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PARENTAL SUPPORT TO PROMOTE CHILDREN'S DIETARY AND PHYSICAL ACTIVITY BEHAVIOURS IN DISADVANTAGED SETTINGS

Åsa Norman

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PARENTAL SUPPORT TO PROMOTE CHILDREN'S DIETARY AND PHYSICAL ACTIVITY BEHAVIOURS IN DISADVANTAGED SETTINGS

THESIS FOR DOCTORAL DEGREE (Ph.D.)

By

Åsa Norman

Principal Supervisor:
Associate Professor Liselotte Schäfer Elinder
Karolinska Institutet
Department of Public Health Sciences

Co-supervisors:
Ph.D. Gisela Nyberg
Karolinska Institutet
Department of Public Health Sciences

Ph.D. Anita Berlin
Karolinska Institutet
Department of Neurobiology, Care Sciences and Society

Associate Professor Àsgeir R. Helgason
Karolinska Institutet
Department of Public Health Sciences

Opponent:
Associate Professor Laura Ferrer-Wreder
Stockholm University
Department of Psychology

Examination Board:
Associate Professor Marie Löf
Karolinska Institutet
Department of Biosciences and Nutrition

Associate Professor Anders Raustorp
University of Gothenburg
Department of Food and Nutrition, and Sport Science

Professor Karin Kjellgren
Linköping University
Department of Medicine and Health Sciences

Till Valeria, Ebba, Elsa, Lisa och Astrid

ABSTRACT

Background: A clear socioeconomic gradient in prevalence of childhood overweight and obesity exists in Sweden whereby children with low socioeconomic status (SES) have higher rates. Parents are an important target group for interventions to promote healthy behaviours and prevent unhealthy weight development in children.

Aims: The overall aim of this thesis was to investigate the effects and implementation of the Healthy School Start (HSS) parental support intervention to promote healthy child dietary and physical activity (PA) behaviours and prevent unhealthy weight development in disadvantaged settings in Sweden.

Study I: To evaluate the effectiveness of the six-month HSS parental support programme targeting dietary habits, PA and body weight of six-year-old children in families with low SES in the school context

Study II: To explore the variation of how mothers and fathers with low SES influence their children's dietary behaviours as explored during a real-life session of Motivational Interviewing (MI).

Study III: To evaluate the psychometric properties of an instrument to measure parental self-efficacy for influencing children's dietary, PA, sedentary, and screen time behaviours in the home environment.

Study IV: To describe barriers and facilitators, related to intervention characteristics and process, that teachers and parents perceived as influencing the implementation of the HSS intervention.

Methods: The HSS intervention was carried out for six months during 2012-2013 in pre-school classes with six-year-old children and included three components: 1. Health information to parents, 2. MI with parents, and 3. Classroom lessons with home assignments.

Study I: Intervention effectiveness regarding children's diet, and PA behaviours, and Body Mass Index standard deviation score (BMI-sds) was assessed in a cluster randomised wait-list controlled trial with 378 children randomised to either intervention or control group. Diet was measured by parent-report, PA objectively by accelerometer, and anthropometry was measured by the research group at baseline, post-intervention, and at five months follow-up.

Study II: Phenomenography was applied to transcripts of MI sessions with 29 parents who focused on their children's dietary habits in the session.

Study III: Exploratory factor analysis was conducted on data regarding parental self-efficacy as reported by 229 parents in both intervention and control group at baseline. Correlations between factors and child behaviours were subsequently applied.

Study IV: Qualitative content analysis was applied to focus groups with 14 parents and 10 teachers in the intervention group.

Results

Study I: A significantly lower intake of unhealthy foods and unhealthy drinks was observed after the intervention, of which the lower intake of unhealthy foods was still significant for boys at follow-up after five-months. A significantly lower BMI-sds was found after the intervention in children with obesity at baseline, but this effect was not sustained at follow-up.

Study II, III, and IV: Results indicate that, in an intervention like the HSS, there is a need for increased focus on the parental capabilities to:

- have a positive interaction around food with their child (study II)
- recognize parental responsibility for the child's dietary behaviours (study II and IV)
- regulate own emotions around the child dietary behaviour (study II), and
- trust the child's satiety response (study II)
- perform the intervention activities (study IV)
- cooperate with the other parent (study II and IV) and with school (study IV)
- believe in their own capability to support the child towards healthy dietary behaviours (study III)

Conclusion: The HSS intervention was effective in decreasing the children's intake of unhealthy foods, and partly regarding BMI-sds in areas with low SES, but had no effect on children's PA behaviours. In future interventions, parental capabilities for positive parenting, cooperation, and for performing intervention activities have to be taken into account.

LIST OF SCIENTIFIC PAPERS

I. **Effectiveness of a universal parental support programme to promote health behaviours and prevent overweight and obesity in 6-year-old children in disadvantaged areas, the Healthy School Start Study II, a cluster-randomised controlled trial**
Nyberg G, Norman A, Sundblom E, Zeebari Z, Elinder L S.
International Journal of Behavioral Nutrition and Physical Activity, 2016 13(1)

II. **Parental strategies for influencing the diet of their children – a qualitative study from disadvantaged areas**
Norman Å, Nyberg G, Elinder L S, Berlin A.
Submitted

III. **Psychometric properties of a scale to assess parental self-efficacy for influencing children's dietary, physical activity, sedentary, and screen time behaviours in disadvantaged areas**
Norman Å, Bohman B, Nyberg G, Elinder L S.
Submitted

IV. **One size does not fit all – qualitative process evaluation of the Healthy School Start parental support programme to prevent overweight and obesity among children in disadvantaged areas in Sweden**
Norman Å, Nyberg G, Elinder L S, Berlin A.
BMC Public Health, 2016 16(1)

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LIST OF ABBREVIATIONS

SES	Socioeconomic status
BMI	Body Mass Index
PA	Physical activity
MVPA	Moderate to vigorous physical activity
HSS	Healthy School Start
WHO	World Health Organisation
MI	Motivational Interviewing
SCT	Social Cognitive Theory
PSE	Parental self-efficacy
EFA	Exploratory factor analysis
MITI	Motivational Interviewing Treatment Integrity code
CFIR	Consolidated Framework of Implementation Research
MET	Metabolic equivalent
EPAQ	Eating and Physical Activity Questionnaire
BMI-sds	Body Mass Index standard deviation score
CMP	Conway-Maxwell-Poisson distribution

1 BACKGROUND

1.1 CHILDHOOD OVERWEIGHT AND OBESITY – PREVALENCE, INEQUALITIES, AND CONSEQUENCES

1.1.1 Prevalence

The prevalence of obesity in children has steadily increased the past decades worldwide (1). The prevalence of overweight in children under the age of five was 6.3% in 2013, which is an increase of 1.3% since 2000. Further, the proportion of overweight children in this age group is expected to increase to 25% by 2025 if the trend continues at the same pace (1). In Sweden, measurements from 2004-2005 on a nationally representative sample of children aged 7 to 9 years reported a 19.4% prevalence of overweight and obesity (2). However, considerable differences in the prevalence throughout the regions of the country have been found. In Stockholm County in 2012, the prevalence of overweight and obesity in 4-year-old children was 11.2% (3). The obesity prevalence across high-income countries including Sweden appears to have levelled off both in adults (4) and in children (5-8) during the last years, though the authenticity of this plateau has been called into question as possibly resulting from methodological weaknesses (9).

1.1.2 Inequalities

Undebatably, there is a social gradient in the prevalence of overweight and obesity in high-income countries to the disadvantage of persons with low socioeconomic status (SES) (10). In Sweden, child obesity prevalence is at least three times higher in areas with low SES compared to high SES areas (6, 11, 12). Living in a deprived area has also been shown to pose a heightened risk for development of childhood obesity in Sweden (12). In addition, it has proven difficult to recruit and retain participants in areas with low SES in health interventions (13, 14).

1.1.3 Health consequences

Childhood obesity increases the risk of morbidity later in life, including type-2 diabetes, impaired mobility, and metabolic disturbances (15, 16). Consequences of obesity in childhood also include attenuated mental health (17), self-esteem, and quality of life (18), and obesity has been associated with increased cardiovascular risk (19). There seems to be a linear association between increase in overweight and the risk of developing diabetes and cardiovascular disease; children run an increased risk for every unit increase in Body Mass Index (BMI) (20, 21). Also, overweight and obesity seem to track through life: children who are overweight are more likely to become obese later in life (22-24). Further, an obese weight pattern is often transferred from parent to child (25, 26).

1.2 DETERMINANTS OF CHILDHOOD OVERWEIGHT AND OBESITY

A wide range of determinants of childhood overweight and obesity have been identified, from a societal to an individual level, where genetic factors constitute an important determinant

(27, 28). Childhood overweight and obesity are also related to modifiable determinants such as dietary (29, 30), physical activity (PA), sedentary behaviours (31), and television viewing (32). These behaviours often track from early childhood into later life (33-36).

1.2.1 Physical activity and sedentary behaviours

1.2.1.1 PA, sedentary behaviours and health

PA is an important determinant for chronic disease in adults (37). Two systematic reviews investigating the health benefits of PA on several outcomes have found that aerobic exercise on a moderate to vigorous activity (MVPA) level produces health benefits regarding blood pressure, insulin levels, blood lipids and cholesterol in children with overweight/obesity, high blood pressure or high cholesterol (38, 39). Both aerobic and resistance exercise are beneficial in reducing body fat and BMI in obese children and youth (38, 39). Compared to obese children, a higher exercise intensity maintained for a longer period of time was needed to influence body fat in normal weight children and youth (38). Children who are more prone to be physically active at a relatively high level are also less likely to be obese than children with lower activity levels (38). Aerobic PA has also shown modest beneficial effects on depressive symptoms (38, 39), memory and academic performance (38). PA focusing on resistance training is beneficial to bone health (39).

MVPA has proven to be the intensity level that confers the most health benefits (38). Janssen et al (39) identified a dose-response relationship between PA and health for children and youth, where more activity led to greater improvement in health. Therefore the authors argue that recommendations regarding PA should be flexible: inactive children could benefit from being a bit more active than they are at present, whereas children who are already active could benefit from even higher activity targets, and this should be reflected in the recommendations (39). The minimum effective dose of physical activity remains unclear, but a frequent recommendation is at least 60 minutes of activity at a level of MVPA per day, and vigorous intensity confers more health benefits than moderate (39). It is also unclear whether the activity needs to be undertaken on a daily basis or whether it can be accumulated over time, e.g. during a week (39). In Sweden, it is recommended that children from the age of six engage in MVPA for at least 60 minutes per day (40).

Time spent sedentary has attracted increased interest during the past years. Little is yet known regarding sedentary behaviour in relation to health in children (41, 42). There are studies pointing to associations between >2 hours of watching TV/day and overweight/obesity, metabolic risk, poor fitness, and poor academic achievement (43, 44). However, other studies, using objective measurements, have not shown any associations between time spent sedentary and poor health (45, 46). No recommendation regarding maximum time spent sedentary for children has been given in Sweden (40).

1.2.1.2 PA behaviours in children

Regarding children's physical activity in general, studies have shown that boys are more physically active than girls at all intensities, and that sedentary time increases with age from childhood to adolescence (47, 48). There are indications that children who are overweight or obese are less physically active than normal weight children, but findings are inconclusive and the causal direction has not been established (48, 49). However, there does not seem to be an association between parental SES and children's physical activity (50, 51).

A study including children from eight European countries showed that only 14.6% of the participating Swedish 2-to-11-year-old children reached the recommended 60 minutes of MVPA per day (52), whereas a previous study on the Healthy School Start (HSS) intervention showed that 100% of the participating 6-year-olds reached the recommendation (53).

1.2.2 Dietary behaviours

1.2.2.1 Dietary behaviours and health

Unhealthy dietary behaviours are important and modifiable determinants of chronic disease in adults worldwide (37). As chronic diseases often appear later in life, fewer such studies are available on children. However, some do exist and show that the relationship between diet and health is important from a young age. An intervention study on children in Finland with long-term follow-up measurements has shown a relation between lower intake of saturated fats and important markers of cardiovascular risk factors, namely lower low-density lipoprotein (54), lower blood pressure and improved insulin sensitivity in childhood (55) and adolescence (56). A cohort study found that a higher intake of fruits and vegetables in childhood resulted in lower risk of atherosclerosis in adulthood (57). Several studies have investigated the effect of childhood intake of sugar-sweetened beverages on health, and found that a high intake was associated with development of diabetes type 2 and metabolic syndrome later in life (56, 58, 59).

Guidelines for healthy dietary habits have been developed jointly in the Nordic countries[1] for both adults and children. These Nordic Nutrition Recommendations (60) include both nutrient- and food-based recommendations. Children between the ages of 4 and 10 are recommended to eat 400 grams of fruits and vegetables per day, fish three times per week, and dairy products corresponding to 500 millilitres of milk per day. The diet should also favour unsaturated and essential fatty acids and whole grain products, and limit the intake of added refined sugar, such as sugar-sweetened beverages or sweets (60).

[1] Including Sweden, Norway, Denmark, Finland, and Iceland

1.2.2.2 Dietary behaviours in children

According to a survey of children's diet in Sweden in 2003, children aged 4 to 11 consumed a larger amount of nutrient-poor and energy-dense foods than recommended and only about half of the recommended amount of fruits and vegetables (61).

Parental education, overall SES, and parental country of birth have all been found to be associated with children's dietary behaviours. A social gradient has been found regarding dietary intake, whereby a lower SES has been associated with more unhealthy dietary habits (62). The national Swedish survey of children's diet found that children of mothers with a low level of education had a higher intake of energy-dense foods compared to children of mothers with a higher level of education (61). Similarly, a study on eight-year-old children in Sweden showed that children of parents with a low level of education had poorer dietary habits compared to children of parents with a high level of education (63). Other studies suggest that parental country of birth is at least as important, if not more so. A study on 520 six-year-old children participating in the HSS trials showed few dietary differences related to SES. Instead, differences in dietary habits were related to the parents' country of birth: children whose parents were born outside the Nordic region had poorer dietary habits than children of parents born within the region (64). In contrast, another Swedish study found that children with parents born outside of Sweden had dietary patterns that adhered more closely to the Nordic Nutrition Recommendations than children of parents born in Sweden (65). Yet another study, including 108 children aged 11-12 years, conducted in Swedish areas with low SES and a high proportion of foreign-born residents, found that 44% drank sugar-sweetened beverages at least four times per week and 38% reported having free access to sweets in the home (66). Further, studies from Norway and Finland have suggested that a higher intake of added sugar is related to a more unhealthy diet containing less nutrients and with a lower intake of fruits and vegetables (67, 68).

1.3 PREVENTION OF CHILDHOOD OVERWEIGHT AND OBESITY THROUGH PROMOTION OF HEALTHY BEHAVIOURS

Prevention can be divided into different stages in relation to disease emergence (primary, secondary, and tertiary prevention), or in terms of population segments (universal, selective, and indicated prevention) (69). Primary prevention refers to risk reduction to prevent the onset of disease; secondary prevention refers to early intervention to prohibit progression of disease; and tertiary prevention refers to mitigation of impact of disease. Universal prevention targets the entire population, selective prevention targets high-risk sub-groups, and indicated prevention targets individuals with high-risk.

Early prevention of childhood overweight and obesity by focusing on healthy dietary and PA behaviours has been firmly endorsed by the World Health Organisation (WHO) (1). WHO emphasises the need for additional evaluation of the effectiveness of obesity prevention interventions, as results are still inconclusive.

The American Academy of Nutrition and Dietetics has taken the position that primary prevention of overweight and obesity should focus on programmes or messages about eating and PA, exemplified by school-based health promotion programmes. Secondary prevention should focus on more structured programmes about eating, exemplified by brief Motivational Interviewing (MI) regarding specific behaviours related to eating (70). The Stockholm County Council has stated that primary prevention of childhood obesity should be included in child health care and student health care (71). The prevention should focus on healthy dietary and PA habits but also on identifying and supporting children with overweight or obesity to mitigate weight gain while the child increases in height. Secondary prevention should also be included in primary health care through support and basic management for children with overweight or obesity (71).

Universal interventions have been advocated as they ease stigma regarding overweight and obesity by including all children; universality also decreases the risk of missing a child with a great need. However, simply assuming that an intervention with a universal approach will inevitably be beneficial for all, and that those with the greatest need will benefit the most because they have the most to gain, may instead increase inequalities within the society or within specific groups (72). Proportionate universalism has been suggested as the approach with the greatest potential to even out inequalities in health (73). Proportionate universalism refers to services or interventions that are universal, but increase in intensity in proportion to the needs of a group or of individuals (73).

1.3.1 Including parents in interventions

Parents are powerful agents for influencing the behaviours of young children (74, 75). The inclusion of a parental component in interventions aimed at children, or even targeting parents directly, is widely encouraged nowadays (70, 76-79) and was suggested as beneficial in promoting healthy behaviours and preventing unhealthy weight development in children at the time when the HSS was being developed (78, 80). Results from interventions are mixed, however (79, 81-85). In general, interventions targeting dietary behaviours seem more effective than interventions targeting PA behaviours (81, 82, 85). The variation in effects among interventions may, among other factors be explained by the wide variety of intervention components and degree of parental influence (81, 85, 86).

Regarding universal child obesity prevention interventions that attempt to promote healthy dietary habits among children aged 2 to 18 years by mainly targeting the parents, face-to face counselling has been shown as the most effective strategy, whereas only weak evidence was found for similar interventions aimed at influencing children's PA behaviours (82). Specific features employed in effective interventions aimed at getting parents to establish obesity-preventive home environments have been identified as prompt identification of barriers, restructuring of the home environment, self-monitoring, early and specific goal setting, greater parental involvement, and that the parents were responsible for participation, not the children (85).

Prevention targeting families with low SES seem to, just as in other groups, benefit from a high parental involvement, behaviour change techniques, and skill building (87). It has also been suggested that parental group counselling is beneficial for families with low SES (82).

1.3.2 Parenting: feeding styles and feeding practices

Parents have a substantial influence on their children's dietary behaviours and weight development through the way they interact with the children around food (88).

Three different concepts are of importance here: general parenting styles, parental feeding styles, and parental feeding practices. Parenting styles comprise four categories pertaining different positions on the two dimensions demandingness – execution of control and supervision, and responsiveness – execution of affective warmth and acceptance (89). The 'authoritative' style is high on both dimensions, the 'authoritarian' is high on demandingness and low on responsiveness, the 'indulgent' style is low on demandingness and high on responsiveness and the 'uninvolved' style is low on both dimensions (89, 90).

Feeding styles refer to the same categories as parenting styles but the dimension 'demandingness' refers to how much the parents encourage eating and the dimension 'responsiveness' refers to the responsive quality of food encouragement (91).

Feeding practices are specific behaviours performed by the parent in relation to the child's eating, such as making sure that healthy foods are prepared, or threatening to take something away if the child does not eat (92). Controlling feeding practices can be divided into 'covert control', which is undetectable to the child, and 'overt control', which is detectable to the child (93).

1.3.2.1 Relationships between parenting concepts and child behaviour, and BMI

The authoritative parenting style has been related to healthy child BMI and healthier diet (94, 95). The indulgent and uninvolved feeding styles have been related to higher child BMI (94, 96). Regarding feeding style, the authoritarian, indulgent, and uninvolved styles have been related to lower child intake of fruits and vegetables. In addition, the indulgent feeding style has been related to a higher child intake of energy-dense products (95) and higher child BMI (94-96). Regarding specific feeding practices, associations have been found between controlling feeding practices and child BMI, where restriction of food has been associated with higher child BMI, and pressure to eat associated with lower child BMI (96, 97). However, the direction of these associations has been debated. Longitudinal studies have found bidirectional relationships between controlling feeding practices and child BMI (98, 99). Furthermore, emotional and instrumental feeding practices have been associated with more unhealthy eating habits, whereas parental encouragement to eat has been associated with healthier eating habits of the child (94, 100).

1.3.2.2 Parenting concepts in relation to SES and cultural diversity

In low SES settings, few parents seem to employ feeding styles and practices that are associated with healthier eating behaviours and BMI among children (101-103). Also, parental feeding styles seem to differ according to cultural context (100, 104). In a Swedish setting, a study including parents of preschool and early school-aged children found that parents with low education were more likely to use pressuring feeding practices than more highly educated parents (105).

1.4 DEVELOPING INTERVENTIONS TO PROMOTE HEALTHY BEHAVIOURS AND PREVENT OVERWEIGHT AND OBESITY IN CHILDHOOD

When developing an intervention it is important to follow a planned structure in order to maximise potential effects. Fraser (106) has described a five-step planning process.

- First, a problem needs to be specified. Here, increasing overweight and obesity in groups with low SES serves as an example.
- Second, a problem theory should be developed where the specified problem is linked to risks and protective factors derived from the scientific literature. In the case of childhood overweight and obesity, risk factors include poor diet, insufficient PA, and possibly too much time spent sedentary. Protective factors include supportive parents, with a positive influence on the child's behaviours.
- Third, a programme theory is developed, where objectives of the intervention are specified, the intermediate outcomes/mediators that should be targeted by the intervention in order to bring about change in the outcomes, such as child behaviours in this case. The programme theory is often based on an existing theory in the research field. A psychological theory of behaviour is suitable when the intervention is aiming for behaviour change.
- Fourth, intervention activities and materials are developed, pre-tested and revised.
- Fifth, the intervention components are confirmed and refined, after which the intervention is carried out and evaluated.

1.4.1 Programme theory

As indicated above, the use of theory when developing an intervention has been strongly suggested (107) as theory can inform determinants of behaviour that can be modified by the intervention. However, theoretically based interventions have not proven more effective than interventions developed without using theory (79, 82). This may be explained by the way theory has been used in the studies, whether theory has been firmly included in the planning or merely mentioned (108). It has been suggested that the integration of theory into the intervention is an important aspect in ensuring effectiveness; interventions with components firmly based on theory and including theoretically derived constructs were more effective than interventions that merely mentioned the use of theory without integrating it (81).

1.4.2 Social Cognitive Theory

The Social Cognitive Theory (SCT) is a commonly used theory in interventions aimed at prevention of childhood overweight and obesity (109). SCT was developed by Albert Bandura as a theory of human behaviour where human agency is in focus. According to SCT, individuals are agents of their own lives and intentionally influence their own functions and life circumstances. Thus, individuals are self-reflective, self-regulating and proactive in their own lives. Agency is produced through reciprocal, bidirectional interaction between three determinants: 1. the individual with cognitive, affective, and biological factors, 2. behaviour, and 3. the environment (110, 111). The dynamic bidirectionality indicates the individual as both subject and object, influenced by the environmental opportunities and constraints and at the same time exerting influence on the environment through behaviour (110, 111). Constructs of importance for behaviour maintenance and change according to SCT comprise:

- self-efficacy – the individual's belief in his or her capability to perform a behaviour
- behavioural capability – capability, through knowledge and skills, to perform a behaviour
- observational learning – learning to perform a behaviour that is modelled by other individuals in the environment
- expectations – anticipated consequences of a behaviour represent 'outcome expectations', whereas 'expectancies' refer to the value that the individual ascribes to the consequence
- reinforcement – responses to a behaviour that have impact on whether the individual will continue the behaviour or not

Bandura describes three modes of agency: the individual mode, the proxy mode, in which individual A attempts to influence individual B to act in a way that produces desired outcomes for person A, and the collective mode, in which individuals as a group influence events (112).

1.4.3 Self-efficacy

As mentioned above, perceived self-efficacy comprises a central construct in SCT and is important for behaviour maintenance and change (111). Self-efficacy is defined as 'beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments' (113). Mediating effects of self-efficacy have been found regarding behaviour change of PA in adults (114, 115), whereas associations have been found between self-efficacy and healthy dietary habits in adults (116, 117).

1.4.3.1 Parental self-efficacy

As parents play such a vital role regarding younger children's change of weight-related behaviours (74, 118), parental self-efficacy (PSE) to influence children's behaviours is of importance in SCT-based interventions targeting behaviours in younger children. Bandura does not present a definition for PSE but describes it as the beliefs that parents hold regarding

their parenting capabilities to support their children in the development throughout the course of childhood, which may include encouraging and limiting child behaviour, and managing child misbehaviour (113). Previous studies have found associations between PSE and children's dietary (119-121), PA (120-123), and screen time behaviours (119, 122, 123).

1.4.4 Motivational Interviewing

MI is a person-centred while yet goal-steering style of conversation for supporting behaviour change in individuals by increasing their intrinsic motivation for the specific change (124). This is achieved through the exploration of thoughts, values, and emotions regarding the change. The counsellor provides support by evoking arguments from the person, with a focus on statements that are positive towards the change, 'change talk', and attempting to decrease statements favouring status quo (125). MI also focuses on the person's own belief in his or her ability to succeed with a behaviour change, hence supporting the person's self-efficacy (124).

1.4.4.1 MI in health promotion and prevention of overweight and obesity

Evidence of positive effects of MI regarding promotion of PA (126-130) and diet (131, 132) in adults has been found. MI has also been suggested as a technique to use in the prevention and management of paediatric obesity and to improve parenting skills (133-135). Using MI with parents in order to influence their children's health behaviours is a rather new strategy in health promotion interventions. A meta-analysis on 12 studies targeting childhood overweight and obesity and promotion of healthy dietary and PA behaviours through parental involvement showed small to medium effect sizes favouring the MI condition: increased PA with a weighted mean effect size ($d+$)=0.15, reduced screen viewing time $d+$=0.16 and screen access $d+$=0.19, and increased healthy diet $d+$0.24 (136). However, counsellor adherence to MI was seldom monitored and the meta-analysis included a mix of studies targeting obesity management and obesity prevention (136). Parental support interventions with a universal design aimed at promoting healthy PA and dietary behaviours in children have shown mixed results and MI adherence can be questioned here as well (137, 138).

However, studies have indicated that MI may increase parents' understanding of their children's weight problems and increase parental motivation to influence their children's weight-related behaviours (135, 139), both of which are important in childhood health promotion and weight management (140). Also, several studies have shown that parents feel supported by MI in their efforts to bring about behaviour change (135, 139, 141, 142). Moreover, MI has specifically been mentioned as a helpful method for parents with low SES (142, 143).

1.5 INTERVENTION IMPLEMENTATION

The importance of process evaluations accompanying thoroughly developed and reported interventions has been voiced in recent years (144). Monitoring the implementation process of an intervention is an important part of assessing how it was received by participants but

also of determining whether the intervention was delivered as intended. Interventions may be ineffective due to a lack of proper implementation (145). Process evaluations are valuable in order to gain in-depth understanding of how the intervention worked, and how it was conducted, received, and influenced by context. These types of evaluations provide valuable information for further development and implementation of an intervention as well as informing policy (144).

2 AIMS

The overall aim of this thesis was to evaluate a parental support intervention to promote healthy dietary and physical activity behaviours and prevent unhealthy weight development among children in disadvantaged settings, and to explore ways of refining and implementing such intervention.

The specific aims were:

- To evaluate the effectiveness of the 6-month Healthy School Start parental support programme targeting dietary habits, physical activity, and body weight of six-year-old children in families with low socioeconomic status in the school context (Study I).

- To explore the variation of how mothers and fathers with low SES influence their children's dietary behaviours as explored during a real-life session of motivational interviewing (Study II).

- To evaluate the psychometric properties of an instrument to measure parental self-efficacy for influencing children's dietary, physical activity, sedentary, and screen time behaviours in the home environment with parents in disadvantaged areas (Study III).

- To describe barriers and facilitators, related to intervention characteristics and process, that teachers and parents in a disadvantaged setting perceived as influencing the implementation of the HSS intervention (Study IV).

Hypotheses were:

- Children in the intervention group will have significantly higher intake of fruits and vegetables and lower intake of energy-dense foods and drinks after the intervention compared to the control group (Study I).

- Children in the intervention group will be significantly more physically active, less sedentary and have less screen time after the intervention compared to the control group (Study I).

3 METHODS

3.1 STUDY DESIGNS AND SAMPLES

3.1.1 Study designs

3.1.1.1 Randomised controlled trial (RCT) (study I)

The RCT design is considered the gold standard to evaluate the effects of an intervention (106). Study I evaluated the effects of the HSS intervention as a cluster randomised wait-list controlled trial (Table 1). As the study was carried out in a real-life setting, it represented an effectiveness study, which is preferred when investigating if an intervention in fact is useful in the life of the target group (106). As all of the participating schools opted for being included in the intervention group, a wait-list design was chosen so that all schools would have the opportunity to conduct the intervention activities, albeit at different times. The control group was offered to take part in all intervention components after the last measurement. The reporting of the trial followed the CONSORT recommendations (146). A protocol was published (147) before the beginning of the study, and the trial was registered (ISRCTN39690370).

3.1.1.2 Mixed-methods process evaluation (study I and IV)

A mixed-method approach has been suggested as the most fruitful one when conducting a process evaluation of a complex intervention (144). To gain a wide perspective of the implementation process of the HSS intervention, a quantitative approach regarding dose and fidelity was included in study I, whereas a qualitative approach regarding acceptance was included in study IV.

A qualitative study design is suitable for studying something in depth (148). The design is suitable in process evaluations as this type of evaluation requires sensitivity to informal patterns and unexpected interaction to capture certain aspects of processes (148). In study IV, a qualitative design was used to study the perceptions that different participants and deliverers had of the intervention (Table 1).

3.1.1.3 Qualitative study - Phenomenography (study II)

Phenomenography is a qualitative study approach. Phenomenography was developed by a group of researchers within the field of education at the University of Gothenburg with Ference Marton in the forefront (149). The approach was originally developed to capture qualitatively different experiences of learning for which a methodological approach was considered missing. Phenomenography has traditionally been used within the field of education, but has garnered more and more interest within the field of medical research (150, 151). The core of phenomenography is to explore variations of perceptions or experiences of phenomena within a certain group of individuals (152). The approach takes a non-dualistic standpoint in which the world is viewed as a constant interaction and influence between the inner world of the individual and the outer world.

The focus of a phenomenographic study is. thus the core of the relationship between the inner and the outer world: the second-order perspective, where the perceptions and experiences are non-verbalised, but taken for granted as implicit and underlying experiences. The rationale for a phenomenographic study is that in order to understand why individuals act in a certain way in relation to a phenomenon, it is vital to understand the underlying experiences the individual has of it. A person acts towards the world according to his or her experience of the world (152). In study II, a phenomenographic approach was used to explore parental strategies to influence their children's dietary behaviours (Table 1).

Table 1. Methodological descriptions of the studies.

	Study I	**Study II**	**Study III**	**Study IV**
Aim	To evaluate the effectiveness of the 6-month Healthy School Start parental support programme targeting dietary habits, physical activity and body weight of six-year-old children in families with low socioeconomic status in the school context	To explore the variation of how mothers and fathers with low SES influence their children's dietary behaviours as explored during a real-life session of motivational interviewing	To evaluate the psychometric properties of an instrument to measure PSE for influencing children's dietary, PA, sedentary, and screen time behaviours in the home environment with parents in disadvantaged areas	To describe barriers and facilitators, related to intervention characteristics and process, that teachers and parents in a disadvantaged setting perceived as influencing the implementation of the HSS intervention
Design	Cluster randomised controlled trial	Qualitative	Cross-sectional	Qualitative
Participants	Children and parents in both control and intervention groups of HSS	Parents in intervention group of HSS.	Parents in both control and intervention groups of HSS	Teachers and parents in intervention group of HSS
Data	Children: accelerometer, scale, stadiometer, measuring tape Parents: EPAQ questionnaire. Collected at T1, T2 and T3	Audio recordings of MI sessions. Collected between T1 and T2	Self-efficacy questionnaire. Collected at T1	Focus groups and semi structured interviews. Collected post T3
Analysis	Descriptive statistics. Mixed-effect Regression analyses (Linear, Poisson)	Phenomenographic analysis	Exploratory factor analysis. Correlation analysis	Qualitative content analysis with deductive and inductive steps

3.1.1.4 Cross-sectional study – evaluation of psychometric properties (study III)

A cross-sectional study design, with data from a sample collected at one time point, is useful to assess the psychometric properties of a questionnaire. Exploratory factor analysis (EFA) is a common approach used to assess construct validity (153). EFA is used to detect latent factors among a number of manifest variables. The latent factors indicate underlying process through which the manifest variables correlate with each other (153). Further, the validity of a factor is often tested through correlation with behaviour discriminating between high and low scorers on the specific factor (153). In study III, EFA was used to explore the factor structure of the PSE instrument based on the targeted behavioural domain. Correlations between the yielded factors and child behaviours were further calculated (Table 1).

3.1.2 Participants

Participants in the four studies of this thesis were all derived from the HSS intervention as described in figure 1. In study I, children in the intervention and control groups were included. In study II, a sample was drawn from parents in the intervention group. In study III, parents in the intervention and control groups were included, and in study IV, a sample of parents in the intervention group, and teachers who had conducted the intervention was drawn.

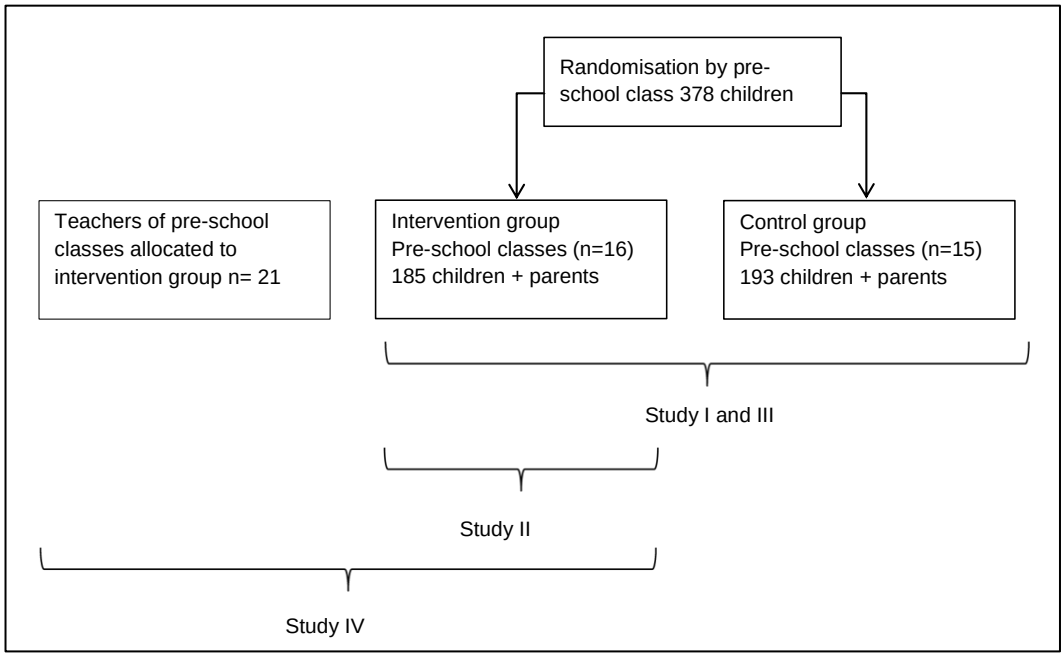


Figure 1. Description of samples of participants in the four studies included in the thesis.

Participants in the four studies were children attending pre-school class in the targeted schools and their parents, provided that the parents had consented to participation in the HSS intervention. Also, teachers in the pre-school classes conducting the intervention were included in study I, and IV. Given the universal target of the HSS, all families with a child in pre-school class in the targeted areas were invited to participate in the intervention. Consequently, the included children were all around six years of age and of differing weight status; the majority were of normal weight as expected in a universal intervention. Both

parents of a child were asked to provide informed consent but there was no requirement that both parents should participate in the components of the intervention. Of the 654 families eligible for inclusion, 378 (57.8%) agreed to participate.

3.1.2.1 Indicators of socioeconomic status

There are several indicators of SES, such as income, occupation, level of education, and housing (154, 155). Typically, the individual indicators are preferred, and education and income are commonly used. However, in areas with a high cultural diversity and where a substantial proportion of the residents have immigrated to the country, education may be misleading with regard to SES (64, 154). In these instances, the social standing of the area of residence, where the local neighbourhood plays an important role, is a useful indicator of SES. The social standing of the area indicates achievement, recognition and acceptance in the society at large and constitutes a useful indicator for SES on a group level (156).

In the HSS intervention, education was used as an indicator of SES on the individual level, complemented by social standing of the area as an indicator of SES on group level. Parental level of education was assessed by self-report where parents indicated the highest education they had attained. Also, all 31 pre-school classes included in the study were located in areas in Stockholm County – Skärholmen, and Rinkeby-Kista – which are targeted by governmental strategies to increase SES (157). These areas have lower employment, higher reliance on social welfare, and fewer people who have graduated from lower secondary school (9 years of schooling) than the national average (157). The proportion of individuals with 12 years of schooling or less accounted for 63.1% in 2012 (158), the year when the intervention was started. Individuals born outside the Nordic region accounted for 54.4% in Skärholmen, and 60.3% in Rinkeby in 2012 (158).

3.1.3 Ethical considerations

Research that includes children is always subject to thorough ethical consideration as children cannot consent for themselves but are dependent on others to make decisions for them. The Declaration of Helsinki 2008 states that vulnerable groups, such as children, should be firmly protected in any research study (159). In such cases, the legally authorized representative, the legal care-giver in the case of children, consents for the individual. However, in addition to the consent of the legal care-giver, any dissent from the child regarding participation in the research should be respected (159). The HSS intervention targeted mainly parents, as it primarily involved parental support. Nonetheless, changes in children's behaviours and weight development were the aims and measured outcomes of the intervention, and the children were also involved directly in the third intervention component (se section 3.2.2). Parents consented to their own participation and to the participation of their children. However, if the child refused to take part in an activity, such as wearing the accelerometer, this was never questioned by the research group. Thus, the children were allowed to make his or her own decisions when possible. Ethical approval was granted by the Regional Ethical Review Board in Stockholm, Sweden (2012/877–31/5) on 14 June 2012.

3.2 THE INTERVENTION A HEALTHY SCHOOL START

The HSS intervention is a universal parental support programme aiming at primary and, to some extent, secondary prevention as it targets all families with children in pre-school class at the schools of the targeted areas. Consequently, most children will be of normal weight and in focus for primary prevention, whereas some children will have overweight or obesity and be in focus for secondary prevention. The intervention is school-based and delivered by teachers and, ultimately, school nurses. However, the intervention targets behaviours in the home environment. HSS is conducted in pre-school class, when children are six years old and runs for six months.

3.2.1 The Healthy School Start programme theory

Based on SCT (111), a programme theory was developed for the intervention, described in the logic model (Figure 2). Input to the intervention was primarily based on the problem theory indicating that low SES is a major risk factor for unhealthy behaviours and development of overweight and obesity. Hence, this pointed to the last column in the logic model: the outcomes, which were identified as being improved child dietary and PA behaviours as well as partly improved BMI in the children who were overweight or obese.

Prior to developing intervention components, mediators important in bringing about a change in the outcomes were identified. The mediators were identified based on SCT, and the central construct of self-efficacy was considered an important mediator to target, in the form of PSE. As part of this intervention, self-efficacy was the only mediator that was measured (not presented in this thesis). However, other mediators (role modelling, parental knowledge, attitude/preference, care and control, and willingness to change) were identified based on other important constructs of the SCT (observational learning, behavioural capability, expectations and reinforcement).

Intervention components were subsequently developed according to their suitability to target the identified mediators. We hypothesised that: 1. Health information to parents would impact on parental knowledge, attitude, and preference; 2. MI with parents would impact on PSE, parental willingness to change, and parental care and control; and 3. Classroom activities for the children, along with home assignments, would impact on the parental role modelling, and children's attitudes and preferences. Subsequently, we hypothesised that change in the targeted mediators would lead to changes in the outcomes, as described in the logic model.

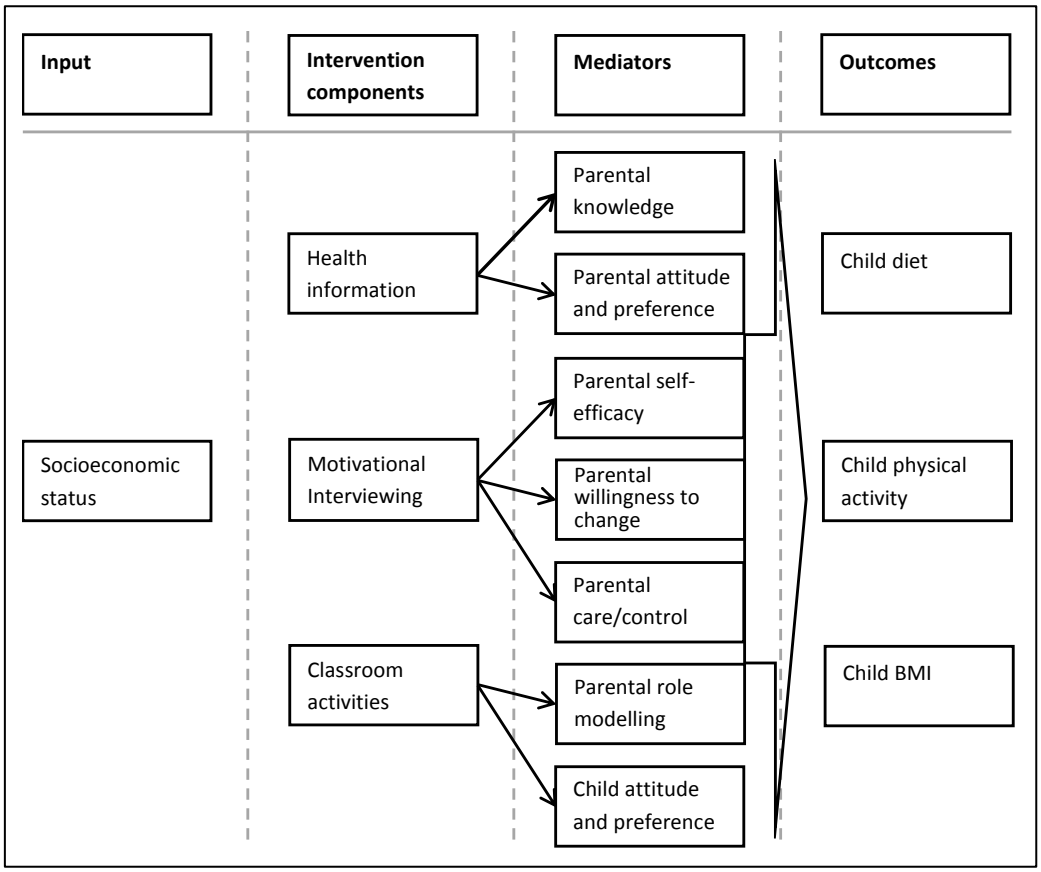


Figure 2. Logic model describing the hypothesised relationship between intervention components, mediators, and outcomes.

3.2.2 The Healthy School Start components

1. Health information was given to parents in the form of a brochure (Figure 3) containing evidence-based information on diet and PA for children, based on a literature review (160). The brochure was composed of seven themes: parental feeding practices, healthy food and family meal times, PA, sweets and sugar-sweetened beverages, fruits and vegetables, inactivity and screen time, and sleep. The text was adapted to easy-to-read Swedish and was also translated to Somali and Arabic. The brochure was distributed to parents via the teacher, who had knowledge of the languages spoken in the families. The parents were also offered group meetings on one occasion at each school. These meetings served as an opportunity for parents to discuss the content of the brochure with other parents and two research assistants.

Figure 3. Component 1: health information brochure to parents in Somali, Arabic, and Swedish.

2. MI was conducted with parents and performed by two MI counsellors. The parents were offered two MI sessions which were conducted by the same counsellor on both occasions and lasted for a maximum of 45 minutes. In the first MI session, the parents had the opportunity to choose a target behaviour regarding their child's dietary or PA behaviours that they wished to alter. The chosen target behaviour was then explored with support from the counsellor, who in turn used the material from the intervention as well as MI-specific material such as an agenda-setting tool to prompt exploration (Figure 4). The parent had the opportunity to set a goal related to the target behaviour if he or she felt ready to do so. A second session was offered approximately 3 months later either face-to-face or by telephone according to the parent's choice.

   The counsellors contacted the parents via telephone to schedule the first session. The counsellors informed the parent about the MI session using a standardised information sheet but delivered the information in a person-centred manner. The sheet included: 'I would like to give you some brief information regarding the session we are about to have so that you can be prepared. The session will focus on your perception of your child's habits and what you would like the child's habits to be. I will be asking you some questions and function as a sounding board for you. Naturally, you may ask me questions as well, but it is your thoughts that will be important in the session.' The counsellors had no information regarding the child's health status prior to the session, but relied completely on the problems perceived by the parent.

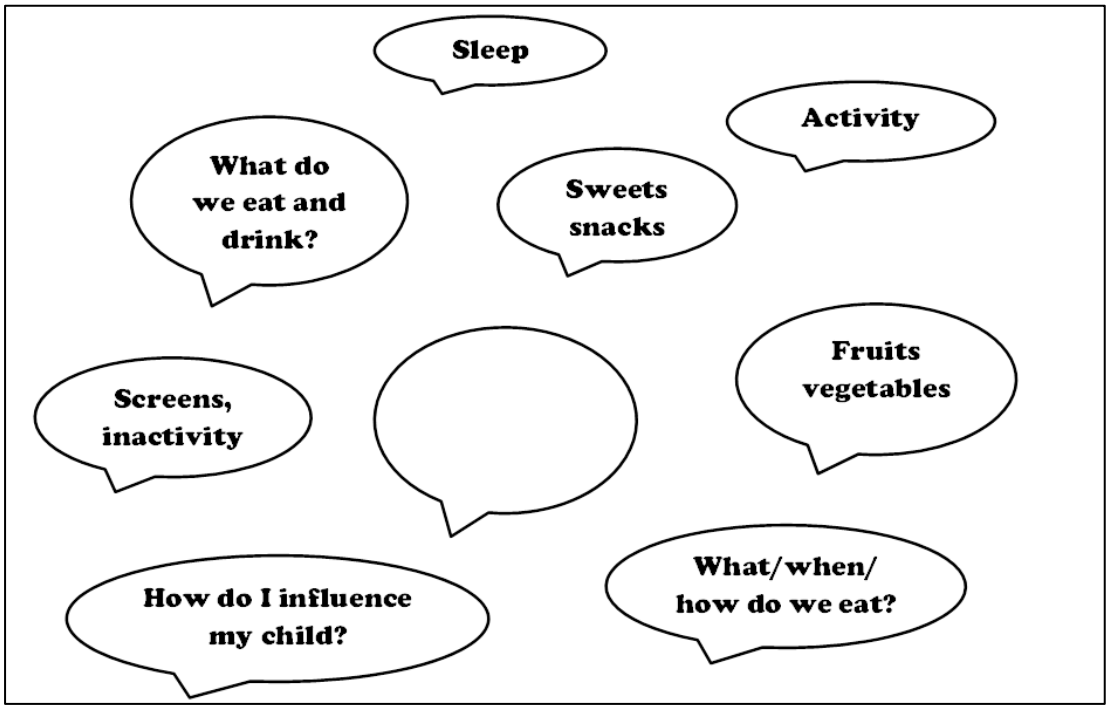


Figure 4. Component 2: agenda-setting tool used in the MI sessions to evoke a target behaviour.

Both counsellors were experienced in working with MI in a treatment setting, specifically a helpline for alcohol misuse among adults. The counsellors were thus accustomed to working with a different target behaviour (alcohol), over the telephone

rather than face-to-face, and in a treatment setting rather than in a prevention setting. Though the counsellors were used to having sessions with friends and family members of adults with alcohol misuse, they had no prior experience of working with parents to change their children's behaviours. Both counsellors had reached beginner's proficiency for MI according to the Motivational Interviewing Treatment Integrity code (MITI) and were continuously supervised and coded for MI fidelity using the MITI 3.1 (161) in the treatment setting prior to starting the HSS intervention. Both counsellors had degrees in Public Health Sciences and received three days of training before commencing their work in the HSS intervention. The training consisted of specific information on evidence-based healthy diet and PA for children of the pertinent age group, as well as specific training regarding the set-up of the MI component of the intervention, where checklists for data collection, scheduling, practical issues, and materials used in the sessions were included. Also, clinical insights into the 'usual' session and how to handle it were included in the training. A very flexible guide for how to handle the session had been prepared based on the MI session in the HSS conducted in 2010-2011. The guide consisted of support for counsellors on how to evoke a target behaviour to focus on in the session, how to use the intervention material, introduce the agenda-setting tool to the parents, evoke change talk, and how to support parents in setting a goal and exploring the first steps towards the desired change. In addition, the training included a meeting with a representative of the Somali community in one of the intervention areas to discuss specific issues related to diet and PA in that community, issues that might be important to take into account in the MI sessions.

Throughout the intervention, the counsellors were supervised on nine occasions by a member of the Motivational Interviewing Network of Trainers and part of the research team. Supervision focused on practical issues revolving around the MI sessions, and the counsellors' experiences and difficulties were discussed. Supervision also included systematic feedback on recorded sessions; MITI codings were included on some occasions.

3. Classroom activities that followed the themes in the parental brochure were led by the teachers. They were guided by a teacher's manual which was developed specifically for the intervention. The ten lessons (30 minutes each) were accompanied by a workbook with assignments that the children were to take home and complete together with their parents (Figure 5). The material for the lessons was developed based on previous interventions (162, 163) and in conjunction with other teachers. Before the material was put to use, four teachers and eleven parents of children in the first grade commented on it. Teachers were provided with two hours of training on how the classroom material was intended to be used and had continuous access to support from research assistants, either upon request or at the initiative of the research group.

Figure 5. Component 3: To the left, the cover of the workbook. To the right, example of two home assignments: Lesson 1: drawing 'a food package with the Keyhole[2] found at home', Lesson 2: drawing 'the plate-model'.

The HSS intervention was first carried out 2010-2011 in areas with medium to low SES. Effects detected included increased vegetable consumption in the intervention group as well as increased PA during weekends among girls in the intervention group, but the effects were not sustained at follow-up (53). The HSS in focus of this thesis was carried out in 2012-2013 in areas with low SES and a high prevalence of overweight and obesity in 4-year-old children; the proportion of children with overweight or obesity was about 15% in Skärholmen and about 16% in Rinkeby-Kista (3). Furthermore, the population in these areas includes a high proportion of individuals born outside the Nordic region: 60.3% in Rinkeby and 53.4% in Skärholmen (164).

The intervention was adapted to suit the target group; the information material was professionally translated to the most common languages in the areas (Arabic and Somali), and examples of common staple foods were included in the classroom material. Also, a group meeting focusing on health information was added, and the material was checked to make sure it was written at a level that would be easy to understand even for parents with low proficiency in Swedish. Schools in the targeted areas were provided with information and invited to participate in the intervention in spring of 2012. Upon agreement, the principals at each school signed a contract that set forth the respective obligations of the school and research group throughout the intervention. Information to the parents was provided at the first regular information meeting in the school as their children started pre-school class, when members of the research group attended and provided information. Randomisation to intervention and control group was conducted after the baseline measurement.

3.3 MONITORING OF INTERVENTION IMPLEMENTATION

When using mixed methods in a process evaluation, it has been suggested that quantitative data should be collected regarding key processes from each of the intervention sites. Further,

[2] The Keyhole is a nutrition label developed by authorities in Norway, Sweden and Denmark to indicate grocery store products that contain less fat, salt and sugar and more whole grain and fibre than the average for that particular foodstuff.

in-depth qualitative data should be collected about factors with strong influence on intervention function. The qualitative data should be gathered from a small, carefully selected sample of participants (144).

There is a lack of consensus regarding terminology of aspects that are important to investigate as part of a process evaluation. Commonly, variables with regard to dose, reach, fidelity, and acceptability are targeted by a process evaluation (144). Dose can be measured in terms of how much of the intended intervention content has been delivered, or in terms of what has been received by the participant. Reach refers to the proportion of the participants who have been reached by the intervention content. Fidelity, particularly, is an aspect under debate. In this thesis, fidelity is related to the quality of the delivery of the intervention content. Acceptability refers to the participant's view of the acceptability of the intervention content (144, 165).

3.3.1 Dose and fidelity to intervention delivery

Fidelity to the delivery of intervention content, dose delivered, and dose received were all investigated quantitatively as part of Study I. Using MI as an intervention component demands thorough monitoring of adherence to MI, to ensure that MI was in fact delivered during the intervention. Monitoring of MI fidelity has been in focus during the past years, as it was largely neglected in earlier interventions (166). A lack of fidelity monitoring results in an inability to attribute any change in the outcomes as an impact of MI, as nothing regarding the delivery of MI is known. Valid and reliable systems for quality assurance of MI have been developed, and guidelines for adequate fidelity assessment are available (167, 168). Audio recordings of MI sessions are coded for two different dimensions capturing MI consistent behaviour in the counsellor: relational components and technical components. These dimensions are coded according to validated instruments, of which the most common, MITI (169), has been validated in a Swedish context (170, 171).

3.3.2 Acceptability

Study IV focused on the process evaluation of the HSS intervention, more specifically on investigating the intervention's acceptability among deliverers and participants. It has been suggested that process evaluations should be guided by implementation theories or frameworks to make findings more transferrable and comparable between interventions (172). Study IV was therefore guided by the Consolidated Framework of Implementation Research (CFIR) (173).

The CFIR is a consolidation of 19 implementation frameworks, theories and models. The CFIR compiles the concepts influencing implementation in health service research, as described in the 19 texts, into one typology with a common terminology (173). The CFIR comprises 37 different constructs spread over five overarching domains which are:

- Intervention characteristics – the evidence strength, source, relative advantage, adaptability, trialability, complexity, design/packaging and cost of the intervention.

- Outer setting – patients' needs and resources, cosmopolitanism with and peer pressure from other organisations and external policy and incentives.
- Inner setting – structural characteristics of the organisation, networks and communication, culture, implementation climate and readiness for implementation such as leadership engagement, within the organisation.
- Characteristics of the individuals – knowledge and beliefs about the intervention, self-efficacy, individual stage of change and identification with the organisation and other personal attributes.
- Process – planning, engaging, executing and reflecting and evaluating.

The authors of the CFIR state that it should be used as suited for the specific study, hence researchers can choose what is relevant for their specific context (173).

3.4 DATA COLLECTION

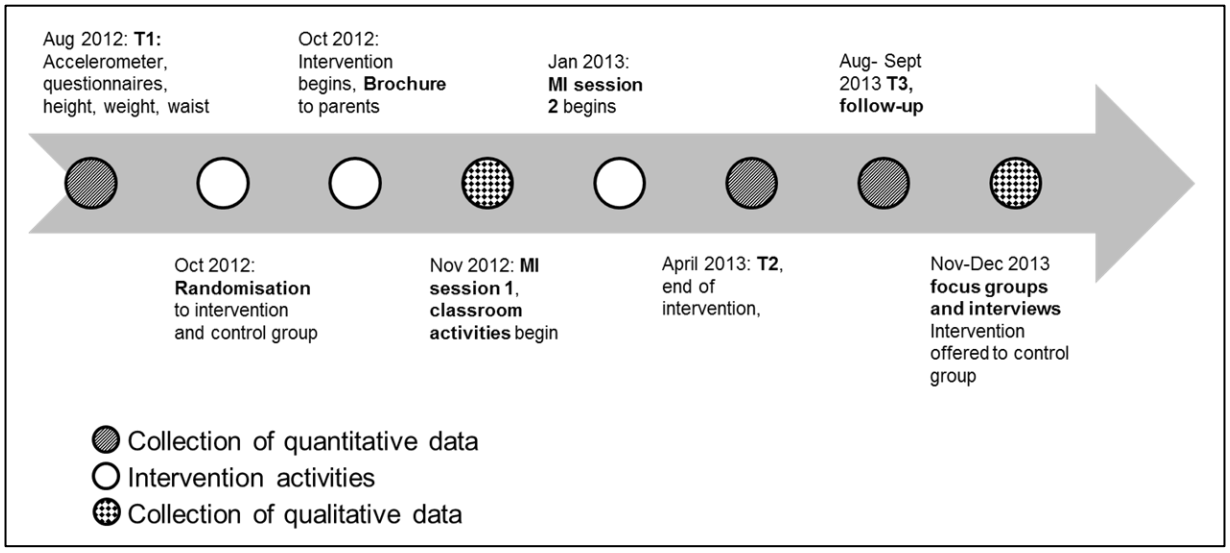


Figure 6. Time line of the Healthy School Start intervention: delivery of intervention and points of data collection.

3.4.1 Quantitative data (study I and III)

Data were collected on three occasions, at baseline (T1) in August-September 2012, after the intervention (T2) in April-May 2013, and at 5-month follow-up (T3) in September-October 2013 (Figure 6).

3.4.1.1 Measurement of physical activity

Physical activity behaviours were used as one of the outcomes in study I. Common methods to measure PA include self-report and objective measurements. Self-report often takes the form of either questionnaires or structured diaries, whereas objective methods often involve pedometers, accelerometers, or heart-rate monitors. Self-reported measurements are low in cost, easily administered, and useful for measurements in large samples of individuals. However, reporting bias is common in self-reported measurements of PA, which ultimately may lead to an exaggeration of effects (174). Self-reported PA has been suggested to

accurately rank PA, but not to validly quantify PA (175). Correlations between self-reported and objective measurement of children's PA are low (176).

In the HSS, objective measures of PA were chosen over self- or parent-reported measures to minimise reporting bias (177) To objectively measure PA and sedentary behaviours, accelerometers were chosen based on scientific guidelines (178).

Measuring PA using accelerometers

Regarding the validity and reliability of the Actigraph in children, a systematic review including children between 2 and 18 years old found intra-instrument reliability presented as an intra-class correlation value of 0.87 for 7 days of monitoring. Regarding validity, correlations with doubly labelled water ranged between r=0.39 and 0.58 for all energy expenditure measurements in 9-year-old children. Also, test correlations with observed PA have been shown as r=0.87 in 4-year-old children (179, 180). Accelerometers have a good capacity to accurately register the level of aerobic activity, such as running, walking and, jumping, as well as time spent inactive. However, bicycling or anaerobic physical activity, such as weight lifting, is systematically underestimated.

The accelerometer consists of vectors that detect acceleration in different directions. It registers data in counts several times per second, and from this, information regarding activity level, duration, and frequency can be derived. The count measure is a sum of post-filtered accelerometer activity at the specific Hertz value of the accelerometer. Therefore, counts cannot be translated between different brands of devices or devices placed in different positions of the body (181). Data can be used as raw data, in which case all data are processed. This has the advantage of capturing activity patterns and of all behaviour being included in the analysis, but with the disadvantage of an abundance of information which may be difficult and time consuming to process. The count value can also be used to derive levels of PA, such as light, vigorous, and moderate activity. For this strategy, each PA level is defined as activity within a specific range of counts per minute. These levels of PA are meaningful and comparable, provided that the same threshold is used (182). Data are then processed into epochs of time, where an epoch comprises a fixed number of seconds, most commonly 5, 15 or 60 seconds. It has been suggested that a shorter epoch length should be used for children than for adults (180) with a preferred length of 5 seconds (183). Epochs are then labelled in activity levels according to the level that has been registered throughout the epoch. The use of different cut points has made it difficult both to compare studies and to determine what proportion of children and youth attain the recommended dose and intensity of physical activity per day (184).

Accelerometers can be worn either on the wrist, which normally facilitates compliance to using the device (185), or on the hip, which improves measurement accuracy (186). The time of measurement varies between studies; seven consecutive days is the preferred measurement period. The participant is usually required to wear the device for a specified minimum number of days. The minimum wear time that is required for a day of measurement to be

considered valid is also usually set. Requirements on both the number of valid days, and the amount wear-time differ between studies. Common numbers of valid days range between 2 and 4. However, the inclusion of only 1 valid day, if randomly selected, has been suggested to be enough for a valid measurement of the week (187).

PA measurement in the HSS intervention

In the HSS, PA and time spent sedentary were measured using the GT3X+ Actigraph device (LCC, Pensacola, USA). Children were encouraged to wear the device on the hip during all time spent awake for seven consecutive days, capturing both weekdays and weekend days, from which data collected between seven am and nine pm were used in the analyses. As the parameter of interest for the HSS was the proportion of children who reached the recommendation for PA, the different intensities, MVPA, time spent sedentary, and total PA were in focus in the assessment. Total PA provided us with an overall measure of the total amount of PA that the child was engaged in per day. To derive this measure we used the mean of the total counts produced by the child each day during the seven-day measurement period. The epoch length was set to 15 seconds, which produces a manageable amount of data. This epoch length has been used in similar studies (188), and thus facilitates comparison between studies. A valid day was set to a minimum of 500 minutes of wear time. A minimum of two valid days was demanded from a measurement in order to be included in the analysis. In studies on children, the number of valid days included in the analysis differs widely. Measurements including at least two days with ten hours of registered data per day have been found reliable (189). In the HSS, all participants exceeded the minimum of two valid days except one, who merely attained the minimum.

Non-wear time was defined as sequences of ten or more minutes of zero counts. Cut points for intensities in PA were defined such that all activity <100 counts per minute was classed as sedentary and all activity >2000 counts per minute as MVPA. In relation to metabolic equivalent (MET) values, moderate activity corresponds to 4 METs and vigorous to 7 METs in children (39). These cut points for PA intensities have been used in several previous studies (190) and are very similar to the Evenson cut points (191) used in other studies of children's physical activity (52), which makes it possible to compare the results of the HSS study with several other studies.

3.4.1.2 Measurement of diet

Dietary intake has proven difficult to measure accurately. There are a number of methods to measure dietary intake, ranging from controlled servings in an experimental observational setting, real life observations, to different forms of self-report, including keeping a prospective food diary or recalling previous intakes retrospectively (192). There are a number of advantages and disadvantages to each of the methods. Any methods including the presence

of a researcher or a laboratory is time-consuming, often expensive and usually only feasible on a small scale.

Keeping a prospective record of the diet may be more or less burdensome to the participant and can demand high literacy depending on how specific the record is and what it is expected to cover. This may make it subject to selection bias among participants, or reporting bias, if the participant over- or under-reports due to social desirability. Also, burdensome reporting often leads to increased drop-out rates (192).

Retrospective reporting on the other hand may be biased due to recall difficulties or due to social desirability. Over-reporting of healthy foods and under-reporting of unhealthy foods have been found for retrospective dietary assessment methods (193). Food frequency questionnaires are used to capture retrospective dietary intakes over a period of time. They are usually self-administered, containing a large amount of questions to capture the entire dietary intake, which makes these questionnaires burdensome for the participant. In the 24-hour recall method, the participant is asked, often in a structured interview, to recall all foods consumed during the past 24 hours. However, the accuracy of the results obtained when using a single 24-hour recall to capture a stable behaviour (dietary intake over time) is questionable. Rather, intra-person variation is extensive and participants' habitual intake cannot be captured using only one day, as a person often compensates for exaggerated or lower intake over a period of days. Therefore, the 24-hour recall method is considered inadequate for capturing habitual intake on an individual level, but useful for capturing intake on group level (194, 195). If the focus is to capture certain food groups rather than the entire dietary intake, a brief dietary assessment instrument may be preferred. Such an instrument may cover only the food groups in focus, for example fruits and vegetables, and thus decrease participants' burden (192).

Measuring dietary intake in children

Measuring dietary intake in children is particularly challenging and different approaches have been suggested depending on the specific age of the child (192). It has been argued that the recall ability of children younger than 8 years old is too limited for them to accurately report dietary intake retrospectively (196). Therefore, it is suggested that information on dietary intake of pre-school children should be collected from a parent, or preferably from both parents and the child together (197). Children's intake collected from one parent only has been found to be variously over- and under-reported (197, 198).

For children of the HSS age group (4-11 years), a review comparing different dietary assessment methods to the method considered as gold standard for measuring energy expenditure – doubly labelled water – suggests that the most valid and reliable method to capture total energy intake is 24-hour multiple pass recall over a period of at least 3 days. The period should include both weekdays and weekend days and parents should be used as proxy reporters (199).

Dietary measurement in the HSS intervention

In the HSS the focus was on capturing habitual intake of obesity-related indicator foods such as energy-dense products, and fruit and vegetables, not the entire dietary intake over a period of time or total energy expenditure. The focus was also on detecting change in habitual intake of the intervention group compared to the control group. Therefore, the choice fell on using a brief assessment questionnaire for parental recall of the child's intake of indicator food groups representing healthy food and unhealthy food during the previous weekday, the Eating and Physical Activity Questionnaire (EPAQ) (200). The EPAQ is a cost-effective and easily administered brief food frequency questionnaire intended for use in population monitoring and to evaluate interventions aimed at obesity prevention through health promotion (201). It has previously been used in an Australian intervention aiming to prevent obesity among children between the ages of 0 and 5 years (200). The EPAQ was developed to measure the consumption of obesity-related foods by children of the ages from 2 to 5 years (201), by parental proxy, with parents being asked to recall the child's intake of certain foods and drinks during the previous weekday. Intake is measured in standard Australian servings, and the questionnaire includes examples. The EPAQ items cover the child's intake of fruit juice, sugar sweetened drinks, water, plain milk, flavoured milk, vegetables, packaged snacks, fruit, chocolate and confectionary, and cakes and sweet biscuits, and was validated in an Australian sample of 90 parents of 4-year-old children against triple-pass 24-hour parental recall (201). Significant ($p<0.001$) Spearman rank correlations between the questionnaire and 24-hour recalls were found ranging between 0.57 and 0.88 (201).

Adaptation and translation of the EPAQ for use in the HSS intervention

To be used in the HSS, the EPAQ was translated into Swedish by a nutritionist who was a member of the HSS project team. The questionnaire was also adapted to the Swedish context by inclusion of food products common in Sweden and in the targeted areas were included. Examples of 'packaged snacks' included crisps and cheese doodles, 'flavoured milk' was listed by the brand name used in Sweden (O'boy), and baklava was added to the category 'cookies and buns'. Also, 'ice cream' was added to the questionnaire as the project group hypothesised that the intake of ice cream could have an impact on the obesity-related dietary behaviour of children in Sweden. The Swedish equivalent of cordial, 'saft', was added to the category 'soft drinks'.

When the questionnaire was distributed, the parents were asked to recall the child's intake, during the previous weekday, of foods and drinks (snacks, sweets/chocolate, ice-cream, cakes/buns/cookies, fruits, vegetables, soft drink, flavoured milk and fruit juice) by marking the number of servings on a 7-point scale: 0, 0.5, 1, 2, 3, 4, 5 or more servings, for foods and: 0, 1, 2, 3, 4, 5, 6 or more servings for beverages. Servings were defined and presented in the questionnaire as: drinks = 1.5 dl, vegetables = e.g. 2 dl grated carrots/cabbage or a big tomato or 2-3 broccoli stalks, fruit = e.g. a small apple or about 10 grapes, snacks = 1.5 dl crisps or cheese doodles, sweets = about 1.5 dl of sweets or 4 pieces from a chocolate bar, cakes = a small bun or 5 small biscuits, ice-cream = a small ice lolly or 1 dl ice cream. The

questionnaire was pre-tested by eleven parents of children in grade 1 in the intervention areas, which resulted in some modifications of the language to facilitate participation for parents less proficient in Swedish. The EPAQ was available in Swedish only and distributed by mail to the parents. However, parents were offered assistance filling in the questionnaires on one occasion at each school, when research staff would be present to help.

3.4.1.3 Measurement of BMI

BMI is commonly used as a proxy for determining weight status in adults and children. BMI as a measurement is easily administered, low in cost, and non-invasive, which makes it a useful measurement for interventions that include large samples. Also, BMI is widely used across studies, which facilitates comparisons. However, BMI is an imprecise measurement of body composition as it does not distinguish between fat mass and fat-free mass (202). The use of BMI as a proxy for overweight and obesity has also been argued to underestimate the effects of interventions compared to other methods, such as measuring body thickness (203).

For adults, standard BMI cut-offs can be used, but for children, growth development needs to be taken into account. BMI is not comparable between different childhood ages or between the sexes. Therefore, a child's weight status is determined from international reference values which are relative to the age and sex of the child, and which follow the growth development curve (204). In addition, the standard deviation score of BMI (BMI-sds) is used for direct comparison between sex and age groups. Reference values for Swedish children born in 1973-1975 are available (205). Values considered indicative of normal weight development according to the Swedish reference, range between BMI-sds -2 and 2 (205).

In the HSS intervention, children's height and weight were measured using standardised stadiometer and scale by two research assistants together. Children were measured in indoor clothing in a room close to their classroom and a maximum of two at a time to ensure integrity. The choice to use BMI-sds as the outcome indicating weight status was based on the method being easily administrated, low in cost and, most importantly, non-invasive for the children. BMI-sds was calculated using the Swedish reference (205) from which weight status categories were derived using the international cut-offs (204).

3.4.1.4 Quantitative data on implementation

MI fidelity to quality of delivered MI was assessed according to suggested procedures (167). All MI sessions were audio-recorded and every tenth session of the first round of MI sessions was chosen by the MI coordinator for fidelity assessment. If the session chosen did not include a target behaviour, the coordinator would listen to the next session on the list for that pre-school class and choose the first subsequent session that included a target behaviour to be assessed for MI fidelity. Eight sessions conducted by each of the two counsellors were assessed for fidelity. The recordings were sent electronically for assessment by reliable observers (170) using the MITI 3.1 (171, 206) .

The dose of classroom activities and home assignments was assessed through teachers filling in a log after each lesson. In the log they, they noted down the time spent on each lesson, barriers and facilitators, and adjustments for each activity with corresponding home assignment that was completed. In-depth information regarding whether the components were delivered as intended, such as whether the home assignments were actually sent home, was collected through qualitative semi-structured interviews.

3.4.1.5 Parental self-efficacy

Study III comprises an assessment of the psychometric properties of an instrument to measure PSE. Guidelines for development and evaluation of instruments to measure self-efficacy has been provided by Bandura (207). The guidelines highlight the importance of domain-specificity of items, which means that items should focus on a specific domain of functioning. Also, items should capture a variety of aspects of the domain. Response scales should include a 0 to 10 range to ensure that the instrument is sensitive enough to capture differences in responses. Instruments should also include challenging situations to reflect the respondents' capability of performing the activities amidst the challenges and ups and downs of everyday life and in order to mitigate ceiling effects (121).

Study III focused on revising the instrument previously used in the first HSS intervention in 2010 (121), capturing the domain of parental prevention of overweight and obesity in their children. This is a broad domain of functioning, which includes closely related activities regarding diet, PA, sedentary, and screen time behaviours. The development of the instrument aimed to include more specific items and increase comprehensibility for parents with low SES and with varying proficiencies in Swedish. For the most part, the instrument followed Bandura's guidelines. However, challenging situations were not included in the items, with one exception. A 15-item instrument including items regarding the children's dietary, PA, sedentary, and screen time behaviours was developed where parents responded on a scale ranging between 0 and 10 with 0 indicating 'not at all certain' and 10 indicating 'certain to a very high degree'. Parents who had responded individually to the instrument at T1 were included in the study measurements.

3.4.1.6 Sample size/power calculation

The sample size/power calculation presented in study I was based on physical activity, outcomes for which no significant effects were detected. However, a power calculation on dietary outcomes was also performed. The power calculations were based on intake of vegetables based on the findings of the first HSS conducted in 2010-2011. In this case, the estimated sample size was calculated for an estimated mean difference of 0.26 servings of vegetables between the intervention and control groups with a power of 80%, a significance level of 0.05, 3% intraclass correlation, and a standard deviation of 0.7. The calculation indicated a need for 12 schools with a total of approximately 600 children (300 in each group) in order to find a significant difference between the groups.

3.4.2 Qualitative data (study II and IV)

Data for study II were collected during the time period when the first MI sessions were conducted between November 2012 and January 2013. Data for study IV were collected as focus groups in November and December 2013 (Figure 6).

3.4.2.1 Qualitative data on implementation – Focus groups

In study IV, focus groups constituted the main method for data collection. Focus groups are among the preferred method of data collection when one wishes to obtain information concerning experiences and usefulness of a phenomenon that is common for a specific group. Data obtained from focus groups comprise perceptions as expressed by the group and produced in interaction between the group participants (208, 209). To investigate barriers and facilitators for the implementation of the HSS intervention, as perceived by parents and teachers, focus groups were therefore considered the appropriate method to use. However, several difficulties arose during the data collection. First, it was very difficult to recruit parents for the focus groups: the majority of the parents identified in the first sample declined participation, mostly due to time constraints. When the sample was extended to include all parents in the intervention group, it was still difficult to recruit. Further, when an appropriate number of parents had agreed to participate, several of them cancelled at last minute or simply did not show up for the focus group. The time aspect was a contributing factor to the small number of participating teachers as well. Also, among the parents who did participate in the focus groups, the variation in Swedish proficiency hampered discussion and resulted in an uneven distribution of power in the groups, where the fluent speakers voiced their arguments and opinions and the non-fluent speakers became more silent.

In this context, individual interviews could have helped circumvent the time constraints of both parents and teachers, as it would allow for more flexible scheduling. Telephone interviews could also have been considered. Individual interviews could also have helped the parents with lower Swedish proficiency. However, individual interviews would not yield the same type of data as focus groups. If focus groups are to be used with groups of parents whose Swedish proficiency differs widely, knowledge regarding language proficiency could be useful in forming homogenous groups, which is desired in focus group methodology (208). Such assessment could be done beforehand, via a telephone conversation, or on the spot. The latter strategy would lead to division into smaller groups according to language proficiency.

3.4.2.2 Unobtrusive data

In study II, unobtrusively collected data were used. The most common method for data collection in studies using a phenomenographic approach is semi-structured interviews. However, using unobtrusive methods, such as collecting data from archives, has been encouraged (210). Unobtrusive data means data that are non-reactively collected, and hence not influenced by either the respondent or the interviewer (211). This type of data prevents reporting bias which often constitutes a problem in obtrusively collected data such as

interviews. In study II, collected audio recordings of MI sessions with parents were used to explore variations in parental strategies to influence children's dietary behaviours. The MI sessions were transcribed and transcriptions thus represented archival records of the session. The use of MI sessions as data in qualitative studies is uncommon, but has been conducted previously (212, 213).

3.5 DATA PROCESSING AND ANALYSES

3.5.1 Quantitative data

3.5.1.1 Mixed model regression

The unit of randomisation in the HSS intervention was pre-school class. Consequently, data from individuals clustered in each school class were presumably dependent. Mixed models (also known as random effect models, multilevel models, or nested data models) were adopted in the analyses since such models allow for cluster effect adjustment (214). Therefore, mixed regression model with two levels – individual and school class – were used to analyse the effects on outcomes between the intervention and control groups. Outcomes were collected on the individual level whereas randomisation was done at school class level. Therefore, the effect of intervention was considered as a fixed effect and a random intercept was included, which can be interpreted to adjust for the effect of school class variance.

The SPSS 22.0 software package (Chicago, Illinois, USA) was used to fit each model with fixed effect of intervention, adjusted for baseline values of outcome, and further adjusted for fixed effects of sex and parental education ($\leq$ or $>$ 12 years of schooling), one at a time. Then, the random intercept was included and a likelihood ratio test (-2 Log Likelihood difference) was used to compare the fit of the two models: the one with a fixed intercept and the one with a random intercept. The test statistic was assumed to asymptotically follow a chi-square distribution with one degree of freedom (the difference between the numbers of parameters between the two models is one, which is only the variance of the random intercept). Few outcome models produced significant test statistic of the likelihood ratio test, which means that the random intercept model of those outcomes had a significantly better fit with data than the model with fixed intercept.

Also, in a log link regression model like Poisson, a pseudo -2 Log Likelihood value is used in SPSS, and model fit assessment using those values must be interpreted with caution. When the mixed Poisson regression was performed in SPSS it became evident that the programme had difficulties in assessing the random intercept (effect of school class variance). Therefore, the analyses regarding the effect of intervention on outcomes were subsequently performed in the software programme MLwiN (version 2.31, 2014, Bristol University), which is specifically developed for Mixed model analyses. However, MLwiN does not permit comparisons of model fit using -2 Log Likelihood values. These comparisons were therefore made using SPSS.

3.5.1.2 Poisson regression

Mixed Poisson regression was used to analyse the dietary count variables in study I. When investigating how data fulfilled the assumptions of the Poisson regression it was clear that the dietary data were, in some instances, underdispersed as indicated by chi square value. Underdispersed data is defined by the variation in data being smaller than accounted for by the model. Consequently, the confidence intervals are inflated as they are wider in the model than what the data contain, which increases the risk of type II error. Underdispersed data is rather uncommon regarding count data. Therefore, there are few strategies for handling underdispersed data. To deal with the underdispersion, negative binominal model was tested. This rendered an even lower chi square value, indicating more underdispersion. Subsequently, adjustment of the standard errors with Pearson chi square was considered, but this could not be conducted in a mixed model and was therefore abandoned. Searching for a solution, the Conway-Maxwell-Poisson distribution (CMP) was found. CMP is a generalisation of the Poisson distribution that permits modelling of underdispersed data (215). Unfortunately, no software was available to run the analyses with a mixed component allowing for a random intercept. However, when testing the CMP without a random intercept in SAS, it was clear that the CMP distribution would have been the most appropriate to use for the dietary data. However, the results of the CMP modelling were consistent with the mixed Poisson regression, in terms of direction of effect (+ or –).

3.5.1.3 Linear regression

Mixed linear regression was used to analyse the continuous PA and BMI variables in study I. The assumptions of linear relationship, error normality, and multicollinearity were tested. All variables indicated that linear regression was applicable to test differences between the groups, controlling for covariates and factors.

3.5.1.4 Exploratory factor analyses

In study III, EFA was used to assess the construct validity of the instrument to measure PSE for influencing children's dietary and PA behaviours. Analyses were performed using SPSS version 22.0.0 (SPSS Inc., Chicago, IL, USA). As a common procedure in EFA, different extraction models were tested in order to monitor communalities, factor loadings of items and the yielded factors (153). Also, different rotations were tested, and oblique rotations were used to test whether correlations between factors demanded the use of an oblique rotation.

3.5.2 Qualitative data

In study II, a phenomenographic analysis was undertaken to explore variations in how parents with low SES influence their children's dietary behaviour. In a phenomenographic study the variations in experiences are described as qualitatively different ways of experiencing a phenomenon: categories of description. These categories are logically related to each other within one or several structural relationship/s: outcome space/s (152, 216). Phenomenography is interested in the different ways of experiencing within a certain group, not the different

individuals in the group. Thus an individual can contribute to several qualitatively different categories of description.

The analysis procedures described by Åkerlind (210, 216) were chosen over the traditional procedures originally described by Marton (149, 152). One major differences between the two procedures lies in the treatment of units of data; Marton relies on separate utterances within a transcript, whereas Åkerlind regards the entire transcript as a unit of data (210, 216). The Åkerlind procedure thus allows for inclusion of context. In study II, where unobtrusive data was used, the inclusion of context was considered important. The MI sessions were conducted without the study in mind and it was therefore important to view the parent's statement in the session in the context of the entire session, in order to be certain of the underlying meaning of the statement.

In study IV, qualitative content analysis was used to describe participants' perceptions of barriers and facilitators to the implementation of the intervention. Qualitative content analysis can be conducted in several different manners. In study IV, a first step using deductive analysis was chosen in order to include the CFIR framework in the analysis. In a deductive analysis, codes are pre-defined according to the theory (217). In this case, codes comprised the five domains of the CFIR. The deductive sorting into the different domains of the framework made it possible to distinguish between the contents of the data. Most of the data fit one of the domains, and data that did not fit in were not used in the study. Deductive analysis is most commonly used to test or find support for a theory. In study IV, the aim was to describe perceptions of the intervention among participants and deliverers, not primarily to test if the perceptions were according to the CFIR framework. Therefore, an inductive analytical step was undertaken. In inductive analysis, codes derive from data, which allows description of the existing perceptions within the specific sample. In the inductive step of the analysis, data that were deductively sorted into the different CFIR domains were analysed separately. The analysis followed the procedures described by Elo and Kyngäs (218) where both deductive and inductive procedures are described.

The findings of the study include data from the CFIR domains 'Intervention characteristics', and 'Process', as it was clear in the inductive step of analysis that data that were deductively sorted into these two domains were thematically closely related.

4 RESULTS

4.1 PARTICIPATION

A selection of characteristics of the participants in the four studies and in Stockholm County overall are summarised in table 2. The percentage of participating parents with a maximum of 12 years of schooling ranged between 47.0 and 100% in the four studies. Parents born outside the Nordic region comprised 57.1 to 80.4% of the participants in the studies, 23.6 to 42.9% of the children were overweight or obese, and 58.4 to 71.4% of the participating families lived in a rented home.

Table 2. Family characteristics of participants in the four studies and in Stockholm County.

Family characteristics (%)	Study I	Study II	Study III	Study IV	Stockholm County
Parent low education [a]	47.1	100	47.0	57.1	51.2[d]
Mothers	65.0[c]	75.9	79.9	64.3	NA
Parent born outside the Nordic region	80.4	79.3	78.6	57.1	19.0[d]
Rental housing	60.5	78.6	58.4	71.4	32.1[d]
Child overweight or obese[b]	26.5	27.6	23.6	42.9	11.2[e]

[a] Maximum of 12 years of schooling.
[b] According to Cole TJ, Lobstein T. Extended international (IOTF) body mass index cut-offs for thinness, overweight and obesity. Pediatr Obes. 2012;7(4):284-94.
[c] Attending the first MI session.
[d] According to Statistics Sweden, Register data on integration, available from http://www.statistikdatabasen.scb.se/pxweb/sv/ssd/START__AA__AA0003__AA0003E/ Oct 2016.
[e] Of 4-year-old children (born 2008) in the county according to Stockholm County Council. (2013), Annual report on child health care.

4.2 OVERALL SYNTHESIS OF RESULTS FROM STUDY I-IV

Figure 7 describes a synthesis of the results of the four studies included in this thesis. Study I found that the HSS intervention had favourable effects on intake of unhealthy foods and drinks, and on BMI-sds in children with obesity. Taken together, study II, III, and IV showed that parents' capabilities are important to take into account when developing parental support interventions targeting children's dietary and PA behaviours, and child weight development. Figure 7 also presents the hypothesis that such development could possibly increase the effects of the intervention. However, this hypothesis has not been investigated in this thesis.

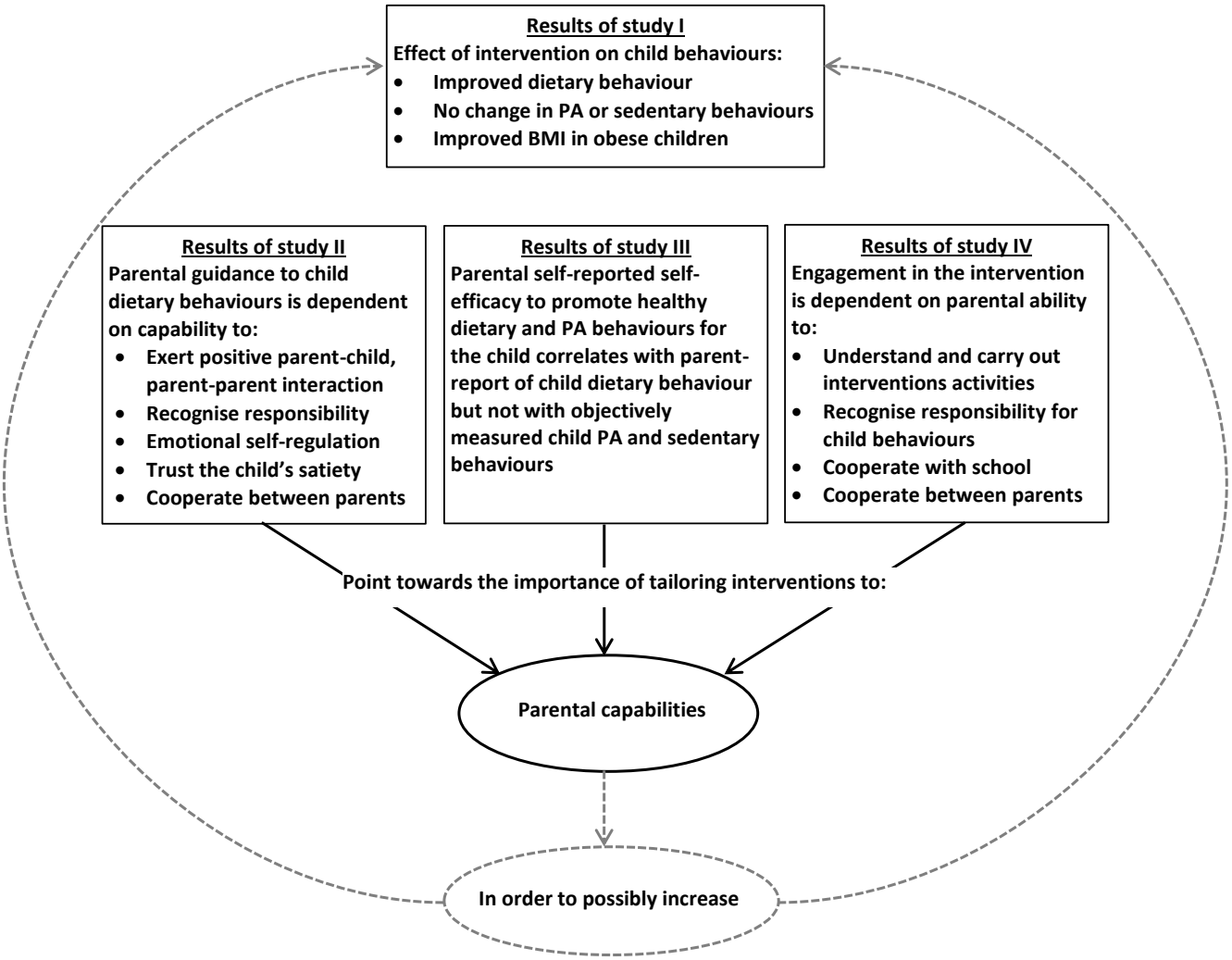


Figure 7. Synthesised results of the four studies. The HSS intervention shows improved child dietary intake (study I). Parental capabilities need to be considered in the development of tailored parental support interventions to prevent child overweight and obesity (study II, III, and IV).
Solid lines: shown by the studies
Dotted lines: hypothesised based on the results of the studies

4.2.1 Results of study I – effects of the intervention on child behaviours

4.2.1.1 Diet

The results of study I showed that children in the intervention group had a significantly lower intake of unhealthy foods and drinks compared to the control group after the intervention. Figure 8 shows that the averages for all outcomes related to intake of unhealthy foods and drinks were 20% to 60% lower for the intervention group. This points towards a trend at T2, although only the intake of unhealthy foods and unhealthy drinks were significantly lower for the entire group, and intake of cookies was significantly lower for boys in the intervention group compared to the control group. No moderating effect of parental education was found.

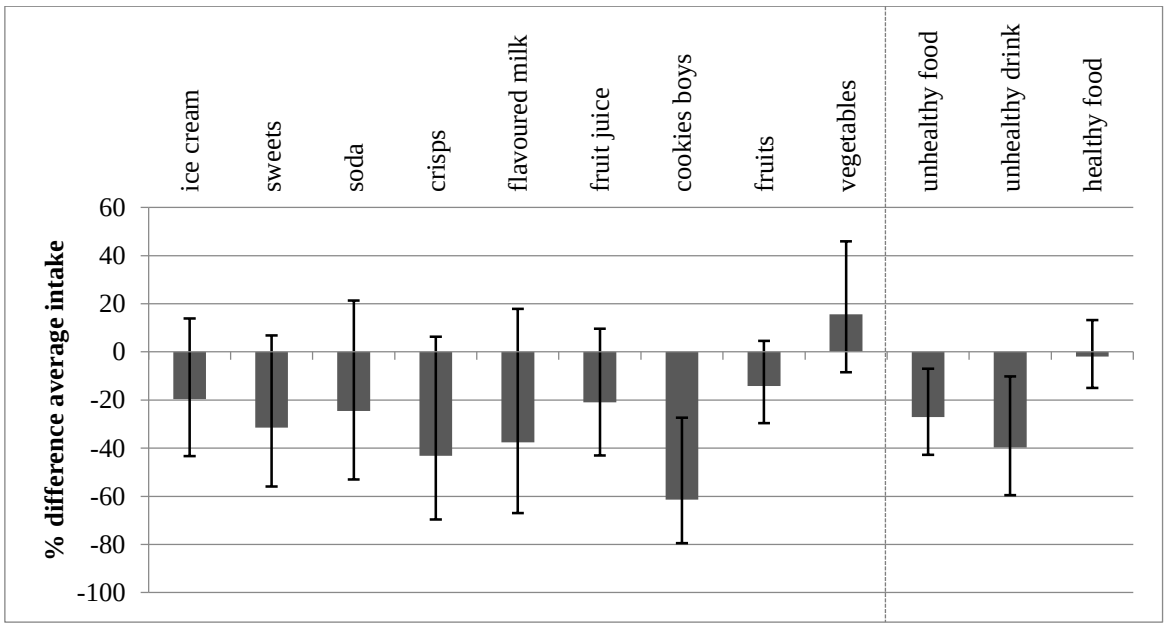


Figure 8. Percent difference in average intake for intervention group compared to control group at T2 adjusted for baseline values, sex and SES.
Bars in grey display differences in average intake in the intervention group in % compared to the control group. Error bars display 95 % confidence intervals.
Left of dotted line: separate variables, right of dotted line: aggregated variables.

At T3, this trend was still visible for most of the outcomes related to unhealthy foods and drinks though weaker than at T2 and only significantly lower for boys in the intervention group regarding intake of unhealthy foods (Figure 9).

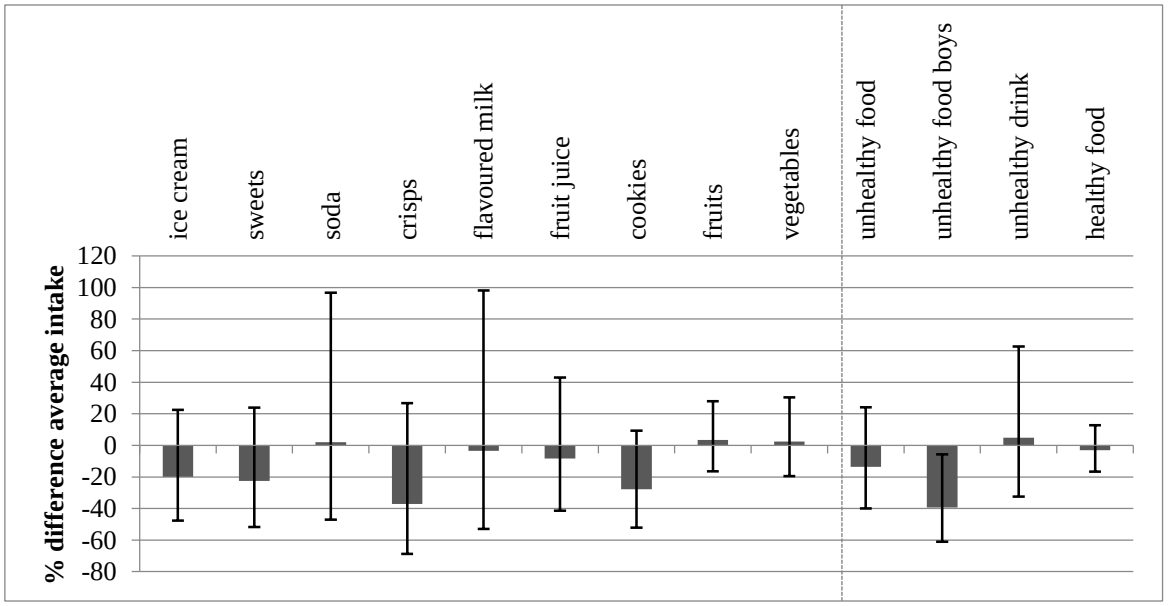


Figure 9. Percent difference in average intake for intervention group compared to control group at T2 adjusted for baseline values, sex and SES.
Bars in grey display differences in average intake in the intervention group in % compared to the control group. Error bars display 95 % confidence intervals.
Left of dotted line: separate items, right of dotted line: aggregated variables.

4.2.1.2 Physical activity

Figure 10 describes the lack of difference between the groups in percentage of time per day spent on PA at different intensities from 7 am to 9 pm on average during the entire week at T1. Also at T1, 88.4% of the children in both groups combined reached the recommendation for PA, i.e. 60 minutes in at least moderate activity per day. As illustrated by figure 11, there were no major differences between the groups or between girls and boys. Study I found no significant intervention effects on any of the PA outcomes, or time spent sedentary at T2 or T3. No moderating effect of parental education was found.

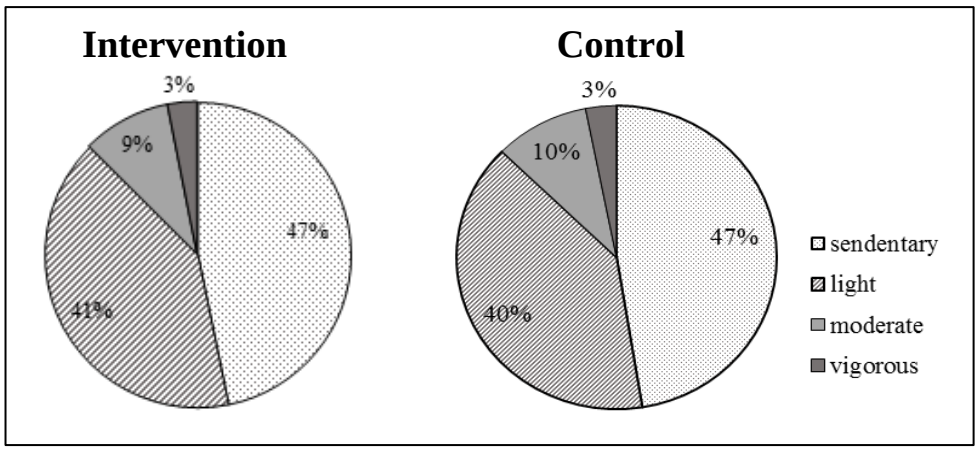


Figure 10. Time spent in different intensities on average during a weekday displayed for intervention and control.

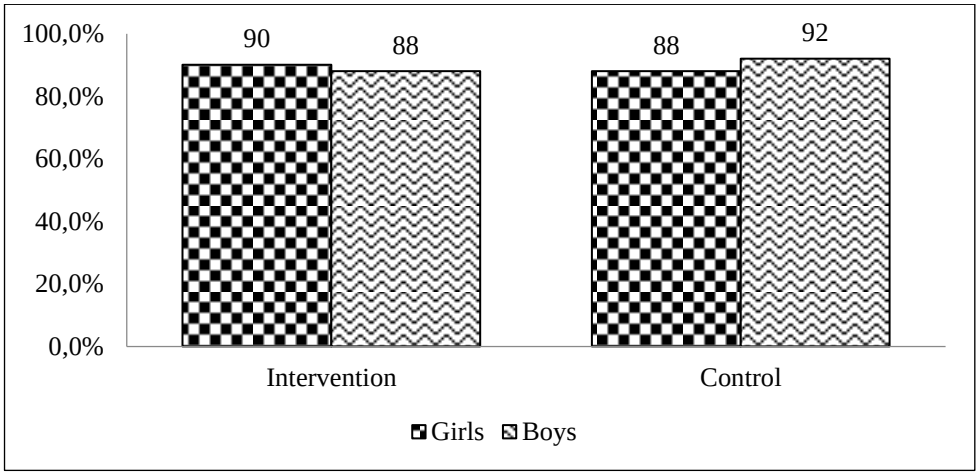


Figure 11. Proportions of girls and boys in intervention and control groups who reached the recommendation for PA, in %.

4.2.1.3 BMI-sds

At the level of the entire group, no significant effects on BMI-sds were found at either T2 or T3. An intervention effect on BMI-sds among children categorised as obese at baseline was found at T2, when the children with obesity in the intervention group had a significantly lower BMI-sds compared to the obese children in the control group. This effect was no longer significant at T3. No moderating effect of parental education was found.

Table 3. Differences at T2 and T3 in dietary intakes, and time spent in MVPA, and sedentary stratified by weight status at baseline.

	T2				T3			
	Unhealthy food (serving ^{log})[1]	Unhealthy drink (serving ^{log})[1]	MVPA Mon-Sun (min/day)[2]	Sedentary Mon-Sun (min/day)[3]	Unhealthy food (serving ^{log})[1]	Unhealthy drink (serving ^{log})[1]	MVPA Mon-Sun (min/day)[2]	Sedentary Mon-Sun (min/day)[3]
	b (n)	b (n)	b (n)	b (n)	b (n)	b (n)	b (n)	b (n)
Underweight[§]	-0.49 (17)	-0.41 (16)	-9.05 (9)	-28.01 (9)	0.95 (16)	0.30 (13)	N/A (3)	N/A (3)
Normal weight[§]	-0.36* (155)	-0.57* (145)	-0.019 (122)	0.82 (122)	-0.21 (132)	-0.02 (123)	-6.55 (101)	-11.39* (101)
Overweight[§]	0.22 (31)	0.30 (29)	-5.36 (34)	10.47 (34)	0.27 (27)	0.37 (24)	-1.58 (27)	15.90 (27)
Obese[§]	-0.77 (27)	0.15 (24)	-1.73 (24)	-3.31 (24)	-0.91* (23)	0.30 (22)	9.88 (19)	-21.81 (19)

b=regression coefficient
*=significant at 5%
[1]=results of Poisson regression, values displayed for intervention condition compared to control adjusted for sex, SES and baseline value
[2]=results of linear regression, values displayed for intervention condition compared to control adjusted for sex, SES, wear time, and baseline value
[3]=results of linear regression, values displayed for intervention condition compared to control adjusted for sex, SES, wear time, MVPA, and baseline value
§ According to Cole TJ, Lobstein T. Extended international (IOTF) body mass index cut-offs for thinness, overweight and obesity. Pediatr Obes. 2012;7(4):284-94.
Subjects are dependent observations between T1 and T2 and between T1 and T3

Sub-group analyses on weight status

To detect what the decrease in BMI-sds at T2 in children with obesity was influenced by, interaction terms with weight status (204) and intake of unhealthy foods, unhealthy drinks, MVPA and time spent sedentary were included in the original model (219) and analysed using Poisson and linear regression in SPSS 23.0 software package (Chicago, Illinois, USA). No significant interaction terms were detected regarding weight status and group impacting on the intake of unhealthy foods or unhealthy drinks at either T2 or T3. However, to further investigate what had influenced the change in BMI-sds at T2 in the children with obesity, stratified analyses were conducted for descriptive purposes (Table 3). The stratified analyses showed that all weight categories within the intervention group have a lower intake of unhealthy foods at T2 compared to the control group. The normal weight children (n=161) had a significantly lower intake (b=0.40), and the children with obesity (n=29) an insignificantly lower (b=-0.27) intake of unhealthy foods compared to the control group. Regarding unhealthy drinks, the normal weight children had a significantly lower intake compared to the control group, whereas the overweight and obese children had higher (albeit not significantly higher) intake of unhealthy drinks compared to the control group at T2.

At T3, the normal weight and obese children in the intervention group still had a lower intake of unhealthy foods, with a significant effect (b=-0.91) for the children with obesity. No significant intervention effect on intake of unhealthy drinks was detected for the different weight status categories (Table 3).

Regarding MVPA and time spent sedentary, there was no significant interaction effect for group and weight status on time in MVPA at T2 or T3, and for time spent sedentary at T2. The stratified analyses for MVPA and time spent sedentary at T2 did not show any significant effects, but values showed that the children with obesity were somewhat less sedentary in the intervention group, whereas the overweight children were more sedentary compared to their counterparts in the control group.

At T3, the overweight children seemed to follow the same pattern as they had at T2, whereas the children with obesity were more active in MVPA and less sedentary compared to the control group. The interaction term for time spent sedentary at T3 was borderline significant (p=0.052). The stratified analyses also showed a significant intervention effect on time spent sedentary for normal weight children at T3. However, as the normal weight children represented the overall majority of the children in both groups, this effect was reflected by the significant effect on time spent sedentary on the entire intervention group at T3, presented in study I, which was not sustained in the sensitivity analysis.

In summary, the children with obesity in the intervention group had a lower intake of unhealthy foods and unhealthy drinks at both T2 and T3 compared to the children with obesity in the control group. The effect only reached significance regarding intake of unhealthy foods at T3. The groups of children with obesity were small at both T2 (n=27) and T3 (n=23). Regarding PA, there were no significant effects regarding PA or time spent

sedentary for the children with obesity. Estimates were larger and in a favourable direction but remained non-significant.

4.2.2 Results of study I and IV – implementation and fidelity of intervention delivery

4.2.2.1 Component 1: health information to parents, and component 3: classroom activities and home assignments

Dose delivered regarding 'component 1: health information to parents' was investigated by assessing the number of parents who had read the brochure and participated in the group meeting. All parents reported having read the brochure and 45 parents in total had attended one of the 11 group meetings that had been delivered (study I).

Dose delivered regarding 'component 3: classroom activities', was investigated by assessing the number of lessons and home assignments completed by each class and the average time spent on the lessons. Teachers spent 33 minutes on average on each lessons and only one of the 16 classes performed as little as eight lessons whereas eleven classes performed all ten lessons and five classes performed nine lessons. Also, twelve of the 16 intervention classes completed all nine home assignments, one class completed eight assignments and three classes completed one to 'a few' of the home assignments (study I). There were no systematically collected data indicating whether the home assignments were carried out at home, as intended in the intervention, or at school. Parents and teachers in some classes mentioned that the assignments were carried out at school, whereas in other classes they were sent home to be completed by the families (study IV).

4.2.2.2 Component 2: Motivational Interviewing

The counsellors delivered MI with satisfactory treatment integrity, as assessed according to MITI 3.1 codings of audio-recorded MI sessions. The parents of 147 of the eligible 185 children attended the first session and 86 of the 147 parents returned for the second MI session, representing dose delivered (study I). Of the parents who attended the first MI session, 37.5% chose to set a goal for behavioural change for the child in the home. About two thirds of the goals focused on dietary issues with one third focusing on PA or screen time. Examples of goals were: offering vegetables in different ways, turning the TV off during meals, allowing sweets once a week, encouraging the child to try a wider range of vegetables, play more outside, and encouraging breakfasts.

Field notes, MI group meeting/supervision protocols, and an informal interview with the two counsellors conducted by ÅN provided perspective on how the MI counsellors experienced the implementation of the MI component in the HSS. Regarding the use of MI to target prevention, the counsellors found that most parents expressed that everything about the child's diet and PA at home was just fine, or that only minor adjustment was necessary. As the counsellors had no prior information regarding the child's health status they were unable to judge whether the parents' perceived lack of problems was due to a lack of problem

recognition and low motivation or if the family did in fact have healthy habits and good health status overall. The lack of perceived problems by the parents was considered challenging by the counsellors, as they felt that they had to use MI in a somewhat different way than they were used to from working with problem drinkers in a treatment setting. Often, the counsellors described that it was more difficult to find and keep the target behaviour in focus in the sessions with the parents. Here, the counsellors found they were helped by the structure of the MI session suggested in their initial training, the agenda-setting tool, specifically formulated open questions, and the intervention materials in their efforts to evoke a target behaviour regarding diet or PA for the child. The parents also asked more specific questions and requested advice to a greater extent than the counsellors were used to from the treatment setting. Thus, the counsellors found themselves using the MI-technique 'Elicit-Provide-Elicit' very often and at times felt they were in need of greater specific knowledge themselves to be able to give advice or answer questions. In addition, they expressed that it would have been beneficial to have information regarding the actual health status of the child in order to evoke motivation in unmotivated parents.

The sessions were shorter than the intended maximum 45 minutes. Also, the counsellors experienced major differences in parental knowledge, awareness and habits regarding diet and PA in the family between different schools; most of the parents in one school would express high awareness and knowledge, whereas the opposite would be evident in another school close by. In some cases, when conducting MI with parents who did not admit to any problem or expressed any need for adjustment, the counsellors considered a second session unnecessary and suggested that the second session should be voluntary for the parent. Some of the parents had clearly not understood that the MI session was provided for their sake and did not know what to expect. They seemed to think that they were there to answer questions. Despite being given thorough information about the first MI session when it was scheduled, these parents needed even more preparation before the session.

Due to the very stressful everyday life of some parents, the MI sessions seemed to be yet another item on the 'to-do list', which made the counsellors sense that they added to the parental stress rather than functioning as a support. These parents also seemed to view diet and PA changes as a luxury and not a priority in their stressful life. However, in summary, the counsellors believed that MI was a good method to use in a preventive setting, as it is flexible and open to the parents' needs. It is important for counsellors who are going to work with MI in a prevention setting where problems are perceived smaller and less prioritised, to prepare themselves for using MI somewhat differently than in a treatment setting. In prevention, more effort is put on finding the target behaviour and keeping it throughout the session, as well as providing information in dialogue according to the MI strategy 'Elicit-Provide-Elicit'.

Another challenge that the two counsellors experienced was to conduct MI adherently with persons with a low proficiency in Swedish. However, although many parents did not speak Swedish fluently, it was still possible to conduct meaningful sessions and few sessions were

cancelled due to the parent's lack of Swedish proficiency. The counsellors experienced that these sessions were usually quite short, characterised by a question-answer dialogue rather than the exploring MI type of conversation where the parent would do most of the talking supported by reflections and open questions, at times abstract or hypothetical, from the counsellor. Here, the tools and structure were considered helpful to engage in the conversation and keep the session going. Also, face-to-face sessions were favoured in these cases, as sessions over the phone were more difficult to conduct.

4.2.3 Results of study II, III, and IV – developing a suitable intervention by tailoring to parental capabilities

Study II showed a variation in qualities of parental guidance of the child towards healthy dietary behaviour; these fell within five categories: silent guidance, open guidance, conscious lack of guidance, unconscious lack of guidance, and enforcement. The guidance was a result of differences in the parental capability of: recognising their own responsibility for the child's behaviours, emotional self-regulation, and trusting the child's satiety response. Also, the study described the importance of positive interaction and cooperation with the other parent around the child's dietary behaviour.

Study III showed that the scale measuring PSE for influencing children's dietary, PA, sedentary, and screen time behaviours in low SES settings had good construct validity with a stable three-factor structure. Significant correlations were found between PSE and child dietary, and screen time behaviours. However, significant correlations were not found with objectively measured child PA.

Study IV showed the importance of tailoring the intervention to the abilities of both parent and child in order to increase the degree of participation in the intervention. Differences in participants' ability to understand and conduct the intervention, to cooperate between parents, and between parents and school, and to recognise the parental responsibility for the child's behaviours appeared in this study.

4.2.3.1 Capability to recognise parental responsibility, trust the child, and regulate emotions in relation to the child's dietary and PA behaviours

Parents' capability to recognise their own responsibility for the child's dietary behaviour was found in study II, and for both dietary and PA behaviours in study IV. In study IV, parents expressed different views regarding which family member should be the main recipient of the intervention: the parent or the child. Some parents voiced that the child was the one in need of the information and knowledge, not the parent, which indicated a lack of recognition of the parental responsibility for the child's behaviours. Other parents thought that food should be something natural and taken for granted for the child. These parents wanted to take full responsibility for the intervention, indicating a clear recognition of parental responsibility.

In study II, parental capability to recognise responsibility, trust the child's satiety response, and self-regulate emotions related to the child's dietary behaviours were found. Parents in the

category ‘unconscious lack of guidance’ failed to recognise their own responsibility to guide the child towards healthy dietary behaviours as they used permissive feeding strategies, focusing more on their own emotional distress than being responsive to the child’s needs. This resulted in a lack of guidance, which left the child to fend for him- or herself. Parents in the category ‘conscious lack of guidance’ expressed a wish to guide, hence recognised their own responsibility for the child’s behaviours, but felt thwarted, e.g. by the other parent, in exercising the responsibility through guidance. The parents in the ‘enforcement’ category expressed a strong sense of responsibility but exercised the responsibility by acting upon their own emotional state rather than being responsive to the child’s emotions or satiety. The parents’ worry or anxiety that the child would eat too little or be abnormal, resulted in the parent trying to make the child eat despite the child signalling satiety, which in turn would often end up in a power struggle between child and parent. Parents using ‘silent guidance’ and ‘open guidance’ with the children showed a clear responsibility for the children’s behaviours, keeping the healthy behaviours in mind at all times but with a guidance characterised by high responsiveness to the child’s emotions, trust in the child’s satiety response, and without any emotional distress on their own part.

In study IV, some parents described how they persuaded the child to do something other than the intervention indicated, or showed the child that the child’s knowledge, acquired from the intervention, was not important. These parents did not act as role models for healthy dietary and PA behaviours, which could be seen as a lack of recognition of their responsibility as parents for their children’s behaviours. Role modelling also appeared in study II, where parents using the ‘silent guidance’ and ‘open guidance’ were clear on the importance of modelling healthy behaviours for the child as part of positive interaction around food. Parents in the category ‘unconscious lack of guidance’ clearly did not acknowledge the importance of modelling healthy behaviours for the child as they openly gave in to their own unhealthy behaviours in front of the child, which the child would imitate, such as eating sweets daily.

4.2.3.2 Parent’s belief in her or his capability to influence the child’s behaviours

Study III showed that two of the three factors in the factor solution correlated significantly with child behaviours. Factor 2 – PSE for limiting intake of unhealthy foods, unhealthy drinks, and screen time – correlated negatively and significantly (r_s=-19 to -29, $p<0.01$) with seven out of eight measurements indicating unhealthy foods and unhealthy drinks. Factor 2 also correlated significantly (r=-29, $p<0.01$) with screen time. Factor 3 – PSE for promoting intake of fruits and vegetables – correlated positively and significantly (r_s=0.26 to 0.39, $p<0.01$) with those behaviours. No significant correlations were found between Factor 1 – PSE for promoting PA – and children’s objectively measured PA.

4.2.3.3 Capability to understand and conduct the intervention activities

Differences in parental capability to understand and conduct the interventions activities were found in study IV. Parents who had difficulties in understanding the activities either did not conduct them or completed them in an unsatisfactory way. Other parents regarded the

intervention information and activities as ‘old news’ and chose to ignore it. The differences in capabilities also seemed to spill over on the children as the teachers described how some children had great difficulties in understanding the activities in the classroom, and the teachers needed to adapt the activities in a way that was not described in the teachers’ manual. Other children seemed to greatly appreciate the activities, they were engaged, asked questions, and the teachers experienced that the intervention was right on spot for them and their age group.

4.2.3.4 Capability to cooperate between parents, and between parent and school

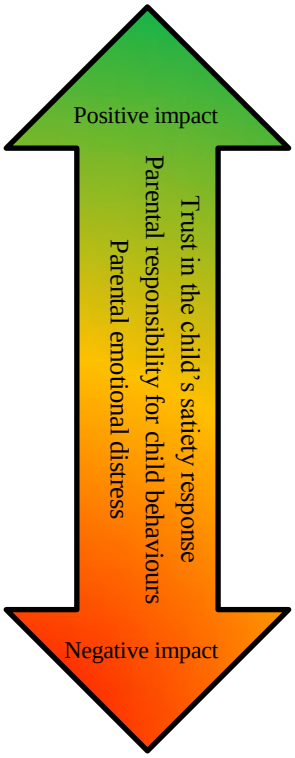
The importance of the capability to cooperate between parents in the family was found in study II and IV. In study IV, some parents voiced the need of including both parents in the intervention in order to facilitate discussion and cooperation between parents regarding the child’s dietary and PA behaviours. In study II, parents in the category ‘conscious lack of guidance’ were thwarted in their guidance of the child by a lack of cooperation with the other parent. This was manifested through the other parent contradicting the guidance of the first parent, e.g. by offering the child sweets daily, being completely permissive about the child’s wishes regarding food, and allowing the child to dictate the rules around food at home, or by convincing the child that what the first parent has said was unimportant.

The capability to cooperate between parent and school was found in study IV. Here, several parents described how a lack of engagement on the part of the school resulted in a stagnation of the intervention; it faded out, as the teachers did not communicate with the parents about it and did not send home the workbook with the assignment to be completed in the family. Parents also wished for a more consistent communication and structure from the school regarding the intervention, e.g. a specific day in the week when the assignment in the workbook should be completed at home and taken back to school. On the other hand, several teachers described how the parents failed to show any interest in the intervention, failed to complete the home assignment, and did not communicate with the school about the intervention, simply due to a lack of interest, not due to difficulties in understanding what to do. This resulted in a decreased focus on the intervention on the part of the teachers. Conversely, when parents experienced clear communication, instructions, and engagement from the teachers regarding the intervention, they felt supported to perform and engage in the activities at home, and discuss with the child.

4.2.3.5 Situation-specific use of capabilities

In unpublished results from study II, the use of a phenomenographic approach when analysing data made it clear that most parents alternated between the different types of guidance as illustrated in figure 12. Thus, the parental capability to create a positive interaction around food through responsibility, emotional regulation, and trust in the child’s satiety response seemed to differ according to the specific situation the parent and child were in. Most parents were found in several of the categories of guidance, ranging from the categories with a positive impact on interaction around food to the categories with a negative

impact on the same interaction. Only three parents, mothers 2, 20, and 21, seemed to use exclusively the categories with negative impact: ‘unconscious lack of guidance’ and ‘enforcement’. A larger number of parents, mothers 3, 14, 15, and fathers 1, and 5 to 7, seemed to use exclusively the categories with a positive impact on parent-child interaction around food: ‘silent guidance’ and ‘open guidance’. However, a majority of the parents, 19 out of the total of 29, used guidance with both positive and negative impact on the parent-child interaction.



Category of description	Parent
Silent guidance	Mother: 3, 5-11, 13-17, 19, 22 Father: 1-7
Open guidance	Mother 1, 3-12, 14, 15, 17-19 Father 1, 2, 4-7
Conscious lack of guidance	Mother 1, 4, 5, 7, 8, 10, 17, 18 Father 4
Unconscious lack of guidance	Mother 6, 7, 9, 13, 16, 21 Father 2, 4
Enforcement	Mother 1, 2, 9, 11, 12, 16, 18, 20-22 Father 2, 3, 4

Figure 12. Parents included in each of the categories of description. Categories of description and arrow depicting relationship between categories regarding parental responsibility for child dietary behaviours, trust in child satiety response, and parental emotional distress and the impact of guidance category on parent-child interaction around food.

5 DISCUSSION

This thesis has evaluated an intervention for parental support to promote healthy dietary and PA behaviours, and prevent unhealthy weight development among children in disadvantaged settings. The thesis has also explored ways of refining and implementing such support. Results showed that the intervention was effective regarding children's dietary behaviours and partly regarding BMI, and that parental capabilities need to be taken into account to a greater extent in further developments of this type of intervention.

5.1 THE UNIVERSAL HEALTHY SCHOOL START INTERVENTION – WHOM DOES IT REACH?

Study I, from which the remaining three samples of parents were drawn, included parents of whom 47% had a maximum of 12 years of schooling. This is comparable to the proportion in Stockholm County (51.2%), but somewhat lower than the average proportion in the targeted areas (63.1%). The intervention was conducted in areas with documented low SES, thus including only families residing in the areas. However, it seems that the parents who chose to participate in the intervention had somewhat higher education than the average in the areas. This is in line with previous studies showing that it may be difficult to engage and retain individuals with low education specifically, or low SES in general, in health interventions (13, 14). However, participation in the intervention was rather high overall, given that recruitment can be challenging in these types of areas. Of the potential families, 57.8% chose to participate, which indicates that the recruitment was rather successful.

As intended, the intervention included families with children with a higher proportion of overweight and obesity than in the county as a whole, which indicates that the recruitment was successful also in this regard. Moreover, the intervention included a large proportion of parents born outside the Nordic region, which is in line with the demography of the targeted areas.

5.2 WHAT WERE THE EFFECTS ON CHILDREN'S BEHAVIOURS?

5.2.1 Diet

The HSS intervention showed significant effects in terms of decreased intake of unhealthy foods and unhealthy drinks after the intervention. The effects on intake of unhealthy foods were sustained among boys at five months follow-up. No intervention effects were found regarding intake of fruits and vegetables.

The national survey in 2003 showed that Swedish children had a lower intake of fruits and vegetables and a higher intake of energy-dense foods than recommended (61). In addition, higher intakes of energy-dense foods were seen in children with low SES compared to children with higher SES (61). The decreases in intake of unhealthy foods and unhealthy drinks in study I were desirable effects given that up to 25% of daily energy came from these types of foods and drinks in the 2003 national survey (61). However, the HSS intervention

did not have any effect on intake of fruits and vegetables. This was unfortunate as 30% of the participating children consumed less than 2 servings of fruits and vegetables daily at home, which suggests that there was substantial room for improvement. Future studies should focus more on change of these behaviours.

5.2.1.1 Comparison with other universal parental support interventions

Results of previous parental support interventions targeting children's dietary intake have shown mixed results (81, 82, 85). These interventions typically report intake of fruits and vegetables, and some report intake of fat or energy, whereas few report on energy-dense products of the type measured in the HSS intervention (81, 82, 85). Regarding intake of fruits and vegetables, universal parental support interventions that achieve a significant increase in intake of fruits and vegetables show mean differences ranging from around 0.19 to 0.8 serving/day in different studies (82). Lack of uniform reporting of measurements of energy-dense foods and drinks make comparisons between universal interventions difficult. Effects have been reported as, e.g., a 47% decrease in intake of sweetened beverages compared to control group, a decreased intake of unhealthy snacks by 0.4 occasions/day and sweetened beverage by 0.6 occasions/day, or as significantly less unhealthy diet-related behaviour compared to controls (82).

5.2.1.2 Comparison with universal parental support interventions using MI

Few universal parental support interventions using MI to target diet, PA, or BMI have been conducted. Comparisons with five similar universal parental support interventions using MI are presented in table 4. Regarding healthy foods, effects on vegetable intake were found in two (138, 220) out of three (138, 220, 221) studies including this outcome. One (138) out of three (138, 220, 221) reported a significant effect on intake of fruits. The study by Nansel et al. (221) further found significant effects on healthy dietary outcomes which were not measured in the HSS intervention, making comparisons difficult.

Regarding unhealthy foods, only two studies (138, 220) included outcomes. Döring et al. (138) found significant effects in terms of lower intake of sugar-sweetened drinks, french fries, and discretionary calories. Keita et al. (220) found significant effects in terms of lower intake of fruit juice, but no effect on sweetened drinks.

In summary, two studies reported similar results regarding unhealthy foods and drinks as those attained in the HSS. Three studies found effects regarding healthy foods that contrasted with the results of the HSS intervention. However, none of the compared studies provided evidence that MI was delivered adherently. One of the studies did not provide any description of fidelity (221), one described the fidelity monitoring but provided no values to support MI adherence (220), and in one study, the values that were provided suggested that MI was not delivered adherently (138).

Table. 4. Universal parental support interventions using MI to target diet, PA, or BMI in children.

Reference, country	Design	Intervention	Child age (n)	Outcome measurements	Results	MI fidelity
Centis et al. 2012, Italy	Controlled study	3 MI session + weekly telephone calls delivered by professionals and students in Nutritional Science over 5 months.	9-10 years (209)	PA: parent-report, interview BMI: measured by research group	After intervention: significantly lower BMI compared to control. Significant improvement in time spent outdoors. No comparison with control.	Not reported
Haines et al. 2013, USA	Randomised controlled trial targeting families with low SES	4 MI sessions and 4 coaching telephone calls by health educators over 6 months. Additional intervention components: educational materials and weekly text messages.	2-5 years (111)	Diet: parent-report questionnaire BMI: measured by research group	After intervention: significantly lower BMI compared to control. No effect on family dinner frequency.	Not reported
Keita et al. 2014, USA	Feasibility study with pre-post-test measurements targeting low-income communities	3 MI sessions by telephone delivered by lay counsellor over 4 months. Additional intervention components: written material, family exercise video, and TV monitor.	2-5 years (39)	Diet: parent report, questionnaire PA: parent-report BMI: measured by research group	After intervention: significantly higher intake of vegetables, lower intake of fruit juice, compared to control. No effect on BMI, intake of fruits, sweetened drinks, exercise, or playing outside.	12-hour training, monitoring of random recordings, and codings with MITI by the trainer. MITI values not reported.
Nansel et al. 2015, USA	Randomised clinical trial with children with diabetes type I	6 sessions of interactive education (activities, problem-solving, goal-setting) on healthy eating delivered in an MI style to parent-child dyads by research assistants over 7 months.	8-16.9 years (136)	Diet: parent-report, 3-day diet record	Through 5 time points: significant effect on Healthy eating index, whole plant food density, and intake of whole grains. No effect on intake of vegetables, whole fruit, legumes/nut/seeds, or % energy from carbohydrates or fat.	Not reported
Döring et al. 2016, Sweden	Randomised controlled trial	8 MI sessions + 1 group session delivered by child health nurses over 39 months.	9-10 months (1488)	Diet: parent-report, questionnaire PA: accelerometry BMI: measured by research group	After intervention at the child age of 4: Significant effect on higher intake of vegetables, fruits, fish, and lower intake of sugared drinks, french fries, and discretionary calories compared to control. No effect on PA or BMI.	3.5-day training + supervision on recordings on 4 occasions. Coding with MITI by reliable coders. Values reported indicating a lack of MI proficiency.

5.2.2 PA

No effects on children's time spent in PA overall, MVPA, or sedentary were found for the HSS intervention. Of the children, 88.4% were physically active at the recommended level of a minimum of 60 minutes of MVPA/day at baseline, which may indicate that these children were already physically active and that there was little room for improvement in this regard.

5.2.2.1 Comparison with other universal parental support interventions

A review and meta-analysis of interventions targeting the physical activity of children aged 0 to 16 years, using objective measurements, with or without parental involvement, and including both interventions targeting children with overweight and obesity, and interventions targeting children of all weight categories, found that interventions had a small pooled effect (standardised mean difference 0.12) that was unlikely to be of much benefit to health (222). A more recent meta-analysis targeting the same types of interventions for children 5-18 years old of all weight categories, using both self-reported and objective measurements, and with at least a six-month follow-up measurement showed no significant pooled effect of intervention on children's PA (223). A recent meta-analysis on family-based interventions targeting 5-to-12-year-old children's PA using both self-reported and objectively measured PA found a small pooled effect of intervention (standardised mean difference 0.29) (83). The review included both prevention and management interventions, and of these, prevention interventions seemed somewhat more effective (83). A review of universal parental support interventions, where 4 out of 7 studies used objective measurements, showed significant effects in terms of increased PA; e.g., a 7-minute difference in MVPA between intervention and control groups, or an increase in total PA of 4 minutes on weekdays and 10 minutes on weekends for intervention group compared to control (82).

5.2.2.2 Comparison with universal parental support interventions using MI

Attempts to compare HSS with similar universal parental support interventions using MI revealed that only one other study used objective measurement of PA (138). That study did not find any significant effects on PA (138). (Table 4)

5.2.3 BMI-sds

No significant effects on BMI-sds were found for the intervention group compared to the control group at either T2 or T3. A significantly lower BMI-sds was found at T2 for children in the intervention group with obesity at baseline, compared to children with obesity at baseline in the control group, but the effect was not sustained at T3. The HSS intervention was not powered to detect differences regarding the different weight categories or BMI-sds. However, the stratified analyses indicate that the dietary behaviours of the normal weight children were affected in line with the intervention aim. The remaining weight categories were small, and therefore no conclusion can be drawn regarding the underweight, overweight, or children with obesity. A clinically relevant change in BMI-sds has been

suggested as 0.6 in the time period of 0 to 12 months and 0.5 SD in 0 to 6 months (224). The results of the HSS are not in the magnitude of these suggested changes.

5.2.3.1 Comparison with other universal parental support interventions

A meta-analysis including 2-to-18-year-old children of all weight categories did not find any significant weighted mean difference in BMI in prevention interventions that were school-based with a home component (225). Another meta-analysis of interventions involving parents with children between the ages of 0 and 6 years, and including 68% universal interventions found a small but significant combined effect size for BMI-related outcomes at short term (84). A systematic review of obesity prevention and management programmes for children of 2 to 5 years of age found that eight out of 21 prevention interventions had significant effects on child BMI, BMI percentile, BMI-sds, waist circumference, or body fat (79). Of the eight effective interventions, six involved parents (79).

5.2.3.2 Comparison with universal parental support interventions using MI

Comparisons were made with four similar universal parental support interventions using MI (137, 138, 220, 226), all of which included BMI-related outcomes, described in table 4. Significant effects were found in two of the four studies, one regarding BMI-sds (137) and one regarding BMI (226). Both studies had a duration comparable to the HSS (5-6 months), were more intense, and included children who were slightly younger (226) or slightly older (137) than those in the HSS. None of the studies reported any data regarding fidelity to MI during the interventions.

5.2.4 Are we targeting the right behaviours/measurements of children?

As the HSS intervention was aimed at universal prevention, the majority of the included children were of normal weight; for whom no BMI changes were desired. It is known that the BMI or body composition outcomes provide larger effects in management interventions than in preventive interventions (79, 84), which indicates that BMI or body composition may not be a suitable outcome for prevention interventions. Instead, behavioural changes related to diet have been suggested as the primary outcome for universal prevention (79). However, in the HSS, no significant effect was observed regarding intake of fruits and vegetables, and indeed, parents in the MI sessions set goals for a behaviour change for their child such as increasing the child's interest in vegetables or different types of foods. Possibly, prevention interventions should focus on broader behaviours than merely intake of certain indicator foods, by adding outcomes indicating e.g. 'increased interest in tasting new foods'. This broader focus has been argued regarding promotion of PA, where setting more general behavioural goals such as 'families coming together to do an activity focused on being together and having fun', or 'activities focusing on increased skills or confidence', may be one way to proceed from the mere focus on amount of time spent at different PA intensities (83). Also, prevention interventions have been known to produce effects on lifestyle behaviours as well as BMI over a longer period of time (227, 228). Given the focus on prevention, a year-by-year increase in the proportion of normal weight children within an age

group would be a desirable outcome. This indicates a need for longer follow-up periods and perhaps a longer-lasting intervention, as new behaviours often take some time to set, and benefit from repetition over a period of time.

5.3 MI IN PREVENTION INTERVENTIONS – IS IT THE RIGHT WAY TO GO?

In the HSS, MI was used with parents to target the children's healthy dietary and PA behaviours in the home environment. Parents appreciated the sessions for the most part, but the MI counsellors experienced that many of the parents did not perceive any real problems with regard to their children's behaviours, which was also found in the previous HSS study in areas with mixed SES (53, 213). As the counsellors lacked information regarding the child's health status it was unclear whether the parents lack of perceived problems was due to a lack of problem insight and motivation to change, or whether there were in fact no unhealthy behaviours to target. It is likely due to both explanations as the preventive focus of the intervention will include families with all types of behaviours ranging from unhealthy to healthy. The parents of families with healthier behaviours will not be in need of behaviour change but rather maintenance of behaviours they were already engaged in, whereas other parents most likely lacked insight regarding the unhealthy behaviours in their family and their child's health and would be supported by increased motivation for change. However, the lack of problem recognition by some parents, as well as the low proficiency in Swedish in others, made the MI counsellors experience difficulties in being adherent to the MI method in the sessions. The counsellors perceived that they focused a lot more on finding and keeping the target behaviour in these preventive sessions than they were accustomed to from a treatment setting. Still, the counsellors concluded that MI was useful for supporting parents, given the flexible focus of the method.

MI is a client-centred style of conversation that was developed for management or treatment settings with focus on behaviour change of the person receiving the MI. It has been argued that MI is most helpful for clients with low motivation to change (229) and that MI in fact should be used with caution with individuals who are highly motivated to make a change (230). A validated and reliable structure for assessing method adherence has been developed for MI (167-169), which is also available for Swedish settings (170, 171). However, the threshold for level of adherence of MI to produce change in a client is arbitrary and based on expert opinion only (161, 231).

The HSS entailed a preventive setting with parents who received MI to influence the behaviours of their children. Parents were thus targeted to in turn influence change in a third party, the child. However, a substantial proportion of the parents may not have seen need for much change but rather for maintenance of behaviours. Consequently, the HSS intervention does not comprise the type of setting or client for whom MI was developed. In addition, at least some of the targeted parents may not have been unmotivated, and the counsellors experienced it as being more difficult to be MI adherent in the sessions than in treatment or management sessions, which has also been found in a previous obesity prevention intervention using parental support (232). However, given the flexibility of this method,

where the counsellor follows the needs of the client, and given that we know little about the level of MI adherence needed to bring about change, MI may be a useful method in interventions like the HSS. Parents with overall healthy behaviours in their family may benefit from a short session focusing on maintenance of behaviours, with a lower level of MI adherence, and where counsellors may be helped by using the MI-strategy 'Elicit-Provide-Elicit' as parents asked for advice a lot. However, in order to be able to distinguish between families that are already engaged in healthy behaviours and families where the parent lacks motivation or does not recognise a problem, the counsellors would be in need of information regarding the child's health status or behaviours prior to the session. If implemented as intended on a large scale, the MI sessions would be conducted by school nurses who would carry out a health check-up of the child prior to the MI sessions and thus have information regarding the child's health status. Further, counsellors may need training in using MI in a slightly different way than in a treatment setting, working more on finding the focus and keeping it throughout the session, and on targeting maintenance of behaviours. The difficulty in using specific MI techniques, such as reflections and open questions, with parents whose proficiency in Swedish is low, and who at the same time express a need of behaviour change regarding the child, constitutes a challenge for the counsellor. This is also a limitation of using MI. These parents will receive sessions with a lower MI adherence on the part of the counsellor, even though they may be in need of an adherent session as they express a need of change.

5.4 PARENTAL CAPABILITIES IN INTERVENTIONS PROMOTING CHILDREN'S HEALTHY BEHAVIOURS – HOW DO WE TAILOR INTERVENTIONS?

The synthesised results of study II, III, and IV indicated that there is a need of greater focus on the parental capabilities to have a positive interaction around food with the child (study II), to recognise the parental responsibility for the child's dietary and PA behaviours (study II and IV), to regulate own emotions around the child dietary behaviours (study II), and trust the child's satiety response (study II) in an intervention like the HSS. Further, the synthesis indicates that parental capabilities to cooperate with the other parent (Study II and IV), to perform the intervention activities (study IV), to cooperate with the school (study IV), and to believe in the own capability to support the child towards healthy habits (study III) also have to be taken into account (Figure 7).

The HSS intervention focused mainly on information regarding amounts of healthy and unhealthy foods, advice on how to promote healthy foods and limit unhealthy foods, and promote PA for the child. Results of study II, III, and IV indicate a likeliness that effects on child behaviours could be increased by tailoring the intervention to parental capabilities to a greater extent. This tailoring would probably be most beneficial if it was included in several parts of the intervention, such as modifying the target and contents of intervention components, and adding implementation strategies

5.4.1 Capability to understand and conduct the intervention activities – tailoring the degree of difficulty in the intervention components

In study IV, results showed that some teachers found the intervention materials right on spot for the children, whereas others found that both children and parents had great difficulties in understanding and benefiting from the material, despite the teachers' manual including several alternatives regarding activities and questions to focus the lessons around. Also, some parents expressed that the material was at such a low level that it simply bored them and made them ignore it, whereas other parents thought the information might in fact be too difficult for parents with low proficiency in Swedish. Previous systematic reviews have suggested that interventions should include age-appropriate activities for children (79) and need to be tailored to the knowledge, understanding and behaviours of the children (109). Results of the HSS expand on these suggestions by including tailoring of the parental knowledge and understanding as well. While knowledge may play a role in this type of intervention, it is clear that messages need to be tailored to the capabilities of the receiving parents and children regarding the classroom component. A way of catering for this variation may be to include alternatives with different levels of difficulty in the teachers' manual for the classroom lessons and the home assignments, as well as in the information brochure to parents, to fit the variation of capabilities among parents and children.

5.4.2 Capability to cooperate between parents, and between parent and school – adding implementation strategies, and modifying intervention components to build cooperation

Study IV found that both parents and teachers requested closer cooperation with each other regarding the intervention. This has also been found in a previous process evaluation of the first HSS intervention (233). In order to build a positive and fruitful cooperation between teachers and parents, the inclusion of an additional implementation strategy, in the form of a 2-3 hour 'kick-off' meeting' may be beneficial. The design could be as follows: teachers invite parents to the meeting, which is opened by the school leader stating the school's dedication to the programme, and where the school health nurse informs about the MI sessions. This is followed by a checklist-guided workshop where teachers and parents work together, trying out some classroom activity material, discussing expectations on the programme and on each other, and practical issues, such as specific weekdays for home assignments etc. The meeting ends with a consensus agreed contract on logistics for the classroom activities and home assignments. This type of implementation strategy would target important aspects of implementation described by expert recommendations on implementation strategies (ERIC) (234): building a coalition, preparing parents to be active participants, obtaining formal commitments, intervening with parents to enhance uptake and adherence, and mandating change.

Study II and IV found that increased parental cooperation was crucial to intervention engagement and possible changes in the families. A previous study on barriers to changing the child's behaviours as expressed by parents in the MI sessions of the first HSS interventions also found negative interaction between parents as one of the most important

barriers (213). To target cooperation between parents, including both parents in the intervention seems ideal. However, given the everyday lives of parents, this could be unrealistic. Consequently, modifying intervention components, or perhaps adding a component, may be beneficial to encourage discussion and agreement between parents regarding habits and possible change at home.

5.4.3 Are we targeting the right behaviours/measurements of parents?

5.4.3.1 Capabilities to trust the child, regulate emotions, recognise responsibility, and have positive interaction with the child

Study II and IV point towards the importance of the parents' capability to recognise their responsibility for the child's behaviours, and role modelling. The importance of parental capability to self-regulate emotions, trust the child, and have a positive interaction with the child around food was found in study II. A previous study on barriers to changing children's weight-related behaviours in the home environment, as expressed by the parents in the first HSS intervention, also found negative parent-child and parent-parent interaction around dietary and PA behaviours to be the most important barrier to change (213). Taken together, these findings indicate the need for the intervention to include a focus on promoting positive parent-child interaction around the child's behaviours, with an increased focus on the parental capability to do so. Such interaction is captured by parenting skills in relation to food and PA. Parenting skills are often divided into the general parenting styles, parental feeding styles, and parental feeding practices. A meta-analysis of interventions involving parents with the aim to prevent childhood obesity found that interventions targeting parenting skills, such as modelling and monitoring, were more effective than interventions targeting diet or PA (84). Current debates in the field of parental support to promote healthy child behaviours and prevent obesity are voicing the need to focus on parenting skills, and on the more specific feeding practices (76, 77, 235, 236). So far, few interventions exclusively targeting prevention by a focus on parenting skills have been tested (77, 237), but there are indications of promising results (238).

5.4.3.2 Additional mediators and outcomes related to parenting

In the development of the HSS, focus was placed on the children's behaviours and little was included with regard to parental behaviours. Consequently, an intervention like HSS may benefit from an increased focus on parental behaviours, either focusing on parenting exclusively or in addition to the behaviours of the child. Parental behaviours, such as parenting skills and parental feeding practices, should probably be included within each of the existing intervention components, and additional measurements of the same concepts should be included as outcomes. In the original logic model, parental role modelling was included as a mediator, but was not measured in the intervention. An increased focus on parenting in the intervention could possibly render a greater impact on parental role modelling. Consequently, measurements of parental role modelling as a mediator should be included in the future.

Self-efficacy has theoretically and through previous studies proven to be of importance (113, 115, 239). However, if a greater focus is placed on parenting skills, self-efficacy for those specific concepts should be included in the logic model and measured in the evaluation.

Regarding motivation, studies using MI with parents to improve diet, PA, and weight development in their children have shown than an important effect of MI is the increase in parental motivation to make changes for the child (135, 139). In prevention studies where effects may not be visible in the short term, measuring motivation could be a better indicator of whether the prevention intervention worked as intended, than specific dietary intakes or time spent at PA intensities. Motivated parents are prerequisites for changes in children of low ages. In the original logic model of the HSS, motivation could be seen in the mediator 'willingness to change' and it could therefore be argued that motivation was included in the HSS. However, the mediator was not measured. Measuring motivation as a mediator or a short-term outcome could be fruitful. In SCT, the motivational process is identified as a key process in developing and executing agency in a person's life, where self-efficacy and expectations play important roles. Thus, including motivation in the logic model would not interfere with SCT as the underlying theory of the intervention.

The original logic model includes the mediators: knowledge, attitudes and preference, self-efficacy, willingness to change, care and control, and role modelling. In addition to expanding the number of mediators, further specification of what the mediators are hypothesised to impact on should be considered. Attitudes towards diet and role modelling are broad concepts. We may need to ask more specific questions regarding what we aim to target with an intervention. 'What behaviour is it that the parents model?', e.g. eating different types of vegetables for dinner, or 'What is it the parent is motivated to?', e.g. trust the child when he/she expresses satiety. This will of course influence the instruments used for measuring the mediators.

Thus, above points indicate the need for a revised logic model of the intervention with regard to mediators and outcomes, as described in Figure 13. In addition to revising the logic model, a supplementary document should be developed where mediators are more thoroughly specified in relation to behaviours: what is it that the parents are motivated to, have PSE for, model, and have an attitude towards.

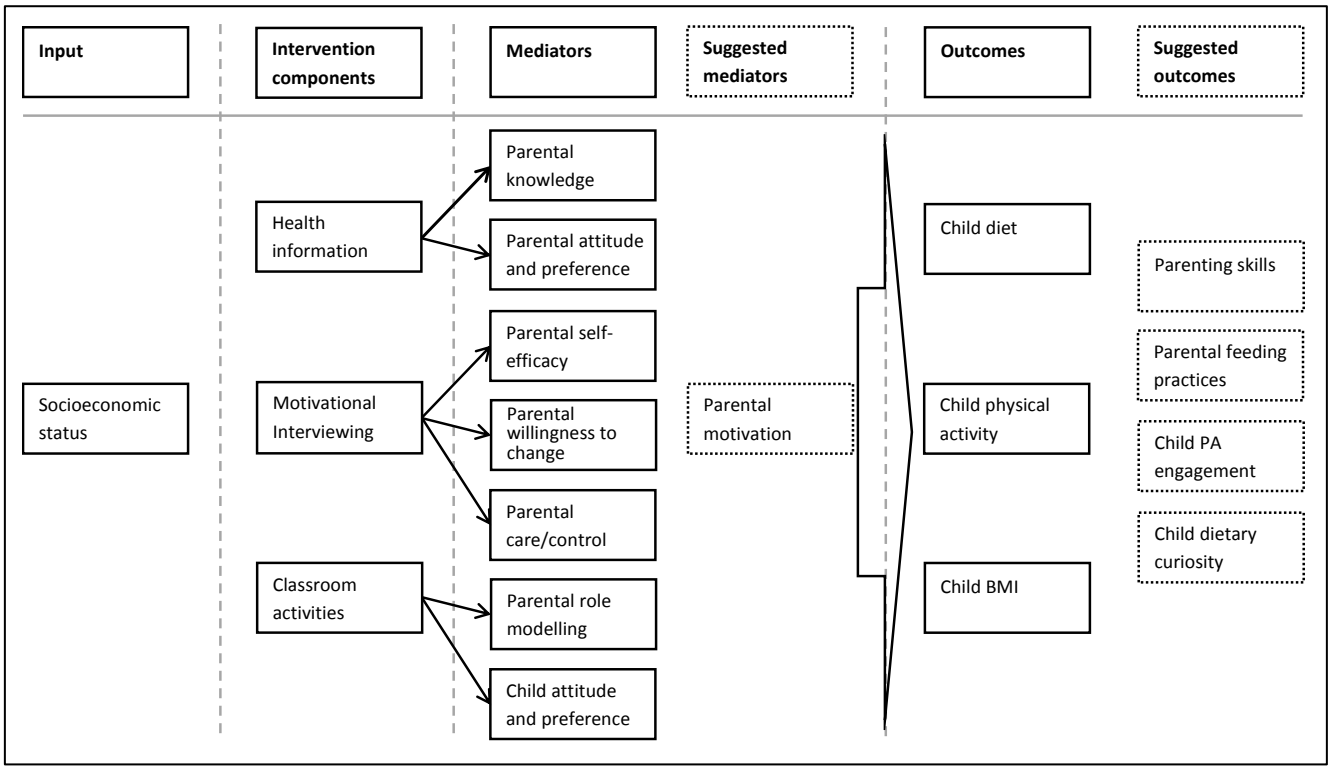


Figure 13. Updated logic model based on the results of this thesis. 'Suggested mediators' and 'Suggested outcomes' have been added (boxes with dotted lines).

5.4.3.3 Parent's belief in her or his capability to influence the child's behaviours – measurement difficulties

The results of study III showed significant correlations between Factor 2 – PSE for limiting intake of unhealthy foods, unhealthy drinks, and screen time, Factor 3 – PSE for promoting intake of fruits and vegetables, and the corresponding behaviours in children, whereas no significant correlations were found regarding children's PA behaviours and Factor 1.

These results indicate that PSE constitutes an important construct to target in parental support interventions promoting healthy behaviours in children. However, the instrument failed to correlate significantly with children's objectively measured PA and further development of the instrument may be beneficial. The scale was only partly developed in accordance with Bandura's recommendations (207). Inclusion of additional challenging situations may be beneficial to discriminate between different levels of PSE, even though this has been tested in previous studies with limited results (240).

Interventions based on SCT often use self-efficacy as a mediator between the exposure and outcome (109, 241). Regarding the mediating effects of PSE, few studies have been conducted and the results are mixed (242-244). Numerous reasons may cause the lack of significant mediation, and the theoretical construct may be the first to be questioned. However, the tools used to measure self-efficacy must also be considered as a possible factor in the lack of effects. SE is traditionally measured using self-report, and numerous instruments have been developed that claim validity and reliability. However, perhaps it is time to consider developing more objective methods to measure SE.

A further issue regarding the measurement of PSE constitutes the level of measurement. In study III, only responses made by individual parents were included. The questionnaire included a box where the parents could tick whether they responded individually or together. The latter option was included partly to encourage discussion between parents. However, in the preparation for the data analysis in study III, the responses made by parents together were considered difficult to interpret as they did not reflect PSE of one individual person. Bandura (113) discusses SE as an individual construct or as a collective construct within group, e.g. a working group. However, Bandura provides no guidance regarding PSE in a parental dyad. The exclusion of responses made by parents together is unfortunate given the complex relationships of a family and intimate discussions regarding a child's behaviour between parents. In Sweden, equality between parents in taking responsibility for the children is an issue that has attracted substantial political attention during the past decades. The norm in Sweden is therefore that both parents usually are active in child rearing, and that parental leave is shared between the sexes to some degree. Therefore, in Sweden, it is most likely that the individual PSE for influencing the child's behaviour is very much dependent on the PSE, or the behaviour, of the other parent. In countries and cultures other than the Swedish one, it is likely that PSE could be dependent on other family constellations. Further theoretical clarification regarding the complexity of PSE within a parental dyad is needed to guide the use of PSE in interventions.

5.4.3.4 Situation-specific capabilities

Additional results from study II showed that one parent could be found in several categories of guidance, indicating that parents may use different parenting styles and feeding practices depending on the specific feeding situation. These findings are in line with previous studies showing that parental feeding styles and practices may change over time (104, 245). Also, parenting styles have been suggested to be behaviour-specific, such that the same parent may use different parenting styles or practices when targeting different child behaviours (246). Future studies may focus on specific situations where parents use different feeding styles or practices; this might make it possible to target situations where parents use less effective styles or practices and tailor parental support for these situations in future interventions.

5.5 HOW DO WE BALANCE INTERVENTION FIDELITY AND ADAPTATION?

Study I and IV reported on implementation measurements of the intervention. Results from study I regarding dose delivered of component 1 and 3, and fidelity of component 2 can be considered good. Dose received regarding part of component 1, the group meeting, was poor whereas dose delivered regarding the brochure, component 2 and 3, can be considered satisfactory. Overall, this seems to reflect that the intervention was delivered as intended to a high degree. However, results regarding acceptance from study IV and statements from the MI counsellors indicate a need for further adaptation to the target group. The need for adaptation is also suggested by the results of study I, II, and III which indicate a need for tailoring the intervention to the variation in parental capabilities, thus adapting the intervention.

The balance between high fidelity of interventions and the need of adapting interventions to the specific setting in focus has been the topic of extensive debate within the field of implementation (165). Implementation frameworks and theories often stress the importance of adaptation of an intervention to be successful in different contexts (165, 173, 247). However, fidelity to the intervention components or activities has also been stressed, as it is impossible to draw any conclusion regarding the effects of an intervention if nothing is known regarding to what extent the intervention was delivered as intended (144).

As discussed previously, needs for tailoring of component 1, the brochure and group meeting, and component 3, the classroom lessons and home assignments, have been identified Regarding component 2, MI, the counsellors found MI a suitable method in the intervention, but nonetheless expressed a need for adapting the session to the parents' proficiency in Swedish, level of awareness regarding healthy behaviours, and level of problem recognition.

5.5.1.1 Adaptation to culturally diverse groups

More than 80% of the parents in the HSS intervention were born outside of the Nordic region. The proficiency in Swedish varied among these parents and participant characteristics of study IV indicate a variation in years as residents of Sweden. Thus, differences in acculturation and language proficiency may be important to take into account in the adaptation of the HSS intervention. A study of Somali parents immigrating to Sweden suggests that parenting may change through migration, and that immigrating parents are in need of support in order to make the transition in their parenting. Parents requested support from parenting programmes on how to exercise positive parenting and parenting in a more responsive way (248). Studies on health professionals' interaction with culturally diverse groups in Sweden have reported misunderstandings within the counselling situation due to didactic counselling strategies and nurses' lack of understanding of patients' needs (249), whereas parents of sick children have reported that fundamental respect, openness and active listening, flexibility towards differences in cultural expressions, and nurses speaking the parent's language facilitate interaction (250).

Although the HSS intervention can be considered to have been delivered and received as intended for the most part, further adaptation is needed, of which some of the adaptations need to take cultural and language diversity into account. Durlak and Dupré (247) argue for a compromise in the battle between fidelity and adaptation where they suggest that core intervention components or activities should be delivered with high fidelity whereas more peripheral activities may be more flexible to adaptations. Following this suggestion in the adaptation of the HSS intervention, component 1 and 3 should include the core information related to the recommendations regarding PA and dietary intake for 6-year-old children, and additional information according the evidence on parenting skills, and parental feeding practices as suggested above. However, the information could be delivered in different forms depending on language proficiency and level of understanding of how to carry out the activities. Regarding component 2, counsellors with proficiency in different languages would be the best choice for an intervention like the HSS. However, given the language diversity of

the target group, it would be impossible to cover all, or even the most common languages. Nonetheless, fundamental respect and non-didactic counselling have been stressed regarding interaction of health professionals in culturally diverse groups in Sweden (249, 250). Central to the method of MI is a non-didactic, person-centred perspective, and active listening (124). This makes MI a flexible method where the counsellor is able to adapt to the needs of the parent in the session while yet being adherent to the MI method, which can easily be measured by a validated instrument (161) to ensure fidelity. The MI component should therefore be suitable in an intervention like the HSS with a high proportion of parents born outside of the Nordic region, as it meets up to the demands of both fidelity and adaptation.

5.6 LIMITATIONS

Effects were found on parent-reported behaviours, not on objectively measured ones. The dietary assessment was based on parent-report using the EPAQ, which has not been validated in a Swedish context. Also, the choice to use a brief assessment questionnaire for parental recall for dietary measurements restrains us from drawing any conclusions about the children's diets as a whole, since the questionnaire only provides information regarding certain types of foods. The remaining dietary intake of the child, not captured by the EPAQ, may very well indicate unhealthy or healthy diet opposing what is indicated by the questionnaire. Further, the intake was only reported for one weekday, and may not be representative for the child's diet, although it is appropriate for analysis at group level.

The intervention reached more than half of the families eligible for inclusion. However, 42.3% chose not to participate. Further, those who did agree to participate had an educational level higher than the average for the targeted areas. Thus, although the intervention was conducted in areas considered to have low SES, it is likely that it did not reach a representative sample of the inhabitants in the areas.

It is clear that the majority of the parents who participated in the intervention were born outside of the Nordic region. Unfortunately, no background question regarding years of residence in Sweden was included in the data collection. This information would have been useful for more precise interpretation of the possible acculturation and the need for tailoring of the intervention, as well as assessing whether the participants included were representative of the population in the targeted areas.

Parents with no proficiency in Swedish were excluded from participation in component 2 of the intervention: the MI sessions. A low level of Swedish was accepted, and it was up to the parent to decide whether they were proficient enough to participate in the MI session in Swedish. Thus, less than five sessions were cancelled due to inadequate parental language proficiency, and a further five sessions approximately were conducted in English. Most parents who do not speak Swedish at all or at a very low level are probably of the lowest SES, as most of them probably are newly arrived immigrants. As newly arrived, a person or family tend to end up in low SES areas where they have little contact with mainstream Swedish society, are frequently unemployed, and have financial constraints (251). The

parents without enough proficiency in Swedish may also be women who have spent many years at home without much contact with the mainstream society.

Counsellors did not receive any prior information regarding the children's health status or behaviours in the family. This made it impossible for the counsellors to distinguish between parents from families with overall healthy behaviours, and parents who did not recognise they had a problem and were not motivated to change. Future interventions should take this into consideration in order for the counsellors to have the possibility to provide support for parents with a low problem recognition and low motivation for change.

The intervention was based on SCT theory which was thoroughly included in the progamme theory. However, only one theoretical construct was measured as a mediator: PSE. Furthermore, the mediating effects are not presented in the thesis. This limits the possibilities to draw conclusions regarding the usefulness of SCT in the HSS intervention. It is also possible that the intervention had a significant effect on one of the mediators which was not measured, and that the follow-up measurement was too short-term in order for the mediator to have had a significant impact on any of the measured outcomes.

The power calculation presented in study I was based on estimations to detect changes in the PA. The additional power calculation for differences in vegetable intake rendered a larger sample size than the number of participants in the HSS trial. Further, the intervention was not powered to detect any differences in effects between groups with different levels of education among the parents. A lack of power diminishes the possibilities of finding significant effects. Therefore, no conclusion can be drawn with regard to the differences in effect of the intervention on groups with different levels of parental education. As the intervention was focusing on families with low SES, enough power to draw conclusion regarding such effects would have been beneficial.

No research question regarding the children's perceptions of the intervention was included in this thesis. Thus, only second-hand information, from parents and teachers, is available in this regard. Future interventions should include an exploration of children's experiences as part of the process evaluation in order to gain a holistic view of the intervention implementation.

6 CONCLUSIONS

- This universal parental support intervention conducted in areas with low SES was effective in terms of decreasing children's intake of unhealthy foods, but not in terms of increasing intake of healthy foods even though 30% had low intake of healthy foods at baseline.

- The large majority of children already engaged in PA according to recommendations at baseline and the intervention had no effect on PA or time spent sedentary.

- Some effects on BMI were seen in children with obesity.

- MI seems to be a suitable counselling method for prevention intervention, though counsellors need to target maintenance of behaviours in addition to behaviour change.

- Future developments of this type of intervention should:

    - Take parental capabilites into account to a greater extent by:
        - Targeting enhancement of positive parent-child interaction.
        - Targeting parental recognition of responsibility for the child's behaviours.
        - Targeting parental emotional regulation in relation to the child's dietary behaviours.
        - Including varying levels of difficulty in components and activities.
        - Targeting cooperation between parents.
        - Supporting cooperation between parents and school.

    - Target parenting mainly through parenting styles and feeding practices, with knowledge on nutrition and PA as a complement.

    - Consider situation-specific parenting.

    - Include child outcomes related to interest in and enjoyment of foods and PA rather than only outcomes measured at intake of foods and drinks, and minutes spent at different PA intensities.

    - Include outcomes on parenting.

    - Include longer follow-up periods.

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