

Barriers and Facilitators of Health Promotion and
Obesity Prevention in Early Childhood:
A Focus on Parents
Results from the IDEFICS Study

By

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Abstract

Background: Childhood obesity has increased dramatically during the past thirty years. Parents are key persons in their children's lives and their efforts to create healthy lifestyles are very important. However, social and economic determinants of health also affect parents' opportunities to promote a healthy lifestyle.

Aims: To explore barriers and facilitators in promoting healthy lifestyles and preventing childhood obesity, focusing on parental roles.

Methods and main findings: Three studies originated from the Identification and Prevention of Dietary- and Lifestyle-induced health Effects in Children and InfantS (IDEFICS) study of determinants for two to nine-year-old children's health in eight European countries. The fourth study was a qualitative interview study conducted in southwest Sweden.

Paper I: In focus group discussions (20 focus groups with children and 36 with parents), parents described lack of time, financial constraints, availability and food marketing techniques as barriers for promoting healthy eating. School policies about food varied; only Sweden and Estonia provided free school lunches. Children described great variation in the availability of unhealthy foods and beverages in their homes.

Paper II: Objectively measured Body Mass Index (BMI) of children (n=16 220) were compared to parents' perception of and concern for their children's health and weight status. In all weight categories and all countries, a substantial proportion of parents failed to accurately judge their child's weight status. In general, parents considered their children to be healthy, irrespective of their weight status. Parents of children with overweight or obesity systematically underestimated their children's weight status across eight European countries. Accurate parental weight perception in Europe differed according to geographic region.

Paper III: Swedish IDEFICS participants (n=1825) were compared with an age- and sex-matched referent population (n=1825), using registers from Statistics Sweden and the Swedish Medical Birth Register. Longitudinal child growth data (n=3650) were collected from child health centers and school health services. Families with low income, less education, foreign background or single parenthood were underrepresented in the IDEFICS study. BMI at inclusion had no selection effect but, at eight years of age, the obesity prevalence was significantly greater among referents.

Paper IV: A qualitative content analysis was used to interpret the findings from interviews with nurses (n=15) working at child health centers in the southwest of Sweden. The BMI Chart to identify overweight and obesity in children facilitated greater recognition but nurses

used it inconsistently, a barrier to prevention. Other barriers were obesity considered a sensitive issue and that some parents wanted overweight children.

Conclusion: Parents may not perceive their child's growth trajectory from overweight to obesity, and the preschool years may pass without effort to change lifestyle. Therefore, objective measurement and information of children's BMI weight status by healthcare professionals is of great importance. To reach all parents and avoid selection bias, health surveys or health promoting activities must be tailored. Health promoting activities at the family level as well as the societal level should start early in children's lives to prevent childhood obesity.

Keywords: parents, children, obesity, weight perception, registers, prevention, health promotion

Sammanfattning på svenska

Bakgrund: Barnfetma har ökat dramatiskt de senaste trettio åren. Fetma i barndomen tenderar att följa med upp i vuxen ålder och medför risk för diabetes och hjärt-kärlsjukdom. Föräldrar är nyckelpersoner i sina barns liv och deras insatser för att skapa en hälsosam livsstil är mycket betydelsefull. Barnfetma drabbar barn ojämnt i befolkningen beroende på föräldrarnas socioekonomiska bakgrund. På samhällsnivå har därför sociala och ekonomiska bestämningsfaktorer inverkan på föräldrars möjligheter att främja en hälsosam livsstil.

Syfte: Att undersöka hindrande och främjande faktorer för att förebygga barnfetma och främja hälsosam livsstil, med speciellt fokus på föräldrarnas roll.

Metoder och huvudresultat: Tre av studierna utgick från IDEFICS (**I**dentification and **P**revention of **D**ietary- and **L**ifestyle-induced health **E**ffects in **C**hildren and **I**nfant**S**)studien, en studie om bestämningsfaktorer för barns hälsa i åldrarna två till nio år (n=16 220). IDEFICS omfattar åtta europeiska länder; Belgien, Cypern, Estland, Italien, Tyskland, Ungern, Spanien och Sverige. Den fjärde studien är en kvalitativ intervjustudie genomförd i Västra Götaland, Sverige.

Delstudie I: Fokusgrupps diskussioner genomfördes med föräldrar och barn, sex till åtta år, i IDEFICS länderna (36 fokusgrupper med föräldrar och 20 fokusgrupper med barn). Föräldrarna beskrev tidsbrist, ekonomiska begränsningar och tillgänglighet och marknadsföring av livsmedel som hinder för hälsosamma matvanor. Regler om mat i skolan varierade. Estland och Sverige var de enda länderna som hade fria skolmåltider. Barnen beskrev stor variation i hemmen avseende tillgängligheten av ohälsosam mat och dryck.

Delstudie II: Vi jämförde barnens (n=16 220) objektiva Body Mass Index (BMI) med föräldrarnas uppfattning om sina barns hälsa och viktstatus och oro för framtida undervikt/övervikt hos sina barn i IDEFICS studien. Logistiska regressionsmodeller identifierade prediktorer för korrekt viktuppfattning hos föräldrarna. En betydande andel föräldrar till barn i alla viktkategorier och i alla länder hade svårigheter att bedöma sitt barns korrekta viktstatus. Föräldrar till barn som objektivt bedömdes ha övervikt eller fetma, underskattade systematiskt sina barns viktstatus, men med ökande BMI och ålder hos barnet och oro för framtida övervikt hos barnet ökade föräldrarnas förmåga att uppfatta fetma hos sitt barn. Föräldrarna uppfattade generellt sina barns hälsa som god, oavsett vilken viktkategori som barnen tillhörde. Det fanns skillnader avseende korrekt viktuppfattning mellan föräldrar från olika geografiska regioner i Europa. Ett oväntat resultat visade att en stor grupp föräldrar var oroliga för att barnen skulle kunna utveckla undervikt. Denna oro sågs i högre grad hos föräldrar i Sydeuropa jämfört med Nord- och Centraleuropa. Det var t.o.m. så att en del föräldrar till barn med fetma var oroliga för att barnen skulle utveckla undervikt.

Delstudie III: Vi studerade om det skett en skevhet i urvalet av de som medverkade i den svenska IDEFICS studien. Med utgångspunkt i data från Statistiska centralbyrån och Medicinskt födelseregister kunde jämförelser göras mellan studiepopulationen (n=1825) och en referenspopulation (n=1825) matchad för barnets ålder, kön och boendeort. Longitudinella tillväxtdata, för de två populationerna (n=3650) insamlades från barnavårdscentraler och skolhälsovården. BMI vid inklusion i studien hade ingen urvalseffekt medan däremot föräldrar med låg utbildning och inkomst, utländsk bakgrund och ensamstående föräldrar var underrepresenterade i den svenska IDEFICS studien i jämförelse med referenspopulationen. Vid åtta års ålder förekom signifikant fler barn med fetma i referenspopulationen.

Delstudie IV: Intervjuer med sjuksköterskor (n=15) verksamma på barnavårdscentraler i Västra Götaland, genomfördes för att studera sjuksköterskornas uppfattning om interaktionen med föräldrar till barn med övervikt/fetma. Resultatet från den kvalitativa innehållsanalysen utföll i 332 koder, 16 underteman och sex huvudteman och grupperades i hindrande och främjande faktorer i det förebyggande arbetet mot barnfetma. Identifierade hinder var att fetma och övervikt upplevdes som ett känsligt ämne att ta upp med föräldrarna och att en del föräldrar uppfattade övervikt hos sitt barn som ett tecken på hälsa. Andra hinder var att föräldrar påverkades av den fetmafrämjande miljön med ohälsosam mat och inaktiv livsstil. BMI kurvan bedömdes vara ett bra verktyg som bidrog till att lättare kunna identifiera övervikt/fetma, men ett hinder var att den inte användes konsekvent eller inte alls av alla sjuksköterskor. Det kan leda till att identifieringen av barn med övervikt/fetma blir uppskjutet, och upptäcks först när barnet blivit äldre. Flera systematiska och strukturerade rutiner inom barnhälsovården identifierades som främjande för det förebyggande arbetet.

Slutsats: Hälsöfrämjande aktiviteter bör starta så tidigt som möjligt i barns liv för att förebygga barnfetma. Alla föräldrar uppfattar inte sitt barns viktutveckling och tillväxt från övervikt till fetma och förskoleåldern kan passera utan livsstilsförändring. Därför är det av stor betydelse att alla föräldrar får information om sitt barns viktstatus när det har vägts och mätts på barnavårdscentraler och i skolhälsovården. I studier av barns hälsa och i hälsöfrämjande interventioner är det viktigt att inkludera alla sorters familjer och det kan krävas skraddarsydda aktiviteter för att nå alla; dvs. föräldrar med sämre ekonomi och lägre utbildning, ensamstående föräldrar och föräldrar med utländsk bakgrund. Fokusgruppsdiskussioner och intervjuer med sjuksköterskor verksamma på barnavårdscentraler, visade att familjer med små barn är påverkade av den "fetmafrämjande miljön". Marknadsföring av- och utbredd tillgänglighet till ohälsosamma livsmedel påverkade och hindrade föräldrar från att välja det "hälsosamma valet." Föräldrar och barnfamiljer behöver stöttas på alla nivåer, från familjenivå till olika insatser på samhällsnivån.

Preface

In 2001, I began working as a pediatric nurse in a treatment and research project for children with obesity (Runda Barn projektet) at the Queen Silvia's Children's Hospital in Gothenburg, Sweden. I already had 14 years of professional experience working with children with a wide variety of health problems, so I felt I was experienced enough to encounter this “new” group of patients. Before the year 2000, childhood obesity was not considered a major health problem in children, and medicine offered no special treatment, if any at all, for this group of patients. When the project started, many referrals arrived due to suppressed demand. During five years, I met hundreds of children and adolescents with obesity, along with their parents. Members of the research- and treatment team supported each other with their professional specialties: a physiotherapist, a psychologist, two dietitians, two nurses, and a medical doctor. We had different types of treatment approaches. All children and adolescents underwent medical examinations, followed by regularly scheduled consultations with nurses alone or with the doctor and the nurse. We offered group physical activities, parents-only group sessions, and individual consultations and group lessons with the dietitians. Despite high motivation in many families, it was sometimes very difficult to reach the treatment goals. Habits are often persistent and hard to replace with new ones. My insights grew stronger that only prevention and promotion of a healthy lifestyle early in life can counteract childhood obesity.

At the Nordic School of Public Health NHV, and at the end of my doctoral studies, at the University of Gothenburg, I had the opportunity to take up research on what I consider one of the most important issues in the prevention of childhood obesity—the parents. As key persons in children's lives, parents' efforts to promote a healthy lifestyle are very important. However, social and economic determinants and the obesogenic environment of modern life are also strong driving forces and mechanisms. Therefore, parents need support from a society with the political will and consciousness to counteract childhood obesity. My studies focused on parents as individuals and parents as members of a society. I hope my research will increase the understanding of the support parents need to promote a healthy lifestyle for their children.

—*Susann Regber*

This thesis is based on the following four papers, which will be referred to in the text by Roman numerals.

Original Papers

- I. Haerens L, De Bourdeaudhuij I, Barba G, Eiben G, Fernandez J, Hebestreit A, Kovács E, Lasn H, Regber S, Shiakou M, De Henauw S on behalf of the IDEFICS consortium. Developing the IDEFICS community-based intervention program to enhance eating behaviors in 2- to 8-year-old children: findings from focus groups with children and parents. *Health Educ Res.* 2009 Jun; 24 (3):381-93. Epub 2008 Jul 5.
- II. Regber S, Novak M, Eiben G, Bammann K, De Henauw S, Fernández-Alvira JM, Gwozdz W, Kourides Y, Moreno LA, Molnár D, Pigeot I, Reisch L, Russo P, Veidebaum T, Borup I, Mårild S. Parental perceptions of and concerns about child's body weight in eight European countries – the IDEFICS study. *Pediatr Obes.* 2013 Apr;8(2):118-29. Epub 2012 Sep 21.
- III. Regber S, Novak M, Eiben G, Lissner L, Hense S, Sandström TZ, Ahrens W, Mårild S. Assessment of selection bias in a health survey of children and families– the IDEFICS Sweden-study. *BMC Public Health.* 2013 May 1;13(1):418
- IV. Regber S, Mårild S, Johansson Hanse J. Barriers to and facilitators of nurse-parent interaction intended to promote healthy weight gain and prevent childhood obesity at Swedish child health centers. *BMC Nurs.* 2013 Dec 5;12(1):27

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ABBREVIATIONS AND ACRONYMS

ANGELO	Analysis Grid for Environments Linked to Obesity
BMI	body mass index
CHC	Child Health Center
CI	confidence interval
IASO	International Association for the Study of Obesity
ICD	International Statistical Classification of Diseases and Related Health Problems
IDEFICS	I dentification and Prevention of D ietary- and Lifestyle-Induced Health E ffects in C hildren and I nfant S
IGT	impaired glucose tolerance
IOTF	International Obesity Task Force
ISCED	International Standard Classification of Education
NCD	noncommunicable disease
OECD	Organization for Economic Co-operation and Development
OR	odds ratio
PIN	personal identity number
SD	standard deviation
SES	socioeconomic status
SHS	school health services
UNCRC	United Nations Convention on the Rights of the Child
WHO	World Health Organization

DESCRIPTIONS OF KEY CONCEPTS AND DEFINITIONS

BMI	Body mass index (BMI) is calculated as an individual's body mass (kg) divided by the square of their height [m ²]. Thus, the unit of measure is [kg/m ²].
BMI z-score	BMI z-score or standard deviation (SD) score measures an individual's BMI in relation to the age and sex BMI values of an external reference population, either national or international. BMI z-scores can be used to compare group means and/or follow weight longitudinally. The mathematical formula is: The child's current BMI minus the reference mean BMI for current age and sex divided with the standard deviation of the reference population.
Childhood	Childhood is defined as the age range between birth and legal adulthood. The age when a person attains legal adulthood varies between countries, but is usually between 18 and 21 years of age. The first year of life is defined as infancy, and the time between 1 and 3 years of age is defined as the toddler period. The entire span between 1 and 8 years of age is often designated as early childhood. Another common description of childhood includes the preschool period before starting school and the school-age period that follows entry into school.
Obesity	Obesity is defined as a disease of abnormal fat accumulation in adipose tissue to such an extent that it may adversely affect an individual's health. However, the amount of excess fat, its distribution within the body, and associated health consequences vary considerably between individuals. The classification of obesity for children between 2 and 18 years of age uses the IOTF's age and gender BMI cutoffs, which correspond to the adult definition of 30 [kg/m ²] or above. Although adult BMI does not differentiate between sex and age, the IOTF classification of BMI in growing children varies with age and sex for every half year from 2 to 18 years of age.

Overweight	Overweight is defined as the identification of individuals and groups at increased risk of morbidity and mortality. The identification of overweight is valuable for intervention at individual and community levels and also for evaluating interventions. The classification of overweight for children between 2 and 18 years of age uses the IOTF's BMI cutoffs for age and gender BMI, which correspond to the adult definitions of overweight, defined as a BMI between 25[kg/m ²] and 30[kg/m ²].
Parents	Parents are the guardians of the child. Parents can be biological, foster, or adoptive or have other legal authority to represent the parent of the child.
Parenting	Parenting encompasses parenting goals, practices, and styles.
The United Nations Convention on the Rights of the Child	The United Nations Convention on the Rights of the Child (UNCRC) treaty for human rights of the child, covering civil, political, economic, social, health, and cultural rights of children. The Convention generally defines a child as any human less than 18 years of age, unless an earlier age of majority is recognized by a country's law.

INTRODUCTION

CHILDHOOD OBESITY AND PUBLIC HEALTH

Childhood obesity and overweight have increased at an alarming rate in recent decades and currently represent one of the 21st century's most serious global public health challenges (1). Obesity is a disease in its own right but, simultaneously, it is also a key risk factor for other noncommunicable diseases (NCDs) such as type 2 diabetes, cardiovascular disease, musculoskeletal disorders and dental disease. NCDs are expected to increase to 57% of the global burden of diseases in 2020 and to appear at a much younger age. Obesity and its related NCDs are largely preventable (2). The World Health Organization (WHO) (3) has defined obesity as "the disease in which fat has accumulated to such an extent that health may be adversely affected" (p.6). The use of body mass index (BMI), also for children (4,5), allows for a graded classification of overweight and obesity, which means that individuals with overweight close to the BMI values of obesity may be considered to be in a pre-stage of obesity.

Although genetic traits have an impact, unhealthy diets, lack of physical activity, and increasingly sedentary activities are the most important determinants of obesity (2). The seriousness of the global problem has also affected the Nordic countries (6). Consequently, to counteract this trend the Nordic countries established the Nordic Plan of Action (2006) to improve diet and physical activity; reduce overweight and obesity, especially among children and youth; and lower the tolerance of social inequality in health problems related to diet and physical activity (6). Children's living conditions (i.e., the built environment as well as cultural, social, and economic environments) associate closely with an individual's lifestyle and opportunities for good health. Because environments where people live and work differ socially and economically, these structures are vitally important in shaping people's lifestyles (7).

Obesity is sometimes described as a consequence of an individually and freely chosen lifestyle that can be changed by health education and personal motivation to make a healthier choice (7). In the case of children with obesity, this viewpoint would of course apply to their parents, because children are dependent on their parents and cannot be responsible. However, obesity as a concept of personal versus collective responsibility is controversial. Many policy makers tailor individual approaches into a message of prevention strategy, but this approach often entails a language of blame and weakness (8). On the other hand, a collective approach to the obesity epidemic entails supporting responsible behavior and creating a healthier default (e.g., improving menu labeling, altering market practices, or taxing unhealthy commodities (8). Individual and population-based prevention strategies do not

exclude each other; both are needed. However, identifying the causes or determinants of incidence of disease prioritizes the population-based strategy (9).

Public health science is defined as the “art of preventing disease, prolonging life, and promoting health through the organized efforts of society” (p. 3) (10). Conceptually, public health also includes health policy and practice and encompasses the well-being of populations rather than individuals.

The Ottawa Charter for Health Promotion (11) emphasizes setting as an important prerequisite for health. Its socioecological approach to health recognizes the interaction between the environment and the individual:

Health is created and lived by people within the settings of their everyday life; where they learn, work, play and love. Health is created by caring for oneself and others, by being able to take decisions and have control over one's life circumstances, and by ensuring that the society one lives in creates conditions that allow the attainment of health by all its members.

Because the dramatic rise in obesity, which some describe as a pandemic, has resulted from environmental change, counteracting overweight and obesity must focus on the environment.

OBESITY AND THE OBESOGENIC ENVIRONMENT

Obesity and overweight occurs when energy intake exceeds energy expenditure, resulting calories that exceed the demands of normal growth, activity and metabolism. Genetic factors and individual traits determine the response to this energy imbalance. From a population perspective, however, genes alone cannot explain the obesity epidemic because genes have not changed substantially during the past three decades. At the societal level, the built environment and transportation systems increasingly encourage passive transportation, and city planning seldom supports physical activity (12), implying an increasingly sedentary and unhealthy lifestyle. In 1999, Swinburn, Egger, and Raza (13) defined the concept of “obesogenic environments”, as “the sum of influences that the surroundings, opportunities or conditions of life have on promoting obesity in individuals or populations” (p. 564). They designed a two-dimensional “Analysis Grid for Environments Linked to Obesity” (ANGELO) to facilitate identification of the “obesogenicity” of modern environments. The micro level of this grid includes homes, schools, neighborhoods (e.g., cycle paths, streets safety), food retailers (e.g., stores and supermarkets), and recreation facilities, whereas the macro level includes transportation systems, political decisions regarding taxes or city planning, food marketing strategies, and food production. Homes usually contain several obesogenic factors (e.g., televisions, microwaves, remote controls, electronic games, and computer activities) that promote sedentary activities.

In the macro level of an ANGELO grid, the globalization and commercialization of food systems, known as the “nutrition transition,” have resulted in a shift toward quantitatively increased intake of high energy density foods, increased intake from animal sources and lower intake of fruit and vegetables (2). The food environment encourages overconsumption, bigger portion sizes, highly appetizing foods, and sugar sweetened beverages, supported by aggressive advertising campaigns (2,12). On the other hand, most countries provide recommendations for dietary composition and nutrition. The Nordic countries (i.e., Sweden, Denmark, Norway, Finland, Iceland, the Faroe Islands, Greenland, and Åland) have a long tradition of joint healthy nutrition recommendations (14,15). However, recommendations to avoid unhealthy foods are also described. For example, the Swedish National Food Agency tell parents to delay giving young children candy, soft drinks, cakes, and buns as long as possible (16). In another joint project undertaken to counteract the obesogenic food environment, the Nordic countries mapped the commercial power that makes children buy, or convinces their parents to buy, unhealthy food products (17). Products commercialized through television, direct mail, websites, and children’s magazines were analyzed during one week in 2005. The definition of unhealthy products, besides the ones described above, also included sweet desserts and snacks, jams and marmalade, ice cream, chocolate pudding, potato chips, highly processed foods, and sweetened cereals. The results showed that advertisements for unhealthy foods were a serious problem that negatively risked children’s health. The European Union has conducted similar initiatives studying food and beverage marketing to children and its own regulation within the public health framework (18). Schäfer, Elinder, and Jansson identified indicators of environmental determinants of food supply (e.g., access to neighborhood food shops, fast food outlets, and food prices) to achieve better evidence for societal actions to counteract obesity (19). Other obesogenic environmental factors include the oversupply of dairy products, meat, oil, and sugar that are driven simultaneously by agricultural subsidies (20,21) and a small budget for fruit and vegetable. In other words, “The result is an ‘obesogenic economy’, i.e. a market economy that encourages weight gain in which children are a prime target” (p.301)(21).

OBESITY, SOCIAL DETERMINANTS OF HEALTH AND INEQUITIES

Health determinants include factors that influence health positively or negatively (7). Politics or public policies cannot influence biological determinants such as age, gender, and constitutional factors. In contrast to individual lifestyle factors, social and community networks, living and working conditions, and general socioeconomic, cultural, and environmental conditions can always be modified globally, commercially, and politically in positive, protective, or risky ways (7). Determinants of social inequities may differ for different socioeconomic groups. Dahlgren and Whitehead explain such inequities as “social, economic and lifestyle related factors that increase or decrease social inequities in health.

These factors can always be influenced by political, commercial and individual choices/decisions” (p. 7) (7). Unemployment, low income, and social exclusion are structural factors often seen in combination and they typically lead to poor health (Figure 1).

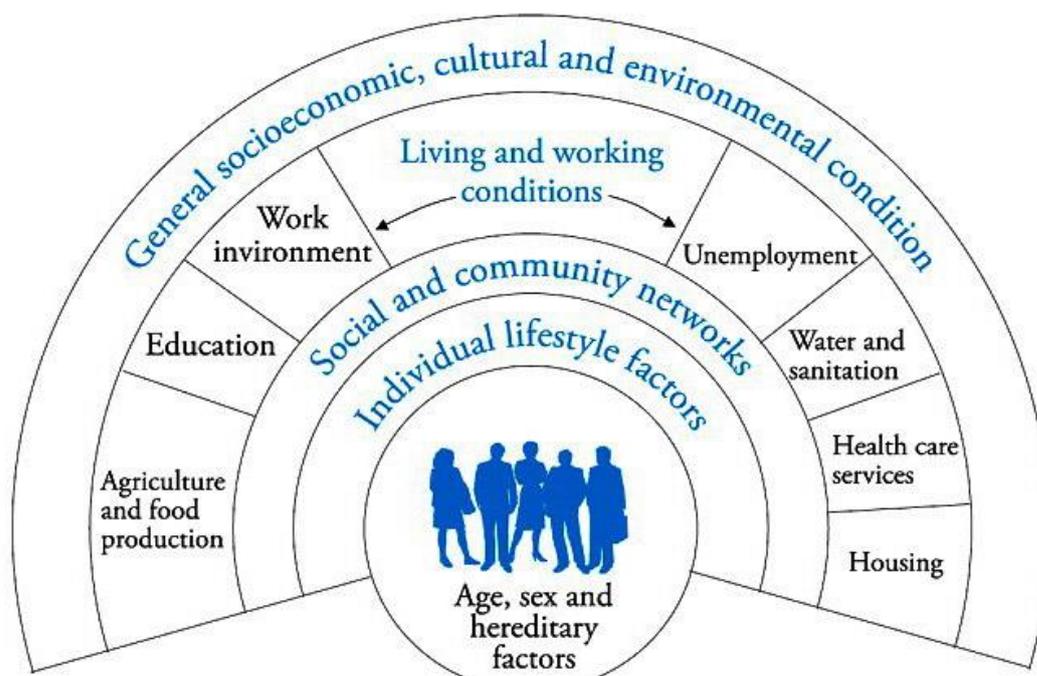


Figure 1. The determinants of health (Dahlgren and Whitehead, 1991)

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The distribution of childhood obesity is usually unequal, both within and among countries. Countries with smaller income differences show lower rates of childhood obesity (22). Although Sweden’s welfare system is fairly complete compared to many other countries and its income distribution is relatively equal, social inequities still occur and affect the prevalence of obesity in very young children. Swedish studies of 4-year-old children showed that prevalence differed according to socioeconomic status (SES) in two diverse populations (23,24). Growth data showed significantly more overweight and obesity in 4-year-old children living in more disadvantaged areas.

The unequal distribution of the social determinants of health is not binary in terms of poor/non-poor or deprived/non-deprived, but rather linear and gradient (25). Pickin and Popay explained the social gradient in health (26) as our place in the social hierarchy: “our health will be better than those below and worse than those above us” (p. 258). Furthermore, a social gradient has been reported within the area of obesity. “Overweight among the poor seems to be strongly associated with income inequality” (p. 93), and in more unequal societies, more children are overweight (22).

PREVALENCE

The global presentation of childhood obesity is restricted due to a lack of available data. Data can vary for different age groups and between the years of the surveys and can also be based on different use of BMI classification systems. However, WHO’s global database, which collected and compiled cross-sectional data from 144 nations during 1991–2008, has been used to estimate global overweight and obesity among preschool children (27). In 2010, 43 million children < 5 years of age worldwide were estimated to be overweight and obese. Estimating this trend suggests that obesity will reach \approx 60 million children in 2020 (27). To ensure regular trend measurement in primary school children (6–9 years of age) in the European region, WHO has established surveillance systems for measuring childhood obesity (28). An average of 24% of children in this age group was classified in the overweight or obese category in 2010.

Although the rise in overweight and obesity have been dramatic since 1990, the United States (USA), New Zealand, Australia, China, and five European countries have reported signs of stabilization (29), and a possible reason could be due to increased public health concern. However, the differences in prevalence across countries are large. Van Stralen et. al. (30) reported a European variation in objectively measured 4-to 7-year-old children, from 8%–30% for overweight and 1–13% for obesity in Belgium, Bulgaria, Germany, Greece, Poland, and Spain. The highest rates occurred in Spain and Greece.

In the Nordic countries, prevalence data also varies a lot regarding to selected age groups and time periods of the surveys. The Organization for Economic Co-operation and Development (OECD) reported prevalence data on children with overweight (including children with obesity) of 16% in Norway (2005, ages 3–17 years), 23% in Iceland (2003, age 9 years), 14% in Denmark (1997, ages 5–16 years) and 22% in Sweden (2001, ages 6–13 years) (31). Although not included in the OECD presentation, a cohort of 12- to 15-year-old Finnish children showed increased prevalence of overweight and obesity, from 13% to 25% between 1974 and 1991 (32). In 2000–2001, objectively measured 10-year-old children in western Sweden showed a two-fold increase in overweight (18%) and a four-fold increase in obesity (2.9%) compared to 10-year-old children in 1983–1985(33).

Despite signs of stabilization in some countries, the worldwide prevalence of child and adolescent overweight and obesity remains alarmingly high (29), and the “obesogenic economy” that encourages weight gain (21) shows no sign of changing. Transnational corporations that profit from increased consumption of ultra-processed food and beverages have stated no interest in self-regulations that will affect their profits (34).

MORBIDITY

Obesity is defined as a disease of abnormal fat accumulation in adipose tissue to such an extent that it may adversely affect an individual’s health (3). However, the amount of excess fat, its distribution within the body, and associated health consequences vary considerably between individuals (3). Within the 10th revision of WHO’s International Statistical Classification of Diseases and Related Health Problems (ICD-10), obesity is coded as E 66.9 (35). Obesity is also connected to a wide variety of comorbidities ranging from biomedical to psychological, including adverse social consequences. Several of these comorbidities appear during childhood and others emerge later, during adolescence or early adulthood (Table 1). Impaired glucose tolerance (IGT) is an intermediate stage in the progression toward type 2 diabetes, a slowly developing consequence observed among children and adolescents with obesity (36). A recent study reported a significant change in fasting levels in blood (insulin, triglycerides and low and high density lipoprotein) in 10- to 11-year-old children with overweight or obesity compared to children with normal weight, suggesting an increased risk in children with overweight or obesity for future cardiovascular disease or diabetes (37). Consequences of obesity such as high blood pressure (BP), low high-density lipoprotein cholesterol (HDL-C), and high triglycerides (38) are all parameters included in the metabolic syndrome (MS) and risk factors for development of cardiovascular diseases, but currently, there is no unified definition to assess MS in children and adolescents. Not only general fatness but also the prevalence of abdominal fatness, which is a driving force for insulin resistance and MS, has increased over the past decades in infants, children, and adolescents (39). Therefore, irrespective of their age, children diagnosed with obesity require screening for biomedical complications.

Table 1. *Examples of comorbidities, risk factors, and other disorders connected to obesity in young individuals < 18 years of age*

Comorbidities, Risk Factors, and Disorders	References	Comorbidities, Risk Factors, and Disorders	References
High blood pressure	(38)	Orthopedic disorders	(40)
Low HDL cholesterol	(38)	Headache	(41)
High triglycerides	(38)	Sleep apnea	(42)
Impaired glucose tolerance	(36)(43)	Asthma	(44)
Insulin resistance	(45)	Poor self-esteem	(46)
Type 2 diabetes	(43)	Depression	(47)
Hepatic steatosis	(45)	Eating disorder	(47)
Gall stones	(48)	Social stigmatization	(46)
Acanthosis nigricans	(43)	Low health-related quality of life	(49)
Precocious puberty	(50)	Obesity in adulthood	(51)
Polycystic ovaries	(52)		

Note: HDL = high-density lipoprotein.

OBESITY AND THE RIGHTS OF THE CHILD

All countries that have ratified the United Nations Convention on the Rights of the Child (UNCRC) have agreed to “recognize the right of the child to the enjoyment of the highest attainable standard of health and to facilities for the treatment of illness and rehabilitation of health” (Article 24) (53). Because obesity is classified as a disease, no child with obesity should be neglected and deprived of their right to support and treatment. However, in western Sweden, only 28% of the estimated 3% of children with obesity were diagnosed in 2012 (54). A recent study in USA reported that only 50% of morbidly obese pediatric patients were screened for comorbidities (55). Therefore, the rights of the child with obesity demand a high level of scrutiny.

Every five years, the UNCRC receives a report written by the State party regarding identified problems, along with a description of the steps taken to improve the Committee's previous recommendations. In return, the Committee gives their consideration on the report. In 2005, the Committee stated its concern about the growing problems of overweight and obesity among Swedish children as a result of low physical activity combined with a poor diet (56). In 2009, the Committee recommended “the Swedish State party to pay close attention to child and adolescent health, and to address overweight and obesity and promote a healthy lifestyle among adolescents, including physical activity” (57).

OBESITY AND STIGMATIZATION OF CHILDREN

For the individual child or adolescent, the everyday negative psychological and social consequences of obesity (i.e., the social stigma) likely represent the most difficult adverse health consequence, affecting their self-esteem negatively and often resulting in impaired social relations (47). Puhl, Luedicke, and Heuer (58) reported that more than three quarters of high school students had observed that students with overweight or obesity were ignored, avoided, excluded from social activities, teased, or subjected to negative rumors. However, the stigmatization of children with obesity occurs at an even younger age. In spite of a doubling of childhood obesity prevalence within 40 years in USA, stigmatization appeared to increase between 1960 and 2000. Children aged 10 to 12 years were asked to rank six drawings of children with obesity, various disabilities, or no disability by ordering the drawings according to how well they liked each child. Both in 1961 and 2001, children liked the drawing of the child with obesity least but the differences between the rankings of the obese and non-obese children was even larger in 2001 (59). Therefore, understanding the pervasiveness of social stigma and identifying effective interventions to improve attitudes and counteract the stigmatization of obesity are major concerns (46).

HEALTH PROMOTION

Health promotion is a broad concept that extends over several fields of science and practice. In 1984, WHO launched a program of concepts and principles for health promotion based on community participation, equity and intersectoral collaboration (60). At that time, the context was the everyday life of the general population rather than a focus on individuals at risk for specific diseases. Since the first International Conference on Health Promotion (Ottawa, Canada; 1986), a series of global conferences have further outlined principles and areas for action in health promotion (61). This thesis will consider the principles of holism, participatory and equity. Holism means that health is seen as a whole (i.e., physical, mental, social and spiritual health); participatory means involving everyone at all stages of the process; and equitable means being guided by a concern for equity and social justice (62). Universal consensus regarding a definition of health promotion is still lacking (60), but the current WHO website (63) states:

“Health promotion is the process of enabling people to increase control over, and to improve, their health. It moves beyond a focus on individual behavior towards a wide range of social and environmental interventions.”

Interventions in health promotion focusing on “upstream” factors use a structural approach at the societal level, encompassing unemployment, education, housing, and the globalization of food supply and food marketing. “Downstream” factors include individual behavioral risk factors such as unhealthy lifestyles, e.g. low fruit and vegetable intake, and physical inactivity (7). Health strategies in individual centered interventions focus on screening and monitoring, health information, and behavioral lifestyle changes. The transtheoretical (stages of change) model elaborated by Prochaska, one of several theories of the health behavior of change within health promotion, focuses on the individual (64,65). Prochaska’s model is often applied in adult obesity prevention, but it also provides an explanatory model for parents of children with obesity. The model has five stages: (i) precontemplation (i.e., not likely or having no interest in making changes); (ii) contemplation (i.e., being “somewhat likely to do changes”); (iii) preparation (iv) action stage; and (v) maintenance. However, a comprehensive health strategy is holistic and includes both downstream and upstream determinants of health (7).

Upstream factors of influence on individual lifestyles include global neoliberal trade policies, income inequalities, and poverty (7). The marketing of sweetened beverages, unhealthy foods, increased portion sizes, ready-made meals, and high-energy processed food exemplifies global neoliberal trades that negatively affect health (17,66).

PREVENTION

Health promotion also includes disease prevention (60). In this thesis, two categorizations of childhood obesity prevention are actual: *primary and secondary* prevention. Primary prevention seeks to avoid any onset of disease, whereas secondary prevention strives to achieve the earliest possible diagnosis and treatment of disease (67). However, childhood obesity focuses simultaneously on treatment, prevention, and health promotion. The persistence of obesity into adolescence requires prevention, and health promoting activities are necessary to increase the child's health and well-being in concert with treating the ongoing adversities of obesity. Treatment for children with obesity also implies prevention of adult morbidity. Consequently, there are several individual and public health reasons to act early in children's lives. Treatment options for adults with obesity, e.g. dieting, pharmacological treatment, or lifestyle behavior treatment or combinations, are options that children usually cannot manage without support, i.e. the treatment of children must be a family-based treatment. For very young children aged four to seven years, there is some evidence that prevention interventions have shown effectiveness for healthy family lifestyle changes, often a combination of diet, exercise and environmental management and parent-directed activities (68). However, health promoting actions at all levels and arenas in society benefit not only a child diagnosed with obesity but all other children and adults as well.

CHILD HEALTH CENTERS AND SCHOOL HEALTH SERVICES

Sweden has offered regular and cost-free visits for all children at child health centers (CHC) and school health services (SHSs) since 1938 and 1942, respective (69,70).

CHCs and SHSs are staffed and run autonomously by full-time nurses, with part-time assistance of physicians. The children and parents attend the CHC nurses at least 15 times and the physicians about three to five times between birth and the age of six years. The nurses follow a basic child health program that includes growth monitoring, vaccinations, screening programs, parental consultations regarding feeding practices, accident prevention, and promoting an active childhood and healthy family lifestyle. CHCs mainly aim to provide parents with the knowledge and ability to make healthy choices. Visits are broadly accepted and frequented up to 99.9 % during the child's first year of life (71).

SHSs are a continuation of CHCs and are, by law, offered to all children between the ages of six and 19 years (72). The main mission of SHS is prevention, preserving and improving mental and physical health, and promoting healthy lifestyle in students. Vaccinations, growth monitoring, and screening programs are part of the SHS program. All children are guaranteed at least five health visits to SHSs, including monitoring of height and weight (73). However, all children generally have their growth measured every second year during their

school years. In 2001, SHSs adopted the BMI curve, which was considered an easier way to assess relative body weight in conditions such as anorexia nervosa and obesity (73). According to Sweden's National Board of Health and Welfare, the parent is considered a competent and necessary partner for cooperation with SHS because the parent has the main responsibility for the health of the child (73).

PARENTING

Parents undoubtedly exert strong influence on habits and behaviors within the family. In everyday life, parents affect their child in what they say, what they do, and the attitudes and values they possess. Parenting requires no formal training or qualification, but nonetheless is a role with high expectations. Parents mostly develop their parenting skills unnoticed and unconsciously. Parental importance and influence in promoting a healthy lifestyle in their children deserves special consideration when it comes to childhood obesity prevention.

According to Darling and Steinberg (74), parenting encompasses goals, practices, and styles. Parents' goals and values in socializing their children influence the practices that parents employ, and parenting styles (see below) affect the climate in which the parents' behavior is expressed (74).

Eriksson, Nordqvist, and Rasmussen (75) studied the relationship between parents as role models and children's physical activity. They found a strong association between the participation of 12-year-old Swedish children in sports and vigorous activities and the physical activity level of their parents. The odds ratios (OR) for children's physical activity were 3.9 for girls and 8.8 for boys, respectively, when both parents were active, compared to children whose parents were inactive.

Using a lifestyle behavior checklist, West and Sanders (76) listed various key parenting challenges that require attention in the treatment of childhood obesity. They provided several examples from all daily living situations, probably recognized by many parents no matter the weight status of their child (i.e., child eats too much or too quickly, eats unhealthy snacks, eats continuously between meals, watches too much television, plays too many computer games, complains about doing physical activity or not having enough friends). However, the researchers explored the lifestyle behavior checklist by comparing parents of 4- to 11-year-old children with healthy weight, overweight, or obesity and found that parents of healthy weight children reported lower levels of lifestyle behavior problems.

Raising children involves making small and large decisions several times almost every day throughout the child's trajectory of growing up. Finding the balance between being too strict or too lenient is probably an experience shared by many parents. Setting limits for children in everyday life; creating a non-negotiable structure around regular meal schedules, nutritious

food, and no snacking between meals, and stimulating and coaching children to participate in movement, active play, and exercise are important parental duties (77). This process is essential for all parents, but it is even more important for parents of children with obesity.

PARENTING STYLES

In the clinical setting in the research and treatments project for children with obesity at Queen Silvia's Children's Hospital (see Preface), parenting styles exerted an influence on the treatment. Therefore, group discussion sessions regarding parenting styles and different parent-child situations were part of the treatment program (78). Others had already achieved success by focusing on parents rather than children. In Israel, Golan (79) studied parents as exclusive agents of change, emphasizing healthy lifestyle instead of weight reduction. After a 7-year follow-up period, Golan observed a significant reduction of overweight children in the parents-only-group versus the parent-child and child-only groups. The advantage of the parents-only group was that it allowed focused discussion of issues, such as parenting practices and parent-perceived barriers, during the intervention sessions.

Through constant dialogue with parents and children during one-on-one consultations in the treatment and research project at Queen Silvia's Children's Hospital, we revealed several conflicts between parents and their children that posed barriers to the treatment program. Some typical case situations were repeated in different families. By applying the knowledge of the four typologies of parenting styles, described first by Baumrind in 1971 (80) and modified in 1983 by Maccoby and Martin (81), case illustrations were created, displayed with an overhead projector, and discussed in parental group sessions. Case illustrations were discussed from the child's, parents', and caregiver's perspective, and parents were free to discuss and share conflicting experiences with other parents in the same situation. Experience-based knowledge (82) was developed during practical work through observations of many similar and unique cases and combined with professional caregivers' theoretical knowledge. Experiences from parental group sessions that used the typology of the four parenting styles were recorded and published in a peer-reviewed journal (78).

The four parenting style typologies include authoritarian, authoritative, permissive, or neglective and are defined as a function of two dimensions, responsiveness and demandingness (80,81) (Table 2). An authoritative parent is high in both responsiveness and demandingness, whereas a permissive parent is high in responsiveness but low in demandingness.

Table 2. *Model for parenting styles* (78)

	High demanding	Low demanding
Empathetic	Authoritative	Permissive
Cold, Not Empathetic	Authoritarian	Indifferent

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In the research field of childhood obesity, several studies have investigated parenting-style typologies. In a systematic review of 36 studies in general parenting and weight-related outcomes, results showed that children raised within an authoritative parenting style adapted healthier eating habits, were more physically active, and had lower BMI levels compared to the three other parenting styles (i.e., authoritarian, permissive/indulgent, and uninvolved/neglectful) (83).

Due to interaction with the child and the challenges parents face in raising children, parenting styles must be addressed early, but to the best of my knowledge this is not applied in CHC, preschool, or school settings in Sweden. Parenting styles should account for all parents, not only parents of children with overweight or obesity. Therefore, providing parents with knowledge of parenting styles could provide a tool for self-reflection and increased possibilities to feel secure and comfortable in the parenting role.

AIM

The overall aim of this thesis was to explore barriers and facilitators in promoting a healthy lifestyle and in preventing obesity in children, with a special focus on parental roles.

SPECIFIC OBJECTIVES

Paper I: To describe important modifiable factors for dietary eating behaviors among children two to eight years of age and determine the best approaches for developing and implementing a standardized intervention feasible for each of the intervention contexts and populations.

Paper II: To evaluate parental perceptions of and concerns about a child's body weight and general health in children in a European cohort.

Paper III: To assess possible selection bias of children participating in the Swedish IDEFICS health survey by comparing participants' socioeconomic, sociodemographic, and anthropometric characteristics with those of an unselected reference population.

Paper IV: To examine nurses' perception of the nurse-parent interaction at CHCs and assess barriers to and facilitators of interaction intended to promote healthy weight gain and prevent childhood obesity.

METHODS

ASSESSMENT OF OVERWEIGHT AND OBESITY IN CHILDREN

Obesity assessment requires the measurement of body fat. Body composition and fat distribution vary in children during the course of their growth, and sex differences appear long before puberty (84). Measurements of body composition most often determine the amount of body fat and lean mass and sometimes assess bone tissue. Direct methods for measurement of body composition include magnetic resonance imaging (MRI), computerized tomography (CT), dual-energy X-ray absorptiometry (DEXA), air displacement pletysmography, or underwater weighing (85). These methods are direct because they measure body fat directly. They are mostly used in clinical research studies and only rarely in clinical practice. Indirect methods do not measure the amount of body fat, but are instead a proxy measurement of fat. These methods include bioelectrical impedance analysis (BIA) skinfold measurements, BMI, waist circumference, or waist-height ratio and weight-for-height, among others (85).

Weight-for-height and BMI are the most used methods used in SHSs and CHCs, and the International Obesity Task Force (IOTF) now recommends BMI as the standard measurement for assessing overweight and obesity. BMI has been validated against other direct measurements of body fatness (86). Measuring height and weight and calculating BMI is fairly simple and can be done at the population level. BMI has a very high specificity and a relatively low sensitivity (i.e., individuals classified as not overweight are not mislabeled as overweight, while those labeled not overweight may be missed because they are truly overweight/obese (87,88). Today, there is a consensus that BMI is the best choice among available measures. However, future research may lead to new measures based on national BMI reference data (89) or to other measurement methods (e.g., waist circumference) (90).

Three BMI-based classification systems are commonly used (91); WHO, the Centers for Disease Control and Prevention (CDC), and the IOTF/Cole system. The IOTF/Cole system provides BMI cutoffs based on international data from six different reference populations (i.e., Great Britain, Brazil, the Netherlands, Hong Kong, Singapore, and the United States). In this thesis we used the IOTF/Cole BMI classification system (4). In 2012, Cole and Lobstein (5) published new BMI cut-offs almost identical to the originals, but with the benefit of e.g. deriving BMI 35 for morbid obesity and also being able to be expressed as BMI centiles.

This thesis used the BMI chart to study and discuss the assessment of a child's weight status. Figure 2 shows one example of BMI development in a preschool child. Each filled circle indicates that the child has visited a CHC or SHS (according to age). After obtaining date of

birth, the sex of the child, date of visit, weight, and height, a computer automatically calculates and plots the child's age and BMI.

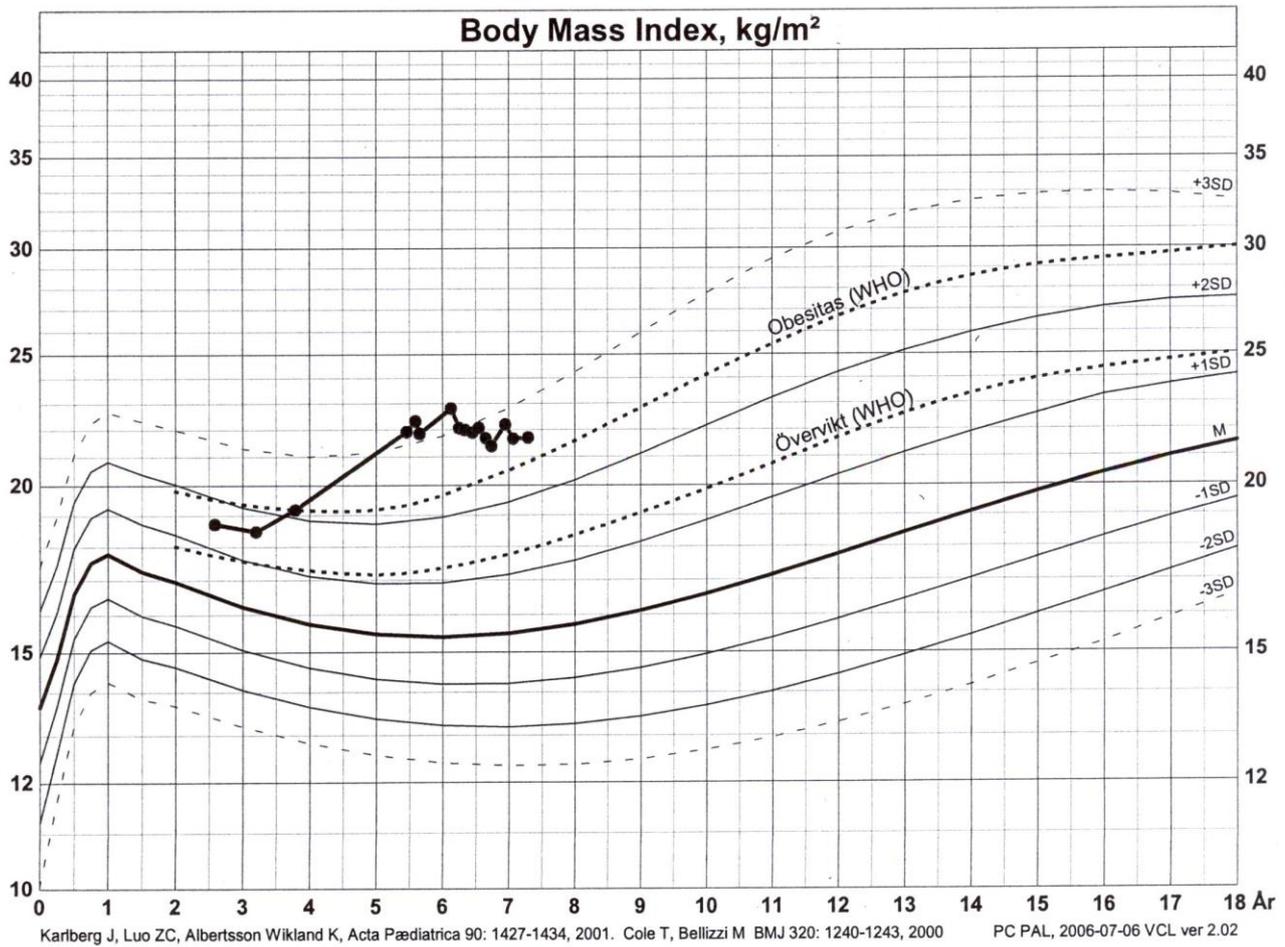


Figure 2. BMI chart showing the development of obesity in a child before the age of eight years.

THE IDEFICS STUDY

In 2006, the IDEFICS study was launched in eight European countries (92). The IDEFICS study aimed to assess children's health, focusing on overweight and obesity, and to develop and evaluate a health promoting community intervention program. The eight participating countries were Belgium, Cyprus, Estonia, Germany, Hungary, Italy, Spain, and Sweden. In 2007–2008, between 1507 and 2566 2- to 9-year old children from each country participated in the baseline survey (T0). A total of 31 543 subjects were informed at kindergartens and schools and 16 224 (51% response rate) participated. Children in the IDEFICS study underwent medical examinations and fitness checks that aimed to gather detailed health information. Blood pressure, ultrasound examination to check bone stiffness, anthropometric measurements, blood, urine and saliva samples, and a variety of tests for children's taste preferences and dietary and physical activity habits were performed. Parents completed a questionnaire consisting of about 70 questions covering behavioral factors, dietary and sedentary habits, and parental perceptions attitudes and values as well as socioeconomic and demographic questions (92).

In 2008–2009, IDEFICS launched its community health promoting intervention in the respective intervention communities of the eight European countries (93). Combined tools of targeting individual behavior and societal change were applied. The paradigm of an “obesogenic environment” (13) and an ecological approach (13,94), i.e., considering the interaction and influences of the different levels of action for health, provided a starting point to create the research framework for intervention (93).

The IDEFICS used a theory- and evidence-based tool for a structured health promoting intervention (95). The project identified several levels of intervention (i.e., community, schools/kindergartens, class and family). Before developing the intervention mapping protocol, researchers analyzed results from focus group discussions in all eight countries (96,97). One important finding from children's focus groups was inconsistent messages from family and schools regarding rules and the availability of foods. Therefore, creating and distributing uniform messages in all settings, at all levels, and in all the participating countries was important in the IDEFICS study. The uniform messages were finally expressed as “Refresh your child with water!”, “Enjoy family time instead of media time!”, “Help your child to get enough sleep!”, “Fruit and vegetables taste delicious!”, “Encourage your child to be more active!”, and “Increase the consumption of water and daily physical activity!”(98).

In Sweden, the municipality of Partille was the intervention community and the municipalities of Alingsås and Mölndal served as control communities. Altogether, 1809 children participated from these three municipalities. In 2009–2010, IDEFICS followed up the same children (T1) to evaluate the effects of the health promoting and primary

prevention program during the intervention phase. In 2010, a second follow up (T2), was conducted using questionnaires mailed to participating families, assessed the sustainability of the interventions (92). Findings from the IDEFICS study are continuously analyzed and published.

DESCRIPTION OF THE PAPERS

Table 3 provides a short description of the papers in this thesis.

Table 3. *Description of Papers I–IV*

Study	I	II	III	IV
Year	Feb–April 2007	Sept. 2007–June 2008	31 December 2007	2010–2012
Design and methods	Focus group discussions, qualitative analysis	Cross-sectional, multi-center quantitative survey study	Cross-sectional, quantitative, case–referent, register study	Individual interviews, qualitative manifest content analysis
Participants and data sources	36 parental focus groups (parents, n = 189) 20 child focus groups (ages 6–8 years, n= 155)	Parental questionnaire, 16 220 children, 2–9 years of age, measured for height and weight	1825 children in the Swedish IDEFICS study. Children’s heights and weights (n= 3367) from CHC and SHS. Register data (n=1431 and n= 1825) from Statistics Sweden and the Swedish MBR	15 nurses working at CHC
Geographical area	IDEFICS: eight European countries*	IDEFICS: eight European countries*	IDEFICS- Sweden: Three municipalities (Alingsås, Partille, and Mölndal)	The region of Västra Götaland, Sweden

Note. IDEFICS participating countries: Belgium, Cyprus, Estonia, Germany, Hungary, Italy, Spain and Sweden. IDEFICS = Identification and Prevention of Dietary- and Lifestyle-Induced Health Effects in Children and Infants; CHC = Child Health Centers; SHS = School Health Services; MBR = Medical Birth Register.

Focus groups discussions were used in this study. Focus group discussions are one of several qualitative methods to study health problems. Focus groups are applied (i) as a research method for collecting qualitative data, (ii) for focused data-gathering efforts, and (iii) to generate data through group discussions (99). Other reasons to choose focus group discussions as a method, and also applicable to this study, include an ancillary method in the initial stage of a larger study for preliminary exploration and later use in subsequent stages of the study (100). Preferably, participants are a homogenous group of about 6–12 people, led by a skilled moderator using a semi-structured interview guide. The subject matter is thoroughly planned and the setting for the meetings is ideally a neutral place (101).

In the IDEFICS study, 20 focus groups with children six to eight years of age (74 boys and 81 girls) and 36 focus groups with parents (28 men and 161 women) were formed in Belgium, Cyprus, Estonia, Germany, Hungary, Italy, Spain and Sweden. The groups of children were homogenous according to gender. The parent groups on the other hand were heterogeneous with respect to gender, but the intention was to keep the parent groups homogenous according to SES. In each country, independent reviews and key findings of the focus groups were performed and summarized in a standardized template as the final summary report. Demographic data were collected on age, gender, and SES of the parents. Descriptive statistics were used to analyze the data using SPSS, a statistical software program.

Focus group discussions were held in the respective municipality chosen for the community health promoting intervention. The focus group discussions were systematically planned and performed using a pretested standardized questioning route at all centers. The focus groups were led by a moderator and a co-moderator. In Sweden, the author of this thesis (SR) and Gabriele Eiben (GE) were co-moderators in the parent focus groups while others were co-moderators in the child focus groups. An English language template was prepared and sent to all study centers to summarize the results from eight different languages into a common language.

Focus group sessions were audiotaped with the oral consent of the participants. Three main themes were discussed: (i) nutrition, (ii) physical activity, and (iii) behavior concerning stress avoidance/relaxation. In this thesis, the study about nutrition is included (Paper I), but SR also co-authored an additional paper about physical activity (97). The questioning route with the parents started with an opening question, followed by one transitional and 10 open-ended questions; children were given seven questions. Nutrition topics ranged from shopping and channels of information about healthy foods to barriers and facilitating factors for their child to eat (un)healthy, food rules at home and kindergarten/school, availability of food, and motivators for behavioral change. The children discussed food preferences and the

availability and rules concerning food at home and at school. Using a standardized English-language template, countries provided the results of their qualitative focus group discussions and sent the results to the Belgian center in Ghent. Two researchers at the Belgian center separately analyzed and summarized the key findings of the focus groups from each country and compared all results. The comparisons were generally consistent between the two researchers. The collected demographic data were analyzed using descriptive statistics.

The Swedish IDEFICS group chose to cooperate with Intermetra, a business and market research company that specializes in quantitative and qualitative research (102). During planning of the focus groups, several meetings were held with the Swedish IDEFICS research team and persons in charge at Intermetra. The author of this thesis (SR) participated in all the planning and meetings with Intermetra. The design of the standardized questioning route was partly changed for all centers as a consequence of the discussions and meetings in Sweden. SR also participated in all parental focus group meetings. A moderator from Intermetra, who was informed and skilled in the prepared questioning route, was in charge of the focus group sessions. Behind a one-way mirror, SR and GE followed the audiotaped sessions with a headphone and wrote notes. Focus group participants were informed of and agreed to this arrangement. Regber, Eiben, and Mårild compiled and wrote a report of the Swedish focus groups and individual interviews that were held with community officials (103), and Regber and Eiben wrote the Swedish summary report.

PAPER II

In paper II we studied parental perceptions of their child's weight, health, and concern about overweight and underweight in a large cohort of European children. Children and parents who participated in the baseline survey (T0) of the IDEFICS study were included in the analysis.

ANTHROPOMETRIC DATA

A total of 16 220 2- to 9-year-old boys (50.9 %, n= 8261) and girls (49.1%, n=7959) from Belgium, Cyprus, Estonia, Germany, Hungary, Italy, Spain and Sweden were measured for height and weight with a standard operating procedure used at all IDEFICS centers. The centers used IOTF's BMI index cutoffs (kg/m²) to obtain the measured BMI categories for normal weight, overweight, obesity (4), and thinness grades I–III (104), and BMI z-score was calculated according to Cole (105,106). Weight was measured on an electronic scale (TANITA BC 42 SMA) and height was measured with SECA 225, a portable stadiometer.

PARENTAL QUESTIONNAIRE

Parents answered a targeted questionnaire containing 70 questions that covered a broad range of variables, including dietary and sedentary habits; parental perceptions, attitudes and values; and socioeconomic, sociodemographic and educational variables. In order to evaluate parental perceptions and concerns about their child's body weight and general health, four questions previously used in research were chosen: parental descriptions of their child's health (107,108), derived from a 5-point Likert scale with the response options "very good," "good," "fair," "bad," and "very bad."

Questions about parents' perceptions of their child's weight category (109) also derived from a 5-point Likert scale and included the following options: "much too underweight," "slightly too underweight," "proper weight," "slightly too overweight," and "much too overweight." We judged parental perception accurate if (i) parents of children with thinness grades III and II or obesity responded "much too underweight/overweight", (ii) parents of children with thinness grade I or overweight responded "slightly too underweight/overweight", or (iii) parents of children with normal weight responded "proper weight."

Questions about parents' concern for their child's becoming overweight or underweight (110) were obtained from a 4-point Likert scale of responses to the following question: "How concerned are you about your child becoming overweight/underweight?" Response options included "unconcerned," "a little concerned," "concerned," or "very concerned." To compare responses by country, we combined "concerned" and "very concerned." Parents' educational level was classified according to the International Standard Classification of Education (ISCED) (111).

The data was described and analyzed separately for each of the eight countries and also for European geographical regions and for all countries together. Northern Europe included Estonia and Sweden; central Europe included Hungary, Germany, and Belgium; and southern Europe included Cyprus, Italy, and Spain.

STATISTICAL ANALYSIS

In paper II we used descriptive statistics and logistic regression models to analyze all data from the parental questionnaire. To test differences between countries, chi-square tests were used for categorical variables and the Kruskal-Wallis test was used for continuous variables. Results were presented as percentages or mean values with standard deviations. The nonparametric Spearman's rank correlation coefficient was used to assess the relationship between children's measured BMI and parental weight perception. Logistic regression models were used to identify independent predictors of accurate parental weight perception about children in the (i) overweight and obesity categories, (ii) the obesity category only, and (iii) in

the underweight category only (data for the underweight category analysis, see Paper II, Table 3). First, univariate regression (unadjusted) analyses were carried out to identify the potential predictors of accurate weight perception. The potential predictors included BMI z-score, age, gender, education, parent concern that a child will become overweight, and European geographic region. Second, multivariable-adjusted logistic regressions (using a forward stepwise method) were performed to identify the independent predictors of accurate weight perception. Results obtained from regression analyses are presented as odds ratios (ORs) and 95% confidence intervals (CIs).

PAPER III

In paper III we applied a cross-sectional, epidemiological, comparative register study using a case-referent design. Two hypotheses were assumed to answer the research questions. The first hypothesis claimed that children and families with disadvantageous socioeconomic and sociodemographic family characteristics were likely to be underrepresented in lifestyle-related health studies. The second hypothesis claimed that children with overweight or obesity were underrepresented.

Paper III was part of the IDEFICS project but it studied only Swedish participants. Swedish IDEFICS participants were compared to a reference population and matched by age, gender, and municipality using register data from Statistics Sweden, a government agency that maintains national population registers. Matching was accomplished using unique personal identity numbers (PINs)(112). Three municipalities in western Sweden were included in IDEFICS/Sweden: Partille, Alingsås and Mölndal.

ANTHROPOMETRIC DATA

Anthropometric data were collected using PINs from healthcare records of 3367 children at CHCs and SHSs in the three municipalities. Children's heights and weights were collected from the records at birth, 6, 12, and 18 months and at 2 ½, 4, 5 ½, and 8 years, respectively, and recorded using EpiData software (113). Time limits for collecting growth data at the different ages were set to ± 2 months for all time points except for 5 ½ years and 8 years. The time limit was extended by $\pm 1/2$ year for age group 5 ½ and by ± 1 year for age group 8 years, explained by different routines at CHCs and SHSs for their age-time points for health visit checkup.

REGISTER DATA

In paper III we retrieved and analyzed register data from Statistics Sweden (114) and the Medical Birth Register at the Swedish National Board on Health and Welfare (115). Sociodemographic data from Statistics Sweden included country of birth for parents and children; type of family (e.g., single or cohabitant/married parents); number of children in the household ≤ 19 years; parental education; and socioeconomic data describing the family's disposable income. The disposable income variable included (i) earned income, (ii) study loan, (iii) social allowance, (iii) unemployment compensation, and (iv) disability pension. Analyzed data from the Medical Birth Register included (i) mother's age, (ii) mother's BMI at maternal health care enrollment, (iii) mother's smoking habits three months before pregnancy, (iv) child's height and weight at birth, (v) single or twin births, and (vi) large or small for gestational age at birth.

After collecting anthropometric data, PINs were replaced by a code for each subject. Data from Statistics Sweden and the Medical Birth Registers were linked for all IDEFICS participants who gave informed consent for register linkage.

STATISTICAL ANALYSIS

Comparisons between groups were conducted using the Mann-Whitney U test for continuous variables, the Mantel-Haenzel chi-square test for ordered categorical variables, and the Fishers exact test for dichotomous variables. To test the second hypothesis, Paper III created a BMS SDS index, using the date each child was included in the IDEFICS health survey. The child's recorded weights and heights at the CHC and SHS before and after the inclusion date were used to calculate this variable as an interpolated BMI SDS. A stepwise multiple logistic regression analysis of odds ratios for participation in the IDEFIFICS study was performed and calculated, as well as Area Under the Curve statistics (AUC) to describe the goodness of the predictors. The distribution of gender and age in the IDEFICS population was compared with the general population in the IDEFICS municipalities and differences in outcome of BMI SDS were tested using a bootstrapping method. All statistical testing was 2-tailed with alpha 5%.

PAPER IV

Paper IV is a qualitative interview study with registered nurses working at CHCs in Västra Götaland in the southwestern part of Sweden. This area includes Gothenburg, Sweden's second largest city; small and medium-sized municipalities; rural areas; and the coastal area of Skagerrak, a part of the North Sea. Because all Swedish children are offered cost-free health visits at CHCs, by law, from birth until age 6 years, the entire child population is at focus for

health monitoring and health promoting activities through CHCs. The CHC in Västra Götaland employs around 270 nurses.

A purposeful criterion sampling of 15 CHC nurses participated in this study with the intention to cover catchment areas of CHCs with different demographics and SES. The nurses were contacted through written and oral information distributed to the four Child Health Developers in the districts of Västra Götaland and through personal contacts (SR) established during the collection of anthropometric data for Paper III. A semistructured interview guide covering predefined themes was used during the interviews, which lasted between 27–35 minutes; all interviews were tape recorded. The first author, SR, transcribed the interviews verbatim. N'Vivo software, version 9, a computer-assisted qualitative data analysis software (CAQDAS), was used as support for storage, coding, memo writing, sorting, and analysis. The coding and analysis was made deductively, following predefined topics (116,117). Following customary practice, themes and subthemes outside the predefined topics that emerged from the conversational mode of the interviews were analyzed inductively (116,118).

ETHICAL CONSIDERATIONS

Research ethics committees in each country approved the IDEFICS study (DNR 264-07). Both parents and children gave informed consent. Because the study included very young children, each child gave his/her verbal consent. Children could refrain to some components of the study and consent to others. Parents signed a written informed consent. Because children may experience pain during some procedures (e.g., blood sampling), we took steps to ensure that all children received the best possible care. We used knowledge from the Queen Silvia Children's Hospital in Gothenburg on how to relieve pain or fear during such procedures. Another consideration was that those children who declined participation could do that disclosed. Risks associated with the health survey of the child were considered to be low. A possible benefit from the health survey of the child was detection of serious health problems (e.g., high blood sugar, low-density lipoprotein or high blood pressure). A special routine evaluated survey findings, and the research team provided medical referrals in the case of abnormal findings.

The Regional Ethical Review Board at the University of Gothenburg, Sweden approved Paper III (DNR 089-09). The Data Protection Council at Statistics Sweden approved transmission of PINs and municipality affiliations to enable retrieval of anthropometric data from the children's healthcare records at CHCs and SHCs. To link register data, Statistics Sweden required written informed consent from IDEFICS participants. This was not required for the referents. The benefits with the register study were to give detailed and valid information on the IDEFICS participants and their representativity of different socioeconomic and sociodemographic groups in the society. This information was important for outcome interpretation. Although any publications would focus on the population level, there was an assumption that some individuals might feel stigmatized if they identified themselves as belonging to a risk group. This concern was considered and balanced against the benefits of increased knowledge of any associations between socioeconomic and sociodemographic backgrounds and childhood obesity.

An approval from local ethical committees for the two qualitative studies was not regarded necessary. Discussion groups in Paper I focused on diet, physical activity, and family routines, contents that had no ethical implications. In addition, the advantage of focus groups is that a single participant can be quiet and let others talk if they don't want to express their feelings about any of the matters discussed. Also, the marketing company that assisted in the discussions had a long experience in focus group research and was acquainted and prepared for any inconvenient situation that might have occurred during the meetings. Parents received written information about the background and aim of the study, voluntary participation, recorded discussions, and anonymity in any context except the focus group meeting. Children invited to attend the focus groups were required to accept participation on

the basis of rights granted by UNCRC to be heard and to participate in all matters affecting them (Article 12) (53).

Since we did not collect personal data we did not apply for ethical approval for paper IV, in agreement with Swedish law on “ethical review of research involving humans” (2003:460). However, we followed WHO’s an ethical recommendation for qualitative studies regarding all interviews and information given to study participants (119).

RESULTS

PAPER I

The results described in Paper I showed wide variability within each country, but also between countries. The results presented below include a summary of the eight European countries, but the quotations are only from the Swedish focus group discussions (103).

FINDINGS AMONG PARENTS

Barriers against healthy eating at home

Barriers against healthy eating at home were easy access to unhealthy products at all times. Other common barriers included stress and lack of time for food preparation due to busy working schedules. One Swedish parent expressed stress and lack of time as follows:

“It is stressful when you come home, you are badly prepared, you look at the potatoes that needs to be boiled for about 30 minutes, the children are yelling because they are so hungry and then you end up making sandwiches instead.”

Parents also mentioned the readiness of other family members to break the rules, unhealthy preferences of partners, shortage of money to buy healthy food products, and difficulty in understanding food labels.

Facilitating factors for healthy eating at home

Factors that facilitated healthy eating at home included parents providing good role models and offering water as the first choice of beverage, the (un)availability of (un)healthy food products, establishing the habit of eating breakfast and offering healthy snacks in a child-friendly way (i.e., cutting fruit and vegetables into small pieces). Swedish parents emphasized the importance of having structured meals in the home rather than firm rules (e.g., keeping regular meal times, eating together at the table, eating what is served, tasting everything, and serving no sweetened beverages on weekdays).

Barriers/facilitators for healthy eating at kindergarten and schools

Barriers and facilitators differed according to country, mainly due to different school systems. Sweden was exceptional. Parents had a positive attitude about the food served at kindergartens/schools and considered the food to be good, varied, and healthy. Swedish parents also appreciated regulations that forbade soft drinks and candies. Parents in the other countries mentioned the lack of regulations or policies for the food served at school, low

quality, availability of soft drinks and unhealthy snacks, and high prices. In some countries, children had to bring food from home. Only Estonia and Sweden offered school meals free of charge. In Sweden, parents reported that they knew less about *how much* the children were eating and didn't really keep track of what food was served at school. One parent expressed herself in this way:

“Thus, as a parent, you know probably not so much, but it is terrible that I do not know, now when I think about it.”

A Swedish parent reported the positive role of kindergarten/school in healthy eating by describing that her child showed her a healthy piece of bread in the shop the child had learned to eat in daycare; the mother had thought her child wouldn't like that type of bread. She was surprised and realized day care's positive role and influence on her child's healthy eating habits.

Information about Shopping

Data about shopping showed that prices, promotions, food quality, and partners' preferences influence parents' shopping behavior. Parents with low SES mentioned that unhealthy foods are cheaper and more tasteful and that they must make sacrifices to buy healthy foods. Most parents reported that they avoided shopping with their children because the children are too influenced by advertisements and free gadgets.

FINDINGS AMONG CHILDREN

Barriers

In most countries children mentioned that all kinds of beverages and foods were available in their homes. But also here was a variation. Children in Cyprus, Belgium, and Germany mentioned that their parents regularly allowed them to have soft drinks. Swedish children reported that this ranged from strict rules to the possibility of having soft drinks every day. One child described his home in this way:

“I think I'm allowed to drink soft drinks every day, but we don't have soft drinks in my home.”

In schools, variability ranged from the possibility of buying beverages or snacks at school (Estonia, Germany, and Hungary), bringing food to school (Italy, Germany, Belgium, Spain, Cyprus), and schools providing healthy snacks such as fruit (Sweden).

Facilitating factors

In all countries, some of the children mentioned that they had to follow rules in their homes regarding food consumption (e.g., children must ask for permission before they eat or drink, and limits on unhealthy food products). Most schools provided drinking water, and children's food preferences included healthy products. Children were also quite aware of what was considered healthy.

PAPER II

The mean age for 2–9-year-old children in the IDEFICS baseline study was 6.0 years; 45.5% were preschool children (2–<6 years of age) and 54.5% were primary school children (6–<10 years of age). Gender distribution was even. Between 1507 and 2566 children were recruited in the eight participant countries. However, gender distribution among parents who completed the parental questionnaire was not even. Respondents were mainly female (n=13452; 82.9%), and rarely males (n=1814; 11.2 %). Several couples completed the questionnaire together (n=231; 1.4%), and several questionnaires had missing information (n=723; 4.5%) (i.e. unknown gender). The results of the four parental perception variables studied in Paper II are not gender specific (i. e., the results are presented for parents as a group).

PATTERNS OF SIMILARITIES AMONG PARENTS IN EUROPE

Parents' perceptions about their child's weight and health in the IDEFICS study showed some similar patterns regardless of the country they lived in. Parents generally perceived their children's health as good or very good, with minor variations between the countries. Parents also perceived their children's weight in a similar pattern. Parental weight perception largely followed a trend corresponding to children's mean BMI z-score in all weight categories (Paper II, Figure 1). However, parents sometimes perceived their children's weight as different as their measured weight category. This occurred in all children's weight categories and among parents in all countries.

Patterns among parents with deviant perception had common trends in the direction of deviation: parents of children with normal weight usually perceived their children as "underweight" and very few parents perceived their children as "slightly too overweight." Likewise, the majority of parents of children in the overweight category perceived "proper weight" rather than "slightly too overweight" and parents of children with obesity perceived their children as "slightly too overweight" or having "proper weight" rather than "much too overweight."

PATTERNS OF DIFFERENCES AMONG PARENTS IN EUROPE

Here, the amplitude of the deviation differed according to country. To illustrate parental weight perceptions, Figure 3 shows the proportions (%) ranked by country. Sixty-three percent (n=1245) of parents of children in the overweight category perceived their children as normal weight.

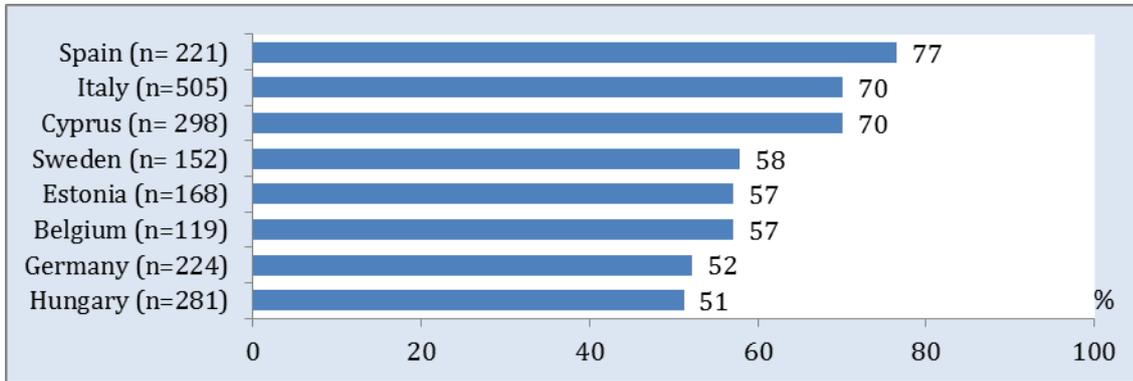


Figure 3. Parents of children in the overweight category who perceived their children as having proper weight in % by country (response numbers in total, n=1968).

In Figure 4, 39% (n=704) of parents of children in the overweight category were concerned that their children might become underweight.

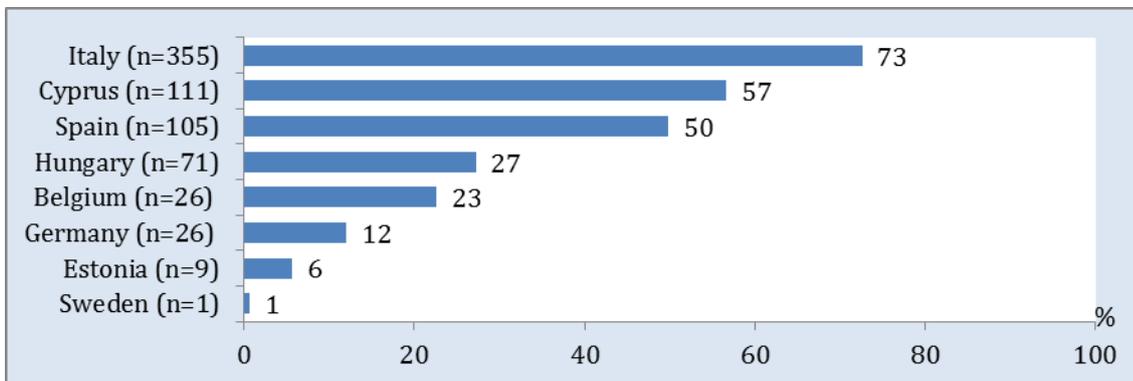


Figure 4. Parents of children in the overweight category (response numbers in total, n= 1801) concerned about their child's becoming underweight (n= 704), in % by country (concern underweight = concerned + very concerned)

The pattern of differences also remained in the trends of ranking for parents of children in the normal weight category (Figure 5). Twenty-nine percent (n=3010) were concerned about their child’s becoming underweight.

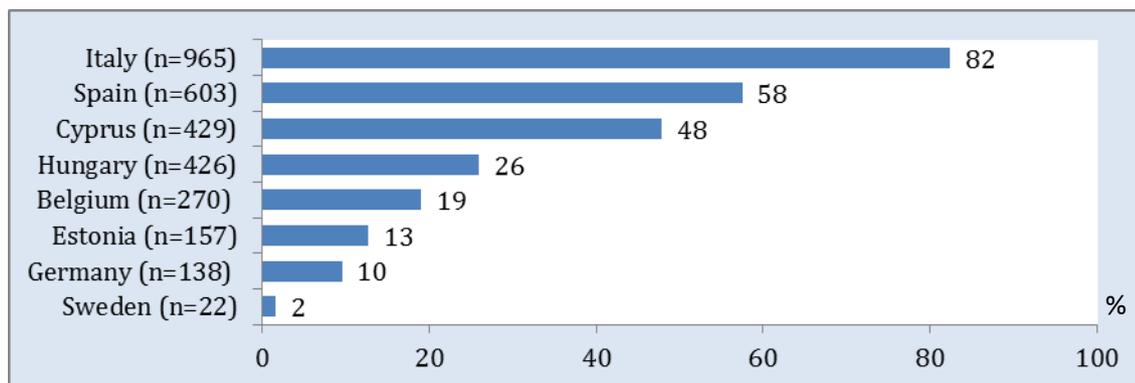


Figure 5. Parents of children in the normal weight category (response number in total n=10 211) concerned about their child’s becoming underweight (n= 3010), in % by country (concern underweight = concerned + very concerned).

PREDICTORS OF ACCURATE PARENTAL WEIGHT PERCEPTION

In the multiple logistic regression analysis of prediction of accurate parental weight perception of children in the overweight and obese categories, regional differences were seen for southern Europe (Cyprus, Italy, and Spain), central Europe (Hungary, Germany, Belgium), and northern Europe (Estonia, Sweden). Results showed that the probability of accurately perceiving children as slightly or much too overweight for parents in central and northern Europe was three to four times higher compared to southern Europe (Table 4).

A second multiple logistic regression analysis included only children in the obese category. The differences between parents from different European regions disappeared, as did the significant gender differences in more accurate weight perception for girls. Increasing age and BMI z-scores, as well as concern for overweight, were the sole predictors of accurately perceiving their children as “much too overweight.” Parental education was not significant in any of the two analyses (Table 4).

Table 4. Multiple logistic regression analysis of predictors of parental accurate perception of children in the overweight and obesity categories (n=3187) and the obesity category (n=1126).

Coefficients	Overweight and Obese, n=3187		Obese, n=1126	
	Unadjusted	Multivariable	Unadjusted	Multivariable
	OR (95% CI)	Adjusted OR (95% CI)	OR (95% CI)	Adjusted OR (95% CI)
BMI z-score	6.72 ^{†††} (5.77–7.83)	7.2 ^{††} (6.06–8.66)	6.01 ^{†††} (4.23–8.52)	13.16 ^{†††} (8.02–21.59)
Age (scale 2.0–9.9)	1.41 ^{†††} (1.34–1.48)	1.34 ^{†††} (1.26–1.42)	1.42 ^{†††} (1.22–1.64)	2.14 ^{†††} (1.70–2.69)
Gender (boys = ref.cat.)	1.19 [†] (1.03–1.37)	1.61 ^{†††} (1.33–1.95)	0.81 ^{NS} (0.56–1.18)	
Education-High (ref.cat.)	1.00		1.00	
Low	1.13 ^{NS} (0.89–1.44)		1.12 ^{NS} (0.63–1.99)	
Medium	1.08 ^{NS} (0.92–1.28)		0.96 ^{NS} (0.61–1.51)	
Europe [‡] South (ref.cat.)	1.00		1.00	
Central	1.73 ^{†††} (1.47–2.04)	3.37 ^{†††} (2.70–4.21)	1.46 ^{NS} (0.97–2.21)	
North	1.33 ^{††} (1.07–1.64)	4.44 ^{†††} (3.30–5.98)	1.28 ^{NS} (0.68–2.41)	
Concern for overweight [§]	3.81 ^{†††} (3.25–4.47)	3.31 ^{†††} (2.71–4.10)	12.51 ^{†††} (3.93–39.77)	7.16 ^{††} (2.19–23.40)

Note. OR = odds ratio; n = number of subjects; CI = confidence interval; BMI = body mass index; NS= not significant; The model predicts perception of “slightly too overweight” or “much too overweight” among children in the overweight or obesity categories, and “much too overweight” in the obesity category. † = p< 0.05, †† = p<0.01, ††† =p<0.001, ‡Europe divided into three geographical areas: Europe-north = Estonia, Sweden; Europe-central = Hungary, Germany, Belgium; Europe-south = Cyprus, Italy, Spain. §Concern for overweight has been dichotomized = “unconcerned” and “a little concerned” = reference category vs. “concerned” and “very concerned.”

DESCRIPTION OF THE SWEDISH IDEFICS MUNICIPALITIES

In paper III we used data from Statistics Sweden (114) to describe the socioeconomic household levels of the Swedish IDEFICS municipalities (i.e., Partille, Alingsås, and Mölndal). A comparison of these three municipalities was made with the Swedish national average for educational level for individuals aged 25 to 64 years and median income in 2007 with the total of 290 municipalities. Alingsås resembled the Swedish average municipality, and Partille and Mölndal were above the average for both measured variables. See fig. 6 and 7.

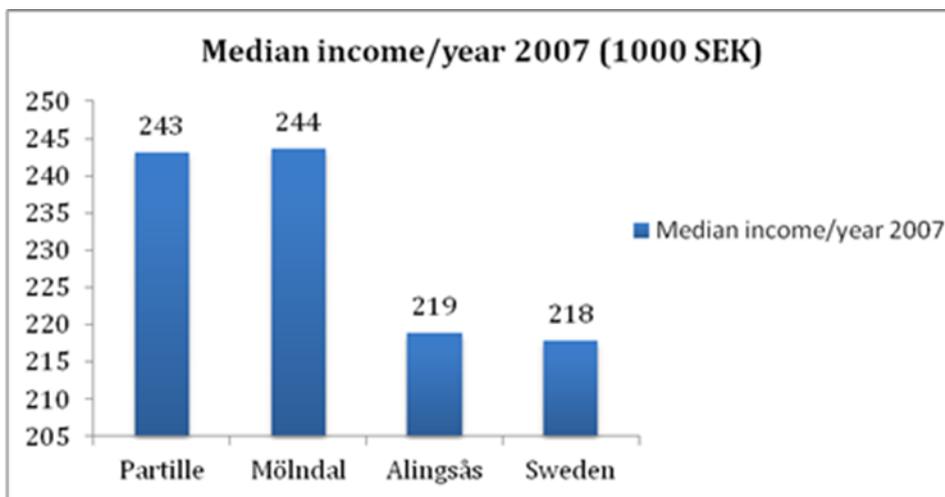


Figure 6. Median income year 2007 in 1000 SEK (Swedish krona) in three municipalities (Partille, Mölndal, and Alingsås) compared to the average Swedish municipality.

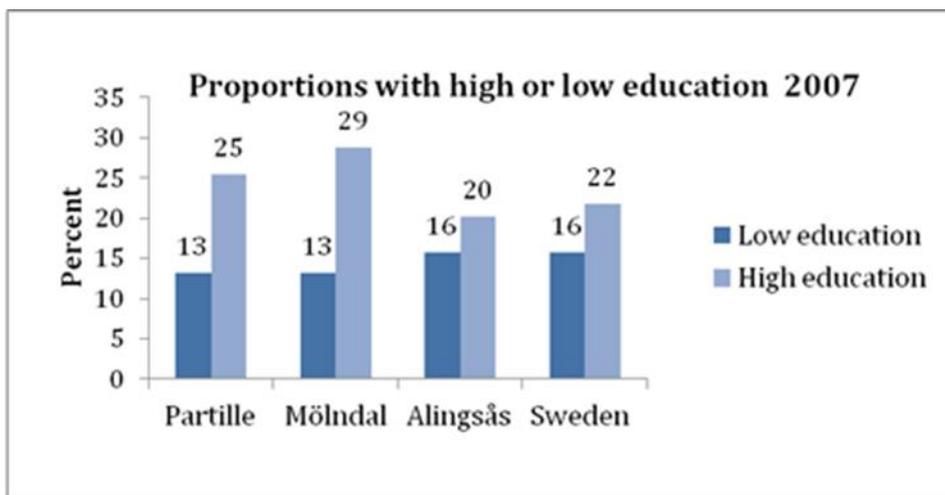


Figure 7. Low or high proportions of education for individuals aged 25 to 64 years in three municipalities (Partille, Mölndal, and Alingsås) compared to the average Swedish municipality.

THE FIRST HYPOTHESIS

Our results showed significant socioeconomic and demographic differences between the IDEFICS and reference populations. Families with single parenthood and foreign background, less education and low income were underrepresented in the Swedish IDEIFICS study, supporting the first hypothesis that families with disadvantageous socioeconomic and sociodemographic family characteristics were underrepresented. Parents in the IDEFICS population had higher disposable income and fewer depended on financial assistance or compensations. Although there were fewer single parent families included in the IDEFICS population, their incomes were higher compared to single parents in the reference population. Parents with the highest educational level were more represented in the IDEFICS population, while those with medium and low levels of education were more represented in the reference population. Compared to the reference population, the IDEFICS population had more parents born in Sweden, married or cohabitating parents, and fewer mothers who smoked tobacco three months before pregnancy. The difference in the number of children in families having two or more children was greater in the IDEFICS population and mothers were slightly older. In contrast, we observed no difference in mothers' BMI at enrollment in maternity care or in the number of mothers having twin or single births (Paper III, Table 3). In a multivariate logistic regression analysis, significant predictors for participation in IDEFICS were parental origin, family type (single or married/cohabiting parents), and parental education (Paper III, Table 4).

THE SECOND HYPOTHESIS

Our results did not support the second hypothesis, where we proposed that children with obesity were likely to be underrepresented in the lifestyle-related health survey, independent of their socioeconomic and sociodemographic determinants. The BMI SDS index at age of inclusion in the IDEFICS study did not differ between the two populations. However, because the collected anthropometric data were longitudinal, we found that the prevalence of overweight and obesity differed at 8 years of age, in contrast to the preceding observations at 2 ½, 4, or 5½ years of age (Table 5).

Table 5. *Comparison of children's anthropometric measurements in the IDEFICS and reference populations*

Child Anthropometric Measurements	IDEFICS Population (n=1825)	Reference Population (n=1825)	<i>p</i> -value
BMI SDS index at age of inclusion ^a	0.110 (1.000) 0.085 (-3.548; 4.010) n=1644	0.169 (0.976) 0.126 (-3.432; 3.671) n=1479	0.1603
BMI categories at 8 years			
Normal weight and underweight	883 (83.2%)	802 (80.0%)	
Overweight	147 (13.9%)	155 (15.5%)	
Obese	31 (2.9%)	45 (4.5%)	0.033

Note. IDEFICS = Identification and Prevention of Dietary- and Lifestyle-Induced Health Effects in Children and Infants; n = number; BMI = body mass index; SDS = standard deviation score. Data are presented as means with standard deviation, median (min; max), or number and percent (%). ^a BMI SDS = Body mass index standard deviation score index.

COMPARISON BETWEEN GENERAL AND IDEFICS CHILD POPULATIONS

We used general municipality registers to compare the general child population in the three IDEFICS municipalities and the demographic characteristics of age and gender in the IDEFICS population. Because the reference population was matched with the IDEFICS population, any skewness in the distribution of age and gender would be reflected in both populations. Population data is updated in November each year and the children in the IDEFICS study were enrolled between September 2007 and May 2008. Therefore, Paper III excluded 36 children younger than 2 years of age, explaining why IDEFICS participants totaled 1789, not 1825.

Our results showed no gender differences, but we observed a significant difference in age distribution. This was most observable in the 6- and 7-year-old age groups. In the entire sample, the differences in proportions by each 1-year age group varied from 0.2% to 3.9%, but varied in direction. However, the bootstrapping analysis we performed to control for the impact of these age differences on BMI SDS showed no effect on the study findings.

Table 6. *Comparison of the general child population, excluding the IDEFICS population and the selection of IDEFICS for gender, age, and place of residence*

Variable	General Population ^a (n=9308)	IDEFICS (n=1789)	p-value
Gender			
Male	4841 (52.0%)	918 (51.3%)	
Female	4467 (48.0%)	871 (48.7%)	0.6076
Age			
2 years	1367 (14.7%)	242 (13.5%)	
3 years	1435 (15.4%)	245 (13.7%)	
4 years	1352 (14.5%)	255 (14.3%)	
5 years	1363 (14.6%)	211 (11.8%)	
6 years	1236 (13.3%)	287 (16.0%)	
7 years	1257 (13.5%)	311 (17.4%)	
8 years	1298 (13.9%)	238 (13.3%)	0.0022
Place of Residence			
Partille	2099 (22.6%)	900 (50.3%)	
Alingsås	2512 (27.0%)	330 (18.4%)	
Mölndal	4697 (50.5%)	559 (31.2%)	<.0001

Note. IDEFICS = Identification and Prevention of Dietary- and Lifestyle-Induced Health Effects in Children and Infants; n = number

^aExcludes IDEFICS children.

The analysis resulted in 332 codes, 16 subthemes and six main themes. Five of the main themes were deductively analyzed according to the topic guide, although one theme (i.e., “lifestyle patterns”) emerged from the conversational mode of the interviews and was consequently inductively analyzed. The main themes were; (i) assessment of the child’s weight status, (ii) initiative, (iii) a sensitive topic, (iv) parental responses, (v) actions, and (vi) lifestyle patterns. The subthemes were analyzed as barriers to or facilitating factors in the nurse-parent interaction intended to promote healthy weight gain and prevent development of childhood obesity. Further, the subthemes were grouped according to the owner of the issue of obesity and the owner of the solution, i.e. the nurse or the parent, see table 7 below. The table is inspired by Söderlund et al. (120).

Table 7. *Facilitators and barriers in nurse/parent interaction at child health centers.*

	Obesity prevention issue/solution owner	
	Nurses	Parents
Facilitators	BMI chart Nurses mainly take the initiative No avoidance—a mission Health promoting activities Preventive activities	Concerned parents take the initiative Positive responses
Barriers	Visual inspection only Height and weight chart only Manual calculation of BMI Avoidance or delayed information Voluntariness at CHC is important	Negative responses Parents deliberately want overweight children Unhealthy diet habits Lack of active play

In summary, because healthcare professionals currently encounter increasingly more children with overweight or obesity, the “normalization” of overweight also affects them. The nurses visually inspect children to globally evaluate children’s well-being, physical appearance and mobility. However, to identify overweight or obesity, visual inspection was often unreliable compared to objective measurements of weight status. The traditional height and weight chart as the only growth measurement tool had the disadvantage of being more difficult to interpret in the presence of overweight or obesity. Manual calculation of BMI at CHCs that still use paper health records could also imply a delay in informing parents. As the only

assessment tools for nurses at CHCs, these tools may therefore be barriers in early identification of a child's weight deviation. The use of the BMI chart on the other hand, proved to facilitate detection and identification of a child's overweight or obesity. This was also true for parents when the nurses displayed the BMI chart and explained it to them. However, the use of the BMI chart seemed to be inconsistently used by the nurses in this study.

Parents who reacted negatively were another barrier. These reactions consisted of denial or parents feeling offended; parents sometimes did not accept extra visits or even turned to another CHC. Since the visits to CHC are voluntary, nurses sometimes postponed a discussion about unhealthily high BMI because they did not want to take the risk that parents would fail to come to the health visits. Another barrier identified was a group of parents who believe that "a chubby child is a healthy child", which presents a special challenge for nurses' health promoting and preventive efforts. On the other hand, there were also parents who took the initiative to start the dialogue because they were concerned about their child's weight, or parents who reacted positively and were receptive to discussing lifestyle changes and accepting the extra visits that were offered.

The nurses recognized that obesity is a sensitive topic. Although few nurses in this study reported that they did not avoid the subject, a dialogue about a child's weight status and family habits could be delayed or postponed because of parents' negative reactions. Parents could choose not to attend extracurricular health visits or choose another CHC. On the other hand, the systematic organization of CHCs in Sweden facilitated health promoting and preventive actions. The nurses described structured dialogues with all parents at the ages of 18 months and 2½ years. All parents had to fill in a questionnaire before the appointments about the child's behavior and family habits, and this form served as a basis for the dialogue. At that early age in a child's life, the focus is not on the child's BMI but on behaviors and family habits, which decreases the risk that parents would feel offended or react negatively. However, barriers for a health promoting lifestyle reported by the nurses were unhealthy diet habits such as introducing sweets and candies very early in children's lives and sedentary activities that replace active play in preschool children.

DISCUSSION

This thesis aimed to study facilitating factors and barriers in promoting a healthy lifestyle and preventing obesity in children, with a special focus on parents. Therefore, the general discussion is divided into two dimensions: barriers and facilitators.

BARRIERS

In Paper I, parents described barriers to promote healthy eating behaviors in their 2- to 8-year-old children. At the individual level, one barrier was discerned when parents discussed food rules at home. Some parents bought unhealthy products only for special occasions; others bought everything and had unhealthy products available in the home at all times. Homes where parents make unhealthy foods and beverages available all the time create obvious difficulties for children regarding temptation. Parents also put themselves at risk for getting into a negotiation situation with the child about these unhealthy products, thus challenging the eventual ambition of setting limits in the home (77). Because young children do not go food shopping, the responsibility for what is available in the home rests solely with the parent. Another perspective to consider is parenting styles (78). Hennessy et al. (121) showed that a permissive parenting style (i.e., being highly responsive to the child's desires and placing few demands on the child) is associated with increased intake of low-nutrient-dense foods in American children. The parent-child dynamic around food, relevant counseling, and guidance for parents are important aspects that extend beyond mere advice about the content of foods and having a meal structure in the home. Other barriers were adult family members (e.g., grandparents or husband/wife) who broke rules and didn't share the same values about healthy lifestyle. In qualitative interviews, parents of children with obesity have described how these situations create a source of discord between family members and undermine efforts of lifestyle changes in the family (122).

Barriers at the structural level included busy work schedules that result in a lack of time, lack of money to buy healthy products, difficulties in understanding food labels, and availability of unhealthy products. Avoidance of shopping with children was also mentioned. Because children are largely influenced by advertisements and free gadgets, they "pester" their parents, who then bought more unhealthy products. These structural factors, mentioned by the parents, concur with the social determinants in health concepts; as such, they are also preventable by politics or policies (7). The power and exposure of children to food marketing is massive and begins early (123,124). Therefore, it is necessary to alter the marketing landscape with various legal, legislative, regulatory, and industry-based approaches (125).

In Paper II, the results showed that a substantial proportion of parents of children with overweight and obesity systematically underestimated their children's weight status. These

results concur with several other studies (126-129), concluding that (i) “these perceptions present a barrier to the prevention of childhood obesity” (p.470) (126), (ii) “(...) parental ability to recognize weight problems in their children is non-reliable” (p.260) (127), (iii) to diminish risk factors for pediatric obesity and its related complications cannot be expected if parents cannot recognize their child’s overweight/obesity (128) and (iv) “the underestimation of overweight may impair the motivation of the parents to adopt weight control” (p.1374) (129). In a recent systematic review of parental weight perception, 86% of parents of 2- to 6-year-old children failed to recognize overweight in their child (130). Therefore, it may be unrealistic to expect parents of children with overweight/obesity to take the first step in raising this issue. However, the results also showed an underestimation of 17% (n= 1712) in parents of children with normal weight who instead responded “underweight,” a finding also reported elsewhere (131). Because overweight and obesity have increased in the population, it may have become the norm (131), making some parents think that their normal weight child is underweight. Given that an accurate parental weight perception is important for the prevention of childhood obesity, healthcare professionals need to help parents correctly classify their child’s weight status (129-132) and to be aware themselves that some parents fail to accurately perceive their child’s weight status. However, parents of children with underweight also failed to recognize their child’s accurate weight status. Forty-seven percent (n= 794) of these parents overestimated their children’s weight as normal, findings also supported by others (127), i.e., parents of children in all weight categories need the support of regular physical measurements of the child’s BMI and the communication of the results with parents.

We observed regional differences in accurate parental weight perception of children with overweight and obesity for parents in central and northern Europe compared to southern Europe and also for increasing BMI, age, and for girls (Paper II, Table 3).

Others have reported the tendency to accurately perceive girls as “slightly or much too overweight” compared to boys (126,133), but the reverse, (i.e., parents more likely to perceive overweight or obesity in boys) has also been reported (129,134). The inconsistency in parental gender perceptions may reflect different social values or may suggest that the children are still too young to affect social and cultural values about body ideal. The regional differences in parental weight perception are also interesting because they largely follow the percentage of children with overweight and obesity participating in the IDEFICS study.

However, one important barrier is that increased BMI and older age of the child combined with parents being concerned about overweight resulted in parents showing an accurate weight perception in the category of children with obesity (Paper II, Table 3). Although it seems reasonable that increasing age and more obvious weight deviation might augment parents’ ability to accurately perceive children’s weight, this assumption implies that

expectations of parents who initiate lifestyle changes in preschool children with overweight or obesity may not be realistic. Rhee et al. (135) used Proschaska's model (64) to study children with overweight/obesity and their parents' readiness for lifestyle changes. The researchers reported that parents' readiness for change was more likely when the child was ≥ 8 years of age, parents perceived obesity as a health problem, parents perceived their child's weight accurately, and when doctors had made a comment that the child's weight was a health problem.

Concern about future underweight in children in the overweight and obesity categories may signal parent's general concern for their children's health, but the proportion of concerned parents of such children exceeded that of parents of children in the thinness and normal weight categories. Parental concern about either under- or overweight affects parental feeding practices relevant to childhood obesity prevention. Gregory, Paxton, and Brozovic (136) studied the relationship between maternal concern about a child's under- and overweight and maternal feeding practices in 2- to 4- year old children. They found that "mothers use more pressure to eat when they are concerned about their child becoming underweight, and more restriction when they are concerned about their child becoming overweight" (p. 555).

Taken together, the results of Paper II emphasize the importance of giving parents objective information about child's weight status and the health consequences of obesity as well as discussing nutritious food, healthy eating habits, and appropriate portion sizes (132).

In paper III we reported that the selection bias in the Swedish IDEFICS population showed greater participation of families with more advantageous sociodemographic backgrounds compared to the reference population. The inverse equity hypothesis, described by Victora et al. (137), suggests that "good public- health programmes for improving child health are more available and being utilized by those families who need them least (p.1098)". In paper III we assumed that families with disadvantageous socioeconomic and demographic backgrounds were underrepresented. Therefore, the risk of consolidating health inequities despite reverse intentions requires consideration when implementing health surveys and community health promotion interventions. According to Victora et al. (137), however, this gap is narrowing over time, making health promoting activities worthwhile and still important. The differences in prevalence of obesity at 8 years of age, which were higher in the reference population compared to the IDEFICS population (4.5% vs 2.9%; $p = 0.0327$), may be explained as diverse effects of the "obesogenic" environment on populations with different socioeconomic and demographic backgrounds over time. The consumption of high-quality diets follows a socioeconomic gradient associated with greater affluence, and persons with lower SES prefer to eat energy-dense and nutrient-poor foods (138). Furthermore, low-income families or single parents may work longer hours and have limited time to purchase

and prepare food (139). The reference population in Paper III included more low-income families, single parents, and parents of foreign background. Immigrant adult populations in Sweden show a higher prevalence of obesity than men and women born in Sweden (140,141). Another Swedish study showed that the prevalence of overweight or obesity was higher in children living in areas with low SES and a high proportion of immigrants and refugees (142). Although the differences at 8 years of age reported in Paper III may be occasional, this might be the first sign of a socioeconomic and demographic difference in BMI prevalence that may continue when the children grow older. Other Swedish studies observed that overweight/obesity is more prevalent in 4-year-old children living in disadvantaged areas (23,24). Compared to other Swedish municipalities, the socioeconomic characteristics of municipalities participating in the Swedish IDEFICS study were average or above average (114). Therefore, the differences first observed at 8 years of age may indicate a positive and protective “neighborhood effect.” For example, ecological studies by Evans et al. (143) showed that access to green space in more advantaged neighborhoods resulted in increased physical activity and lower BMI, independent of family income. Results from another IDEFICS study on SES and childhood overweight showed that the gradient of SES and childhood overweight and obesity varies across European regions, indicating a strong influence not only at the family level but also of region and country (144). Therefore, obesity, as a measure of health inequity (22) and a complex web of ecological obesogenic causes (145), may benefit from political decisions and actions taken at the outer layers in the rainbow of social determinants of health (7) to prevent obesity (Figure 1). Altogether, Paper III supports the position that the causes of the childhood obesity epidemic are not limited to individual responsibility.

In paper IV we showed barriers at CHCs concerning growth monitoring and assessment of children’s weight status. The interview study showed that all nurses used the common weight-for-height chart, but the recommended BMI chart (146) was not used by all nurses, or not used regularly, suggesting inadequate guidelines regarding uniform and standardized procedure for these tasks. Some suggest that regular and longitudinal plotting of a child’s BMI (Figure 2) facilitate identification of early weight gain in children (147,148) and activate dialogue with parents on healthy lifestyle issues, possibly enhancing prevention efforts regarding further weight gain.

Others have described the effort to discuss weight issues with parents as difficult and “inherently sensitive” (149,150). Many of the nurse participants reported that raising the issue of child’s overweight or obesity is “a sensitive topic.” Similar to earlier reports (149,150), the nurses feared that they might offend parents or lose parents from the centers. The nurses made efforts to use a defensive approach to avoid provoking parents or jeopardizing the relationship. Still, some parents who were offered extra visits failed to keep scheduled appointments or switched to another CHC. When parents were not receptive or lacked

motivation to cooperate, the perceived lack of options revealed a gap between the care of children by cooperative or uncooperative parents and the impact of voluntariness at CHC. When nurses couldn't reach the parents, some expressed feeling conflicted about the Swedish goals of good health and equal care on equal terms (151) and the goals of the UNCRC to ensure a healthy start in life (53).

In Paper IV another barrier was identified: some parents want “chubby” children. Earlier studies described the view that chubbiness is a healthy sign that indicates successful parenting (110). Influences from older relatives or an irrational and unfounded concern among parents might explain this view. The findings in Paper IV are consistent with the findings in Paper II. A remarkably high proportion of parents worried about their child becoming underweight. Reaching and understanding these parents requires a deeper understanding of this parental perspective and could be a subject for future research.

The theme “lifestyle patterns” revealed several unhealthy dietary habits at the individual level. Some parents lacked knowledge about cooking, while others were good at cooking but gave children servings that were too large. Other parents introduced sweets too early in children's lives. Nurses strove to inform parents to avoid the influence of marketing messages that urge them to buy unnecessary food products, relying instead on their own skills (e.g., cooking their own oatmeal). These findings are in line with Harris et al. (125), who states that food marketing contributes to childhood obesity. The results in Paper IV are largely consistent with what parents reported in the IDEFICS focus group discussion reported in Paper I. These results also point at societal-level interventions to tackle the obesity problem because parents as individuals are also influenced by “upstream” factors” (94). Moreover, many parents relied too much on gruel. Served in baby bottles it was a convenient food product to serve. Some parents served their young children at night or early in the morning, before they ate a “second” breakfast at daycare. Such behavior may be a sign of contemporaneous stress. Lack of active play and sedentary behavior were other issues that had to be raised with many parents. The results from another IDEFICS study investigating television habits showed that habitual television exposure, television viewing during meals, and television in the bedroom indicate increased risk of overweight (152). Additionally, a permissive parenting style associates with high levels of television viewing (153). Parental group sessions provide an opportunity to direct and discuss health issues and parenting styles and to encourage parents to limit and restrict children's screen time. However, the lack of CHC group sessions for parents of older children may be a disadvantage.

FACILITATORS

Parents in the focus groups mentioned a number of facilitating factors to promote healthy eating behaviors in young children. At home, rules or structures (e.g., family meals, no snacking before meals, no eating before dinner or when watching television, tasting everything, and no sweetened beverages on weekdays) were mentioned. At kindergartens, parents mentioned that rules against biscuits, crisps, and chocolates facilitate healthy eating habits. However, only Swedish schools seemed to have clear regulations (e.g., allowing only healthy snacks, such as fruit). The food served at Swedish schools was considered good, varied, and healthy. Only Estonia and Sweden offered school meals free of charge. Importantly, this social determinant of health is influenced by regulations and politics (7). Therefore, children's school meals may be a facilitating factor in one country but a barrier in another, pointing to the importance of building protective societal structures to support parents and children in our contemporaneous obesogenic environment (13). Parents viewed group pressure as both a positive and a negative factor. Peers or older children can function as a good example: "children are stimulated to eat healthy food products if they see other children eat those products." Kindergartens that practice this approach can support parents' efforts at teaching their children to eat and enjoy healthy food products.

A substantial number of parents perceived their children's weight category accurately (Paper II, Figure 1). This is a facilitating factor in the prevention of childhood obesity. The similarity among parents in all eight countries regarding deviant patterns in parental weight perceptions is valuable knowledge. Healthcare managers and planners can take action and educate healthcare professionals in this regard. In USA, some states require or recommend school-based BMI screening to identify children at risk for weight-related health problems and send parents a notification (154). Sweden regularly monitors children for height and weight, but there is no mandatory parental notification of their child's BMI to the very best of my knowledge.

The IDEFICS and reference populations were similar in several respects concerning maternal and child characteristics at birth. There were no significant differences in mothers' BMI at enrollment in maternity care, child's weight and height at birth, ponderal index at birth, single and twin births, and children born too large or too small for gestational age. Children's BMI at 2½, 4, and 5½ years of age did not differ between the two populations. These are positive signs of a fairly equal start in life.

Another facilitating factor for studies and early interventions such as the IDEFICS study was that we found no selection effect related to children's BMI at the time of inclusion in the IDEFICS study (i.e., children with overweight or obesity were not underrepresented). Assumptions that might explain this finding include; (i) because the IDEFICS study focused

on 2- to 9-year-old children, the well-known stigma of childhood obesity may be less severe than that for older schoolchildren (59); (ii) parent's inability to accurately perceive their child's overweight or obesity status (155); and (iii) children in the IDEFICS study lived in municipalities with average of above average socioeconomic status compared to other municipalities in Sweden (114), possibly reflecting a "delay of inequity in health signs." Nonetheless, because Sweden is a reasonably homogenous society with comparatively equal income distribution and the IDEFICS municipalities were not negatively deviant from the average level, these results did not indicate health inequity when using BMI as a health indicator. This finding has important implications for preventive interventions, suggesting that early childhood intervention seems beneficial.

Parents who were concerned, help-seeking, and open to discussing lifestyle changes were viewed as having positive reactions (i.e., they were easier to reach), thus facilitating nurses' prevention at CHCs. The wide range of parental responses when communicating about a child's overweight or obesity includes relief, disinterest, denial, and anger (156). The nurses reported that initial reactions could be strained, but also that parents gradually became more responsive. These situations were described as successful because the nurses had managed to plant a seed for lifestyle changes. The nurses in Västra Götaland are educated in motivational interviewing (157), which may explain the positive outcomes in the dialogue with some parents. On the other hand, if parents were not responsive, some nurses reported that it was their duty to advocate for the children and keep the health of the child in focus. They used several strategies to reach the parents, and their option was always mission, not avoidance.

Several nurses also used the recommended BMI chart. In agreement with others (147-149), these nurses all expressed the usefulness of the BMI chart in identifying overweight or obesity. They considered the BMI chart easy to visualize and explain to parents, irrespective educational background. When the nurses displayed the BMI chart to all parents, no one had to be singled out. The nurses used a participatory approach when displaying the growth chart. Another advantage was that the weight status demonstrated on the BMI chart had nothing to do with the nurses' own opinion. This helped the nurses to keep an objective professional attitude and facilitated the dialogue with parents about how to proceed with a healthier lifestyle.

The high attendance of children and parents at CHCs constitutes a facilitator per se, because 99% of the Swedish child population is reached. Moreover, the several systematic and structured routines at CHCs are health promoting and primary prevention actions (60,67) because at certain ages they reach all children and their parents. The growth measurements conducted during all health visits and the structured health dialogues with parents that occur when their children are 18 months and 2 ½ years of age are such actions. Parents get a valuable opportunity for confidential discussions with the CHC nurse, and the nurses have

an opportunity to inform and educate parents about different health issues. As a secondary prevention action (60,67), nurses referred children with obesity to a physician or pediatrician. A majority of the nurses could also refer parents to a dietitian. Further, personal communication directly with parents at CHCs places the preschool children at an advantage for prevention.

METHODOLOGICAL CONSIDERATIONS

This thesis comprises both quantitative and qualitative studies. The rationale behind each study was governed by the research questions and the purpose of the study. Based on the viewpoint that the question is more important than the methods used, the philosophical underpinnings of pragmatism is the paradigm (101). Taken together, the integration and analysis of the findings of all four studies enhances and complements the area of exploration (158). This thesis mainly applied a deductive research paradigm. In quantitative studies, deduction often implies hypothesis testing. A hypothetical-deductive study is formulated and based on theories as the starting point; certain outcomes are predicted and tested by using predefined variables (101). Close-ended questionnaires support a deductive approach because the items or questions are predetermined by the criteria chosen as important (159). One of the quantitative studies, Paper III, applied hypothetical-deductive analysis, and Paper II used close-ended questions. In contrast, the inductive research paradigm uses an exploratory approach; the discovery of patterns, themes, and interrelationships are the driving logics. In open-ended questions, the respondent is open to answer what is meaningful and comes in his or her way, and the respondent is not enforced to answer predefined categories (159). Close-ended questions have several advantages such as quick and easy to answer, respondents are not disadvantaged if they are less articulate and for the researcher the answers are easy to code and statistically analyze. Disadvantages with close-ending questioning are for example that it forces the respondent in certain directions and simplistic answers.

However, a deductive approach can be applied in qualitative research. Categories can be predefined based on theories or literature search and data can be coded according to categories (116). Qualitative research uses semistructured interview guides to guarantee the use of predefined categories during interviews. In practice, however, qualitative research commonly combines both approaches (118). In this thesis, both qualitative papers used a deductive approach.

Qualitative research strives to be holistic and to gain understanding of the entire issue of research; as the instrument of the research, the researcher is typically intensely involved (101). Therefore, the researcher may also influence the findings, and the subjective bias of the researcher is a component in qualitative research. In addition, the data transcripts are often rich and varied. Nonetheless, the systematicity and transparency in sampling and analysis is shared ground for both quantitative and qualitative research (160).

In the IDEFICS study presented in Paper I, the multi-center focus group discussions had certain strengths. Extensive information was gathered simultaneously in eight European countries in the relatively short period of three months. The advantage of qualitative research is the richness of collected data, but the challenge is interpreting that data in a reliable and

valid way (161). The eight different spoken and written languages in this multi-center study may have been a limitation because valuable language nuances might have been lost. On the other hand, the authors prepared a summary English-language template for all countries to ensure standardization and improve the validity of the qualitative results. The composition of focus groups is considered optimal if they are homogenous. The intention is that people will feel freer and more comfortable when allowed to express their own viewpoints (101). The children's focus groups were homogenous according to gender and all children were recruited from lower socioeconomic areas. Parental focus groups were not homogenous according to gender because gender distribution was uneven. Our aim to have homogenous parent groups according to SES was not possible in three countries (i.e., Cyprus, Italy, and Sweden) because the population in their intervention communities was generally medium SES. The parents were informed that focus group subjects were about eating and nutrition habits, physical activity, health behaviors, and lifestyle in families with young children. All participation was voluntary. Due to financial constraints, the IDEFICS study did not provide child care during focus groups sessions or language interpretation, possibly restricting the participation of single-parent families and parents of foreign backgrounds.

Paper IV was a qualitative content analysis design, according to Polit and Beck (101). The purposive sampling of 15 professionally experienced nurses from different geographical parts of the region was a strength because their experience with parents and children showed both similarities and variations (i.e., richness in data). The ambition to grant trustworthiness in Paper IV is the systematicity and transparency of the analysis process described, and the results were presented both as subthemes/themes and verbal citations (160). The possibility that an assumed limitation of subjective bias by the researcher (i.e., SR) could have occurred was made explicit, examined, and discussed with her co-authors. There were ongoing discussions between the authors concerning the analysis and understanding of the translated transcripts to strengthen reliability. On the other hand, the researcher's professional acquaintance with the area of research may have been an advantage because interviewees may have felt comfortable in openly discussing the issues of the interview. Paper IV gives descriptions of context, selection, characteristics of respondents, data collection and analysis in order to facilitate transferability. But to further test transferability of the results to other contexts, additional studies should be performed.

To examine relationships between variables, the quantitative methods used in Papers II and III were based on descriptive and cross-sectional designs. Because the sample in the IDEFICS study was not longitudinal, no causal relationship can be established. A strength of cross-sectional quantitative designs such as the IDEFICS study is that a large amount of data can be collected in a relatively short time and several associations can be drawn and discovered between predefined variables (101). The "real world" is studied and compared to

studies conducted in artificial environments (e.g., laboratories), knowledge can be enhanced and put in praxis within a field of public health interest (101).

Paper II included some methodological limitations and strengths. In the parental questionnaire, the parent respondent was predominantly the mother of the child (n=13 542; 82.9%) versus 1814 fathers (11.2%). Both parents jointly filled in the questionnaire (n=231; 1.4%) and 766 responses (4.7%) were missing. However, Paper II reported their answers together as “parental perceptions and concern about their child’s weight.” Therefore, the results in Paper II don’t provide gender-specific answers to the questions. Despite an uneven gender distribution, the sample was large and could have permitted a gender-specific analysis. In other child health population studies, mothers have been the main respondent (162). Another limitation in paper II is that the correspondence between the wording of the subjective response ratings of parents’ perception about their child’s weight and the objective BMI categorizations are not absolute. For instance, instead of using the term “normal weight”, which is the denomination of the IOTF/Cole system, the term “proper weight” was used, and for obesity (the IOTF/Cole system) the wording “much too overweight” was used. It cannot be excluded that some parents interpreted this differently than what was intended by the researchers. A social desirability bias, i.e. the general wish to present the child in the most favorable way, may have affected the responses of the parents (163).

The majority of children in the IDEFICS study were assessed by their parents as having good health, possibly because the children were drawn from the general population, not hospital or primary health care samples. Our results concur with a Finnish population-based survey of 4032 children under 12 years of age and an English health survey of over 13 000 children aged 2–15 years, both using a 5-point general health scale wherein most parents rated the health of their children as good at 97% and 93%, respectively (162,164). However, we could not rule out that the answers in Paper II show a ceiling effect i.e., “the effect of having scores at or near the highest possible value, which can constrain the amount of upward change possible and also tends to reduce variability in the variable”(p.721)(101). However, measuring perceived general health status is the most commonly used public health indicator in health surveys recommended by WHO (108), which uses five verbally indicated categories that include the common terms “good” and “bad.” In agreement with the results in Paper II, responses to this question give a unimodal skewness toward “good health” (165). An important strength in the IDEFICS study is that it included a large sample of 16 220 young children. The children were objectively measured using standardized methods. The inclusion of eight participating countries also allowed the assessment of differences and similarities among countries and cultures. Compared to other child health population studies the response rate in the IDEEFICS was somewhat lower, however (51% response rate). In Finland, parents of children aged less than 12 years (n= 4032; response rate 67%) were asked to complete a questionnaire (162) and, in Germany, children 0 to17 years of age (n= 17 641;

response rate 67%) were measured for height and weight (166). The response rate in both studies was higher than the response rate for the IDEFICS study. However, an array of investigations in the IDEFICS study claimed broader engagement of the participants, which may explain a lower response rate.

A methodological strength of Paper III was its ability to use unique PINs (112) to closely match a referent child with the IDEFICS child living in the same municipality and to compare the two populations. The Swedish registers are derived directly from the authorities and have very little missing data, granting validity to the information in the study. Another strength was the possibility of gathering anthropometric data about the children from CHCs and SHSs. Because these data were gathered longitudinally, from birth until the age of 8–9 years, the prevalences of the different weight categories could be determined over time.

Concerning the group of parents with a low educational level, this group was 1.3% in the IDEFICS population and 2.7 % in the referent population, which is low in comparison to the national average educational level of 16 %. However, the national population includes individuals aged between 25 and 64 years, which may explain these differences since the older generation often has less education compared to the younger generation, e.g. the parents in papers II and III. In paper III, due to a rather small sample size in the low education group, the estimates in the logistic regression analysis will result in rather wide confidence intervals (i.e. there is some uncertainty in the point estimates for the OR).

CONCLUSIONS

Paper I: The findings from the focus group discussions showed a large diversity between and within countries in the environment of eating behaviors for children aged two to eight years. Children meet different rules at home and at school and the variability between families is large, e.g. from having strict rules for the consumption of unhealthy products to allowing everything. Parents meet several barriers for supporting healthy eating at the family level, such as lack of time, financial constraints and family members breaking rules. Environmental barriers were marketing and availability of unhealthy foods and beverages to children and difficulties in understanding food labels. Facilitators were e.g. school policies such as healthy and cost-free lunches at school. Therefore, interventions with consistent health messages need to be tailored both at the individual level and the environmental level.

Paper II: Parents of children with overweight or obesity systematically underestimated their child's weight status across the eight participating IDEFICS countries. Irrespective of the children's weight status, parents in general consider their children to be healthy. Increasing BMI, age and parental weight concern were the sole predictors for parental accurate weight perception among children with obesity. Regional differences showed a more accurate weight perception in Central and Northern Europe compared to Southern Europe. Parents also differed regionally in their concern for future underweight/overweight, with a high proportion of parents in Southern Europe showing more concern for their children's both under- and overweight. Parents need to be informed about their child's objectively measured weight status.

Paper III: There was a selection bias in the Swedish IDEFICS health survey of children two to nine years of age, with an underrepresentation of families with foreign background, single parenthood and low education and income. These families need to be supported in health promoting interventions in the future, and the findings are important to consider when interpreting survey findings. Children's BMI at inclusion had no selection effect, but developing obesity was significantly greater in the referent population. This has implications for preventive interventions, indicating that starting in early childhood is favorable.

Paper IV: The systematic organization of CHCs in Sweden offers favorable opportunities to prevent childhood obesity. All children are measured for growth at all health visits to the CHCs. However, inconsistent use of the recommended BMI chart and lack of quality assurance may impede or delay identification of overweight or obesity. Nurses who used the BMI chart considered it a facilitator for greater recognition of a child's weight status, and it was also easy to display and explain to parents. Nurses viewed obesity as a sensitive topic, and the nurses were the main initiators of a dialogue about a child's overweight or obesity.

The nurses also considered parents to be influenced by the obesogenic environment concerning unhealthy diet habits and too many sedentary activities.

IMPLICATIONS AND FUTURE RESEARCH

SPECIAL OPPORTUNITY FOR ACTIONS DURING THE PRESCHOOL AND EARLY PRIMARY SCHOOL YEARS

To avoid negative influences of selection to interventions and of exposure to the obesogenic environment, health promotion must start at an early age, ideally at conception or at least before the child is about three years of age. Health promotion is most important at these ages because it targets all children. Thus, initiating interventions/actions during early childhood will limit health inequity and inverse health development resulting from different socioeconomic and demographic characteristics. This concept will require future research, including (i) reviews and meta-analysis of the literature of already completed studies on early-age health promotion interventions (ii) international intervention policies,(iii) qualitative studies on practices and traditions in relation to the obesity epidemiology, (iv) on parent's views in each setting and also (v) to conduct intervention studies. Health economy studies may aid the argument for societal health actions directed at children at an early age.

THE IMPORTANCE OF AVOIDING OR LIMITING SELECTION BIAS

To avoid selection bias in health surveys or health promoting efforts politicians and “society” at large must tailor policies and instruments to reach all parents. Information should be translated and adapted to recipients. Flexible routines should be the rule to avoid unnecessary nonparticipation due to parental work schedules, culture, and traditions, etc. Health equity is a fundamental principle in Sweden, and our government has ratified the UNCRC (i.e., the equal right to good health). Therefore, health equity is an important democratic principle for our leaders to act upon. To avoid selection effects, there is also a great need for more research; both qualitative and quantitative studies are important here. Qualitative studies may approach; (i) parents in various socioeconomic circumstances,(ii) healthcare providers,(iii) politicians and community officials (iv) international and regional aspects of policies, and (v)commercial versus social marketing. It is also important to study the long-term consequences of health inequity, using population BMI as a marker.

THE IMPORTANCE OF PARENTAL PERCEPTION AND CONCERNS ABOUT CHILDREN'S BODY WEIGHT FOR THE PREVENTION OF CHILDHOOD OBESITY

Parents' perception of their child's weight category is important because it has implications for the prevention of obesity. Increasing BMI and age and parents having weight concerns were the sole determinants for accurate weight perception for children with obesity. Because

parents may not react during their child's growth trajectory from overweight to obesity, the preschool years may pass without effort to change lifestyle. Therefore, objective measurement and information of children's BMI weight status by healthcare professionals is of great importance. On the other hand, are healthcare professionals aware that a substantial proportion of parents either under- or overestimate their child's weight status? In the combined group of children with overweight and obesity there were European regional differences for accurate parental perception of their child's weight category. Therefore, it is important with further studies of the regional differences in weight concerns and perceptions between northern and central Europe versus southern Europe. Several perspectives can be studied, such as consequences of economic, cultural, and political differences, or possible differences in healthcare systems. The IDEFICS study includes special options to investigate regional differences and the longitudinal effects in BMI-development in relation to differences in parental perceptions at baseline and intervention effects.

COMMUNICATING CHILDREN'S GROWTH DEVELOPMENT BY NURSES AT CHILD HEALTH CENTERS

Sweden's child health centers provide very valuable support to parents and their preschool children. There is a long tradition of going to the centers and the participation rate is extremely high. However, we determined that one important task at the CHC (i.e., growth monitoring of children and the use of BMI as a determinant of health) is not conducted in a uniform and standardized way. The weight for height chart was commonly used while following individual BMI trends was either not being used by all nurses or not regularly used. Guidelines for growth monitoring appeared to be missing or were not followed. It appeared that each nurse had an individual approach monitoring growth and communicating findings. One finding was that visualization of the BMI chart to parents seemed to improve communication about the child's weight status. Some nurses stressed their duty to protect children and fight for the UNCRC. Other nurses experience a great deal of frustration when their perception of a child's weight and health differ from the parents' perception. Was there a risk that parents would leave the CHC if the nurse mentioned obesity or if she said that the parents' ideal of a "chubby" toddler was not the best? The most common consultations are individual meetings. Group sessions were not available for parents of children older than one year. For this group, education and information of lifestyle issues or discussions on parenting styles and limit setting were not in praxis. The valuable support parents may have from the CHC can be improved. There are many research needs: parental perspectives versus the child's perspective regarding the UNCRC, implementation of existing guidelines (e.g. including BMI monitoring in growth monitoring standards), computerization aspects, and also using the nurse's skills in public health approaches, not only in individual consultations. For instance, systematic and routine compilation of unidentified BMI values for certain age

groups would give valuable information on the population level. Longitudinal studies using BMI screening of children at e.g. four and at ten years of age is another example of an important research area. On the European level, it would be very interesting to follow and map the kind of support families with newborn babies receive from family and society in relation to health outcomes.

THE POSSIBILITY OF TACKLING THE FOOD ENVIRONMENT IN A COMMUNITY HEALTH INTERVENTION TO COUNTERACT CHILDHOOD OBESITY IN EUROPE

Focus groups discussions in eight different European countries gave an overview of several changeable items in the environment of interest to target in preventive interventions. Although the situation varies in different countries, common barriers at the societal level included difficulty understanding food labels and financial constraints against buying healthier food. Another common experience involved children pestering their parents while they shopped for food. It is difficult for parents to tackle an obesogenic environment and there is a need for regulation and some restrictions. Policies regarding food labeling could be improved all over Europe. However, divergent structural and societal aspects emerged. Only two of the eight countries (i.e., Sweden and Estonia) serve cost-free, nutritious and healthy school meals. It is important to protect and highlight established health promoting societal structures. Other divergent items include socioeconomic factors, culture, traditions, and family structure; the degree of support provided by society varies greatly. Still, the countries share many phenomena. Children in Europe experience an environment with easy access to energy-dense food, liberal opportunities to view television, and aggressive commercials pitching unhealthy products.

To prevent the harm of the ultra-processed food and drink industries there must be an introduction of public regulations and market interventions. An example would be to regulate and prohibit marketing that sells two or three products at a cheaper price than only one product. Social marketing is an alternative in order to counteract the marketing of unhealthy dietary products. This could include television programs about e.g. cooking skills, nutrition, age-related portions sizes and cheap and easy-to-prepare food for parents with young children. However, for future research, questions are raised as to whether there are European regional or national differences e.g. regarding the impact of the obesogenic environment. Within the IDEFICS project, further research on country-specific environments and their relation to the longitudinal development of health and the prevalence of obesity is a unique possibility.

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