, as well as in the Social Support Act (WMO). In addition, it is one of the eight priority areas of Jong Amsterdam (Young Amsterdam) for 2012-2014. Despite the attention for comprehensive policy, however, there are still too many barriers between the various municipal domains. From the perspective of ‘one city - one organisation’, progress is also required here.

**Focus on a district-based community approach**

Not only the schools should be involved, but the entire community as well, with activities that focus not only on changing behaviour, but also on changing the social and physical environment. Comprehensive community-based public health interventions are beginning to show encouraging results in reducing childhood obesity. Such an approach is being tested across Europe in the Ensemble Prévomons l’Obésité Des Enfants (EPODE) project, which engages whole communities, including local government and businesses. In the Netherlands, JOGG (Youth at a Healthy Weight, Jongeren Op Gezond Gewicht) is the counterpart of EPODE. JOGG is based on the principles of community-based health promotion (Bracht 1990; Minkler 1998). Amsterdam is one of the frontrunners in the JOGG movement, and started in 2011 the first JOGG community. As a result, the municipality of Amsterdam made a commitment to an even broader, intersectoral approach. The JUMP-in school programme is an important component of this community approach.

**Establish a framework for legitimacy, delineation and review**

A programme evolves continuously based on evaluation and feedback, and resulting from a changing environment, societal developments and political influence. To improve effectiveness and to safeguard the links with practice and policy, new insights are preferably integrated immediately in the content and structure of the intervention. This is sometimes difficult to combine with the ambition of demonstrating the evidence of an intervention with controlled trials.

This iterative process therefore requires an assessment framework to ensure legitimacy, and delineation when choosing new components or making changes in the programme. This framework is based on data (how big is the problem? where is the problem? and who has the problem?), urban policy, political priorities, theory and healthcare standards.

**Long-term sustainable investments are required**

A successful and sustainable behavioural change towards a healthy lifestyle requires a long-term, structural approach. The battle against obesity and physical inactivity has become a national and municipal priority; there is attention to the problem and awareness, along with the realisation that obesity is a major public health problem. A decade ago, we dared not hope for what is happening today. Nevertheless, it may be years before the results become fully visible. Therefore,
it is important to continue the iterative process of testing and adapting interventions and to monitor the outcomes in terms of health, behaviour and process measures. In the next chapter recommendations concerning future research are discussed.

Table 1. The evolution of JUMP-in from 2002 to 2013.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target group</strong></td>
<td>Children aged 6 to 12</td>
<td>Children aged 6 to12, specific attention for children at risk.</td>
</tr>
<tr>
<td><strong>Objectives</strong></td>
<td>Increased sports participation and daily physical activity</td>
<td>Increased sports participation and daily physical activity</td>
</tr>
<tr>
<td><strong>Programme components¹</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School sports</td>
<td>Easily accessible school sports activities.</td>
<td>Establishment of structural and easily accessible school sports clubs.</td>
</tr>
<tr>
<td>Parental information</td>
<td>Information meeting about importance of PA and sports for children and the supporting and stimulating role of parents.</td>
<td>Information, meetings and courses for parents. Extra attention for parents of high-risk children.</td>
</tr>
<tr>
<td>Class focused components</td>
<td>‘The Class Moves!’ ‘Choose your Card’</td>
<td>‘The Class Moves!’ and ‘This is the way you move!’</td>
</tr>
<tr>
<td>Healthy nutrition policy</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Adapted sports and motor remedial teaching</td>
<td>-</td>
<td>Children with motor and movement disabilities or hampering factors in PA behaviour such as overweight receive tailored interventions.</td>
</tr>
<tr>
<td>Offers for children at risk.</td>
<td>-</td>
<td>Children at risk (inactivity, overweight, motor problems) are offered tailored interventions or are referred to the health care.</td>
</tr>
<tr>
<td>Activity week</td>
<td>In the yearly JUMP-in Activity-week all components are brought together.</td>
<td>Optional</td>
</tr>
<tr>
<td>Active outdoor play school policy</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Pilot study</td>
<td>Effect and process evaluation study</td>
</tr>
<tr>
<td>JUMP-in 2010-2013 70 schools</td>
<td>JUMP-in future: school programme in broader community approach</td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>---------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Children aged 4 to 12</td>
<td>Children aged 2 to 12</td>
<td></td>
</tr>
<tr>
<td>Increased sports participation, daily physical activity and healthy nutrition</td>
<td>Increased sports participation, daily physical activity and healthy nutrition</td>
<td></td>
</tr>
<tr>
<td>Structural and easily accessible school sports &amp; PA clubs.</td>
<td>2-4 years: ‘Beweegkriebels’ and physical activities for parents and children. 4-12 years: School sports clubs</td>
<td></td>
</tr>
<tr>
<td>Information, meetings and workshops. Increased attention for parental styles &amp; skills. Parents are offered practical tools to improve children’s PA and healthy eating behaviour.</td>
<td>Besides prevention, new means are being investigated for applying coercion and compulsion to parents of obese children.</td>
<td></td>
</tr>
<tr>
<td>An extended menu including lessons and activities aimed at JUMP-in related objectives (sports, PA and nutrition).</td>
<td>An extended menu is offered including lessons and activities aimed at JUMP-in related objectives (sports, PA and nutrition).</td>
<td></td>
</tr>
<tr>
<td>School policy including agreements about (1) snacks and drinks during the morning break; (2) lunch and; (3) birthday treats.</td>
<td>Policy at all schools including agreements about healthy nutrition.</td>
<td></td>
</tr>
<tr>
<td>JUMP-in offers support and advice for making the motor analysis and setting up MRT at school.</td>
<td>MRT, as with other forms of remedial teaching, must be viewed as an educational task in tailored education for pupils who need additional support.</td>
<td></td>
</tr>
<tr>
<td>JUMP-in facilitates detection and referral of overweight children and offers support for setting up MRT. Inactive children are motivated to participate in sports and PA.</td>
<td>JUMP-in facilitates the detection of children at risk (overweight and motor problems). Inactive children are motivated to participate in sports and PA.</td>
<td></td>
</tr>
<tr>
<td>Optional</td>
<td>Optional</td>
<td></td>
</tr>
<tr>
<td>Active outdoor play policy at school, aimed at social and environmental factors.</td>
<td>Active outdoor play policy at all schools.</td>
<td></td>
</tr>
<tr>
<td>Application of the PDCA circle (Plan Do Check Act)</td>
<td>Monitoring BMI, sports participation and Application of the PDCA circle.</td>
<td></td>
</tr>
</tbody>
</table>
Explanation of programme components table 1:

**School sports:**
2002-2005: During PE lessons children get acquainted with a variety of sports. Subsequently they can join a club out of school hours in or near to the school premises. Existing local providers of PA and sports clubs are involved.
2006-2009: Based on outcomes of the JUMP-in pupil follow up system (PFS) inactive children are motivated to participate.
2010-2013: Inactive children are identified and motivated to participate in sports and PA. Children who are unable to make the transition to community sports associations can permanently participate in the school sports club.

**“The Class Moves!”:**
Programme offering regular breaks for PA, relaxation and posture exercises during normal lessons. There are different calendars for each grade.

**“Choose your Card!”:**
A card game approach with assignments to be done in the class and at home. The method is aimed at raising awareness on the importance of PA. The cards are used to prepare an Activity-week and can be linked to an exhibition.

**“This is the way you move!”:**
Workbooks with assignments to perform in class and at home, aimed at raising awareness of the importance of PA for health and at improving self-efficacy, social support, self-regulation and planning skills.

**“Beweegkriebels”:**
Educational staff are being trained to implement a challenging, but playful, physical activity that is adapted to the ages of the children.

**Parents-toddlers physical activities:**
Parents and their toddlers participate in weekly lessons focussing on the possibilities of engaging in PA with the toddler as part of everyday life.

**Parental information:**
2002-2005: The information meeting takes place once a year can and be given in the parents’ own language by trained information officers.
2006-2009: Parental information services contain several options: meetings, courses and sports activities for parents. A JUMP-in information movie is developed. Personal approach of parents from high-risk children is facilitated by the PFS. Existing structures such as language courses or coffee meetings are used to maximise attendance.
2010-2013: Parent meetings are led by specialists, such as dieticians, or by the JUMP-in intervention team. Parents become actively involved in the physical activities and the after-school sports and exercise programmes for children. More attention for parental style and pedagogic skills.

**Healthy nutrition policy at school:**
The JUMP-in intervention team supports the implementation process, which consists of: a) analysis of baseline situation; b) creating support for change among school staff and parents; d) policy establishment; e) policy implementation, and; f) safeguarding policy within the school.

**Adapted sports and MRT:**
2006-2009: Children with motor disabilities or children experiencing hampering factors in PA behaviour such as overweight are detected by the JUMP-in Pupil follow up system. They receive additional adapted PE or MRT by a qualified teacher.
2010-2013: JUMP-in offers support and advice for making the motor analysis and setting up MRT at school. JUMP-in schools that initiate MRT qualify for one-time incentive funding for the implementation of MRT or the MRT training of the teacher concerned.

**Activity week:**
2002-2005: The Activity-week takes place once a year. Parents play an important role in this week. Examples of activities in this week are: a sport and activity exhibition where products of ‘Choose your Card’ are presented, sports activities for parents and children and a sport market where parents and children meet local sport clubs.
2010-2013: Schools focus on one or two annual themes, in which combined interventions are deployed simultaneously, targeting changes in cognitions, policy and the environment. Examples of such themes are outdoor play, biking or walking to school, lunch, snacks, drinking water and eating fruit and vegetables.

**Active outdoor play school policy:**
Alteration of the schools’ playground, outdoor play schedules, training in outdoor play supervision for staff, introduction of recess games and parental participation in outdoor play supervision.

**PDCA (Plan–Do–Check–Act)**
An iterative four-step management method used for the control and continuous improvement of processes and products. It is also known as the Deming circle/cycle/wheel. PCDA helps to achieve higher quality in results and processes and to gain continual increases in work efficiency (Moen 2011).
**IMPLICATIONS FOR FUTURE RESEARCH**

Although the studies in this thesis have provided new insights into personal, social and environmental issues concerning the encouragement of an active lifestyle among children by using a multilevel approach, they have also raised new questions. Several recommendations for future research are presented below.

**Develop valid, reliable and sensitive measures in children.**
Future research is needed on the development of measurement tools for primary school children that detect changes in determinants and behaviour and that are valid, reliable and sensitive to change. Furthermore, it is advisable to explore the potential of combining self-reported and objective measurements.

**Explore environmental determinants of children’s PA and sports behaviour.**
Mediation analyses showed that JUMP-in was not effective in changing the hypothesised perceived environmental mediators. Therefore other strategies should be included in JUMP-in. However, the lack of a significant association between perceived environmental barriers and sports participation suggests that JUMP-in should target other determinants. To identify relevant environmental determinants of PA and sports behaviour in children, it is advisable to add the Analyses Grid for Environments Linked to Obesity (ANGELO) conceptual framework (Swinburn 1999) to the JUMP-in theoretical basis. This ANGELO framework has been specifically developed to conceptualise ‘obesogenic’ environments. This enables the identification of specific areas to be targeted by intervention settings and strategies in type (i.e., physical, socio-cultural, economic and political) and size (i.e. micro: home, school, neighbourhood, and macro: health care or the media).

**Formulate organisation aims and targets focussing on the environment**
Demonstrating the effectiveness of a prevention programme will also require other indicators besides health and BMI. Although a preventive approach at the population level often yields greater health benefits than a programme focusing on the high-risk group, it is often years before health effects can be demonstrated (Petersen 2004). This makes it difficult to acquire funding and support for such interventions, or to continue such interventions over the long-term. It is therefore crucial to not only demonstrate changes in PA and eating behaviour, or related social-cognitive mediators, but also to formulate process targets. Examples of process targets at the organisation level are the number of partners that have committed to attaining the final target, the scope of the intervention or the inclusion of obesity prevention on the national and local political agendas. Examples of process targets at the environmental level are the construction of more bike paths and more playgrounds – with adequate and varied facilities – in the neighbourhoods (van Koperen 2012).
Involve stakeholders and the target group in the evaluation

Participation of professionals, politicians, management, policy makers and the target group is not only an important element in the health promotion campaign, but also in the evaluation (Cousins 1998; USAID 1996). This is because all stakeholders have their own ideas about when the programme is successful, and this determines what they would like to know from an evaluation. Participation of stakeholders in the evaluation contributes to the relevance and believability of the evaluation results, and to the use of these results (Butterfoss 2001; WHO 1998; Patton 1997). Moreover, when stakeholders talk with each other about the evaluation of the programme (what everyone wants, how this can be measured, who is able to take on this responsibility and wants to do so), this promotes cooperation (van Koperen 2012; WHO 1998). Furthermore, it will increase their sense of ownership in the evaluation process and the results and will also avoid surprises when the final report is published (Patton 1997).

Consequently, the evaluation of the recent Amsterdam approach, which is comprehensive and intersectoral, involves experts and stakeholders from politics, public and private organisations and the target group. JUMP-in is now evaluated annually together with the schools and the programme partners. The results of the evaluation are used to formulate improvement measures. For this purpose the PDCA (Plan Do Check Act) method of Dewing (1950) is used, an iterative four-step management method used for the control and continuous improvement of processes and products. It is also known as the Deming wheel. PCDA helps to achieve higher quality in results and processes and to gain continual increases in work efficiency (Moen 2011). Examples of such measures that have recently been implemented are the development of an interview guide and reporting form for annual evaluation interviews with schools and partners, the inclusion of the BMI measurement in the regular workflow of child healthcare and the creation of a newsletter for JUMP-in partners.

Investigate long-term effects

It would be of great interest to monitor the JUMP-in cohort over the long-term and to determine whether effects persist into adolescence and beyond and whether the prolonged exposure to the programme results in larger effects. Long-term process evaluation is needed to strengthen the sustained implementation and the organisation.

Gain insight into cost-effectiveness

In the choice between these various intervention strategies, cost-effectiveness has been one of the considerations. Consequently, to make a balanced choice, effect estimates of various intervention strategies (including low-cost alternatives) must be made. In this context, it is advisable to evaluate the potential and actual effects of JUMP-in on the health of the participating children. Relevant questions include: 1) How many children in Amsterdam participated more frequently in sports as a result of JUMP-in, and how much could this number increase if JUMP-in is expanded to include additional schools? 2) To what extent could the renewed JUMP-in
programme contribute to obesity prevention, also in adulthood, in the cohort of Amsterdam residents who are currently attending primary school? The EPHOPE model (van Hooijdonk 2009) could be used to calculate the potential effects of increased sports participation and physical activity, and decreased BMI, on mortality and the prevention of chronic disabilities in the current cohort of JUMP-in pupils. This would allow us to estimate the effects of JUMP-in on the lifespan and quality of life of this generation (Gunning-Schepers 1998; Kunst 2009).

**FINAL CONCLUSION**

The power and value JUMP-in lies in the meticulous completion of a lengthy iterative process of development, evaluation and adaptation. In 2002, JUMP-in began at four primary schools in Amsterdam, and during the past decade it has evolved from a modest sports programme into a comprehensive intervention that forms the basis of the Amsterdam approach to childhood obesity at 70 primary schools. Table 1 illustrates the evolution of the programme during the past decade. Intensive evaluations have made it possible to assess the effect of the intervention. The chosen approach appears to be effective; the sports participation of children can be increased by means of interventions at school and in the environment. To encourage daily PA and to have more influence on the behaviour-related cognitions of children and their parents, adaptations were required to both the content and structure of the intervention. Innovative strategies such as intersectoral cooperation and community building have now become part of the Amsterdam approach, in which the entire community is involved. From the beginning, parents were a JUMP-in target group, and the attention for their role and influence has increased over the years.

JUMP-in represented, and still represents, the challenge of not only focusing on prevention, but also on the large group of high-risk pupils with overweight, motor problems and physical inactivity. By facilitating early detection and guidance to appropriate care, JUMP-in has become an important bridge between prevention and care. Achieving a comprehensive care chain is now a policy priority in Amsterdam at both the executive level and for the practitioners who are involved.

The municipal organisation has various possibilities to promote and support a healthy lifestyle for children. This thesis provides an overview of the efforts and results of a school-based intervention. The final chapter provides recommendations for strengthening this approach, which will result in even more Amsterdam children participating in sports, engaging in more physical activity and developing healthier eating habits.
REFERENCES


Annesi JJ, Westcott WL, Faigenbaum AD, Unruh JL. Effects of a 12-week physical activity protocol delivered by YMCA after-school counselors (Youth Fit for Life) on fitness and self-efficacy changes in 5-12-year-old boys and girls. Res Q Exerc Sport. 2005 Dec;76(4):468-76.

Annesi JJ. Improvements in self concept associated with reductions in negative mood in pre-adolescents enrolled in an after-school physical activity program. Psychological reports. 2005; 97: 400-4004.


Bergeron MF. Improving health through youth sports: Is participation enough? (www.interscience. wiley.com) • DOI: 10.1002/yd.221


Borys JM, Le Bodo Y, Jebb SA, Seidell JC, Summerbell C, Richard D, De Henauw S, Moreno LA,


Brug J, van Lenthe F. Environmental determinants and interventions for physical activity, nutrition and smoking: A review. 2005


Bulk-Bunschoten AMW, Renders CM, Leerdam FJMv, Hirasing RA. Overbruggingsplan voor kinderen met overgewicht; Methode voor individuele primaire en secundaire preventie in de jeugdgezondheidszorg. Amsterdam: VUMC, 2005.


Chaiken S, Trope Y. (Eds.), 1999, Dual-process theories in social psychology (pp. 73-96). New York: Guilford Press.


De Meij JS, Chinapaw MJ, van der Wal MF, van Mechelen W. Process and determining characteristics in the implementation of JUMP-in, a Dutch multi-level intervention aimed at the promotion of youth physical activity. 2012.


Deming WE. 1950. Elementary Principles of the Statistical Control of Quality, JUSE


References


Gunning-Schepers LJ. Dwalingen in de methodologie. V. De preventieparadox: weinigen met hoog risico versus velen met matig risico Ned Tijdschr Geneeskd. 1998;142:1870-3


References


Kunst A, van Hooijdonk C, EPHOPE: a dynamic simulation model for assessing the Effects on Population Health of Obesity Prevention in Europe. Department of Public Health Erasmus Medical Center, Rotterdam, The Netherlands and Department of Public Health Amsterdam Medical Centre (AMC), University of Amsterdam, The Netherlands.


References


Rothwell PM. External validity of randomised controlled trials: “to whom do the results of this trial apply?” Lancet 2005, 365:82-93.


Van Sluijs EM, McMinn AM, Griffin SJ. Effectiveness of interventions to promote physical activity in children and adolescents: systematic review of controlled trials. BMJ2007;335:703


SUMMARY

Promoting children’s physical activity behaviour

Regular physical activity (PA) is associated with a decreased risk of physical and mental health problems and can prevent overweight and obesity. Dutch children living in socioeconomically deprived areas seem to have the lowest levels of PA and the highest rates of overweight. The determinants of children’s PA are complex and interrelated. Accordingly, local preventive intervention requires multilevel and multi-sectoral preventive strategies and demands a careful coordinated planned approach. In 2002 the municipality of Amsterdam started the development of JUMP-in, a primary-school-based multi-level intervention. JUMP-in aimed to promote sports participation and PA behaviour and reduce sedentary time among children in economically deprived areas. JUMP-in was evaluated on a continuous basis and on a variety of levels to determine its positive impact on its participants. This thesis describes the stepwise development, effectiveness and feasibility of the JUMP-in intervention.

The stepwise development of JUMP-in

The JUMP-in development process consisted of several stages: 1) development and pilot test from 2002 to 2004; 2) translation of pilot outcomes into an improved programme and study design in 2005; 3) wide scale implementation and evaluation in 2006 to 2009, and; 4) revision and institutionalisation from 2010 to 2012. Chapter 2 presents the description of step 2, in which the lessons learned in the pilot period were translated into an improved programme, using the RE-AIM framework (Reach, Efficacy, Adoption, Implementation and Maintenance). Weaknesses concerning the pilot programme were the fact that school sports clubs especially reached already active children and the lack of attention to hampering factors at the individual level such as being overweight or having motor developmental problems. Furthermore it was clear that, to implement and embed the programme in daily practice and policy, highly structured cooperation was required between municipal authorities, local city districts, schools, child health care and local sports clubs, aiming at effective local planning and action. The RE-AIM framework appeared a useful guide in combining the pilot process- and effect outcomes and translating them into improved intervention methods, delivery strategies and planning procedures.

The improved intervention consisted of school sports clubs, regular physical activity breaks during normal lessons, and workbooks with assignments to perform in class and at home. Parents were offered information, meetings, courses and sports activities. Inactive children and children with overweight or motor problems were detected by the JUMP-in pupil monitoring system and referred to tailored interventions or Child Health Care.

Effectiveness of JUMP-in

Chapter 3 presents the results of the controlled trial we carried out to evaluate the effectiveness of the JUMP-in intervention. Nine intervention schools and ten comparable control schools were recruited from geographically separated city districts. Measures were performed among 2848
children aged 6 to 12 years, at the beginning of the first school year (T0: 2006) and repeated at the end of the first (T1: 2007) and second school year (T2: 2008). To estimate the effect of the intervention we used linear and logistic multilevel auto regression analyses. A significant beneficial intervention effect was found on sports participation. Effects were stronger for girls and for Moroccan and Turkish children. Participation in organised sports was associated with increased aerobic fitness. We found no significant intervention effects on overall daily PA rates, outdoor play or screen behaviours. As leisure time PA behaviours typically take place after school, a combination of school-based and community-based intervention strategies involving the social and physical home environment may be needed to improve these behaviours as well.

We found no significant intervention effect on body composition. This may be explained by the fact that JUMP-in was primarily aimed at PA behaviour and did not include dietary behaviour, or may be due to a lack of longer term follow-up measurements. To offer overweight children tailored care, the JUMP-in pupil monitoring system was developed, and children who were classified as overweight or obese were given a modified sports programme or were referred to suitable care.

Mediating effects on changes in sport participation, outdoor play and screen behaviours.
In chapter 4 we explored the intervention effect on potential mediators that were hypothesised to be causally related to sports participation and PA behaviour (i.e. attitude, self-efficacy, habit strength, social support and social norms) as well as mediating mechanisms. JUMP-in was not effective in changing the hypothesised mediators so no significant mediating mechanisms could be identified. However, changes in self-efficacy, social support and habit strength were positively associated with increased sport participation, and changes in social support, self-efficacy, perceived planning skills, enjoyment and habit strength were associated with increased outdoor play. Change in enjoyment was positively associated with changes in TV-viewing while parental rules were negatively associated. Having a computer in the bedroom and enjoyment were positively associated with increased computer use, while changes in parental rules were negatively associated.

The lack of an intervention effect on potential mediators may be due to unsuccessful intervention strategies, inappropriately implemented strategies, or inadequate measures of the cognitions. Additionally, the school setting may not be the sole channel to influence leisure time activities.

Still, a number of constructs were associated with change in sport participation, outdoor play and screen behaviour and when successfully targeted may be potential mediators.

Sports participation and mental wellbeing
In chapter 5 we examined whether JUMP-in was effective in improving mental wellbeing. No significant intervention effect on indices of mental wellbeing (depression, perceived quality of life and perceived sports competence) was found. However, children who were active in sports during the whole follow-up period had significantly higher perceived sport competence and lower depression scores at follow-up compared to children who did not participate in sports
at either time point. An explanation for the lack of effect in our study might be that we did not take into account the frequency, intensity and type of activity or the time that a child had participated in PA. Some children started participating in sports in the last months before the follow-up measurement. This may not have been long enough to show any effects yet.

Parents
From the beginning, parents were a JUMP-in target group, and the attention for their role and influence has increased over the years. Chapter 6 describes the effects of JUMP-in on parents’ cognitions towards children’s sports participation and whether parents’ cognitions mediated the JUMP-in intervention effect on sports participation. JUMP-in was effective in increasing parents’ social support and social pressure to encourage children to participate in sports. These determinants significantly mediated the intervention effect on sports participation. We found no significant intervention effect on parents’ perceived pros, self-efficacy, perceived sports competence, perceived barriers, planning skills or habit strength, while these hypothesised mediators were significantly associated with sports participation. Further, there was no intervention effect on intention, perceived cons, social modelling and social norm. These constructs were not significantly associated with sports participation either.

Process evaluation
In Chapter 7 we present the results of the JUMP-in process evaluation using a mixed-method approach including qualitative and quantitative data. We investigated factors influencing the adoption, implementation and institutionalisation process, in order to optimise the dissemination of the intervention and to improve its effectiveness. Our results show that JUMP-in has been successfully embedded in Amsterdam policy and in organisational structures of the sectors involved. The programme was generally delivered as planned, and its perceived importance and commitment among participants was high. All participants planned to continue the programme in the future. An impeding factor, however, was the complexity of the programme involving multidisciplinary collaboration. In addition, the process evaluation exposed some discrepancies between the prerequisites for effective innovation and the requirements for daily implementation. One example is the conflict between the need to tailor the intervention strategies to the local profile and local needs and the recommendation to standardise and simplify the innovation. Main recommendations for improving both effectiveness and implementation concerned enhanced information exchange, a stepwise implementation, synchronisation of tasks, planning schedules and protocols between collaborating organisations, and structural intervention support.

Main findings and implications for practice, policy and research
Chapter 8 discusses the main findings, identifies and discusses methodological issues and compares JUMP-in with similar school-based programmes. Additionally, implications and directions for further development of the JUMP-in intervention and the local public health practice and policies are discussed. Finally, recommendations for future research are proposed.
SAMENVATTING

JUMP-in, de ontwikkeling en evaluatie van een interventie gericht op het stimuleren van sport en beweeggedrag van kinderen.

Stimuleren van beweeggedrag van kinderen
Voldoende lichamelijke activiteit heeft een positief effect op het lichamelijk, psychisch en sociaal welzijn van kinderen en draagt bij aan de preventie van overgewicht en obesitas. Met name kinderen in achterstandswijken bewegen onvoldoende en hebben vaker overgewicht in vergelijking met leeftijdgenoten landelijk. Beweeggedrag van kinderen wordt beïnvloed door een complex geheel van onderling samenhangende persoonlijke, sociale en omgevingsfactoren. Lokaal beleid gericht op het stimuleren van beweeggedrag van kinderen vraagt dan ook om een integrale benadering en intersectorale samenwerking.

In 2002 startte de gemeente Amsterdam de ontwikkeling van JUMP-in, een multi-level interventie voor kinderen van basisscholen in achterstandswijken. Doel van JUMP-in was het stimuleren van sportdeelname en dagelijkse lichamelijke activiteit. De ontwikkeling en implementatie JUMP-in interventie is geëvalueerd op effectiviteit en proces. Dit proefschrift beschrijft de ontwikkeling, effectiviteit en haalbaarheid van JUMP-in.

De ontwikkeling van JUMP-in
Het ontwikkeltraject van JUMP-in bestond uit verschillende fasen: (1) ontwikkeling en pilot van 2002 tot 2004; (2) vertaling van de pilot uitkomsten naar een verbeterde programma-inhoud, organisatie en onderzoeksdesign in 2005; (3) brede implementatie en evaluatie van 2006 tot 2009, en; (4) aanpassing op basis van de evaluatie uitkomsten en inbedding van JUMP-in na 2010.

Hoofdstuk 2 beschrijft stap 2, waarin met behulp van het RE-AIM raamwerk (Reach, Efficacy, Adoption, Implementation en Maintenance) de bevindingen uit de pilot werden vertaald naar een verbeterd programma. Knelpunten in de pilot waren dat de schoolsportactiviteiten vooral kinderen bereikten die al actief waren en dat er onvoldoende aandacht was voor individuele risicofactoren zoals overgewicht en motorische problematiek. Bovendien bleek dat voor een succesvolle implementatie en inbedding van het programma meer samenwerking en afstemming nodig was tussen stadsdelen, scholen, jeugdgezondheidszorg en sportverenigingen. Het RE-AIM raamwerk was een bruikbaar instrument voor het combineren van proces- en effectevaluatie uitkomsten en de vertaling ervan naar betere interventiemethoden en strategieën en een effectievere uitvoeringsorganisatie.

De vernieuwde interventie bestond uit schoolsportclubs, bewegingstussendoortjes tijdens de reguliere lessen en voor ieder kind een werkboek met individuele opdrachten voor in de klas en thuis. Ouders kregen informatie, er werden voorlichtingsbijeenkomsten en cursussen georganiseerd en ouders werden betrokken bij sport- en beweegactiviteiten. Inactieve kinderen,
kinderen met overgewicht en kinderen met motorische problematiek werden gesignaleerd door het Jump-in leerlingvolgsysteem en indien nodig verwezen naar passend zorgaanbod.

**Effectiviteit van Jump-in**


We vonden geen significante interventie-effecten op de hoeveelheid dagelijkse lichamelijke activiteit, buitenspeelgedrag of de tijd besteed aan computeren/TV. Dit suggereert dat voor het realiseren van veranderingen in deze gedragingen ook de buitenschoolse setting van cruciaal belang is. Een combinatie van schoolprogramma’s met een brede integrale buurtaanpak gericht op sociale en fysieke factoren thuis en in de leefomgeving zouden elkaar moeten versterken en aanvullen.

Er was geen significant interventie-effect op BMI en heup- en middelomtrek. Waarschijnlijk is voor effecten op deze uitkomstmaten een langere termijn nodig. Daarnaast was Jump-in in deze periode primair gericht op het bevorderen van sport- en beweeggedrag en bevatte nog geen componenten gericht op gezonde(re) voeding.

In **hoofdstuk 4** onderzochten we het Jump-in effect op potentiële intermediaire factoren – mediatoren - waarvan we verwachtten dat ze de sportdeelname en dagelijkse lichamelijke activiteit (o.a. attitude, eigen effectiviteit, gewoonte gedrag, sociale steun en sociale norm) zouden bevorderen. Jump-in was niet effectief in het veranderen van deze potentiële mediatoren. Eigen effectiviteit, sociale steun en gewoonte gedrag waren echter wel positief geassocieerd met sportdeelname, en sociale steun, eigen effectiviteit, ervaren planningsvaardigheden, plezier en gewoonte waren positief geassocieerd met toegenomen buitenspeelgedrag. Plezier in TV kijken was positief geassocieerd met TV kijktijd terwijl regels over beeldscherm tijd van ouders negatief waren geassocieerd. Een computer op de eigen slaapkamer en plezier in computeren waren positief geassocieerd met meer computer gebruik, terwijl computerregels van ouders negatief was geassocieerd. Deze resultaten bieden aanknopingspunten voor toekomstige interventies. Jump-in was niet in staat deze potentiële mediatoren te beïnvloeden, mogelijk als gevolg van ineffektieve interventie- of implementatiestrategieën maar daarnaast waren de meetinstrumenten mogelijk onvoldoende nauwkeurig. Bovendien is, zoals eerder aangegeven, de school setting niet de meest geschikte setting om gedrag in de vrije tijd te beïnvloeden.
Hoofdstuk 5 beschrijft de effecten van JUMP-in op het mentaal welbevinden van kinderen. We vonden geen significant interventie-effect op de gemeten indicatoren van mentaal welbevinden (depressie, ervaren kwaliteit van leven en ervaren sport competentie). Echter, kinderen die gedurende het gehele onderzoek – dus zowel op de voor- en nametingen - aan sport deelnamen hadden significant minder depressieve klachten en een hogere ervaren sport competentie vergeleken met kinderen die op geen van de meetmomenten aan sport deelnamen. Een mogelijke verklaring voor het gebrek aan effect op mentaal welbevinden is we geen rekening hebben gehouden met de frequentie, de intensiteit en het type sportactiviteit en de duur van deelname. Sommige kinderen startten pas enkele maanden voor de nameting met sport. Deze periode was mogelijk te kort om een effect op welbevinden te bewerkstelligen.

Ouders

Ouders zijn vanaf de start van JUMP-in een belangrijke doelgroep geweest en de aandacht voor hun rol en invloed is in de loop van de jaren alleen maar toegenomen. Hoofdstuk 6 beschrijft de effecten van JUMP-in op cognities van ouders met betrekking tot sportgedrag van hun kind. JUMP-in was effectief in het vergroten van de sociale steun en de sociale druk van ouders op de sportdeelname van hun kinderen. Mediatieanalyses laten zien dat het interventie-effect op sportdeelname voor een deel verklaard kan worden door deze toegenomen sociale steun en sociale druk van de ouders. We vonden geen effect van JUMP-in op de door ouders ervaren voordelen van sport deelname, hun eigen effectiviteit met betrekking tot het ondersteunen en stimuleren van hun kind, de ervaren sport competentie van hun kind, ervaren barrières, planningsvaardigheden of gewoonte gedrag van ouders. Verder was er geen interventie-effect op de intentie van ouders om hun kind te stimuleren of ondersteunen bij sportdeelname, de ervaren nadelen van sport voor het kind, voorbeeldgedrag of de sociale norm van de ouders. Deze constructen waren echter ook niet geassocieerd met sportdeelname.

Procesevaluatie

In hoofdstuk 7 presenteren we de uitkomsten van de JUMP-in procesevaluatie waarbij we een mix van kwantitatieve en kwalitatieve onderzoeksmethoden hebben toegepast. We onderzochten factoren die het adoptie-, implementatie- en institutionalisatie proces beïnvloeden met als doel het optimaliseren van de bredere uitrol van de interventie en het verbeteren van de effectiviteit. JUMP-in blijkt succesvol ingebed in het Amsterdamse beleid en in de organisatiestructuren van de betrokken partijen zoals scholen, gemeentelijke diensten en stadsdelen. Het programma is over het geheel genomen uitgevoerd zoals gepland en bij de betrokkenen was het ervaren belang van de interventie en het commitment om deel te nemen aanzienlijk. Na afloop van de onderzoeksperiode continueerden alle partijen de uitvoering van JUMP-in. Een belemmerende factor in de uitvoering was de complexiteit van het programma en de benodigde multidisciplinaire samenwerking. De procesevaluatie legde ook enkele discrepanties bloot die zich voordeden tussen enerzijds de eisen die worden gesteld aan een effectieve integrale
aanpak, en anderzijds de randvoorwaarden die voortkomen uit de dagelijkse uitvoeringspraktijk. Een voorbeeld daarvan is het conflict tussen de behoefte om programmaonderdelen aan te kunnen passen aan lokale wensen, behoeften, problematiek en kenmerken van de omgeving en doelgroepen, en tegelijkertijd de vraag om gestandaardiseerde en vereenvoudigde protocollen en instrumenten. Aanbevelingen voor een haalbare, duurzame en effectieve programma-implementatie die aansluit bij bestaande structuren en de lokale praktijk zijn onder meer een gefaseerde invoering, helderheid over opdrachtgeverschap, afstemming van taken en verantwoordelijkheden, structurele ondersteuning bij de implementatie en duidelijke communicatielijnen.

**Hoofdstuk 8** geeft een samenvatting van de belangrijkste bevindingen uit de hoofdstukken 2 tot en met 7, bediscussieert methodologische aandachtspunten en vergelijkt JUMP-in met andere soortgelijke schoolprogramma’s. Vervolgens worden implicaties en richtingen besproken voor de verdere ontwikkeling van JUMP-in en voor lokaal beleid op het gebied van publieke gezondheid met betrekking tot bewegingsstimulering en preventie overgewicht. Hoofdstuk 8 sluit af met aanbevelingen voor toekomstig onderzoek.
DANKWOORD

Ik werkte al enige jaren samen met het VUmc EMGO Instituut toen Mai mij in 2005 vroeg of ik geen interesse had om zélf een promotietraject te starten. Ik hoefde er niet lang over na te denken. Het was een unieke kans om me nog verder te verdiepen in het werk waar ik van houd en er een heleboel bij te leren in een rijke en inspirerende omgeving. En ik heb er geen moment spijt van gehad. De afgelopen jaren heb ik met veel plezier aan dit proefschrift gewerkt. De combinatie met een baan en een gezin vergde weliswaar veel energie en doorzettingsvermogen, maar ik heb ervan genoten en er enorm veel van geleerd.

Dit proces had ik niet kunnen doorlopen zonder de steun van velen om mij heen. Ik wil in deze laatste alinea’s dan ook een dankwoord uitspreken aan allen die mij in de afgelopen jaren met raad en daad hebben bijgestaan.

Willem, Mai en Marcel, mijn promotor en copromotoren, allereerst wil ik jullie bedanken voor jullie kennis, aanwijzingen, sturing en het vertrouwen en de steun die ik mocht ontvangen. Mai, jij was het die mij aanmoedigde deze uitdaging aan te gaan. Door alle jaren heen ben jij van onschatbare waarde geweest voor mijn motivatie en zelfvertrouwen. Ik kon 365 dagen per jaar bij je terecht en kwam steevast vol energie en goede moed van onze besprekingen vandaan. Ik ben je hiervoor heel dankbaar. Marcel, jij bent voor mij een voorbeeld als het gaat om het bouwen van bruggen tussen wetenschap, beleid en praktijk. Ik dank je voor de discussies die we voeren, je betrokkenheid en de ruimte die je me geeft. Zonder jouw steun had ik de combinatie van werk en promotieonderzoek niet vol kunnen houden. Willem, het was voor mij een eer om door jou te worden begeleid. Ik heb veel geleerd van jouw kennis en kunde en je scherpe feedback. Het is inspirerend en stimulerend om deel uit te maken van jouw onderzoeksgroep. De hieruit voortkomende contacten leiden bovendien tot mooie nieuwe samenwerkingsprojecten die voor mij en voor de gemeente Amsterdam heel waardevol zijn.


Stagiaires. Het onderzoek had niet kunnen worden uitgevoerd zonder de enorme inzet van alle stagiaires. Marije van der Veer, Marieke Dijkman, Merlin Jurg, Sandra Bleeker, Thomas Slotema, Klara van der Vaart, Anne-Marie de Wildt, Anne Loyen, Bodil Belderok, Anne Ybema, Emilie Krol, Iris van der Meulen, Henrike van der Ploeg, Joukje Braam, Kim Zijlstra, Kristel Everaars, Leon Doorn, Paul Opdorp, Marionne van der Velde, Marijke van Dijk, Mirjam Stuij, Natasa Aulman, Priyanta Malhoe, Renske de Winter, Loek Leenen en Sanne Gerards, bedankt! Jullie hebben allemaal mooie scripties geleverd die belangrijk zijn geweest voor ons voortschrijdend inzicht en de kwaliteit van het programma, en ook ik heb daar veel van geleerd. Overigens, niet voor niets
zijn Merlin en Marieke, Marije, Marianne, Loek en Paul inmiddels zeer gewaardeerde collega’s bij de GGD in dienst.

**JUMP-in team**

**Bertram**, in 2002 zijn wij samen JUMP-in gestart, jij vanuit DMO Sport, ik vanuit de GGD. Als duo waren wij in staat om bruggen te bouwen tussen de sectoren sport, bewegen en gezondheid. Jouw creativiteit, humor, inzicht en originaliteit maken het een feest om met je samen te werken. Ik ben dan ook heel blij dat jij mijn paranimf wilt zijn.

**Lotte**, jij kwam ons team versterken op het moment dat de metingen voor het evaluatie onderzoek van start gingen. Met een ijzeren discipline heb jij de planning en controle van de dataverzameling op je genomen. Je talenten zijn niet onopgemerkt gebleven en inmiddels ben je onze steun en toeverlaat als onderzoekscollega in de productgroep Jeugd van EDG.

**Arnold, Fatiha en Hans**, jullie zijn de JUMP-in collega’s van het eerste uur. Met elkaar waren we een klein slagvaardig team en wat hebben we een werk verzet. Heel veel dank voor alles wat jullie ook voor het onderzoek hebben gedaan.

**Femke en Felipe**, de JUMP-in revisie die nodig was na de effect- en proces evaluatie is door jullie begeleid. Onder jullie leiding doen nu 70 scholen en 22.000 kinderen mee aan JUMP-in. Petje af voor de wijze waarop jullie de verdere uitrol hebben gerealiseerd en leiding geven aan de uitvoering van het huidige JUMP-in programma.


**Frank en Thijs**, bedankt voor jullie werk voor het JUMP-in leerlingvolgsysteem en de website.

**Loek en Marianne**, sinds 2011 projectleiders van respectievelijk de eerste Amsterdamse JOGG-wijk en de zorgketen voor kinderen met overgewicht, bedankt voor jullie betrokkenheid en de samenwerking in de versterking en verbreding van de aanpak van overgewicht.

**Collega’s van de GGD.** Ik heb het enorm naar mijn zin op het werk en dat komt voor een groot deel door de fijne collega’s. Kamergenoten van 5.22 en alle andere EDG-ers, maar ook collega’s van andere clusters zoals JGZ, Communicatie en Beleid, bedankt voor jullie interesse en steun in de afgelopen periode. Een bijzonder woord van dank wil ik richten tot Wilco, Marjo, Merlin en Marieke, gesprekken met jullie hielpen mij altijd weer verder. Francoise, bedankt voor al je praktische ondersteuning. Arlette, je bent niet meer werkzaam bij de GGD maar gelukkig blijven we elkaar zien. En Adèle, lang geleden begonnen wij tegelijkertijd als stagiaires onze loopbaan bij de GGD. Samen hebben wij veel meegemaakt en een hele weg afgelegd. Ik ben dan ook heel blij dat jij mijn paranimf wilt zijn.

176
Ook wil ik graag bedanken alle collega’s van stadsdelen, de diëtisten van Cordaan, de onderwijsbegeleidingsdienst ABC, sportverenigingen, de Hogeschool van Amsterdam, de collega’s van het NISB, het Voedingscentrum, de Hartstichting, het Sportbedrijf Amstelveen, Amstelring en betrokken zorg- en welzijnsinstellingen. Ik wil jullie allemaal bedanken voor de fijne samenwerking. In het bijzonder wil ik Elise Sijthoff van Fysio Educatief bedanken voor de wijze waarop we samen hebben gewerkt aan de ontwikkeling en implementatie van Kies je Kaart, Bewegen doe je Zo! en De Klas Beweegt!

Collega’s van VUmc
Maartje, graag richt ik een speciaal woord van dank aan jou. Ik kon met al mijn onderzoeksvragen bij je terecht, ik heb veel van je geleerd, en het is een groot plezier om met jou nu verder samen te werken en te schrijven aan artikelen en nieuwe onderzoeksvoorstellen. Datzelfde geldt voor Amika, Teatske en Femke. ik verheug me op de toekomstige samenwerkingsprojecten voor een gezondere jeugd in Amsterdam.


Collega’s van het Amsterdams programmateam Gezond Gewicht
In november 2012 is door het Amsterdamse college van burgemeester en wethouders besloten tot het programmatisch aanpakken van overgewicht en obesitas van Amsterdamse kinderen. Dat wil zeggen: een integrale aanpak met structurele financiering voor de langere termijn. Met een uitgebreid breed Amsterdams programmateam starten we in 2013 met het verbreiden en versterken van de aanpak, waaronder ook de (voor)schoolprogramma’s. De missie is ‘alle kinderen op gezond gewicht en een gezond gedrag voor al onze kinderen’. Ik kijk uit naar de toekomst!

Familie en vrienden
Mijn familie en vrienden hebben het geweten dat ik aan het promoveren was. Er was zeker in het laatste jaar weinig tijd voor ontspanning. Mijn ouders, zus, broers en (schoon)familie, ik wil jullie bedanken voor de liefdevolle steun door alle jaren heen. Vrienden en buurtgenoten, jullie durfden bijna niet meer naar de voortgang te vragen! Bedankt voor alle belangstelling en vriendschap.
Maar bovenal wil ik mijn man en kinderen bedanken voor hun medeleven en geduld. Jan, dankzij jou kon ik mijn passie volgen en was het mogelijk om werk, promotie en de zorg thuis te combineren. Lieve Jan, Theo, Anton en Vera, het is af!
Judith de Meij was born on September 21st, 1967 in Amsterdam, the Netherlands. After graduating from secondary school at the Hermann Wesselink College in Amstelveen in 1986, she started her study Psychology and Education at the VU University in Amsterdam. She completed her master in Social Psychology with an interdisciplinary designed major in Health Education and Health Promotion at the faculty of Health Sciences of Maastricht University and graduated in 1992. Hereafter she started working at the Public Health Service (GGD) of Amsterdam. The first years she supported the departments Child Health Care and Infectious Diseases with programmes aimed at the promotion of a healthy lifestyle and the prevention of diseases. In 1997 the cluster Epidemiology, Documentation and Health Promotion (EDG) was established and she joined the product group Youth. In the absence of effective programmes aimed at the promotion of physical activity and sports for youth, she started the development of a school-based intervention in collaboration with the Amsterdam Sports Department in 2002. For her research she co-operated with colleagues from both Maastricht University and VU University Medical Center. Besides her work as health promoter she started her PhD project at the EMGO institute of the VU University in 2006, under the supervision of Prof. dr. Willem van Mechelen, dr. Mai Chin A Paw and dr. Marcel van der Wal. In 2009 she became team leader at the Public Health Service, providing guidance, instruction, direction and leadership in the promotion of physical activity and healthy nutrition behaviour and the prevention of overweight in youth. She is married to Jan Snellen and together they have two sons and a daughter.