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Using knowledge discovery to identify potentially useful patterns of health promotion behavior of 10-12 year old Icelandic children

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USING KNOWLEDGE DISCOVERY TO IDENTIFY POTENTIALLY USEFUL PATTERNS OF HEALTH PROMOTION BEHAVIOR OF 10-12 YEAR OLD ICELANDIC CHILDREN

by

Brynja Orlygsdottir

An Abstract

Of a thesis submitted in partial fulfillment
of the requirements for the Doctor of
Philosophy degree in Nursing
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Thesis Supervisor: Professor Ann Marie McCarthy

ABSTRACT

Icelandic children can expect to live a long and healthy life and have the right to the highest possible standard of health. Despite this, as in other Western countries, the prevalence of psychosocial complaints and long term conditions in Icelandic children is growing and they are struggling with increased levels of preventable health conditions.

The purposes of this cross sectional, secondary analysis were to perform a psychometric evaluation on the instrument *School-Children Health Promotion*; to describe self-reported health promotion behavior of 10-12 year old Icelandic school children, and to predict novel and potentially useful patterns of health promotion behavior of 10-12 year old Icelandic school children using data mining methods. Existing data from 480 10-12 year old Icelandic school children and 911 parents were analyzed.

Analysis of the instrument *School-Children Health Promotion* indicates that it is, in general, a valid and reliable instrument for measuring health promotion behavior of 10-12 year old Icelandic children. Five factors emerged from the 21 item instrument, which were labeled: "Positive Thinking." "Diet and Sleep Pattern," "Seek Psycho-social Support," "Coping Behavior," and "Health Habits." The results indicated that girls use more positive health promotion behavior than boys; however, differences in health promotion behavior between 5^{th} and 6^{th} grade students were not obvious. The results of data mining analyses, using the classifiers decision tree (*J48*) and logistic regression (*Logistic*) to predict health promotion behavior, showed better performance with the subsets of the five factors and the overall instrument than with the full dataset of 199 items. For the subsets, the logistic regression models performed better than the decision trees with AUC ranging from 0.71 to 0.80. The strongest predictors of health promotion behaviors were validation and caring in friendship, intimate disclosure between friends, and quality of life.

Results of this secondary analysis indicate that friendship is of vital importance with regards to health promotion behavior. Therefore, further studies on the effect friendship has on health promotion behavior of Icelandic children in the 10-12 year old age group are clearly needed.

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CERTIFICATE OF APPROVAL

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PH.D. THESIS

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This is to certify that the Ph.D. thesis of

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To Óli, Örlygur, Bryndís and Ingibjörg

Veiztu, ef þú vin átt,
þann er þú vel trúir,
ok vill þú af hánum gótt geta,
geði skaltu við þann blanda
ok gjöfum skipta,
fara at finna oft.

If you find a friend you fully trust
and wish for his good-will,
exchange thoughts, exchange gifts,
go often to his house.

Eddukvæði úr Konungsbók [From the Poetic Edda]
Hávamál [The Saying of Hár]

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Icelandic children can expect to live a long and healthy life and have the right to the highest possible standard of health. Despite this, as in other Western countries, the prevalence of psychosocial complaints and long term conditions in Icelandic children is growing and they are struggling with increased levels of preventable health conditions.

The purposes of this cross sectional, secondary analysis were to perform a psychometric evaluation on the instrument *School-Children Health Promotion*; to describe self-reported health promotion behavior of 10-12 year old Icelandic school children, and to predict novel and potentially useful patterns of health promotion behavior of 10-12 year old Icelandic school children using data mining methods. Existing data from 480 10-12 year old Icelandic school children and 911 parents were analyzed.

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CHAPTER I

INTRODUCTION

Icelandic children can expect to live a long and healthy life (World Health Organization (WHO), 2006a). Infant mortality in Iceland is low, life expectancy is high, and the economy and health care system are strong. Moreover, due to the importance of good health to children's quality of life and its profound effect on their health as adults, Icelandic children have the right to the highest possible standard of health (Office of the United Nations High Commissioners for Human Rights, 1990; Samningur Sameinudu thjodanna um rettindi barnsins nr. 18/1992; Stein, Stanton, & Starfield, 2005; Svavarsdottir & Orlygsdottir, 2006a; United Nations Children's Fund (UNICEF), 2007). Despite this, the prevalence of psychosocial complaints and long term conditions in Icelandic children is growing. Similar to children in other Western countries, they are struggling with increased levels of preventable health conditions such as being overweight and obese, which can put them at higher risk of morbidity and mortality later in life (Berntsson & Köhler, 2001; Livingstone, 2001; Lydheilsustod, 2004).

Children in the 10-12 year old age group are establishing numerous health behavior patterns that may follow them throughout the lifespan and even into the next generation (Cunnane, 1993; WHO, 2006b). Effective health promotion focused on children in this age group in particular is therefore an investment for the future. Thus, the Icelandic Expert Panel on Health Promotion and the Minister of Health are currently emphasizing healthier lifestyles for children (Fagrad Landlaeknisembaettisins um heilsueflingu, 2003; Heilbrigdis- og tryggingamalaraduneytid, 2007).

Schools are a suitable place for health promotion, and one of the main purposes of school health nursing in Iceland is to promote the well-being of school children and their families (Nutbeam, 1997; Thorsteinsdottir, Hedinsdottir, Halldorsdottir, Davidsdottir, & Barkardottir, 2000). Icelandic school health nurses are in a good position to deliver

health promotion interventions to school children. School based health promotion has been shown to improve the health and well-being of the recipients (Stewart-Brown, 2006). However, not much is known about what 10-12 year old Icelandic school children do to promote their health, or what other can do to positively impact their behavior. Based on the findings of this study, future resources can be aligned to increase the effectiveness of the practices of school health nurses as they address health promotion for Icelandic 10-12 year old school children.

Purpose

The purposes of this secondary data analysis were threefold: first, to perform psychometric evaluation on the instrument School-Children Health Promotion; second, to describe self reported health promotion behavior of 10-12 year old Icelandic school children; and third, to predict novel and potentially useful patterns of health promotion behavior (using the subscales of the School-Children Health Promotion instrument) of 10-12 year old Icelandic school children using data mining methods (as a step in the knowledge discovery in database [KDD] process). Existing data from 480, 10-12 year old Icelandic school children and 911 parents from a study on health promotion behavior of children were analyzed. Following are the specific research questions used to address the purposes of this secondary data analysis.

Research Questions

1. What are the subscales of the instrument School-Children Health Promotion?
2. What is the internal consistency of the main subscales of the instrument School-Children Health Promotion?
3. What are the self reported health promotion behaviors of 10-12 year old Icelandic school children (questions, subscales, and the overall health promotion instrument)?

4. Does the self reported health promotion behavior of 10-12 year old Icelandic school children differ based on their gender and/or grade?
5. Is there a pattern/s of information and important variables/attributes that can predict health promotion behavior of 10-12 year old Icelandic school children?

Conceptual Model and Definitions

The conceptual model developed for this study was the Model of Predictors of Health Promotion Behavior of 10-12 Year old Children. The model was influenced by the Ecological System Theory of Bronfenbrenner, which looks at the development of the person in the context of his/her ecological environments. Bronfenbrenner´s theory consists of layers (environmental systems). Each layer is inside the next one, with the person at the innermost level and bi-directional interactions taking place between the layers. The layers in the Ecological System Theory are: a) Microsystem; b) Mesosystem; c) Exosystem; and d) Macrosystem (Bronfenbrenner, 1979). The Model of Predictors of Health Promotion Behavior of 10-12 Year old Children consists of Microsystem, Mesosystem, and Macrosystem, in addition to a biodemographic factor, and is used to predict health promotion behavior of 10-12 year old Icelandic school children. Bronfenbrenner´s theory and the Model of Predictors of Health Promotion Behavior of 10-12 Year old Children are discussed in depth in Chapter 2.

For the purposes of this study, the conceptual definition of health promotion behavior of children was how children engage in the process of increasing control and improving their health in everyday life (Christensen, 2004; WHO, 2006c). The instrument *School-Children Health Promotion* provided an operational definition of health promotion behavior by capturing this conceptual definition stated above.

Significance

As Icelandic school children are struggling with increased prevalence of preventable health conditions, which can put them at higher risk of morbidity and mortality later in life (Livingstone, 2001; Lydheilsustod, 2004; WHO, 2006a), effective school nursing health promotion for children is an investment for the future (Koivusilta, Rimpela, & Vikat, 2003; Nutbeam, 1997; WHO, 1997). Health and health promotion behavior in childhood provides the foundation for health status in adulthood (WHO, 2006b). This is especially relevant for 10-12 year old children because they tend to be receptive to learning health promotion behavior from school health nurses (Borup, 1998a).

This study is important because there is a lack of literature that explains health promotion behavior in this population. More attention has been focused on health risk rather than health promotion of children so they can learn and act to promote their health as an important foundation for their future health (Cagle, 2006). Once there is a better understanding of current health promotion behaviors of 10-12 year old Icelandic children, school nurses will be in a better position to provide effective interventions targeted for children in this age group based on gender and/or age group.

In a recent nursing KDD study, research data was found useful to predict health behavior (Poynton & McDaniel, 2006); however, KDD has never been used to predict health promotion behavior of preadolescents. By building knowledge with KDD and by using existing cross-sectional research data collected at schools, representing all neighborhoods in Reykjavik, the capital city of Iceland, the investigator might be able to identify unexpected but useful and novel patterns of information that can be of use to school health nurses to better understand and target appropriate strategies to promote the health of 10-12 year old Icelandic school children. By performing a data mining analysis, an understanding of health promotion behavior of preadolescents may be enhanced. Moreover, KDD methods may aid in hypothesis generation for future research of health

promotion behavior of 10-12 year old school children and thus potentially have an impact on decreasing the prevalence of preventable health conditions of 10-12 year old Icelandic school children.

Summary

The overall purpose of this secondary data analysis was to evaluate psychometric properties of the instrument *School-Children Health Promotion*, in order to describe and predict health promotion behavior of 10-12 year old Icelandic school children. To measure health promotion behavior in this population, it is important to determine the validity and reliability of the instrument *School-Children Health Promotion.* This is especially important when instruments are new, or have been shortened and modified from the original (Rattray & Jones, 2007). Existing data were analyzed with traditional statistics in addition to data mining methods. Since Icelandic school children are struggling with an increased prevalence of preventable health conditions, which can put them at higher risk of morbidity and mortality later in life, effective school nurse health promotion for children is an investment for the future.

The model which guides the study and related literature review will be presented in the following chapter.

CHAPTER II

LITERATURE REVIEW

Introduction

This chapter includes discussion of the health of school children, social influences on school children, health promotion of school children (lifestyle of school children), research on health promotion behavior of school children, the conceptual model that guides the study, and knowledge discovery in databases (KDD). The KDD process was chosen for secondary data analysis in this study. It allows the researcher to use high dimensional data to predict some outcome variables of interest. Since it is fairly new in nursing research, it is discussed in a separate section at the end of this chapter.

Literature was identified through online searches of CINAHL, Medline, PsychINFO, ERIC, and PubMed databases for the last 10 years (1996-2007), and reviewed systematically. Additionally, the reference lists of key articles were also searched. All searches were limited to English and the Icelandic language. Search terms used included health, psychosomatic symptoms, health promotion, health behavior, well being, life satisfaction, happiness, quality of life, lifestyle, bullying, friends, friendship, school connectedness, children, school children, preadolescents, knowledge discovery in databases, KDD, and data mining.

School Children

Health of School Children

Health is a resource for life (Nutbeam, 1997) and has an impact on children's quality of life, along with a profound effect on their health as adults (Stein, Stanton, & Starfield, 2005; Svavarsdottir & Orlygsdottir, 2006a). In the year 1948, health was defined by WHO as the "The state of complete physical, mental and social well-being" (WHO, 2007, p. 1). According to Article 24 of the Convention on the Rights of the

Child, which was passed as law by the Icelandic parliament in 1992 (Office of the United Nations High Commissioners for Human Rights, 1990; Samningur Sameinudu thjodanna um rettindi barnsins nr. 18/1992), children in Iceland have the right to the highest possible standard of health. In addition, specific priority areas of the program *Healthy People 2010* for Iceland focus on reducing health differences among children and adolescents due to socioeconomic status of parents, extending psychiatric services, and reducing dental caries among children and adolescents (Heilbrigdis- og tryggingamalaraduneytid, 2001).

Icelandic children have a great possibility of living a long and healthy life. Even though Iceland is a country with only little over 300,000 inhabitants, it has a strong economy and puts great value on general welfare (WHO, 2006a). The health care system is socialized with equal access for all citizens to health care services irrespective of residence, age, or financial status (Log um heilbrigdisthjonustu nr. 97/1990). The total expenditure on health (public and private) was ranked fifth (3,115 US dollars per capita) among the Organization for Economic Co-Operation and Development nations (OECD) in 2003 (2006). Infant mortality is low (2.4 deaths per 1,000 live births in the year 2003), which is the lowest of the OECD countries, and life expectancy is 80.1 years on the average (81.8 years if female and 78.4 years if male) (Organization for Economic Co-Operation and Development (OECD), 2006). Icelandic males have the highest life expectancy in the world; however, Icelandic females rank fourth after women from Japan, Switzerland and Spain (Hagstofa Islands, 2007a).

Although Icelandic children enjoy a high standard of living and are considered to be a healthy population, a recent report from the Icelandic Centre of Child Health Services, based on answers from school health nurses and elementary school principals, showed that 19.25% of Icelandic elementary school children, age 6-16, had a chronic health condition in the beginning of 2005 (Gisladottir, Erlendsdottir, Bjarnadottir, Elisdottir, & Gudnadottir, 2005). The most frequent condition was attention deficit

disorder which affected 29.67% of the children who had a chronic disorder; this accounted for 5.71% of the sample under study (Gisladottir , Erlendsdottir, Bjarnadottir, Elisdottir, & Gudnadottir, 2005). As in the other Nordic countries, the prevalence of chronic health condition among children is increasing and, according to a study from 1996, Iceland has the highest prevalence of chronic conditions (17.00%) among all the Nordic countries (Berntsson & Köhler, 2001). The prevalence of chronic health conditions was even higher (24.5%) when reported by parents in a study of 10-12 year old Icelandic school children (Svavarsdottir & Orlygsdottir, 2006a). However, in that study hyperactivity/attention deficit disorder was only reported as a problem for 15.75% of the children. Mental disorders and learning disabilities counted for 45.89% of the children with chronic health conditions versus 54.11% with physical conditions (Svavarsdottir & Orlygsdottir, 2006a). According to Svavarsdottir and Orlygsdottir (2006a), children with chronic health conditions perceive their quality of life to be lower than children without chronic health conditions. Furthermore, health problems in children increase as they become older. In a Swedish longitudinal study, health of girls got worse with age (from 6^{th} to 9^{th} grade), and they showed an increase in both psychological and somatic symptoms (Gådin & Hammarström, 2003).

Psychosomatic complaints of Icelandic children were similar in 1996 to other Nordic children (Berntsson & Köhler, 2001; Gisladottir et al., 2005; Svavarsdottir & Orlygsdottir, 2006a). In a Swedish study, factors that contributed to ill-being were somatic and anxious/depressed symptoms (Lindberg & Swanberg, 2006). Furthermore, in another Nordic study (Norwegian) adolescents who experienced somatic complaints (headache, stomach ache, backache and feeling dizzy) were unhappier than adolescents who did not have those complaints (Natvig, Albrektsen, & Qvarnstrom, 2003).

Although children age 10-12 are able to report on their own health, no published Icelandic study exists on self-perceived health of school children. In a US study on children age 7-12 (n=302), over half of the children (56%) perceived themselves to be

very healthy. This was fairly consistent with the reports of the parents where 60% reported their children to be without illnesses (Polivka & Ryan-Wenger, 1999). In a large Finnish study of 12 year old school children (n=1,231), half of them found themselves to be very healthy and the other half found their health to be fair or poor (Honkinen, Suominen, Välimaa, Helenius, & Rautava, 2005). Moreover, in a recent UNICEF report, perceived health of US children (11, 13, and 15 years old) was the worst of all the OECD countries. Approximately 22.5% of the US children reported their health as fair or poor. On the other hand, perceived health of children in Spain and Switzerland was considerably better, with less than 10% of children reporting their health to be fair or poor (UNICEF, 2007).

Families who are in a weak position economically and socially are at increased risk of having children with long term health conditions and psychosomatic complaints (Berntsson & Köhler, 2001; Berntsson, Köhler, & Vuille, 2006). However, even though Icelandic children with a low socio-economic background have poorer health than their peers with more affluent backgrounds, the utilization of physician services is the same between the two groups (Halldorsson, Cavelaars, Kunst, & Mackenbach, 1999).

Moreover, the quality of life (QOL) of Icelandic children is high and increasing. A cross-sectional study of QOL of children age 2 to 17 in five Nordic countries, measured at two points in time (1984 and 1996; n=15,000 at each point in time), showed that the 7-12 year old children had higher quality of life than younger (2-6 years old) and older children (13-17 years old), and girls scored higher than boys. The study analyzed QOL from three domains: 1) personal (child's activity, family activity, activity satisfaction, self-esteem, psychosomatic symptoms, peer acceptance, and school satisfaction); 2) external (education, profession, work satisfaction, combined disposable income, poverty, satisfaction economy, type of housing, space, and if the child has his/her own room); and 3) interpersonal (number of siblings, available time, satisfaction family, family type, household size, life events, satisfaction friends/relatives, satisfaction social

support, satisfaction contacts). The Icelandic children scored higher than children in the other Nordic countries on all domains at the second point in time, and they had the highest interpersonal scores of all the Nordic countries (Berntsson & Köhler, 2001).

Quality of life of children from Nordic countries is high compared to other OECD countries, according to a recent report on comprehensive assessment of lives and well being of children in industrialized countries (UNICEF, 2007). Due to insufficient data from Iceland, it could not be included in the overview (UNICEF, 2007). However, in another Icelandic study which looked at health related quality of life (HRQOL), girls were also found to have higher HRQOL than boys (Svavarsdottir & Orlygsdottir, 2006a). Additionally, fathers evaluated the HRQOL of their daughters to be higher compared to their sons. No gender differences were found in the mothers' perceptions (Svavarsdottir & Orlygsdottir, 2006b). In a Norwegian study of 887 adolescents age 13-15, who participated in the *European Network of Health Promoting Schools Project*, no gender difference was found on happiness by gender; however, happiness was found to be higher among the older adolescents (Natvig et al., 2003).

Social Influences on School-Children

According to a recently published report from the Icelandic Prime Minister's Office (Forsaetisraduneytid, 2006), 6.6% of children live in poverty, which is a rate among the lowest of the OECD countries. Most of these children live in single parent households with parents who are younger than 20 years of age (Forsaetisraduneytid, 2006; Olafsson, 2005). In Iceland, divorce rates and single parenting has increased considerably. Between the years 2001 and 2005, 11 marriages out of 1,000 ended in divorce, compared to 8.2 out of 1,000 30 years previously (1971-75) (Hagstofa Islands, 2006a). Furthermore, in year 2000, over 20% of Icelandic children under the age of 15 lived in a single parent household; however, in 1991, less than 17% of children younger than 15 lived with one parent (Olafsson, 2005). More Icelandic women are working

outside of their home than before, and their working hours are getting longer, even though they have more children on average than other European countries except for Turkey (Hagstofa Islands, 2006b; Organization for Economic Co-Operation and Development (OECD), 2006). A recent Icelandic study showed that for close to 90% of parents, it is sometimes or often not possible to coordinate work and family life (Rannsoknastofa i vinnuvernd (RIV), 2007).

According to parental responses in a cross-sectional study of slightly over 3,000 children age 2 to 17, social status has an effect on well-being of Icelandic children (Halldorsson et al., 1999). However, as the study focused on a wide age range, and the results do not distinguish between age groups. Therefore, the results do not specifically focus on the well-being of preadolescents (Halldorsson et al., 1999). Additionally, divorce and conflicts between parents have been shown to have an effect on the long-term well-being of children. In a Dutch longitudinal study called "Ultrecht Study of Adolescent Development," 1,772 respondents age 12 to 30 participated in the third wave of the study, which was conducted in 1997. Results showed that well-being of participants who came from well functioning nuclear families was higher than well-being of children who came from one-parent families, stepfamilies, or from ill-functioning nuclear families. The ones who lived in well functioning nuclear families showed better physical and mental health, and their satisfaction with life was higher. They also bonded better with their mother and father than the other participants (Spruijt, DeGoede, & Vandervalk, 2001). In a European multi-national study called *Health Behavior in School-aged Children* (HBSC), children who lived in a single parent family or a stepfamily found it more difficult to talk to their mothers (79%) and fathers (59%) than children who lived with both of their parents (mothers 83%; fathers 64%) (Pedersen, Alcón, & Rodriguez, 2004).

Children today are spending a large part of their day at school. To address the need for daycare for school children of parents working outside the home, every school in

Reykjavik is offering an after-school program for children in 1st through 4th grade; however, older children may have to spend time at home alone for part of the day (Reykjavikurborg, 2006). The school environment is a very influential place and it is important to make the school a healthy place to be (Borup, 1998b; Samdal, Dür, & Freeman, 2004). The main purpose of school health nursing is to promote general well being of school children and their families (Midstod heilsuverndar barna, n.d.; Thorsteinsdottir et al., 2000).

However, children do not always feel well at school. In an Icelandic survey from 2001, 7% of boys in 5th grade and 10% in 6th grade felt bad or rather bad in school during class. This statistic was a little lower for the girls where 5% in 5th grade and 4% in 6th grade felt bad or rather bad in class. Moreover, during recess, 4% of boys and 7% of girls in 5th grade felt bad or rather bad; and 3% of both boys and girls in 6th grade felt bad or rather bad (Jonsdottir, Bjornsdottir, Asgeirsdottir, & Sigfusdottir, 2002). This statistic was even higher in another Icelandic survey which showed that 19% of 6th grade girls and 26% of the boys reported feeling not good or bad, rather bad or very bad in school (Bjarnason, Jonsson, Olafsson, Hjalmsdottir, & Olafsson, 2006). Children who like school are more likely to feel good about themselves and experience high subjective well being (Samdal et al., 2004). They experience higher life satisfaction and better health; but this association is stronger for girls than boys (Ravens-Sieberer, Kökönyei, & Thomas, 2004). Furthermore, the girls and the youngest age group (mean age 11.88 years) were significantly more likely to have a good perception of their school, teachers and peers (McLellan, Rissel, Donnelly, & Bauman, 1999). In a Swedish study modified from the HBSC Study (Lindberg & Swanberg, 2006), protective factors for subjective well-being were relations to school, teacher, and peers (Lindberg & Swanberg, 2006). This is consistent with results from a study by Natvig et al. (2003), who found that adolescents who had social support from their teachers and were connected to the school

were happier than others. Moreover, the happiest adolescents in the study experienced support from their peers.

Friends play a big part in children's lives, and they can affect attitudes and health related behavior of children. This influence can involve both protective- and risk factors (Settertobulte & de Matos, 2004a). In 2001, 78% of 5th graders in Reykjavik, and 81% of 6th graders said the children in their class were good friends. Moreover, 85% of 5th graders and 81% of 6th graders felt they could be "themselves" at school (Jonsdottir et al., 2002). About 10% of 15 year old Icelandic adolescents feel like outsiders and left out of things; feel awkward and out of place; and lonely; data were not available for younger age groups (UNICEF, 2007). In an Italian study of 330 children age 11-19, the ones who had good relationships with their peers and parents experienced better psychological well-being (Corsano, Majorano, & Champretavy, 2006).

As in other countries, bullying is increasing in Iceland, even though in 1996 the prevalence of bullying in Iceland was lower than in all the other Nordic countries except for Sweden (Berntsson et al., 2006; Nordhagen, Nielsen, Stigum, & Köhler, 2005). That year, 15.1% of Nordic children age 2-17 were bullied according to their parents, while 9.7% of Icelandic children were bullied (Berntsson et al., 2006; Nordhagen et al., 2005). In the same study of parents of approximately 20,000 Nordic children age 2-17 years old, prevalence of bullying was highest in the 7-12 year old age group and boys were more likely to be bullied than girls. In addition, children with psychiatric/nervous problems and hyperactivity were not only at high risk for being bullied, but also for bullying others. Results from the HBSC study conducted in Iceland (Bjarnason et al., 2006), showed that 26% of children in 6th grade had been bullied. However, bullying seems to decrease with increased age since, in that same study, 18% of 8th graders had been bullied and only 13% of the 10th graders. Moreover, in a study of 10-12 year old Icelandic school children, children who were bullied perceived their HRQOL lower than their peers who were not bullied (Svavarsdottir & Orlygsdottir, 2006a). According to Nordhagen et al.

(2005), children of parents with low education and single parents were at higher risk for being bullied, as were children with chronic health conditions.

In a self-reported survey of 11, 13, and 15 year old children from 25 countries, involvement in bullying was associated with poor psychosocial adjustment across all countries (Nansel, Craig, Overpeck, Saluja, Ruan, & Health Behaviour in School-aged Children Bullying Analysis Working Group, 2004). Both the bullies and bully victims reported poor emotional and social adjustment and more health problems than other children (Nansel et al., 2004). However, for 15 year old adolescents in the HBSC study, being a bully victim had a stronger association with low life satisfaction than being a bully (Ravens-Sieberer et al., 2004).

Health Promotion of School-Children

Since health in childhood provides the foundation for health status and, therefore, quality of life in adulthood, effective health promotion of children is an investment for the future (Koivusilta et al., 2003; Nutbeam, 1997; WHO, 1997). The major causes of disease burden in adults are often preventable, with many of these diseases beginning in childhood. School health nurses who put an increased emphasis on health promotion may have an impact on the lifestyles of children that will have an impact into adulthood (WHO, 2006b; Nutbeam, 1997).

Health promotion is not an outcome in itself, but an activity with the aim of helping persons enhance their control over their health and life (Nutbeam, 1997). The idea of health promotion is not new (Awofeso, 2004). Florence Nightingale talked in 1859 about nursing of the well and asked the question “Is all this premature suffering and death necessary?” (Nightingale, 1859/1992, p. 7). On November 21, 1986, the First International Conference on Health Promotion was held by WHO in Ottawa, Canada. The conference was a public response to increasing hope for a new public health movement that focused mainly on industrialized countries. After the conference, WHO

put an emphasis on health promotion to achieve equity in health. The definition of health promotion from the conference in Ottawa is:

> … the process of enabling people to increase control over, and to improve, their health. To reach a state of complete physical and mental and social well being, an individual or group must be able to identify and to realize aspirations, to satisfy needs, and to change or cope with the environment. Health is, therefore seen as resource for everyday life, not the objective of living. Health is a positive concept emphasizing social and personal resources, as well as physical capacities. Therefore, health promotion is not just the responsibility of the health sector, but goes beyond healthy life-styles to well being (WHO, 2006c, ¶ 1).

Today, health promotion is available to all Icelandic children right from the earliest age. Antenatal- and well child care (e.g., routine immunizations, developmental screening) in Iceland is free of charge, and is provided by local primary health clinics for children until they enter school at the age of 6. Subsequently, school health nurses, who are located in most elementary schools in the country, provide well child care for the students until they finish the compulsory part of their education at age 16. School health nurses are employed by primary health clinics, but work in the schools and are therefore able to bridge the gap between the health care system and the school environment (Log um grunnskola nr. 66/1995; Wicklander, 2005). Even though school is not the only site for health promotion for children, it is certainly the most viable choice since all Icelandic children attend school, and have the opportunity to meet with a school health nurse (Bremberg, 1998; Elias, Kress, Gager, & Hancock, 1994; Fok & Wong, 2002; Nutbeam, 1997). Therefore, an emphasis is put on health promotion in school health nursing in Iceland (Gisladottir et al., 2005) by building the best possible physical, social, and spiritual environment in which children can grow up (Midstod heilsuverndar barna, n.d.; Thorsteinsdottir et al., 2000).

An effort to promote the health of children in Iceland is seen in the development of a framework for health promotion by Icelandic school health nurses called *The Six H´s of Health*. This framework includes references to: Healthy nutrition; Have a rest; Happiness; Hygiene; Healthy exercise; and Have courage (Midstod heilsuverndar barna,

n.d.). By the age of ten (5th grade), school nurses have educated children about five of the *Six H's* (Healthy nutrition, Have a rest, Happiness, Hygiene, and Healthy Exercise. Have courage component of the program is taught to adolescents. No studies have been published that measure the effectiveness of this framework.

The *European Network of Health Promoting Schools* is a joint project of WHO, the Council of Europe, and the European Commission (EU) begun in 1991; Iceland joined the project in 1999. The project "aims at achieving healthy lifestyle for the whole school population by developing supportive environment conductive to the promotion of health" (Burgher, Rasmussen, & Rivett, 1999, p. 4). The project is multi-national, with 43 countries currently involved. Many participating countries have dedicated themselves to the project; however, others have faced barriers and challenges due to political changes and priority settings (Barnekow et al., 2006). The project was only carried out in 6 Icelandic elementary schools and 1 preschool. After the foundation of the Public Health Institute (Lydheilsustod) in Iceland in mid-2003, the project was merged with a program called *Everything Affects us, Especially Ourselves [sic]* (Lydheilsustod, n.d.), which focuses on improving the lifestyle of children and their families with increased physical activity and better nutrition (Aradottir & Bjornsdottir, 2002; J. Heimisdottir, personal communication, October 23, 2007). The project is a developmental program sponsored by the Public Health Institute of Iceland and several municipalities in the country, where the municipalities formulate their own policy and action. On November 16th, 2006 it received *The Counteracting the Obesity Award* from the WHO.

Preadolescent years are especially important in health promotion since it is a period when numerous life long patterns of behavior are established (Cunnane, 1993; WHO, 2006b; Neumark-Sztainer, Story, Toporoff, Himes, Resnick, & Blum, 1997). An Icelandic study showed that girls who used health promotive behavior experienced higher HRQOL than girls who did not; however, this difference did not exist for boys (Svavarsdottir & Orlygsdottir, 2006a). In addition, children in this age group have a

positive attitude towards heath promotion. In a qualitative study using a draw-and-write technique, 8-11 year old children were conscious about their health and had a positive attitude toward health and health promotion (Piko & Bak, 2006). Furthermore, when children age 11-14 (n=110) were asked about how they define health and what it means to be healthy, close to half of the participants (42.4%) described it as a health promoting behavior (Buck & Ryan-Wenger, 2003). In Danish studies of student's age 11, 13, and 15, the youngest age group benefited more than the older age groups from health promotion dialogue with school health nurses, and girls gained more from the dialogue than the boys in all age groups. Moreover, students from lower socioeconomic groups were more likely to learn health promotion from the school health nurse than their classmates who came from more affluent families. Children who had greater school satisfaction were also more likely to follow the advice of the school health nurse, discuss the health promotion information with parents, and reflect about the content. The students who perceived their health dialogue with the school health nurse as good were the ones who were in very good health; liked school; were assessed by teachers as doing well in school; and felt they were able to decide on the content of their health dialogue with the school health nurse. The researchers did not report all the results by age groups, so it is not always clear if there were a differences between the 11 year old students and the ones who were 15 years old (Borup, 1998a, 1998b; Borup & Holstein, 2004, 2006).

A study from Australia (based on the HBSC Study) showed that children in grades 6, 8 and 10 who had positive perceptions toward their school environment and positive teachers' perceptions were more likely to engage in behavior that promotes health (e.g., physical activity, dental hygiene, and nutritional intake) (McLellan et al., 1999). The authors found no relationship between experiencing peer support and health promoting behavior (McLellan, Rissel, Donnelly, & Bauman, 1999). However, research shows that friends have an effect on diet and physical activity of children (Contento, Williams, Michela, & Franklin, 2006; Grimm, Harnack, & Story, 2004; Wold &

Anderssen, 1992; Settertobulte & de Mantos, 2004b). Otherwise, little literature is available on the association between friendship and health promotion behavior of 10-12 year old children, but more has been written on the association between friends and health risk behavior, especially for adolescents (Settertobulte & de Mantos, 2004a, 2004b). Moreover, in a Turkish HBSC study on 4,500 students (11,13, and 15 years old), children who were either bullies or victims of bullies were more likely than their peers to live a sedentary lifestyle, watching TV more than 4 hours a day and playing computer games. They also had more difficulty talking to both of their parents (Alikasifoglu, Erginoz, Ercan, Uysal, & Albayrak-Kaymak, 2007).

Life Style of School-Children

As in other Western countries, the life style of children in Iceland has changed during the last decades, as can be noted by an increase in prevalence of overweight, obesity, and cavities in children (Briem, 1999; Erlendsdottir, 2006; Lydheilsustod, 2007). Of 9 year old school children in Reykjavik (the capital city of Iceland), overweight among girls increased from 3.1% to 19.7% among girls from the year 1938 to 1998, and 0.7% to 17.9% among boys (Briem, 1999). In the same group, obesity increased from 0.4% to 4.8% and 0% to 4.8% among boys during these six decades (Briem, 1999). This is consistent with data collected in a school computer information system (from all schools in the greater Reykjavik area) during the 2004-05 and 2005-06 school years, where over 20% of children in 1^{st}, 4^{th}, 7^{th} and 9^{th} grades were either overweight (16.1%) or obese (4.7%) (Erlendsdottir, 2006). These findings are receiving attention since these children are more likely than others to be overweight or obese later in life. They are therefore at risk of getting diseases that have been shown to be expensive for society, such as diabetes, cardiovascular diseases, some types of cancer and musculoskeletal disorders (WHO, 2006b). Furthermore, oral health of Icelandic children is declining. In a recent report on oral health status of 12-year old Nordic children, prevalence of cavities

in Icelandic children is increasing and is the highest among Nordic children (Lydheilsustod, 2007). Results from the Icelandic HBSC study conducted in 2006 showed that only 72% of 6th grade girls and 55% of the boys brush their teeth more than once a day (Bjarnason et al., 2006).

Nutritional patterns of children change as they get older (Hackett, Gibbon, Sratton, & Hamill, 2002; Hart, Bishop, & Truby, 2002; Lytle, Seifert, Greenstein, & McGovern, 2000). In a cohort study of children in 3rd, 5th and 8th grades from Minnesota, their breakfast, vegetable, fruit, and milk consumption decreased with increased age. At the same time, the consumption of soft drinks increased (Lytle et al., 2000). At an older age, children are likely to eat foods of their own choice (Hart et al., 2002); however, girls prefer healthier food than boys (Robinson & Thomas, 2004). The social background of children is also associated with their dietary choices. A study from the UK (n=2146) showed that 11 year old children who had mothers working outside of home or who were unemployed, sick or disabled ate less healthy food than the children who lived with a mother who was a full time homemaker (Sweeting & West, 2005). No Icelandic cohort study has been published on nutrition of children as they mature.

In the baseline survey of the project *Everything Affects us, Especially Ourselves [sic]* in 1999 among students in 6th, 8th, and 10th grade, only 20% of the boys and 26% of the girls ate fruit every day and 25.1% of both boys and girls less than once a week. Even fewer children ate vegetables every day. Although girls participating in the study ate more both fruit and vegetable than boys, the quantity decreased for both genders with increased age (Lydheilsustod, n.d.). Results of a newly published dietary survey conducted on 9 and 15 year old Icelandic children and adolescents (n=325) indicated that, despite the low consumption of fruits and vegetables, there are some indications that consumption of both fruits and vegetables in these age groups is slowly increasing (Thorsdottir & Gunnarsdottir, 2006). However, consumption of fruits and vegetables in Icelandic children is still among the lowest of the European countries.

Additionally, children eat and drink a lot of food and beverages with added sugar (Thorsdottir & Gunnarsdottir, 2006). Boys drink more soda than girls, and younger children drink more sodas than the older age groups (Steingrimsdottir et al.,2006). These findings are consistent with results from others studies which show that the caloric intake of young Icelanders is increasing (Thorsdottir, 2005).

No Icelandic study has been published on nutritional status in relation to socio-economic status; however, studies from other countries indicate that children with low SES background are more likely to eat unhealthy food and are less knowledgeable about healthy diets (Hart et al., 2002). Moreover, in a prospective longitudinal study comparing SES with behaviors for oral health, children from low SES background consumed more sweet beverages and at the same time had a greater number of cavities (Hamasha, Warren, Levy, Broffitt, & Kanellis, 2006).

It is not just the nutritional patterns of children that are changing, but also patterns of physical activity and sedentary lifestyle. The time children spend watching television is increasing. Around 15% of Icelandic girls in 6^{th}, 8^{th} or 10^{th} grade watch four or more hours of television, DVDs, or videocassettes a day on weekdays, and close to 40% do so on weekends. Boys watch these media even more than the girls. Almost 20% of Icelandic boys at the same grade levels watch four hours or more of television on weekdays and 45% do so on weekends. The time boys spend using the computer is more than they spend watching television; however, girls spend less time using the computer than watching the television (Steingrimsdottir et al., 2005). In 2003, 66% of children in a survey (n=786) of Icelandic 10 to 15 year old children had a television in their own room, and 40% of them watched television alone (Broddason, 2005).

At the same time as children are spending a lot of time watching television and/or using the computer, only 47.6% of boys and 36.8% of girls in 6^{th}, 8^{th}, and 10^{th} grade meet the goal of the Public Health Institute of Iceland of exercising 60 minutes or more at least five days a week. These results formed a baseline in 1999 of students in 6^{th}, 8^{th} and 10^{th}

grade for the project *Everything Affects us, Especially Ourselves [sic]*. Although these numbers are a little higher for children in younger grades, the survey results showed that exercise and sport participation decline with increased age. In addition, only half (50.6%) of children in 6th grade walked or biked to school (Steingrimsdottir et al., 2006). This is especially alarming since physical education is a part of the curriculum in all elementary schools in Iceland according to Icelandic law (Log um grunnskola nr. 66/1995).

In a Japanese cross-sectional study of 12-13 year old children (n=7,887), life-style choices of the children had an effect on their QOL (Chen, et al., 2005). Children, who skipped breakfast, ate snacks frequently, participated infrequently in physical activity, spent a long time viewing television, and went to bed late at night had poorer QOL than the children who lived a healthier lifestyle. The instrument used to measure the QOL was a Japanese version of a self-administered questionnaire called COOP Chart, which consists of nine domains: physical fitness, feelings, daily activities, social activities, pain, overall health, change in health, social support and quality of life (Chen, et al., 2005). Moreover, in a Swedish study modified from the HBSC Study (Lindberg & Swanberg, 2006), healthy eating was one of the predicting variables for subjective well-being of 12 year old children (well-being was measured by asking the students "How are you these days"?) (Lindberg & Swanberg, 2006).

Research on Health Promotion Behavior of School Children

Many studies have been conducted on health promotion and health promotion behaviors of children since the First International Conference on Health Promotion was held by WHO in Ottawa in 1986. Most of the studies have been cross- sectional with large sample sizes. However, the main limitation of these studies has been that it is not

possible to establish a causal relationship with data collected in the cross-sectional time frame (Newman, Browner, Cummings, & Hulley, 2001).

As an example of a cross-sectional study, the Health Behavior of School Children (*HBSC*) Study was conducted in many nations in collaboration with the WHO Regional Office for Europe. The aim of the study was to increase understanding of the health of young people (11, 13 and 15 year old children). This study has been conducted every other year for a total of seven times (1983-04 to 2005-06). The number of participating countries has increased from the initial five to 41. Iceland joined the HBSC Study for the first time during 2005-06.

The National Longitudinal Study on Adolescent Health (Add Health) is a large US study of adolescents in grades 7 through 12 and their outcome in young adulthood. It focused on adolescents; however it might have implications for those who are younger. The adolescents participated in the study at three time points; 1994, 1996, and 2001-02 (90,000 participants at the first time point; 20,000 participants at the second and third time point). The aim of the study was to see how social context influences adolescent health and risk behavior (The National Longitudinal Study on Adolescent Health, 2006). Results of the Add Health study have indicated that individual characteristics, family and school environment are associated with health of adolescents and their health risk behavior (Resnick, et al., 1997). An example of another longitudinal study is a large Finnish study (N=11,149) (Koivusilta et al., 2003). Educational level in adulthood was predicted from health and health behavior at age 12-16. Data on highest education attained at age 27-33 (in year 1998) was linked to data from the Finnish Adolescent Health and Lifestyle Study in 1981-1983 and 1985. Results showed that low perceived health and behaviors that compromised health at ages 12-16 were predictive of low educational levels for participants as adults.

As Simpson and Freeman (2004) point out, qualitative literature on health promotion of children is lacking. However, numerous intervention studies have been

conducted with the objective of improving children's lifestyle (Rodeamel et al., 2007; Taylor et al., 2006). Good evidence exists for a range of interventions; for example, those that aim at promoting and facilitating lifestyle activity for children (Rodeamel et al., 2007; Taylor et al., 2006). However, these interventions are often heterogeneously designed and with a small sample size (Licence, 2004). These studies are valuable, but do not directly relate to the purpose of this study, and will therefore not be reviewed specifically.

Summary

In summary, Icelandic children have a great potential to live a long and healthy life. However, they are struggling with an increased prevalence of preventable health conditions which can put them at higher risk of morbidity and mortality later in life. Yet, not much is known about how 10-12 year old Icelandic school children act to promote their health, or what can be done to make a positive impact on their behavior. Icelandic school nurses need therefore new knowledge to understand health promotion behavior of this group to be able to apply effective health promotion interventions.

Conceptual Model

Development of conceptual models is a dynamic process, which gives investigators an important context for their work. Conceptual models are abstract and not limited to any one person, group, situation, or event (Fawcett, 2000; Polit & Hungler, 1995). The conceptual model of this study is the Model of Predictors of Health Promotion Behavior of 10-12 Year old Children. It is influenced by the Ecological System Theory by Bronfenbrenner (1979) and variables that stood out from the reviewed literature and were accessible for this secondary data analysis. Urie Bronfenbrenner (1917-2005) was a developmental psychologist who moved to the United States from Russia as a child. With the Ecological System Theory, Bronfenbrenner changed the

approach many scientists used for research on persons and their environment (Ceci, 2006).

The Ecological System Theory

The Ecological System Theory (see Figure 1) focuses on the development of the person (children as well as adults) in the context of his/her ecological environments. It looks at how the person develops within his/her immediate environment, as well as how the larger perspective can have an influence on the person and his/her close surroundings. According to the Bronfenbrenner theory (1979), the ecological environment consists of layers (environmental systems); with the person at the innermost level, and two directional interactions take place between the layers. The layers in the Ecological System Theory are: a) Microsystem; b) Mesosystem; c) Exosystem; d) Macrosystem (Bronfenbrenner, 1979).

The Microsystem is a pattern of activities, roles and settings where most direct interaction of the person takes place. It represents the immediate environments of the person, like family, school, and peer group. Next is the Mesosystem, which is a system of microsystems and provides a connection between the immediate environment of the person, for example between home and school. Whenever the person experiences a new setting, a Mesosystem is formed or extended. The Exosystem refers to events that have indirect affects on the person's development, and do not involve it as an active member. Examples of Exosystems are the public health policies, or policies guiding the work of the school health nurse. Lastly, the outermost layer is the Macrosystem, which represents the larger cultural context in the development of the person. According to Bronfenbrenner, "The *macrosystem* refers to the consistencies, in the form and content of lower-order systems (micro-, meso-, and exo-) that exist, or could exist, at the level of the subculture or the culture as a whole, along with any belief systems or ideology

underlying such consistencies" (1979, p. 26). Examples of macrosystems are cultural values, customs, ethnicity, and economy.

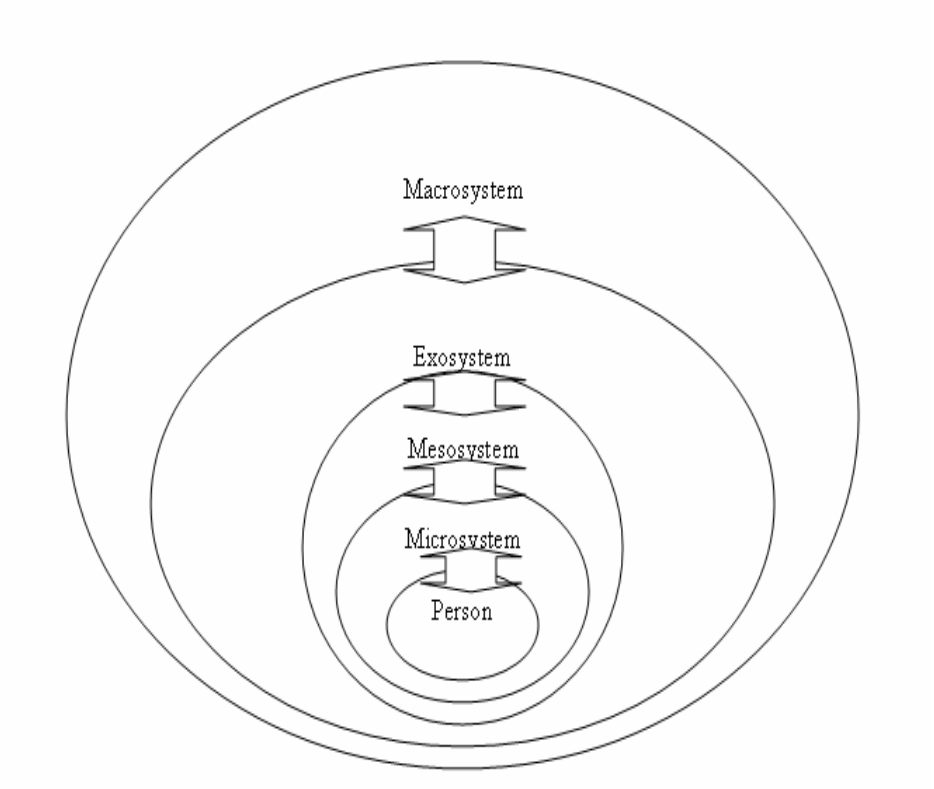

Figure 1. The Ecological System Theory by Bronfenbrenner (1979)

Many studies have been published based on the Ecological System Theory; however, no studies were found that focused on health promotion behavior and preadolescents. Most published studies of the Ecological System Theory have been conducted by both social- and behavior scientists. An example of such a study that used the Ecological System Theory as a framework is a multi-national study looking at risk factors for behavioral problems of 125 children age 7 to 9.6 years from ethnically

different backgrounds. Questionnaires were given to the children and their parents; additionally, parent-child interactions were videotaped. The results showed that problem behavior was predicted by having a lower level of self-worth, lower IQ score, less adaptive temperament, and being a boy (personal level); parental negative behavior, more negative friend- and sibling relationship, and growing up in less balanced families (microsystem level); less parental social support, more parental job spillover, and less levels of parental marital satisfaction (exosystem level); and ethnicity (macrosystem level) (Atzaba- Poria, Pike, & Deater-Deckard, 2004). In another study, which used a convenience sample of 105 adolescents (22% males and 78% females) who attended a pregnancy prevention program, adolescents who did not have a child/children and were not pregnant were compared with adolescents who were parents or pregnant. The authors demonstrated the usefulness of using the Ecological System Theory to group variables related to adolescent pregnancy and parenting. Their findings point toward the need of not only providing sex education and health information to adolescents, but also improving coping with stress (Microsystem), skills to communicate with the family (Mesosystem), and improving resources and opportunities (Macrosystem) (Corcoran, Franklin, & Bennet, 2000).

Health care researchers have also used the Ecological System Theory to guide their studies. A nursing researcher used Bronfenbrenner´s theory as the basis for an ethnographic study. She conducted semi structured interviews based on the theory to describe and understand the experience of 15 -17 year olds with cleft lip and/or palate. The author found Bronfennbrenner´s theory helpful to understand the interaction between the adolescents and the people in their lives, and how it could be strengthened with support (Chapados, 2000). The Ecological System Theory has also been found useful to guide the discussion of a literature review on reasons why women have unprotected intercourse while being at risk of unintended pregnancies (Ayoola, Nettleman, & Brewer, 2007).

Model of Predictors of Health Promotion Behavior of 10-12 Year old Children

The Model of Predictors of Health Promotion Behavior of 10-12 Year old Children (see Figure 2), which is presented in this study, is influenced by three of the layers from the Ecological System Theory by Bronfenbrenner (1979). The layers are Microsystem, Mesosystem, and Macrosystem, which in addition to a Biodemographic factor are used to predict health promotion behavior of 10-12 year old Icelandic school children. The study (Svavarsdottir & Orlygsdottir, 2006a; Svavarsdottir & Orlygsdottir, 2006b) from which the data for this subanalysis were taken did not discuss variables that had indirect affects on the school children; therefore, the Exosystem was not available for the secondary data analysis and is not included in the Model of Predictors of Health Promotion Behavior of 10-12 Year old Children.

The Biodemographic factor in the model includes the variables: a) gender and b) having chronic disease or not. The Microsystem's variables included in a recent study are: a) bullying; b) extra-curricular activity; c) feelings about school; d) friendship quality; and e) quality of life. The study includes three Mesosystem variables: a) grade; b) connection to school; and c) family structure. The Macrosystem variables are: a) education of parent(s); b) ethnic origin; and c) occupation of parent(s).

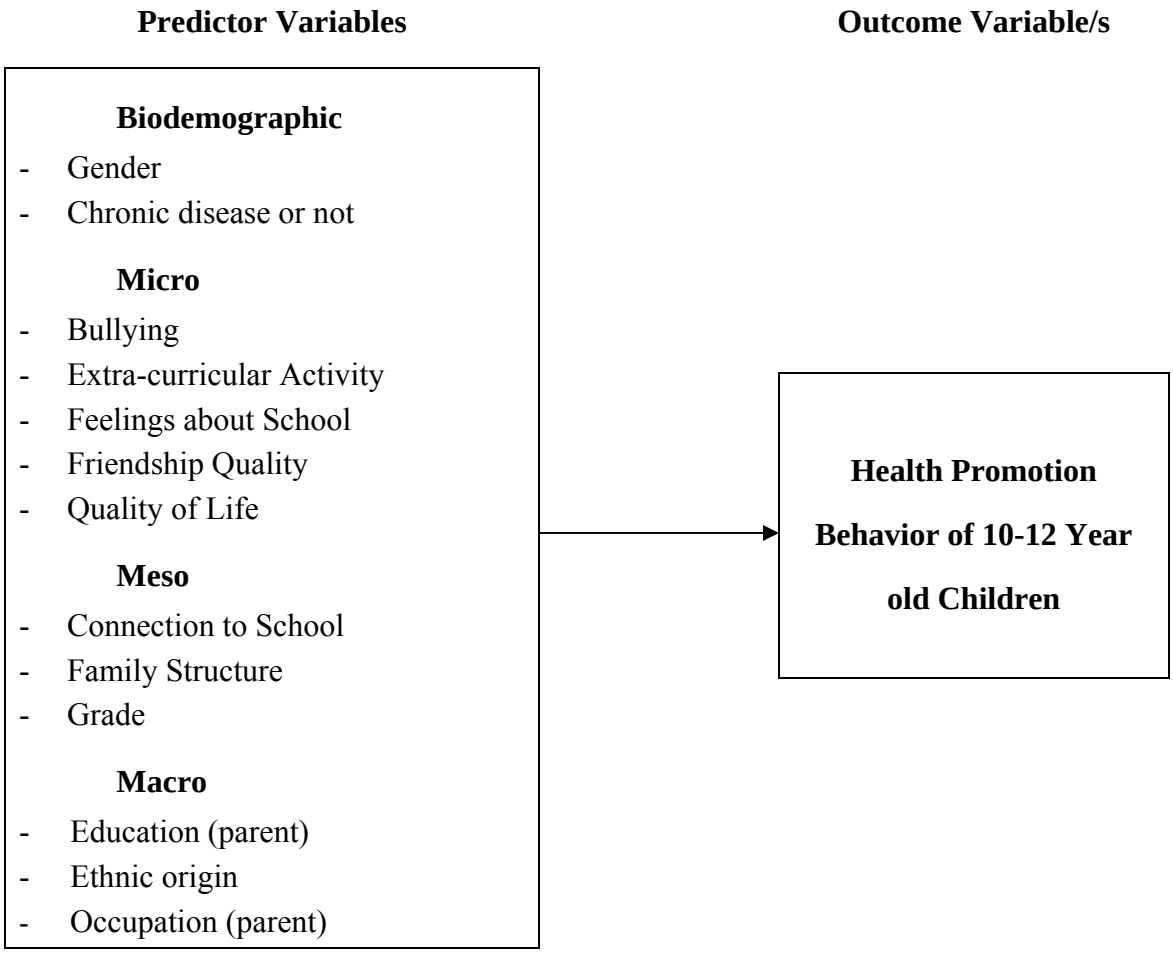

Figure 2. Model of Predictors of Health Promotion Behavior of 10-12 Year old Children

For the purposes of this study, the conceptual definition of health promotion behavior of children is how children engage in the process of increasing control and improving their health in everyday life (Christensen, 2004; WHO, 2006c), as noted in Chapter I. The instrument *School-Children Health Promotion* provided an operational definition of health promotion behavior by capturing the conceptual definition stated above.

Table 1. Relationships between Concepts, Predictor Variables, and Instruments in the Model

Concepts	Predictor Variables	Instruments
Biodemographic	- Gender - Chronic disease or not	- Background Information (children and parents)
Micro	- Bullying - Extra-curricular Activity - Feelings about School - Friendship Quality - Quality of Life	- Background Information (children) - Feelings about School (children) - Friendship Quality Questionnaire (children) - Pediatric Quality of Life Inventory (children and parent)
Meso	- Connection to School - Family Structure - Grade	- Connection to School (children) - Background Information (children and parents)
Macro	- Education (parent) - Ethnic origin - Occupation (parent)	- Background Information (parents)

Table 1 presents the relationship between concepts in the model, predictor variables under study, and the instruments. Data were analyzed with traditional statistics in addition to knowledge discovery in databases (KDD) data mining methods.

Knowledge Discovery in Databases (KDD)

Knowledge Discovery in Databases (KDD) was the process chosen for secondary data analysis in this study. It allows the researcher to use high dimensional data to predict some outcome variables of interest. Since it is fairly new in nursing research, it is discussed in the following section.

KDD is receiving increased attention among nursing scholars for the purpose of discovering unknown patterns and producing nursing knowledge (Goodwin et al., 2001; Lu, Street, & Delaney, 2006; Poynton & McDaniel, 2006; Sigurdardottir, Jonsdottir, &

Benediktsson, 2007). By applying KDD to the existing database, previously unrecognized patterns of health promotion behavior of 10-12 year old Icelandic school children can be detected, which may be of use to school health nurses in better understanding and targeting appropriate strategies in order to have a positive impact on health promotion behavior. Furthermore, results can also help with hypothesis generation and assist Icelandic school health nurses in furthering their development of *the Six H´s of Health* framework.

KDD grew out of recognition of the limitations of traditional statistics to handle vast amounts of data that were being collected as well as the development of profoundly powerful technology tools (Tan, Steinbach, & Kumar, 2006). Large databases often include not only a very large number of records, but also many fields (attributes, variables) (Fayyad, Piatetsky-Shapiro, & Smyth, 1996, p. 26). The data used in KDD research are usually preexisting data (secondary data analysis) and may include audio, text, images, noise, and geographical as well as numerical data (Glymour, Madigan, Pregibon, & Smyth, 1997; Hand, 1998). Data mining software, including "freeware", is readily available for consumers (Hand, 1998; Witten & Frank, 2005).

Even though the terms "KDD" and "data mining" are used interchangeably by many, they are not synonyms (Berger & Berger, 2004). Th-e KDD process is a multi-step process of converting raw data into useful information and knowledge, and is used to guide the process of converting data into potentially useful information and knowledge (Fayyad et al., 1996). Data mining is only one step in the KDD process, which involves the actual application of algorithms to the data (Berger & Berger, 2004). Algorithms attempt to fit data to a model which is closest to the distinctiveness of the data being examined (Dunham, 2003). According to Fayyad, et al., the KDD process is both interactive and iterative and includes the following five steps: data selection, preprocessing, transformation, data mining, and interpretation/evaluation. The KDD process is presented in Figure 3.

The first step of the KDD process focuses on selecting the data to be used in the study (data discovery) (Dunham, 2003; Pyle, 1999). Preprocessing (step 2) involves cleaning the data and deciding how to handle missing data. The data miner may also have to transform data (step 3) into formats that are more useful, and select feature subsets, which, according to Fayyad, et al is "… finding useful features to represent the data depending on the goal of the task" (p. 10). In step 4, the data mining task and data mining algorithm(s) to use when searching for patterns in the data are chosen and the actual data mining takes place. The investigator finally interprets and evaluates the data in step 5 (possible return to prior steps for further iterations) and consolidates discovered knowledge. See Figure 3.

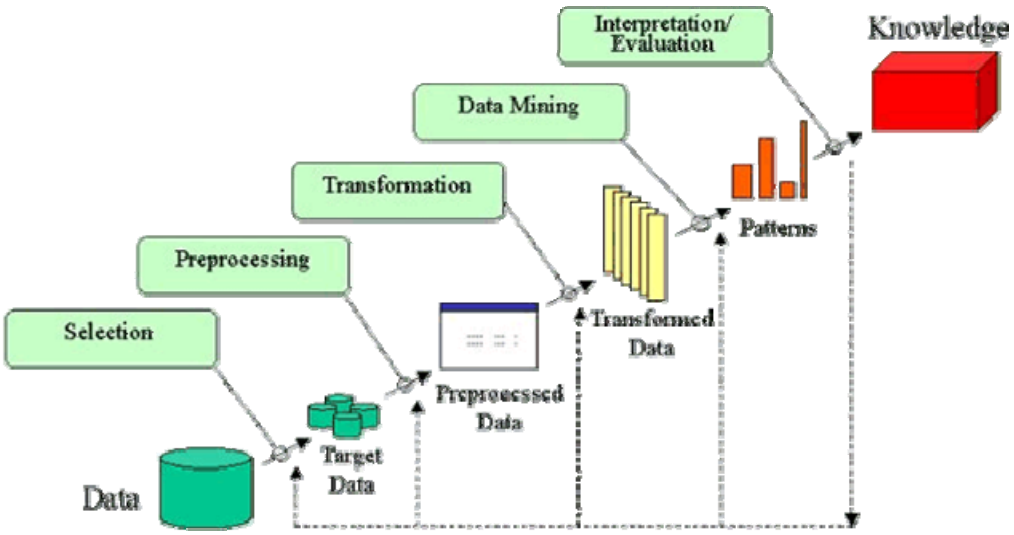

Figure 3. The KDD Process (Fayyad et al., 1996, p. 10)

Data mining has the primary goals of describing, predicting, and building knowledge (Fayyad et al., 1996). The objective of descriptive data mining is to derive patterns of relationships in the data. Examples of descriptive data mining tasks are cluster analysis, association rules, summarization, and sequence discovery (Dunham, 2003). However, prediction uses variables or fields to predict future values of other variables (Chen, 2001; Fayyad et al., 1996; Tan et al., 2006). The tasks of building a model for the dependent variable (target) as a function of the independent variables (explanatory) is called predictive modeling (Berger & Berger, 2004; Tan et al., 2006). One of the main types of predictive modeling tasks is classification (Dunham, 2003; Weiss & Indurkhya, 1998). In classification, data are mapped into classes (groups), which are redefined before the data are examined (supervised learing) (Dunham, 2003). An example is classifying algorithms applied to data to predict health promotion behavior of preadolescents. Two of the classification algorithms are the decision tree algorithm *J48* and *Logistic* (logistic regression). These algorithms are widely published and easy to interpret (Goodwin et al., 2001; Lu et al., 2006; Sigurdardottir et al., 2007; Witten & Frank, 2005).

Decision tree classifiers represent supervised learning where it maps the data into predefined classes in a simple flow-chart tree structure. They require no prior assumption of probability distribution, are computationally inexpensive, robust to noise, and easy to understand (Dunham, 2003; Tan et al., 2006). The purpose of classifying data with decision tree is to discover if it contains well-seperated classes of items that can be interpreted meaningfully. It is a popular classification, originally developed by J. Ross Quinlan, and described as "divide-and-conquer" approach (Quinlan, 1993). The decision tree classifier algorithm *J48* is improved version of the original C4.5 algorithm, which is based on the theory of Information Gain, where there is a split on the node with most information gain (the features with more information is preferred to others) (Tan et al., 2006; Witten & Frank, 2005). The *J48* decision tree algorithm classifies both categorical

and numerical data; however, the output attribute must be categorical. The topmost node of the tree is called a root node and does not have incoming edges; however, it can have zero or more outgoing edges. The root node connects to internal nodes, each of which has one incoming edge and two or more outgoing edges. When a subgroup has the same value for all output features, it is called a terminal or leaf node and reflects decision outcomes. Most decision trees use greedy approach where items are passed through the tree beginning at the root node, so numbers of records become smaller as they travel down the tree. When redundant items are present, they do not harm the accuracy of the decision tree, since when one of the redundant item has been used for plitting, the other one will not be used (Tan et al., 2006). Moreover, so called "pruning" of the decision tree can be performed, and can therefore avoid complex sub-trees, and decision rules (IF - THEN and AND rules) can easily be drawn from the tree and are simple to understand.

Logistic regression is applicable in KDD to solve classification problems by learning a function to estimate output value (classes) based on the input features. The logistic regression classifier *Logistic* assumes that relationship between input features and the response is nonlinear, and builds a model where data is fitted to a logistic curve. It gives a value between 0 and 1, that can be interpreted as the probability of class membership of 0 or 1, which are are independent of each other. A model is created which allows classification of negative or positive classes, where 1 belongs to positive class and 0 to negative class (Witten & Frank, 2005).

Ideally, the data miner tries all possible feature subsets in the data mining algorithms that are being used and chooses the subset/features that provide the best results; however, that may be impossible due to computational constraints. Hence, automated feature subset selection may be a more sensible choice (Tan et al., 2006). A way of selecting features in a computational efficient way is so called filter approach (John, Kohavi, & Pfleger, 1994). Filter approach is when a subset that is most likely to predict class is selected before the data mining takes place, and therefore selects features

without involvement of learning algorithms (Yu & Lie, 2003). One of those automated attribute search methods is called *BestFit*, and uses greedy selection of attributes with backtracking. It can start the search for feature subsets by an empty set of features, or backwards from the full set of features, or even from the midway. The search can be performed in both directions were all possible addition and deletions are considered (Witten & Frank, 2005). Features can be sorted by the *CfsSubsetEval* attribute subset evaluator algorithm, which looks at each attribute individually and considers its predictive value and redundancy (Hall, 1998). It prefers attributes that have low intercorrelation, however high correlation with the class. Features that have the highest correlation with the class are therefore added to the subset, if the subset does not already include a feature that correlates even higher with the class (Witten & Frank, 2005). The subset can be evaluated by comparing classification of it to the full dataset (Tan et al., 2006).

When classifiers classify objects incorrectly they are considered to be misclassified. Moreover, the algorithm *ZeroR* predicts the proportion of correctly classified objects, which is called accuracy (Witten & Frank, 2005). To evaluate the performance of the classifiers, a 10-fold cross validation can be used. Ten-fold cross validation is a standard way to measure error rates by estimating the performance; this is done by partitioning the database into ten randomly selected equal sized parts. Ten rounds of training and testing are performed, where the learning scheme is trained on nine-tenths of the datasets and one-tenth is held out as test data. The data (fold) that is used for testing rotates for the test/training rounds (Witten & Frank, 2005). By summing up the error for all 10 runs, the total error is found (Tan et al., 2006). Correctly and incorrectly predicted instances can be summarized in a confusion matrix (2x2 table), where sensitivity (true positive rate) and specificity (true negative rate) can be calculated. Moreover, the Receiver Operating Characteristic (ROC) curve is a graphical method to compare performance of different classifiers by demonstrating the tradeoff between false

positive rate and true positive rate. Since the false positive rate is plotted on the x - axis and the true positive rate on the y - axis, the location of good classification models are in the upper left corner. When area under the ROC curve (Area under the Curve (AUC)) equals 1 the model is perfect; however, when the AUC equals 0.5 the model is performing random guessing (Tan et al., 2006).

Nurses, as domain experts, are in a good position to use the KDD process and transform data into potentially useful knowledge (Berger & Berger, 2004). To date, few data mining studies have been published by nurse researchers. However, an example of a nurse data mining study is the work of Goodwin and colleagues (Goodwin et al. 2001; Goodwin & Iannacchione, 2002) with the goal of identifying accurate predictors of preterm births. Their outcome performance between logistic regression, neural networks, classification- and regression trees did not have significant difference. The original database included a total of 1,232 variables; however, seven demographic variables (maternal age, marital status, race, education, patient category, county, and religion) produced an AUC of 0.72 under the ROC curve, which the authors found respectable result (Goodwin et al, 2001; Goodwin & Iannacchione, 2002). Another study used the data mining classification method *Decision tree J48* (Witten & Frank, 2005) to detect from a clinical dataset with 8,259 older patients with the nursing diagnosis "Impaired Mobility" (Lu et al., 2006). After feature selection, five of the original eight variables (gender, service, marital status, disease code, and age) were found to have the strongest association with impaired mobility. The investigators were able to classify patients with the nursing diagnosis Impaired Mobility with 65% sensitivity and 72% specificity (Lu et al., 2006). The *Decision Tree J48* was also used in a newly published nursing study to predict what factors help to improve glycemic control for type 2 diabetes patients in educational interventions (Sigurdardottir et al., 2007). Twenty-one articles which reported results of 18 randomized controlled trials were analyzed, but each single study was characterized as one instance. Result showed a small change for initial glycosylated

hemoglobin (HbA1c) ≤ 7.9% for the educational intervention groups. Moreover, duration, content and intensity of the education did not predict changes in the HbA1c (Sigurdardottir et al., 2007).

Most KDD studies in health care have focused on predicting clinical outcomes. However, the only nursing KDD research focusing on health behavior is by Poynton and McDaniel (2006). The authors found the high quality health survey data (2000 National Health Interview Survey (NHIS)) to provide adequate information for classifying smoking cessation status (current and former smokers) with backpropagation neural network. Attribute subsets were selected automatically and by removing redundant variables. Three of the attributes were found novel; for the former smokers: calcium supplement use within the past 12 months, vitamin E supplement use within the past 12 months, and ever having had a head-to-toe skin examination. Additionally, several unpublished nursing doctoral dissertations on data mining have been completed (Berger, 2005; Cullen, 2001; Kraft, 2003; Lee, 2003).

Summary

In summary, recently KDD is receiving increased attention among nursing scholars for the purpose of providing an additional way to carry out analysis by discovering previously unknown patterns and producing new nursing knowledge. Knowledge discovery is a process which involves numerous steps and is interactive and iterative. Data mining is a one step in the process of KDD, which involves the actual application of algorithms to the data.

Data mining, as traditional statistics, has the primary goals of describing, predicting and building knowledge. Data mining studies are usually secondary analysis, with the aim of finding unsuspected relationships. Data mining is therefore an inductive exercise, as opposed to the traditional statistics which uses a deductive hypothetical approach. Use of KDD has been found successful in nursing studies.

CHAPTER III

METHODOLOGY

Introduction

The purpose of this secondary data analysis was to evaluate psychometric properties of the instrument *School-Children Health Promotion*, in order to describe and predict health promotion behavior of 10-12 year old Icelandic school children. Existing data on the health promotion behavior of children was analyzed. This chapter includes: description of the study design; description of the primary study (purpose, design, sample and instruments, and results); description of secondary data analysis (purpose and design, population and sample, and instruments); procedures; ethical considerations; and data analysis.

Design of the Study

This secondary data analysis grew out of a larger study on quality of life of Icelandic 10-12 year old children. The purpose of the primary study was twofold: First "…to evaluate generic HRQOL (health related quality of life) among 10 to 12-year-old Icelandic children who were either with or without chronic health condition" (Svavarsdottir & Orlygsdottir, 2006a, p. 210); and secondly "…to evaluate mothers' and fathers' perception of their child's HRQOL (health related quality of life) among 10- to 12-year-old Icelandic children with or without a chronic health condition" (Svavarsdottir & Orlygsdottir, 2006b, p. 180).

Design, Sample, and Instruments

The primary study was a cross-sectional study for which data were collected from 480 10-12 year old Icelandic school children in 5th and 6th grade of 12 public elementary schools in Reykjavik. The 12 schools were representative for all neighbourhoods in

Reykjavik; 911 parents; and the teachers of 381 children. Data were collected from March to June 2004.

Table 2. Instruments used in the Primary Study

Children´s Self-Report	**Name of Instruments**
Quality of Life	Pediatric Quality of Life Inventory Version 4.0. Child Report (ages 8-12) (Varni, Seid, & Kurtin, 2001; Varni, Seid, & Rode, 1999).
Health Promotion Behavior	School-Children Health Promotion (Chen et al., 2003; Svavarsdottir & Orlygsdottir, 2006a, 2006b).
Friendship Quality	Friendship Quality Questionnaire-Revised (Short Form) (Boys or Girls) (Parker & Asher, 1993).
Connection to School	Connection to School (Sieving et al., 2001).
Feelings about School	Feelings about School (FAS) (Short Version) (Valeski & Stipek, 2001).
Demographics and Background	Demographic and Background Information (Children) (Svavarsdottir & Orlygsdottir, 2006a, 2006b).
Children´s Status: Reported by the Parents	
Quality of Life (Parents' proxy)	Pediatric Quality of Life Inventory Version 4.0. Parent Report for Children (ages 8-12) (Varni et al., 1999; Varni et al., 2001).
Health Promotion (Parents' proxy)	School-Children Health Promotion: Parent Report for Children (Chen et al., 2003; Svavarsdottir & Orlygsdottir, 2006a, 2006b).
Demographics and Background	Demographic and Background Information (Parents)(Svavarsdottir & Orlygsdottir, 2006a, 2006b).
Children's Status: Reported by the Teachers	
Social Competence of Children	The Teacher Social Competence Rating Scale (Kam & Greenberg, 2001).
Demographics and Background	Demographic and Background Information (Teachers) (investigator generated and unpublished)

The data collected for the primary study included: children's quality of life (reported by the children and their parents); health promotion behavior (reported by the children and their parents); friendship quality (reported by the children); connection to school (reported by the children); feelings about school (reported by the children); and demographic and background variables of the children and their parents (mother and/or father). Data on the social competence of the children were collected from teachers, as well as demographic and background variables of the teachers. Table 2 shows the instruments used in the primary study.

Results of the Primary Study

Two papers have been published from the primary study (Svavarsdottir & Orlygsdottir, 2006a, 2006b). The first article focused on the children, and the purpose was to "…evaluate generic HRQOL among 10 to 12-year-old Icelandic children who were either with or without chronic health condition" (Svavarsdottir & Orlygsdottir, 2006a, p. 210). Results showed that girls reported higher HRQOL than boys; however, no significant difference was found on HRQOL between age groups. Additionally, children who had chronic health conditions, reported by their parents, experienced significantly lower HRQOL than their healthier peers. Moreover, of the children with chronic health conditions, the ones who had physical conditions scored higher on the HRQOL scale than children with psychiatric health problems. Furthermore, children who had visited the school health nurse over the last week had lower HRQOL than the ones who had not paid the school health nurse a visit. Also, the children who had experienced bullying had lower HRQOL than the ones who had not been bullied at school; however, this difference was not found for children who reported themselves being bullying perpetrators. By using stepwise regression, HRQOL of girls was predicted (43.8% of the variance) by health promotion, their own health, connection to school, bullying victimization, age and their visit to the school health nurse. On the other

hand, the HRQOL of boys was predicted (48.1% of the variance) by their own health, connection to school, bullying victimization, chronic health condition, and after school activities (Svavarsdottir & Orlygsdottir, 2006a).

The purpose of the second paper was "…to evaluate mothers' and fathers' perception of their child's HRQOL among 10 to 12-year-old Icelandic children with or without a chronic health condition" (Svavarsdottir & Orlygsdottir, 2006b, p. 180). No significant statistical difference was found between how mothers perceived the HRQOL of the child based on gender. However, fathers experienced girls to have higher HRQOL than boys. No difference was noted between mothers and fathers on the overall HRQOL scale; however, on the school functioning subscale, mothers found their children to have better school functioning than the fathers. No gender difference was found between parents on how they perceived their child HRQOL based on whether or not the child had chronic health condition. However, parents (both mothers and fathers) perceived children with chronic health conditions to have lower HRQOL than healthy children. Mothers of children who had visited the school health nurse over the last week reported the HRQOL of their children significantly higher than fathers; however, no difference was measured on how mothers and fathers perceived the HRQOL of their child if they had experienced bullying or not. When using stepwise regression, the mothers' perception of the HRQOL was predicted (21.8% of the variance) by the mothers' perception of the child's health promotion, chronic health condition of the child, the mothers' perception of the health status of the child, and if the child was a victim of bullying at school. The fathers' perception of the HRQOL was predicted (21.6% of the variance) by the child's health promotion, the fathers' perception of the child's health, the child being a bully victim, and after school activity of the child (Svavarsdottir & Orlygsdottir, 2006b).

Secondary Data Analysis

Purpose and Design of the Secondary Analysis

This secondary data analysis grew out of the primary study on quality of life of Icelandic 10-12 year old children. The three purposes of this secondary data analysis were to: 1) perform psychometric evaluation on the instrument *School-Children Health Promotion*; 2) describe health promotion behavior of 10-12 year old Icelandic school children; and 3) predict novel and potentially useful patterns of health promotion behavior (using the subscales of the *School-Children Health Promotion* instrument) of 10-12 year old Icelandic school children using data mining method (as a step in the knowledge discovery in database (KDD) process). Existing data from 480 10-12 year old Icelandic school children and 911 parents from a study on health promotion behavior of children were analyzed.

Unique for the secondary data analysis was that the health promotion behavior reported by the children was the dependent variable. The independent variables for the study were: demographic and background variables of the school children and their parents (mother and/or father); quality of life of the children (reported by the children and their parents); friendship quality (reported by the children); connection to school (reported by the children); and feelings about school (reported by the children).

Population and Sample

The study sample (convenience sample) included parents as well as the children. From March to June 2004, all children in 5th and 6th grade in 12 randomly selected schools in Reykjavik and their parents (total 1,079 children and their parents) were invited to participate in the study. Reykjavik is the capital of Iceland, and, in 2004, had a population of 113,667 people, which was 38.7% of the total Icelandic population (N=293,186). Of the Reykjavik population, 4,746 were children 10, 11, and 12 years old, which is 34.4% of the total population (N= 13,790) in Iceland in that age range. Of the

4,746 children in Reykjavik, 1,552 were 10 years old (boys = 826; girls = 726); 1,596 were 11 years old (boys = 802; girls = 794); and 1,598 were 12 years old (boys = 813; girls = 785) (Hagstofa Islands, 2007b). Of the 1,079 children who were invited to participate in the study, the researchers received written consent from 480 children (boys n=209; girls n=271) and 911 parents (mothers n=510; fathers n=401); participation was therefore 45% for the children, 47% for the mothers, and 37% for the fathers.

Table 3. Marital Status, Education and Employment Status of the Parents

	Mothers (n = 510)	**Fathers (n=410)**
	n (%)	**n (%)**
Variables		
Marital Status		
Married/cohabiting	414 (81.5)	377 (95.2)
Single parent	94 (18.5)	19 (4.8)
Education		
General	75 (15.2)	49 (12.4)
Technical	178 (36.2)	155 (39.1)
University	239 (48.6)	192 (48.5)
Employment Status		
Working full time and a second job	40 (8.0%)	49 (12.5)
Working full time	242 (48.3%)	334 (85.5)
Working part time	156 (31.1%)	4 (1.0)
Not employed	63 (12.6%)	4 (1.0)

The sample included data from 480 10-12 year old Icelandic school children and 911 parents (mothers and fathers). Of the children, 209 were boys (43.5%) and 271 girls (56.5%). The mean age of the children was 10.96 years (SD = 0.67); the mean age of the boys was 10.97 years (SD = 0.646); and the mean age of the girls was 10.93 years (SD = 0.685) (Svavarsdottir & Orlygsdottir, 2006a). Five hundred and ten mothers (55.9%) participated in the study. Their age ranged from 24 to 57 years, and mean age 40.07 years (SD = 5.45). The sample included 401 fathers (44.1%); their age ranged from 27 to 72 years old, and mean age was 42.15 years old (SD = 6.08). Marital status, education and employment status of the parents are reported in Table 3 (Svavarsdottir & Orlygsdottir, 2006b).

Instruments

The data included: health promotion behavior (reported by the children); demographic and background variables of 10-12 year old school children and their parents (mother and/or father); quality of life of the children (reported by the children and their parents); friendship quality (reported by the children); connection to school (reported by the children); and feelings about school (reported by the children) (See English and Icelandic versions of the instruments in Appendices A to F). A list of the instruments, items and subscales of the secondary data analysis are presented in Table 4. Data collected for the purpose of the primary study, but not analyzed for the purposes of the secondary data analysis were: demographic and background information from teachers and social competence of the children (reported by teachers); and health promotion behavior of children reported by the parents, see Table 2.

Table 4. Instruments, Items and Subscales of Secondary Data Analysis

Instrument for Children	Items (#)	Subscales
Children´s Self Report		
Dependent Variables		
School-Children Health Promotion (Chen et al., 2003; Svavarsdottir & Orlygsdottir, 2006a, 2006b).	Item # 1-22, see Appendix A	**Original Instrument (Questions in Icelandic version)**: Social Support (#1, 2, 3, 4) Life Appreciation (#5, 6, 7) Health Responsibility (#8, 9,10, 11,12,13) Stress-Management (#14, 15, 16, 17) Nutrition Behavior (#18, 19, 20, 21) Exercise Behavior (#22)
Independent Variables		
Demographic and Background Information (Children) (Svavarsdottir & Orlygsdottir, 2006a, 2006b).	Items # 2,3,4,5,6,7,8, 9,10,11,12,13, 15,16,17,18,20, 21. See Appendix B	N/A
Pediatric Quality of Life Inventory Version 4.0. Child Report (ages 8-12) (Varni et al., 1999; Varni et al., 2001).	Item # 1-23, see Appendix C	Physical Functioning (8 items) Emotional Functioning (5 items) Social Functioning (5 items) School Functioning (5 items)
Friendship Quality Questionnaire- Revised (Short Form) (Boys or Girls) (Parker & Asher, 1993).	Item # 1-30, see Appendix D	Companionship and Recreation (1 item; #16) Validation and Caring (7 items; #3,4,5,6,10,22,30) Help and Guidance (6 items; #12,13,17,24,25,29) Intimate Disclosure (5 items; # 9,11,18,21,28) Conflict Resolution (3 items;#8,19,26) Conflict and Betrayal (7 items; #2,7,(14),15,20,23,27) “Warm-up” item (1 item; #1)
Connection to School (Sieving et al., 2001).	Item # 1-7, see Appendix E	N/A
Feelings about School (FAS) (Short version) (Valeski & Stipek, 2001).	Item # 1-6, see Appendix F	N/A

Table 4. Continued

Children's Status: Report by the Parents		
Independent Variables		
Demographic and Background Information (Parents) (Svavarsdottir & Orlygsdottir, 2006a, 2006b).	Items # 4,5,6,7,8, 9,10,11,12,13, 15,16,17,19,21 See Appendix B	N/A
Pediatric Quality of Life Inventory Version 4.0. Parent Report for Children (ages 8-12) (Varni et al., 1999; Varni et al., 2001).	Item # 1-23, see Appendix C	Physical functioning (8 items) Emotional functioning (5 items) Social functioning (5 items) School functioning (5 items)

All the instruments, except the *Demographic and Background Information* which were investigator generated, were instruments translated from English into Icelandic and linguistically validated with permission from the authors (Svavarsdottir & Orlygsdottir, 2006a, 2006b). The aim of the linguistic validation was to create a clear and easy to understand Icelandic version of the instruments which were conceptually equivalent to the original English versions (Orlygsdottir & Svavarsdottir, 2005). The linguistic validation process was performed in three phases: 1) Forward translation; 2) Backward translation; and 3) Pilot testing on school children and their parents.

In the phase 1, two translators independently produced forward translation, and after consulting specialist in school health nursing, an agreement was made on a reconciled new version. In phase 2, a bilingual translator (native speaker of English) and an Icelandic linguistic scholar back translated the instruments. The back- and forward translators decided together on a new and conceptually equivalent Icelandic version. In phase 3, the instruments were pilot tested on seven 10-12 year old school children and their families. Finally, the instruments were proofread by an Icelandic linguistic professional.

School-Children Health Promotion

Health promotion of the child was measured by an instrument called the *School-Children Health Promotion*, which is a modified and shortened version of the Taiwanese instrument *Adolescent Health Promotion Scale* (Chen et al., 2003). For the purposes of this study, as noted in Chapter 1 and 2, the conceptual definition of health promotion behavior of children was how children engage in the process of increasing control and improving their health in everyday life (Christensen, 2004; WHO, 2006c). The instrument *School-Children Health Promotion* provides a good operational definition of health promotion behavior.

The *School-Children Health Promotion* instrument was appropriate for the primary study because it captures the broad spectrum of health promotion behavior. The original version includes 40 items across six subscales; however, the modified version has only 22 items. Possible scorings were from 22 - 110. The subscales of the original version were: 1) social support; 2) life- appreciation; 3) health-responsibility; 4) stress-management; 5) nutrition behavior; and 6) exercise behavior (Chen et al., 2003) (See Table 4). The original instrument was developed for an older age group (12 to 22 year olds) and was modified to capture data for 10-12 year old children. The investigators eliminated all questions that were not age appropriate for the target group. An example of an eliminated question is original item number 14: "Observe my body at least monthly" and item number 15 "Read food labels at every purchase." After the modification, the items of the shortened scale were translated and adapted for culture and age, as described earlier. Content (face) validity was assured by consulting a number of people, including a teacher who teaches 10-12 year old children, a school health nurse, and parents of 10-12 year old children (Cummings, Stewart, & Hulley, 2001; Rattray & Jones, 2007). After content validity was established, instruments were pilot tested on seven 10-12 year old school children. However, factor analysis on the shortened and modified 22 item Icelandic version of the instrument was not carried out for the primary

study; therefore, the secondary analysis provided an opportunity to further analyze the conceptual validity of the instrument.

The children answered the items with a 5-point Likert type scale ("never"; "rarely"; "sometimes"; "usually"; and "always"). Reported internal consistency by Cronbachs α for the original scale is 0.93 (Chen, et al., 2003) and 0.85 (for both boys and girls) for the Icelandic shortened and modified version (Svavarsdottir & Orlygsdottir, 2006a). See English and Icelandic versions in Appendix A.

Demographic and Background Information

The demographic information collected from the children was: age, gender, grade, physical symptoms, extracurricular activities, questions regarding teasing and bullying, and visits to the school health nurse. Information collected from the parents was: age, grade, gender, origin of the child, and connection of the child to the respondent; physical symptoms and chronic illness/es of the child. Also collected were data on: age and gender of the parent (and spouse, if applicable); marital status; education; profession of the respondent (and spouse, if applicable); connection of the respondent to the child; and whom the child lives with. See English and Icelandic versions in Appendix B.

Quality of Life

The quality of life (QOL) of the child was measured by an instrument called Paediatric Quality of Life Inventory™ (PedsQL™), the Generic Core Scale for 8 to 12-year old children (children's self-report) (Varni et al., 1999; Varni et al., 2001). The instrument includes 23 items and four subscales (physical functioning, 8 items; emotional functioning, 5 items; social functioning, 5 items; and school functioning, 5 items). The children were asked how much of a problem they had with each item for the past one month ("never" (=0); "almost never" (=1); "sometimes" (=2); "often" (=3); "almost always" (=4)). The items were reverse scored and transformed linearly to a 0-100 scale, so higher scores direct to higher QOL (0=100; 1=75; 2=50; 3=25; 4=0). The items were

then summed and divided by answered numbers to account for missing data. If more than 50% of items were missing from a participant, the total score was not computed (Varni, Seid, Knight, Uzark, & Szer, 2002). Reported internal consistency for the US version is 0.88 for the total scale and 0.68-0.80 for the subscales (Varni, Seid, & Kurtin, 2001). For the Icelandic version, the internal consistency is 0.90 for boys and 0.86 for girls for the total scale; and for the subscales 0.70-0.79 (boys) and 0.66-0.77 (girls) (Svavarsdottir & Orlygsdottir, 2006a).

The QOL of the child perceived by the parents was measured by an instrument called *Paediatric Quality of Life Inventory™ (PedsQL™), the Generic Core Scale for 8 to 12-year old children (parent proxy report* (Varni et al., 1999; Varni et al., 2001). The instrument is identical to the children's self-report; however, it is intended to be administered to the parents and the wording is in the third person. Reported internal consistency for the US sample is 0.90 for the total scale and for the Icelandic version is 0.86 for mothers and 0.87 for fathers (Svavarsdottir & Orlygsdottir, 2006b). See English and Icelandic versions in Appendix C.

Friendship Quality

The aspects of children's quality of friendship was measured by an instrument called *Friendship Quality Questionnaire – Revised (Short Form)* (Parker & Asher, 1993). The original instrument includes 40 items; however, in the Icelandic shortened version there were 30 items. Moreover, the Icelandic instrument had separate versions for boys and girls. The questions in the versions for boys and girls were identical; however, due to linguistic rules of the Icelandic language, different sets of questionnaires were prepared for each gender. The instrument has six subscales (companionship, 1 item; validation and caring, 7 items; help and guidance, 6 items; intimate disclosure, 5 items; conflict resolution, 3 items; conflict and betrayal, 7 items; and "warm-up" item, 1 item). A 1-5 point scale was used ("not at all true", "a little true", "somewhat true", "pretty true", and

"really true"). Item number 15 had to be reverse scored before summing. The items for each subscale were summed up and then divided by the number of items for the subscale. Authors do not recommend using the overall score for the instrument (Parker & Asher, 1993). Reported internal consistency for the original instrument is 0.75-0.90 (Parker & Asher, 1993) and for the modified version was 0.59 – 0.85 for Icelandic boys and 0.58-0.87 for Icelandic girls (Svavarsdottir & Orlygsdottir, 2006a). However, when item number 14 (My friend and I argue a lot) was omitted from the subscale with the lowest Cronbachs α, "conflict and betrayal" (now 6 items), the consistency increased from 0.59 to 0.73 for boys and from 0.66 to 0.79 for girls. Therefore, a decision was made for the primary study to exclude item 14. Thus, item 14 will not be present in the secondary analysis (the instrument is therefore 29 items). See English and Icelandic versions in Appendix D.

Connection to School

Connection to school was measured by an instrument developed for the National Longitudinal Study of Adolescents (Add Health Study) called *School Connectedness* (Sieving et al., 2001). The instrument is 7 items and uses a 5-point Likert type scale ("strongly agree", "agree", "neither agree/disagree", "disagree", and "strongly disagree"). Possible scoring is from 7 to 35. Reported internal consistency of the original scale is 0.75-0.79 (Sieving et al., 2001) and 0.79 for boys and 0.81 for girls in the Icelandic version (Svavarsdottir & Orlygsdottir, 2006a) (See English and Icelandic versions in Appendix E).

Feelings about School

The children's feelings about school (attitude toward school and feelings about teachers) were measured by a short version of an instrument called *Feelings about School (FAS)* (Valeski & Stipek, 2001). The original instrument included 12 items; however, it was designed for children in kindergarten and first grade and the questions were meant to

be read aloud for the children. The Icelandic version has been adapted for 10-12 year old children, is in paper-pencil format, and includes only 6 items. The instrument has a 5-point Likert type scale which has bars of increasing size with increased number. Possible scoring is from 6 to 30. The internal consistency of the original instrument is 0.52 – 0.74 for kindergartners and 0.59 – 0.79 for first graders (Valeski & Stipek, 2001). For the Icelandic short version the internal consistency was 0.84 for boys and 0.83 for girls (Svavarsdottir & Orlygsdottir, 2006a) (See English and Icelandic versions in Appendix F).

Procedure

One of the investigators of the primary study and the school nurse in each school informed the children about the study, invited them to participate, and gave them documents in an envelope to take home to their parents. Inclusion criteria were that the children needed to be in 5th or 6th grade; they needed to be able to read and write Icelandic at grade level; and their parents had to be able to read and write Icelandic. The envelope the children brought home included an introduction letter, an informed consent document, questionnaire booklets (one for the mother and one for the father), and a return envelope for a signed consent form (from the child and the parents) and completed questionnaires). The children who brought back school signed consent forms and completed questionnaires from the mother and/or the father were eligible to take part in the study at school. The questionnaires completed by the parents had an identification number (ID) identical to the ID for the children with the aim of being able to link them to the child's questionnaire. The school health nurse kept a record of the ID's and the students (parents) names; however, the nurse did not have access to completed questionnaires, and deleted the records when data collection in the school was completed. The consent form did not include the research ID and was kept separately from the questionnaire in a locked cabinet.

The school nurse and one of the investigators for the quality of life study took the participating children out of the classroom to answer the questionnaires and gave instruction verbally and answered any questions the children had. Also, if the children had difficulties reading, the school health nurse or the investigator read the questions out loud for them.

Ethical Consideration

Institutional Review Board of the Reykjavik Health Services, Reykjavik Council of Education, the principals in the 12 elementary schools, and the National Bioethics Committee gave approval for the primary study. It was also reported to the Icelandic Data Protection Committee. These approvals are valid for this proposed secondary analysis. Additionally, the principal investigator has given permission for the secondary data analysis. Approval was also obtained from the Institutional Review Board (IRB) at The University of Iowa.

Data Analysis

For the purpose of the secondary data analysis, all data collected from the children were analyzed except redundant and open ended questions. Therefore, four questions from the child *Demographic and Background Information* instrument were excluded (#1, #14, #19, and #22). The first excluded question asks the children about their age. It was omitted because information about the grade was used instead of age to answer research questions number four. The other three questions are open ended, therefore not included in the analysis. All data collected from the parents were analyzed except seven redundant and open ended questions from the parents *Demographic and Background Information* instrument (#1, #2, #3, #14, #18, #20, and #22). The first three questions which were excluded ask the parents about age, grade and gender of their child. The data from the children themselves were used to answer the research questions of the study instead data from the parents; therefore the questions asking parents about age, grade and gender of

the child were excluded from the analysis. The other four questions are open ended and therefore excluded.

The data were double-entered using Data Entry software (DOS environment) by the Social Science Research Institute at the University of Iceland (See the coding of the items in Table 5). Data were then transferred into the SPSS software, version 15.0 (SPSS Inc., Chicago, IL., USA), which was the statistical software used to analyze the data for research questions one to four. SPSS was used for experimental factor analysis (principal factor analysis), calculating Chronbach´s α, independent t-test, and descriptive analysis like means, standard deviations, and frequency distribution. The Waikato Environment for Knowledge Analysis (WEKA) software was used for the data mining (decision tree classifier algorithm *J48* and *Logistics*) in the fifth research question (Witten & Frank, 2005).

Table 5. The Coding of the Items of the Instruments

Instrument Questions	**Items**	**Coding**
School-Children Health Promotion (Children)		
	Never	1
	Rarely	2
	Sometimes	3
	Usually	4
	Always	5
	Don't answer	9
Background Information		
Grade (Children)	5th grade	1
	6th grade	2
	Don't answer	9
Gender (Children)	Boy	1
	Girl	2
	Don't answer	9
The child's origin? (Parents)	Both parents are Icelandic	1
	One parent is Icelandic	2
	Both parents are of foreign origin	3
	Don't answer	9
Psychosomatic symptoms (stomach ache; headache; feeling dizzy; falling asleep at night) (Children and Parents)	Always	1
	Sometimes	2
	Seldom	3
	Always	4
	Don't answer	9
Does the child have chronic disease (asthma; diabetes; ADD; learning disabilities, delayed development, seizure/epilepsy; migraine; other mental diseases; and other physical diseases) (Parents)	No answer	0
	Answer	1
	Don't answer	9
Gender of the person who answers this questionnaire (Parents)	Woman	1
	Man	2
	Don't answer	9

Table 5. Continued

Questions	**Items**	**Coding**
Connection of the person who answers the questionnaire to the child (Parents)	Mother Father Stepmother Stepfather Other Don´t answer	1 2 3 4 5 9
Your age (Parents)	Age	Real
Age of your spouse (Parents)	Age	Real
Do you have hobbies? (Children)	Yes No	1 2
If hobbies, what: Music; sport; dance or ballet; linguistic studies; chess; drama; boy/girl scout (Children)	No answer Answer	0 1
Have you been teased by other children? (Children)	Yes No Don't answer	1 2 9
If teased: how often were you teased by other children last week? (Children)	Often a day Every day (once a day) Few times a week Once a week Less than once a week Don't answer	1 2 3 4 5 9
Do you tease other children? (Children)	Yes No Don't answer	1 2 9
If teased other children last week: how often last week? (Children)	Often a day Every day (once a day) Few times a week Once a week Less than once a week Don't answer	1 2 3 4 5 9
Have you been bullied by other children (Children)	Yes No Don't answer	1 2 9

Table 5. Continued

Questions	**Items**	**Coding**
If bullied: how often last week? (Children)	Often a day	1
	Every day (once a day)	2
	Few times a week	3
	Once a week	4
	Less than once a week	5
	Don't answer	9
Do you bully other children? (Children)	Yes	1
	No	2
	Don't answer	9
If bullied other children last week: how often last week? (Children)	Often a day	1
	Every day (once a day)	2
	Few times a week	3
	Once a week	4
	Less than once a week	5
	Don't answer	9
Have you visited the school nurse last week? (Children)	Yes	1
	No	2
	Don't answer	9
If visited school nurse last week: how often? (Children)	Often a day	1
	Every day (once a day)	2
	Few times a week	3
	Once a week	4
	Less than once a week	5
	Don't answer	9
What is your marital status? (Parent)	Married	1
	Co-habiting	2
	Single parent	3
	Separated	4
	Divorced	5
	Divorced and re-married (or co-habiting)	6
	Widow/widower	7
	Don't answer	9

Table 5. Continued

Questions	**Items**	**Coding**
With whom does the child live with? (Parent)	Both biological parents	1
	One biological parent and a foster parent	2
	Foster parents	3
	With one parent	4
	Parents have shared custody (child has 2 homes)	5
	Don't answer	9
What education have you completed? (Parent)	Elementary school	1
	Work related education, other than vocational degree	2
	Vocational degree	3
	Highschool degree	4
	Bachelors degree	5
	Master's or a doctoral degree	6
	Other education	7
	Don't answer	9
How much do you work? (Parent)	Do not work outside the home	1
	Part time work	2
	Full time work	3
	Full time work in one place and part time work in another	4
	Don't answer	9
How much does your spouse work? (Parent)	Does not work outside the home	1
	Works part time	2
	Works full time	3
	Works full time in one place and part time in another	4
	Don't answer	9

Table 5. Continued

Instrument Questions	**Items**	**Coding**
Pediatric Quality of Life Inventory Version 4.0 Child Report (ages 8-12) and Parent Report for Children (ages 8-12)		
	Never Almost never Sometimes Often Almost always Don't answer	0 1 2 3 4 9
Friendship Quality Questionnaire – Revised (Short Form) (Children)		
	Not at all true A little true Somewhat true Pretty true Really true Don't answer	1 2 3 4 5 9
Connection to School (Children)	Strongly agree Agree Neither agree/disagree Disagree Strongly disagree Don't answer	1 2 3 4 5 9
Feelings about School (FAS) (Short version)		
	Likert type scale of increasing size	From 1-5

Research Questions

Research Question 1: What are the subscales of the instrument School-Children Health Promotion?

Experimental factor analysis (principal factor analysis) was used to determine subscales of the instrument *School-Children Health Promotion* (Kline, 2002; Rattray & Jones, 2007). First assumption testing (sample size, skewness and kurtosis) was performed to see if the data are appropriate for principal factor analysis. A scree plot and eigenvalues greater than 1 were used to decide the numbers of factors/subscales. The process was used to show if items produced similar subscales (a total of 6 subscales as can be seen earlier) as the original instrument *Adolescent Health Promotion Scale*, which was developed in Taiwan (Chen et al., 2003).

Research Question 2: What is the internal consistency of the main subscales of the instrument School-Children Health Promotion?

The scores of the subscales were summed and Cronbach´s α was calculated for each subscale of the instrument *School-Children Health Promotion* to determine the internal consistency (Polit & Hungler, 1995; Rattray & Jones, 2007). Cronbach´s α is a coefficient to rate the reliability of an instrument or homogenety of it´s subparts (Polit & Hungler, 1995). It measured 0.93 for the overall instrument, as noted earlier in the chapter.

Research Question 3: What is the self reported health promotion behavior of 10-12 year old Icelandic school children (questions, subscales, and the overall health promotion instrument)?

Descriptive analysis (means, standard deviations, and frequency distribution) was calculated for all questions of the instrument *School-Children Health Promotion,* the subscales (that were calculated in research question number one), and the overall instrument (Polit & Hungler, 1995).

Research Question 4: Does the self reported health promotion behavior of 10-12 year old Icelandic school children differ based on their gender and/or grade?

Independent t-test was used to determine if there was a significant difference between genders and/or grades and health promotion behavior. Independent t-test (α=0.05; two tailed) was calculated, where the mean of the questions of the instrument *School-Children Health Promotion* was the dependent variable, and gender and/or grade were the independent variables (Polit & Hungler, 1995).

Research Question 5: Is there a pattern/s of information and important variables/attributes that can predict health promotion behavior of 10-12 year old Icelandic school children?

The investigator followed the KDD process, which involved 5 steps which are interactive, and iterative (Fayyad et al., 1996).

The data were double entered and cleaned by the Social Science Research Institute at the University of Iceland, as described earlier. In addition, reversely scored

items in the instrument *Pediatric Quality of Life Inventory Version 4.0 (Child Report ages 8-12* and *Parent Report for Children ages 8-12* and the *Friendship Quality Questionnaire* (item #15) had been corrected for by the Social Science Research Institute; subscales of the instruments *Pediatric Quality of Life Inventory Version 4.0 (Child Report ages 8-12, Parent Report for Children ages 8-12*, and *Friendship Quality Questionnaire – Revised Short Form* had been summed up, and the overall score for the instruments, *School-Children Health Promotion, Pediatric Quality of Life Inventory Version 4.0 (Child Report ages 8-12 and Parent Report for Children ages 8-12*, *Connection to School,* and *Feelings about School* had been summed up. For the purpose of the secondary data analysis, the data were checked for outliers; however, none were identified.

The data files were in an SPSS data format (flat file) when e-mailed to the investigator of the current secondary data analysis. Since the data were in three separated files (children, the mothers, and fathers), the three files had to be merged into one file. Each family was identified with a unique identifier, which was retained doing the merging process.

The first part of feature selection took place by removing manually features that were clearly redundant or duplicated (Pyle, 1999), and therefore excluded from the secondary data analysis. As an example, when the child and the parents answered the same questions, the child's answer was retained and the parents' answers were not included (e.g., the age of the child). Open ended questions and data irrelevant for this analysis, like ID, were removed (Tan, Steinbach, & Kumar, 2006). Additionally, the items of the instrument *School-Children Health Promotion* were also removed. Four hundred and eighty instances corresponded to a child plus a mother and/or a father; however, 68 instances corresponded only to data from a mother and/or a father (child was absent from school the day data collection took place). Data from these parents (n=68)

were removed; remaining data for further analysis were from 447 mothers and 347 fathers.

Table 6. Number of Predictive Variables used for Data Mining

	Number of Attributes n (for second parent)	**Number of Subscales/or summed up variables n**	**Overall Score for the Instrument N**	**Total Attributes n**
Demographic and Background Information (Children) (Svavarsdottir & Orlygsdottir, 2006a, 2006b).	24	N/A	N/A	24
Demographic and Background Information (Parents) (Svavarsdottir & Orlygsdottir, 2006a, 2006b).	21 (+21)	N/A	N/A	42
Pediatric Quality of Life Inventory Version 4.0. Child Report (ages 8-12) (Varni, Seid, & Kurtin, 2001; Varni, Seid, & Rode, 1999).	23	4	1	28
Pediatric Quality of Life Inventory Version 4.0. Parent Report for Children (ages 8-12) (Varni, Seid, & Kurtin, 2001; Varni, Seid, & Rode, 1999).	23(+23)	4(+4)	1(+1)	56
Friendship Quality Questionnaire- Revised (Short Form) (Boys or Girls) (Parker & Asher, 1993).	29	5	N/A	34
Connection to School (Sieving, Beuhring, & Resnick, 2001).	7	N/A	1	8
Feelings about School (FAS) (Short version) (Valeski & Stipek, 2001).	6	N/A	1	7
Total Number of Predictive Variables				**199**

Question number 9 ("If you answered "yes" in question 8, what hobby/ies do you have?") in the *Demographic and Background Information Instrument* for children (Svavarsdottir & Orlygsdottir, 2006a, 2006b) counted as 7 items instead of 1 item, since the children could mark more than one hobby (see Table 4 in Chapter 3). Moreover, question number 9 ("Does the child have a chronic disease (or diseases)? (mark everything that applies)") in the *Demographic and Background Information* for parents (Svavarsdottir & Orlygsdottir, 2006a, 2006b) also counted as 7 items instead of 1 item, since the parent/s could mark more than one disease (see Table 4 in Chapter 3). The final number of predictive variables used for the data mining task under study are displayed in Table 6.

The data included 480 instances and 199 attributes of mixed types. The 199 attributes were nominal, numeric, and ordinal attributes (Likert scale). Nominal and numeric are the two basic data types that ARFF files accommodate (Witten & Frank, 2005); therefore ordinal attributes were defined as numeric. The data were thereafter transformed into a CSV (comma separate value) file and loaded into WEKA version 3.4.10 (Explorer, which is WEKA´s main graphical user interface) using a built in converter, which converts the CSV file into an Attribute Relationship File Format (ARFF file) which is a text file. The ARFF file was evaluated manually to make sure that each variable was defined correctly. Empty entries [ ] and "no answer" (defined as 7, 9 or 99 in SPSS), were combined into "missing value" (WEKA also reads question mark [?] as missing value) when appropriate (Witten & Frank, 2005). No special technique was used for missing data.

After all the remaining variables had been defined appropriately and loaded into WEKA (Explorer) as an ARFF file, automated feature selection took place as a second part of the feature selection (Witten & Frank, 2005). For the secondary data analysis, the search method for the attribute selection was the ranking method *BestFit*, which was sorted by the *CfsSubsetEval* algorithm (Witten & Frank, 2005).

The predictive data mining task used for this study was classification. The classification algorithms were the decision tree algorithm *J48* and *Logistic* (logistic regression). Pruning of the decision trees was tried out. When the confidence factor was raised from the default one, it resulted in bigger and more complicated tree. However, when the confidence factor was lowered it resulted in identical decision tree to the initial one. Therefore, further results of the pruning will not be introduced. Moreover, the results of the decision trees were executed with default parameters provided by WEKA (Witten & Frank, 2005).

To evaluate the performance of the classifiers, a 10- fold cross validation was used. The accuracy of the classifiers was reported, and the sensitivity and specificity were calculated for each model from confusion matrixes. A paired t-test (α=0.05; two tailed test) was then used to see if the accuracy and sensitivity of each classification is the same or significantly different from each other (Tan et al., 2006; Witten & Frank, 2005). Receiver Operating Characteristic [ROC] curves were reported to visualize true positive rates versus false positives rate, in addition to Area Under the Curve [AUC´s] (see in detail in Chapter II). It should be noted that the significance of predicting attributes of the *Logistic* classifier was only interpreted for the subsets created with the ranking method *BestFit* and reported in Chapter IV, since it is uninterruptible for the full dataset as it includes 199 attributes. Table 7 shows how each research question was tested.

Table 7. How each Research Question was Tested

Research Question	Variables	Analysis
1. What are the subscales of the instrument *School-Children Health Promotion*?	Question 1-22 of the instrument *School-Children Health Promotion*	Principal Factor Analysis (experimental factor analysis)
2. What is the internal consistency of the main subscales of the instrument *School-Children Health Promotion*?	Subscales of the instrument *School-Children Health Promotion*	Cronbach´s α
3. What is the health promotion profile of 10-12 year old Icelandic school children (questions and subscales, and overall health promotion instrument)?	22 questions of the instrument *School-Children Health Promotion,* the subscales, and the overall instrument	Descriptive analysis (means, SD, and frequency distribution)
4. Does the health promotion profile of 10-12 year old Icelandic school children differ based on their gender and/or grade?	Subscales of the instrument *School-Children Health Promotion* and question number 2 and 3 (grade and gender) in the *Background and Demographic Information for Children*	Independent t-test (α=0.05; two tailed)
5. Is there a pattern/s of information and important variables/attributes that can predict health promotion behavior of 10-12 year old Icelandic school children?	Subscales of the instrument *School-Children Health Promotion* and all independent variables listed in Table 3	Decision tree algorithm (*J48*) and logistic regression (*Logistic*)

Summary

The study was a cross sectional secondary data analysis. The secondary data were derived from a larger cross-sectional study of 10-12 year old Icelandic children in 5th and 6th grade of public elementary schools in Reykjavik, the capital city of Iceland. Data were collected in 12 randomly selected schools in Reykjavik, from March to June 2004.

The data includes health promotion behavior (reported by the children); demographic and background variables of 10-12 year old school children and their parents (mother and/or father); quality of life of the children (reported by the children and their parents); friendship quality (reported by the children); connection to school (reported by the children); and feelings about school (reported by the children).

All the instruments, except the demographic and background information which were investigator generated, were translated from English into Icelandic and linguistically validated with permission from the authors.

The statistical software which was used to analyze the data for research questions one to five was the Statistical Package for Social Scientists version 15.00 (SPSS Inc., Chicago, IL., USA). The WEKA software was used for the data mining (Witten & Frank, 2005).

CHAPTER IV

RESULTS

Secondary data analysis was conducted from a larger study on the quality of life of Icelandic 10-12 year old children. In this chapter, the research questions are addressed, the demographics of the children and their parents are reviewed, and results of research questions 1 through 5 are presented. The statistical software used was the Statistical Package for Social Scientists, version 15.0 (SPSS Inc., Chicago, IL., USA). The Waikato Environment for Knowledge Analysis (WEKA 3.4.10) software was used for the data mining in the fifth research question (Witten & Frank, 2005).

Research Questions

The research questions presented for this study are:

1. What are the subscales of the instrument School-Children Health Promotion?
2. What is the internal consistency of the main subscales of the instrument School-Children Health Promotion?
3. What are the self reported health promotion behaviors of 10-12 year old Icelandic school children (questions, subscales, and the overall health promotion instrument)?
4. Does the self reported health promotion behavior of 10-12 year old Icelandic school children differ based on their gender and/or grade?
5. Is there a pattern/s of information and important variables/attributes that can predict health promotion behavior of 10-12 year old Icelandic school children?

Demographic

As presented in Chapter III, the sample included data from 480 10-12 year old Icelandic school children and their parents. Data from 794 parents (447 mothers [56.30%] and 347 fathers [43.70%] were analyzed for the purpose of this secondary analysis. Of the 480 children, 209 were boys (43.5%) and 271 girls (56.5%). The mean

age of the children was 10.96 years (SD = 0.67); the mean age of the boys was 10.97 years (SD = 0.646) and the mean age of the girls was 10.93 years (SD = 0.685) (Svavarsdottir & Orlygsdottir, 2006a). The age of the mothers ranged from 24 to 57 years, and mean age was 40.07 years (SD = 5.45). The age of the fathers ranged from 27 to 72 years old, and mean age was 42.15 years old (SD = 6.08). Further sample characteristics are presented in Chapter III; marital status, education and employment status of the parents are listed in Table 3.

Research Question Number 1

What are the Subscales of the Instrument School-Children Health Promotion?

Testing of assumptions was conducted to ensure that the data were appropriate for exploratory factor analysis. Cases were excluded listwise, resulting in a sample size of 375. That way missing values were excluded from further analysis since it is usually the same participants who hand in missing values. The size of the sample was adequate for the factor analysis, as can be seen in Table 8 which compares sufficient sample size to the sample under study. Moreover, the instrument *School-Children's Health Promotion* uses a Likert scale, which is acceptable for exploratory factor analysis (Ferguson & Cox, 1993).

Table 8. Sample Size for Factor Analysis (Ferguson & Cox, 1993)

Stable Factor Structure	For this Study
Minimum number of subjects (N):100	N= 375
Minimum subjects to variable ratio (*N*/*p*: 2:1- 10:1)	*375/21*: ~18:1
Minimum variable to factor ratio *p/m*: 2:1 – 6:1	*21/5*:~4:1
Minimum subject to factor ratio *N/m*: 2:1 – 6:1	*375/5*: 75:1

Descriptive statistics, skewness and kurtosis were calculated for each of the 22 items of the instrument, *School-Children's Health Promotion* (see Table 9), and histograms of the variables are presented in Appendix G. Item number 22 ("Participate in physical education class at school weekly") was omitted from the instrument, since it was not normally distributed (Mean = 4.84; SD = 0.586; Skewness = – 4.926; and Kurtosis = 27. 587), and according to Icelandic law all school children participate in physical education (Log um grunnskola nr. 66/1995). Therefore, only 21 of the items were kept for further analysis of the instrument, *School-Children's Health Promotion*. All results presented hereafter include only the 21 items of the instrument.

Table 9. Mean, Skewness, and Kurtosis of the 22 variables of the instrument *School-Children's Health* Promotion

	Mean	**Skewness**	**Kurtosis**
1. Discuss my concerns with others	2.93	-0.026	-0.534
2. Express my caring and warmth to others	3.66	-0.661	-0.005
3. Talk about my troubles with others	2.92	-0.032	-0.886
4. Enjoy keeping in touch with relatives	4.38	-1.400	1.764
5. Make an effort to feel happy and content	4.23	-1.011	1.022
6. Make an effort to like myself	4.15	-0.983	0.747
7. Make an effort to know what's important for me	3.93	-0.744	0.223
8. Search for health information	2.76	0.160	-0.913
9. Discuss my health concerns with the school nurse	2.12	0.856	-0.275
10. Brush my teeth and use dental floss in the morning and at nights	3.96	-1.138	0.500
11. Make an effort to moderate my body weight	3.53	-0.569	-1.044
12. Make an effort to stand or sit straight	3.05	-0.075	-0.980
13. Wash my hands before meals	3.35	-0.220	-0.935
14. Make an effort to determine the source of each stress that occurs	3.13	-0.205	-0.946
15. Make an effort to spend time daily to rest	2.70	0.339	-1.069
16. Make schedules and set priorities	3.24	-0.276	-0.943
17. Sleep 8-10 hours each night	4.14	-1.158	0.840
18. Eat three regular meals daily	4.41	-1.781	2.885

Table 9. Continued

	Mean	Skewness	Kurtosis
19. Eat breakfast daily	4.52	-1.989	3.127
20. Include five food groups in each meal (dairy, meat/fish, vegetables, fruit, and corn)	4.10	-1.080	0.677
21. Drink at least 6-8 glasses of water daily	3.32	-0.198	-0.923
22. Participate in physical education class at school weekly	4.84	-4.926	27.587

When examining the correlation matrix, a number of the correlations exceed 0.3 and determinant equals 0.004 (see Figure 4). Since the determinant is >.00001, multicollinearity is not a problem (Gudmundsson & Kristjansson, 2005). The Kaiser-Meyer-Olkin statistic, which measures the sampling adequacy, was above the acceptable level (0.864) and Bartlett´s test of sphericity was significant ($\chi^2 = 2064.279$; $df = 210$, $p = 0.000$). In the Anti-Image correlation matrix, the Measures of Sampling Adequacy (MSA) are above the acceptable level of 0.5. Based on the results of these tests of the assumptions, the data are suitable for factor analysis.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	1.000																				
2	0.410	1.000																			
3	0.732	0.358	1.000																		
4	0.216	0.287	0.215	1.000																	
5	0.220	0.386	0.231	0.238	1.000																
6	0.151	0.319	0.160	0.199	0.600	1.000															
7	0.203	0.341	0.284	0.237	0.471	0.475	1.000														
8	0.299	0.346	0.300	0.220	0.287	0.258	0.405	1.000													
9	0.244	0.142	0.227	0.100	0.147	0.166	0.169	0.267	1.000												
10	0.154	0.280	0.120	0.210	0.266	0.233	0.206	0.219	0.080	1.000											
11	0.156	0.249	0.188	0.138	0.237	0.234	0.318	0.319	0.220	0.225	1.000										
12	0.236	0.306	0.210	0.248	0.292	0.254	0.282	0.292	0.127	0.210	0.245	1.000									
13	0.164	0.231	0.198	0.141	0.143	0.119	0.189	0.188	0.117	0.248	0.138	0.312	1.000								
14	0.244	0.199	0.224	0.165	0.282	0.188	0.319	0.317	0.241	0.132	0.284	0.280	0.138	1.000							
15	0.210	0.186	0.243	0.136	0.245	0.184	0.280	0.323	0.166	0.212	0.315	0.297	0.258	0.372	1.000						
16	0.180	0.298	0.229	0.232	0.243	0.257	0.362	0.319	0.148	0.165	0.229	0.284	0.171	0.350	0.387	1.000					
17	0.180	0.193	0.197	0.212	0.335	0.246	0.271	0.225	0.085	0.408	0.196	0.325	0.207	0.194	0.299	0.296	1.000				
18	0.189	0.216	0.181	0.131	0.345	0.194	0.271	0.150	0.075	0.306	0.129	0.293	0.120	0.294	0.258	0.307	0.473	1.000			
19	0.114	0.171	0.103	0.097	0.204	0.149	0.168	0.088	0.036	0.175	0.071	0.159	0.068	0.144	0.218	0.288	0.327	0.444	1.000		
20	0.062	0.172	0.134	0.177	0.257	0.170	0.193	0.141	0.113	0.244	0.187	0.162	0.112	0.071	0.250	0.268	0.309	0.307	0.220	1.000	
21	0.073	0.143	0.092	0.150	0.225	0.175	0.230	0.197	0.149	0.216	0.185	0.179	0.226	0.110	0.182	0.184	0.305	0.209	0.094	0.269	1.000

Figure 4. Correlation Matrix for the Exploratory Factor Analysis of the Instrument School-Children Health Promotion (Cases Excluded Listwise n=375)

Principal factor analysis (PFA) with oblique (direct oblimin) rotation was performed on the instrument, *School-Children Health Promotion*. The communality (h^2) of the items ranged from 0.283 (item 4) to 0.822 (item 1); item 4 was the only one with communality below 0.3 (see Table 10). According to Gudmundsson and Kristjansson (2005) that level is acceptable (for n=400, communalities need to be > higher than 0.258). The magnitude of the commonalities indicates that the factors account for substantial proportions of variance in most of the items.

Five factors were extracted that explained 52.57% of the variance and with eigenvalues greater than 1. The scree test also showed 5 factors, since the slope of the curve began to emerge and fall below 1 at the sixth point, see Figure 5. The final five component solution was based on 21 items; see the factors and their loadings in Table 10.

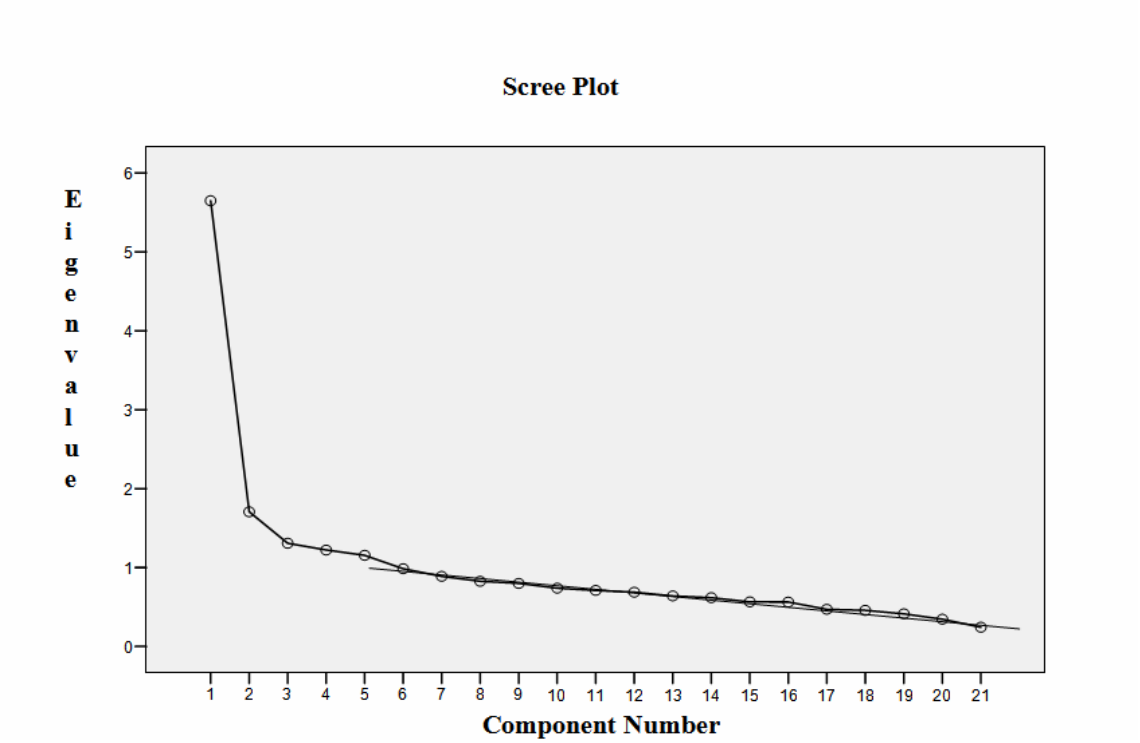

Figure 5. Scree Plot

Table 10. Factor Loadings and Factor Structure of the School-Health Promotion Instrument

	Factor 1 Positive Thinking	Factor 2 Diet and Sleep Habits	Factor 3 Seek Psycho-social Support	Factor 4 Coping Behavior	Factor 5 Health Habits	h^2 Communalities
6. Make an effort to like myself	**.874**	-.028	-.058	.005	-0.43	.712
5. Make an effort to feel happy and content	**.778**	.130	.041	-.007	.009	.688
7. Make an effort to know what's important for me	**.625**	.016	.015	.288	-.021	.580
19. Eat breakfast daily	.012	**.776**	.062	.032	-.087	.603
18. Eat three regular meals daily	.066	**.730**	.078	.060	.098	.645
17. Sleep 8-10 hours each night	.064	**.490**	.043	0.00008848	.440	.570
1. Discuss my concerns with others	-.061	.061	**.916**	.039	-.065	.822
3. Talk about my troubles with others	-.047	.058	**.861**	.083	-.045	.762
2. Express my caring and warmth to others	.385	.000	**.477**	-.040	.104	.512

Table 10. Continued

	Factor 1 Positive Thinking	Factor 2 Diet and Sleep Habits	Factor 3 Seek Psycho-social Support	Factor 4 Coping Behavior	Factor 5 Health Habits	h^2 Communalities
4. Enjoy keeping in touch with relatives	.249	-.021	**.278**	-.094	.265	.283
14. Make an effort to determine the source of each stress that occurs	.057	.171	.051	**.703**	-.171	.557
15. Make an effort to spend time daily to rest	-.122	.239	-.007	**.640**	.163	.546
11. Make an effort to moderate my body weight	.187	-.146	-.090	**.534**	.183	.429
16. Make schedules and set priorities	.109	.354	.025	**.486**	-.015	.471
8. Search for health information	.222	-.135	.178	**.475**	.104	.475
9. Discuss my health concerns with the school nurse	.006	-.186	.153	**.473**	.035	.306
13.Wash my hands before meals	-.183	-.133	.158	.140	**.646**	.480
21.Drink at least 6-8 glasses of water daily	.064	-.026	-.146	.079	**.640**	.439

Table 10. Continued

	Factor 1 Positive Thinking	Factor 2 Diet and Sleep Habits	Factor 3 Seek Psycho-social Support	Factor 4 Coping Behavior	Factor 5 Health Habits	h^2 Communalities
10. Brush my teeth and use dental floss in the morning and at nights	.120	.161	.055	-.128	**.594**	.466
20. Include five food groups in each meal (dairy, meat/fish, vegetables, fruit, and corn)	.073	.331	-.085	.022	**.402**	.350
12. Make an effort to stand or sit straight	.097	.106	.146	.242	**.308**	.341

The scores of the subscales were obtained by summing the responses of each item in the subscales. Factor (subscale) 1 was the strongest factor, explaining the greatest percentage of variance (See how much variance is explained by each of the five factors in Table 11). Histograms of the 5 factors and the overall instrument can be seen in Appendix H.

Table 11. Total Variance and Variance by each of the Five Factors Explained

Factors	Eigenvalues	Variance explained (%)	Cumulative %	Eigenvalues after rotation
1 Positive Thinking	5.65	26.89	26.89	3.47
2 Diet and Sleep Habits	1.71	8.13	35.01	2.47
3 Seek Psycho-social Support	1.31	6.23	41.24	2.92
4 Coping Behavior	1.22	5.82	47.07	3.27
5 Health Habits	1.16	5.50	52.57	2.98

Factor (subscale) 1 was the strongest factor explaining the greatest percentage of variance (26.888), and was labeled "Positive Thinking". Factor loadings ranged from 0.625 to 0.874, and the factor includes three items: "Make an effort to like myself; "make an effort to feel happy and content;", and "make an effort to know what's important for me," The structure of the factor is simple and strong; all three items that construct the factor have high loadings on the factor and no "crossloadings" (items do not have high loadings on more than one factor) (Costello & Osborne, 2005). Possible scores on this factor are from 3 to 15.

Factor (subscale) 2 was labeled "Diet and Sleep Habits", and accounted for 8.126% of the total variance. Factor loading ranged from 0.490 to 0.776, and the factor includes three items: "Eat breakfast daily;" "eat three regular meals daily;" and "sleep 8-10 hours each night." The structure of the factor is simple and strong; all three items that support the factor have high loadings on the factor and no "crossloadings" (Costello & Osborne, 2005). Possible scores for this factor are from 3-15.

Factor (subscale) 3 was labeled "Seek Psycho-social Support", and accounted for 6.229% of the total variance. Factor loadings ranged from 0.278 to 0.916, and the factor

included four items: “Discuss my concerns with others;” “talk about my troubles with others;”, “express my caring and warmth to others;”, and “enjoy keeping in touch with relatives”. The factor has crossloading with the factor “Positive Thinking” that exceeds 0.3 (0.385) on one of the four items that construct the factor (“Express my caring and warmth to others”) (Costello & Osborne, 2005). Possible scorings for this factor are 4 to 20.

Factor (subscale) 4 was labeled “Coping Behavior” and accounted for 5.822% of the total variance. Factor loadings ranged from 0.473 to 0.703, and the factor included six items: “Make an effort to determine the source of each stress that occurs;” “make an effort to spend time daily to rest;” “make an effort to moderate my body weight;” ”make schedules and set priorities;” “search for health information;”, “discuss my health concerns with the school nurse”. The factor has crossloading with the factor “Diet and Sleep Habits” that exceeds 0.3 (0.354) on one of the six items that construct the factor (“Make schedules and set priorities”) (Costello & Osborne, 2005). Possible scores for this factor are 6 to 30.

Factor (subscale) 5 was labeled “Health Habits” and accounted for 5.500% of the total variance. Factor loadings score ranged from 0.308 to 0.646, and the factor included five items: “Wash my hands before meals;” “drink at least 6-8 glasses of water daily;” “brush my teeth and use dental floss in the morning and at nights;” “include five food groups in each meal (dairy, meat/fish, and vegetables, fruit and corn;” “and make an effort to stand or sit straight”. The factor has crossloading with factor “Diet and Sleep Habits” that exceeds 0.3 (0.331) on one of the five items that construct the factor (“Include five food groups in each meal (dairy, meat/fish, and vegetables, fruit and corn)”) (Costello & Osborne, 2005). Possible scores for this factor are 5 to 25.

The correlational matrix in Table 12 indicates low to moderate positive correlation (0.076 – 0.320) between factors. The strongest correlation is between Factor 1 (“Positive Thinking”) and Factor 5 (“Health Habits”). Correlation was lowest between

Factor 2 (“Diet and Sleep Habits”) and Factor 3 (“Seek Psycho-social Support”), and not statistically significant t=1.4718; p>0.05; however, p<.20.

Table 12. Component Correlation Matrix

Component	Positive Thinking	Diet and Sleep Habits	Seek Psycho-social Support	Coping Behavior	Health Habits
Positive Thinking	1.00				
Diet and Sleep Habits	**0.22**	1.00			
Seek Psycho-social Support	**0.27**	**0.08**	1.00		
Coping Behavior	**0.29**	**0.13**	**0.29**	1.00	
Health Habits	**0.32**	**0.20**	**0.22**	**0.26**	1.00

Research Question Number 2

What is the internal consistency of the main domains (subscales) of the instrument School-Children Health Promotion?

A final five component solution was obtained on the 21 items from the instrument. The scores of the subscales were obtained by summing the responses of each item in the subscales. The internal consistency (Cronbach´s α) of the total instrument (n=22) was 0.85 (Svavarsdottir & Orlygsdottir, 2006a). After item 22 was omitted (n=21), Cronbach´s α was 0.86; 0.85 for both boys and girls. The Cronbach´s α statistic for the factors ranged from 0.57 to 0.75 (see Table 13). The Cronbach´s α was very good for the overall instrument; respectable for factor 1 and 3; minimally acceptable for factor 2 and 4; and unacceptable for factor 5 (DeVellis, 1991).

Table 13. Internal Consistency of the instrument School-Children Health Promotion

Subscales (Factors)	**Items (n) (Items are listed according to order in Table 10)**	**Alpha Boys**	**Alpha Girls**	**Alpha Total**
Positive Thinking	#6,5,7 (3)	0.77	0.72	0.75
Diet and Sleep Habits	# 19,18, 17 (3)	0.67	0.65	0.66
Seek Psycho-social Support	#1,3,2, 4 (4)	0.69	0.68	0.71
Coping Behavior	# 14,15, 11, 16,8, 9 (6)	0.68	0.72	0.67
Health Habits	#13, 21, 10, 20, 12 (5)	0.57	0.54	0.57
Total scale	**#1 through 21 (21)**	**0.85**	**0.85**	**0.86**

Research Question Number 3

What are the self reported health promotion behaviors of 10-12 year old Icelandic school children (questions, subscales, and the overall health promotion instrument)?

To answer this research question, the individual items (1-21) of the instrument *School – Children's Health Promotion*, the five factor/component solutions identified in research question number 1, and the overall instrument were analyzed descriptively (means, standard deviations, and ranges) (see Table 14). Individual items are scored on a 5 point Likert scale ("never," "rarely." "sometimes," "usually,"; and "always"); higher scores indicated higher frequency of event.

Table 14. Children's Health Promotion Behavior by Items and Factors/Subscales and the overall Instrument *School – Children's Health Promotion*

Variable	n	Mean	SD	Range
Items				
1. Discuss my concerns with others	479	2.90	1.056	1-5
2. Express my caring and warmth to others	473	3.64	1.036	1-5
3. Talk about my troubles with others	478	2.94	1.147	1-5
4. Enjoy keeping in touch with relatives	473	4.39	0.827	1-5
5. Make an effort to feel happy and content	480	4.21	0.811	1-5
6. Make an effort to like myself	475	4.11	0.900	1-5
7. Make an effort to know what's important for me	479	3.90	0.911	1-5
8. Search for health information	474	2.77	1.228	1-5
9. Discuss my health concerns with the school nurse	473	2.13	1.211	1-5
10. Brush my teeth and use dental floss in the morning and at nights	426	3.97	1.168	1-5
11. Make an effort to moderate my body weight	471	3.49	1.454	1-5
12. Make an effort to stand or sit straight	473	3.01	1.249	1-5
13. Wash my hands before meals	479	3.31	1.228	1-5
14. Make an effort to determine the source of each stress that occurs	477	3.15	1.266	1-5
15. Make an effort to spend time daily to rest	477	2.65	1.336	1-5
16. Make schedules and set priorities	472	3.24	1.261	1-5
17. Sleep 8-10 hours each night	477	4.13	1.006	1-5
18. Eat three regular meals daily	478	4.38	0.963	1-5
19. Eat breakfast daily	474	4.48	0.987	1-5
20. Include five food groups in each meal (dairy, meat/fish, vegetables, fruit, and corn)	477	4.05	1.032	1-5
21. Drink at least 6-8 glasses of water daily	475	3.27	1.213	1-5
Factors/Subscales				
Positive Thinking	474	12.22	2.267	3-15
Diet and Sleep Habits	472	12.99	2.278	4-15
Seek Psycho-social Support	463	13.91	2.969	6-20
Coping Behavior	453	17.42	4.910	6-30
Health Habits	417	17.78	3.542	8-25
Overall Instrument (items=21)	375	74.52	11.868	29-102

The central tendencies (mean) and the standard deviation of the 21 items of the instrument *School-Children Health Promotion* varied. The children scored highest on the

item “Enjoy keeping in touch with relatives,” and “Make an effort to like myself”. These are two out of three items of the factor “Positive Thinking.” However, the items with the lowest mean and most variability were the items: “Search for health information” and “Discuss my health concerns with the school nurse,” which are two of six items of the factor “Coping Behavior”.

Histograms, skewness, and kurtosis showed that four of the five subscales and the overall instrument were fairly symmetrical, with skewness and kurtosis less than $< \pm 1.00$ for four of the subscales; only the subscale “Diet and Sleep Habits” was negatively skewed more than 1.00; however less than $< \pm 2.00$ (see Table 15). Histograms of the factors can be seen in Appendix H.

Table 15. Normal Distribution of the Factors and the Overall Instrument showed by Skewness and Kurtosis

Factors/Subscales	**Skewness**	**Kurtosis**
Positive Thinking	-0.929	0.957
Diet and Sleep Habits	-1.473	1.853
Seek Psycho-social Support	-0.189	-0.328
Coping Behavior	0.012	-0.490
Health Habits	-0.480	-0.081
Overall Instrument (items=21)	-0.444	0.118

Research Question Number 4

Does the self reported health promotion behavior of 10-12 year old Icelandic school children differ based on their gender and/or grade?

Gender

Of the 480 children who participated in the study, 209 (43.5%) were male and 271 (56.5%) were female. Boys scored lower than girls on all the questions except two (items # 15 and 19). Of the 21 items in the instrument, statistically significant differences were found in 13 of the 21 items (61.90%) (items # 1, 2, 3, 4, 5, 7, 8, 10, 12, 16, 17, 18, and 20). Similar differences, boys scoring lower than girls, were also found for all the factors (subscales); however, the difference was not statistically significant for factor number 4 ("Coping Behavior"). A statistically significant difference was also found based on gender on the total score of the instrument *School-Children's Health Promotion* (n=21). Boys scored significantly lower (mean 71.23; (SD) 11.901) than girls (mean 76.82; (SD) 11.321; $p = 0.000$) ($t=-4.561$) (See Table 16).

The Bonferroni correction was used to correct for multiple comparisons; the significance level ($p \leq 0.05$) was divided by the number of factor items (n=21) to get corrected p - level to detect significance between the mean scores (corrected p level is therefore ≤ 0.00238). After the Bonferroni correction, statistically significant differences existed in 7 out of 21 items (33.33%) (items #1,2,3,5, 8,10, and 17). Moreover, after the correction, the difference was significant on factor 3 and 5, and also on the overall instrument (See Table 16).

Table 16. Health Promotion Behavior by Gender

Variables	Boys Mean (SD)	Girls Mean (SD)	t-value	p-value[a]
Items				
1. Discuss my concerns with others	2.60 (1.019)	3.12 (1.031)	-5.405	0.000*#
2. Express my caring and warmth to others	3.26 (1.086)	3.94 (0.893)	-7.240	0.000*#
3. Talk about my troubles with others	2.75 (1.120)	3.09 (1.147)	-3.282	0.001*#
4. Enjoy keeping in touch with relatives	4.29 (0.847)	4.47 (0.804)	-2.275	0.023*
5. Make an effort to feel happy and content	4.04 (0.921)	4.34 (0.690)	-3.980	0.000*#
6. Make an effort to like myself	4.04 (0.987)	4.16 (0.826)	-1.498	0.135
7. Make an effort to know what's important for me	3.80 (0.994)	3.98 (0.983)	-1.964	0.050*
8. Search for health information	2.57 (1.227)	2.93 (1.209)	-3.127	0.002*#
9. Discuss my health concerns with the school nurse	2.11 (1.141)	2.15 (1.264)	-0.412	0.685
10. Brush my teeth and use dental floss in the morning and at nights	3.68 (1.309)	4.18 (1.264)	-4.296	0.000*#
11. Make an effort to moderate my body weight	3.49 (1.471)	3.50 (1.443)	-0.089	0.929
12. Make an effort to stand or sit straight	2.83 (1.219)	3.14 (1.257)	-2.672	0.008*
13. Wash my hands before meals	3.26 (1.285)	3.35 (1.183)	-0.836	0.404
14. Make an effort to determine the source of each stress that occurs	3.07 (1.318)	3.21 (1.224)	-1.186	0.236
15. Make an effort to spend time daily to rest	2.68 (1.385)	2.62 (1.298)	0.438	0.661
16. Make schedules and set priorities	3.09 (1.252)	3.36 (1.258)	-2.330	0.020*
17. Sleep 8-10 hours each night	3.94 (1.120)	4.28 (0.884)	-3.600	0.000*#
18. Eat three regular meals daily	4.23 (1.083)	4.49 (0.844)	-2.878	0.003*
19. Eat breakfast daily	4.52 (0.958)	4.46 (1.009)	0.654	0.514
20. Include five food groups in each meal (dairy. meat/fish. vegetables. fruit. and corn)	3.93 (1.081)	4.14 (0.984)	-2.289	0.023*
21. Drink at least 6-8 glasses of water daily	3.18 (1.252)	3.34 (1.181)	-1.390	0.165

Table 16. Continued

Variables	Boys Mean (SD)	Girls Mean (SD)	t-value	p-value[a]
Factors				
Positive Thinking	11.87 (2.408)	12.48 (2.023)	-2.982	0.003*
Diet and Sleep Habits	12.67 (2.465)	13.25 (2.097)	-2.674	0.008*
Seek Psycho-social Support	12.98 (2.951)	14.62 (2.789)	-6.051	0.000*#
Coping Behavior	16.98 (4.822)	17.75 (4.959)	-1.661	0.097
Health Habits	16.97 (3.715)	18.36 (3.296)	-4.040	0.000*#
Overall Instrument (n=21)	71.23 (11.901)	76.82 (11.321)	-4.561	0.000*#

[a] Independent t-test
*$p \leq 0.05$
#After the Bonferroni correction $p \leq 0.00238$

Grade

Of the 480 children who participated in the study, 244 were in 5th grade (50.83%) and 236 in 6th grade (49.17%). Difference between grades was only significant for one of the 21 questions. The younger age group (mean 3.40; (SD) 1.221) was more likely to drink at least 6-8 glasses of water daily (item #21) than the older group (mean 3.14; (SD) 1.193; $p = 0.017$) ($t = 2.398$). There was not a statistically significant difference between the grades on the factors and the total score of the instrument *School-Children's Health Promotion*. After the Bonferroni correction ($p \leq 0.00238$) no statistically significant differences were observed for any of the 21 items, factors or the overall instrument (See Table 17).

Table 17. Health Promotion Behavior by Grade

Variables	5th Grade Mean (SD)	6th Grade Mean (SD)	t-value	p-value[a]
Items				
1. Discuss my concerns with others	2.88 (1.063)	2.91 (1.050)	-0.314	0.753
2. Express my caring and warmth to others	3.70 (1.054)	3.59 (1.016)	1.208	0.228
3. Talk about my troubles with others	2.92 (1.190)	2.96 (1.101)	-0.414	0.679
4. Enjoy keeping in touch with relatives	4.42 (0.826)	4.37 (0.829)	0.663	0.508
5. Make an effort to feel happy and content	4.23 (0.804)	4.19 (0.819)	0.581	0.561
6. Make an effort to like myself	4.16 (0.882)	4.06 (0.918)	1.287	0.199
7. Make an effort to know what's important for me	3.93 (0.966)	3.87 (1.017)	0.678	0.498
8. Search for health information	2.81 (1.263)	2.73 (1.191)	0.758	0.449
9. Discuss my health concerns with the school nurse	2.20 (1.213)	2.07 (1.209)	1.142	0.254
10. Brush my teeth and use dental floss in the morning and at nights	3.97 (1.150)	3.96 (1.187)	0.077	0.938
11. Make an effort to moderate my body weight	3.45 (1.430)	3.54 (1.480)	-0.649	0.517
12. Make an effort to stand or sit straight	3.04 (1.245)	2.97 (1.254)	0.588	0.557
13. Wash my hands before meals	3.35 (1.218)	3.28 (1.240)	0.662	0.508
14. Make an effort to determine the source of each stress that occurs	3.19 (1.273)	3.11 (1.261)	0.612	0.541
15. Make an effort to spend time daily to rest	2.61 (1.325)	2.68 (1.348)	-0.590	0.555
16. Make schedules and set priorities	3.30 (1.243)	3.18 (1.279)	1.043	0.298
17. Sleep 8-10 hours each night	4.14 (0.982)	4.12 (1.032)	0.140	0.888
18. Eat three regular meals daily	4.42 (0.936)	4.33 (0.990)	0.984	0.325

Table 17. Continued

Variables	5th Grade Mean (SD)	6th Grade Mean (SD)	t-value	p-value[a]
19. Eat breakfast daily	4.46 (1.018)	4.51 (0.955)	-0.554	0.580
20. Include five food groups in each meal (dairy. meat/fish. vegetables. fruit. and corn)	3.98 (1.064)	4.12 (0.995)	-1.433	0.153
21. Drink at least 6-8 glasses of water daily	3.40 (1.221)	3.14 (1.193)	2.398	0.017*
Factors				
Positive Thinking	12.32 (2.190)	12.11 (2.243)	1.071	0.285
Diet and Sleep Habits	13.01 (2.333)	12.98 (2.226)	0.142	0.888
Seek Psycho-social Support	13.89 (3.009)	13.93 (2.933)	-0.105	0.917
Coping Behavior	17.47 (5.080)	17.36 (4.738)	0.232	0.817
Health Habits	17.93 (3.550)	17.63 (3.536)	0.871	0.384
Overall Instrument (n=21)	74.88 (11.499)	74.18 (1.233)	0.572	0.567

[a] Independent t-test
*$p \leq 0.05$

Gender and Grade

Of the 244 children in 5th grade who participated in the study, 108 (22.50%) were boys and 136 (28.33%) were girls. In 6th grade, 101 (21.04%) were boys and 135 (28.13%) were girls. For the younger age group (5th grade), the girls scored higher than the boys on all the items but # 11 and # 19 (for 90.48% of the questions). For the older age group (6th grade), the girls scored higher than the boys on all items but # 15 (for 95.24% of the questions), and the scores of the genders were equal in item #19.

Significant difference ($p \leq 0.05$) was between boys and girls for both the older (6^{th} grade) and the younger (5^{th} grade) age groups for items # 1, 2, 3, 10, and 17 (for 23.81% of the questions). For items # 4, 5, 16, 18, and 20 (23.81%), statistical significance ($p \leq 0.05$) was only between boys and girls in the older age group (6^{th} grade); but not between genders in the younger age group (5^{th} grade). For items # 8 and 12 (9.52%), statistical significance existed only between boys and girls in the younger age group (5^{th} grade); however not between the older age group (6^{th} grade). No statistical significance ($p>0.05$) were between genders on items # 6, 7, 9, 11, 13, 14, 15, 19, and 21 (42.86%). See Table 18.

Boys in 5^{th} grade also scored lower than girls in 5^{th} grade on all the factors; however, the differences were only statistically significant for factor 3 ("Seek Psycho-social Support") and factor 5 ("Health Habits"). Moreover, in 6^{th} grade boys scored lower than girls on all the factors, and the difference was statistically significant for all the factors except for factor number 4 ("Coping Behavior").

In the 5^{th} grade, boys in 5^{th} grade (mean 71.54; (SD) 11.683) scored at a statistically significantly lower level on the total score of the instrument *School-Children's Health Promotion* (n=21) than did girls (mean 77.33 (10.805; (SD) 10.805; p= 0.001) (t = -3.483). This was the same for children in 6^{th} grade; boys scored statistically lower (mean 71.05; (SD) 12.229) than girls (mean 76.33; (SD) 11,812); p=0.001) (t=-2.996) (See Table 18)

After the Bonferroni correction ($p \leq 0.00238$), significant differences between genders in 5^{th} grade were observed for 6 out of the 21 items (28.57%) (items# 1,2,3,8,10, and 17). Moreover, after the correction the difference was significant for factor 3 and the overall instrument. Statistically significant differences between genders in 6^{th} grade were observed on 3 out of the 21 items (14.28%) (items# 1,2, and 5); however, only for the third factor and not for the overall instrument (See Table 18).

Table 18. Health Promotion Behavior by Grade and Gender

Variables	**5th Grade** **Boys Mean (SD)** Girls Mean (SD)	**t-value**	**p-value[a]**	**6th Grade** **Boys Mean (SD)** Girls Mean (SD)	**t-value**	**p-value[a]**
Items						
1. Discuss my concerns with others	**2.61 (1.075)** 3.10 (1.007)	-3.622	0.000*#	**2.60 (0.960)** 3.14 (1.059)	-4.008	0.000*#
2. Express my caring and warmth to others	**3.29 (1.141)** 4.03 (0.849)	-5.587	0.000*#	**3.23 (1.026)** 3.84 (0.929)	-4.780	0.000*#
3. Talk about my troubles with others	**2.75 (1.208)** 3.05 (1.163)	-1.977	0.000*#	**2.74 (1.021)** 3.13 (1.133)	-2.693	0.008*
4. Enjoy keeping in touch with relatives	**4.39 (0.759)** 4.44 (0.878)	-2.851	0.652	**4.19 (0.928)** 4.50 (0.724)	-2.851	0.005*
5. Make an effort to feel happy and content	**4.12 (0.914)** 4.32 (0.696)	-1.899	0.059	**3.96 (0.927)** 4.36 (0.685)	-3.767	0.000*#
6. Make an effort to like myself	**4.08 (0.987)** 4.22 (0.789)	-1.201	0.231	**3.99 (0.990)** 4.10 (0.861)	-0.944	0.346
7. Make an effort to know what's important for me	**3.87 (1.024)** 3.98 (0.918	-0.861	0.390	**3.72 (0.960)** 3.98 (1.047)	-1.917	0.056
8. Search for health information	**2.52 (1.274)** 3.04 (1.210)	-3.273	0.001*#	**2.63 (1.178)** 2.80 (1.201)	-1.096	0.274
9. Discuss my health concerns with the school nurse	**2.17 (1.215)** 2.22 (1.216)	-0.295	0.768	**2.04 (1.059)** 2.09 (1.312)	-0.316	0.760
10. Brush my teeth and use dental floss in the morning and at nights	**3.67 (1.387)** 4.19 (0.890)	-3.070	0.001*#	**3.68 (1.237)** 4.17 (1.110)	-3.034	0.003*

Table 18. Continued

Variables	**5th Grade** **Boys Mean (SD)** Girls Mean (SD)	**t-value**	**p-value[a]**	**6th Grade** **Boys Mean (SD)** Girls Mean (SD)	**t-value**	**p-value[a]**
11. Make an effort to moderate my body weight	**3.50 (1.416)** 3.41 (1.446)	0.469	0.639	**3.48 (1.534)** 3.59 (1.441)	-0.569	0.570
12. Make an effort to stand or sit straight	**2.86 (1.155)** 3.19 (1.298)	-2.049	0.042*	**2.81 (1.286)** 3.10 (1.219)	-1.733	0.084
13. Wash my hands before meals	**3.27 (1.343)** 3.41 (1.112)	-0.874	0.372	**3.25 (1.228)** 3.30 (1.252)	-0.298	0.766
14. Make an effort to determine the source of each stress that occurs	**3.16 (1.326)** 3.21 (1.234)	-0.294	0.769	**2.98 (1.310)** 3.21 (1.218)	-1.415	0.158
15. Make an effort to spend time daily to rest	**2.55 (1.346)** 2.66 (1.311)	-0.651	0.516	**2.81 (1.419)** 2.59 (1.289)	1.280	0.202
16. Make schedules and set priorities	**3.20 (1.247)** 3.39 (1.238)	-1.191	0.235	**2.97 (1.252)** 3.33 (1.281)	-2.152	0.032*
17. Sleep 8-10 hours each night	**3.92 (1.079)** 4.31 (0.865)	-3.151	0.002*[#]	**3.96 (1.166)** 4.25 (0.905)	-2.044	0.035*
18. Eat three regular meals daily	**4.32 (1.060)** 4.50 (0.818)	-1.495	0.125	**4.14 (1.105)** 4.48 (0.871)	-2.665	0.008*
19. Eat breakfast daily	**4.52 (0.982)** 4.41 (1.046)	0.879	0.381	**4.51 (0.937)** 4.51 (0.971)	0.020	0.984
20. Include five food groups in each meal (dairy. meat/fish. vegetables. fruit. and corn)	**3.93 (1.101)** 4.02 (1.037)	-0.635	0.526	**3.92 (1.065)** 4.27 (0.916)	-2.677	0.008*
21. Drink at least 6-8 glasses of water daily	**3.32 (1.300)** 3.47 (1.155)	-0.962	0.337	**3.04 (1.188)** 3.21 (1.196)	-1.072	0.285

Table 18. Contined

Variables	**5th Grade** **Boys Mean (SD)** Girls Mean (SD)	**t-value**	**p-value[a]**	**6th Grade** **Boys Mean (SD)** Girls Mean (SD)	**t-value**	**p-value[a]**
Factors						
Positive Thinking	**12.05 (2.405)** 12.54 (1.987)	-1.695	0.091	**11.68 (2.407)** 12.42 (2.064)	-2.544	0.012*
Diet and Sleep Habits	**12.75 (2.495)** 13.21 (2.186)	-1.532	0.127	**12.59 (2.442)** 13.28 (12.009)	-2.295	0.023*
Seek Psycho-social Support	**13.05 (3.088)** 14.59 (2.768)	-4.071	0.000*[#]	**12.90 (2.797)** 14.64 (2.821)	-4.562	0.000*[#]
Coping Behavior	**16.93 (5.111)** 17.90 (5.033)	-1.452	0.148	**17.03 (4.505)** 17.60 (4.899)	-0.878	0.381
Health Habits	**17.13 (3.759** 18.52 (3.283)	-2.805	0.006*	**16.82 (3.686)** 18.22 (3.315)	-2.897	0.004*
Overall Instrument (n=21)	**71.54 (11.683)** 77.33 (10.805)	-3.483	0.001*[#]	**71.05 (12.229)** 76.33 (11.812)	-2.996	0.003*

[a] Independent t-test
*$p \leq 0.05$
[#]After the Bonferroni correction $p \leq 0.00238$

Research Question Number 5

Is there a pattern/s of information and important variables/attributes that can predict health promotion behavior of 10-12 year old Icelandic school children?

The outcome measures (the factors from research question number one and the overall score of the instrument *School-Children Health Promotion*) for supervised learning were converted into binary variables. To do so, first a cutoff point was calculated for each item that constructed the factors and the overall score of the instrument; see Table 10 for the items that create the 5 factors. Each item was given the code zero to indicate lack of health promotion behavior when the score was "Never," "Rarely," or "Sometimes." To indicate positive health promotion behavior, each item was coded with the value of 1 when the score was "Usually" or "Always" (Lindberg & Swanberg, 2006). Thereafter, new factors were obtained by summing the new binary variables for each of the five subscales and the overall instrument. Then, the new factors were converted into binary variables. Factor 1 ("Positive Thinking") and Factor 2 ("Diet and Sleep Habits") included three items; lack of health promotion behavior was therefore coded 0 for scores 0-1 and positive health promotion behavior was coded 1 for scores 2-3. Factor 3 ("Seek Psycho-social Support") included four items. Lack of health promotion behavior was coded 0 for scores 0-2 and positive health promotion behavior was coded 1 for scores 3-4. Factor 4 ("Coping Behavior") included six items. Lack of health promotion behavior was coded 0 for scores 0-3 and positive health promotion behavior was coded 1 for 4-6. Factor 5 ("Health Habits") included five items. Lack of health promotion behavior was coded 0 for scores 0-2 and positive health promotion behavior was coded 1 for 3-5. For the overall instrument (items 1 through 21), lack of health promotion was coded 0 for 0-10 and positive health promotion behavior was coded 1 for 11-21.

Table 19 displays the frequency of lack of health promotion behavior and positive health promotion behavior for each of the binary outcome variables (the five factors and the overall instrument).

Table 19. Binary Outcome Variables (Frequency of Lack of Health Promotion Behavior versus Positive Health Promotion Behavior)

Name of Factors and Overall Instrument	**Lack of Health Promotion = 0 n (%)**	**Positive Health Promotion = 1 n (%)**	**Missing Data n**
Positive Thinking	85 (17.9%)	389 (82.1%)	6
Diet and Sleep Habits	59 (12.5%)	413 (87.5%)	8
Seek Psycho-social Support	309 (66.7%)	154 (33.3%)	17
Coping Behavior	344 (75.9%)	109 (24.1%)	27
Health Habits	163 (39.1%)	254 (60.9%)	63
Overall Instrument (items 1 through 21)	125 (33.3%)	250 (66.7%)	105

Factor One: "Positive Thinking"

Full Dataset

The full dataset (199 items, see Table 6) was used to classify "Positive Thinking" of 10-12 year old children (Factor 1) with decision tree (*J48*) and logistic regression (*Logistic*). The results of the *ZeroR*, which predicts the test data majority class, were also presented (Witten & Frank, 2005). Accuracy, sensitivity, specificity, AUC, and the confusion matrix of the two classifiers are reported in Table 20.

Table 20. Accuracy, Sensitivity, Specificity, AUC, and Confusion Matrix of Full Dataset for Factor 1

Full Dataset						
	Accuracy	**Sensitivity**	**Specificity**	**AUC**	**Confusion Matrix**	
ZeroR	83.06%	-	-	-		
J48	78.90%	94.43%	8.23%	0.58	367	22
					78	7
Logistic	70.88%[#]	77.64%[#]	40.00%	0.61	302	87
					51	34

[#] statistically worse than the other classifier

The accuracy and sensitivity of the logistic regression were significantly worse than using the decision tree. Neither classifier did very well, as can bee seen in the estimated ROC curves for the two classifiers in Figure 6.

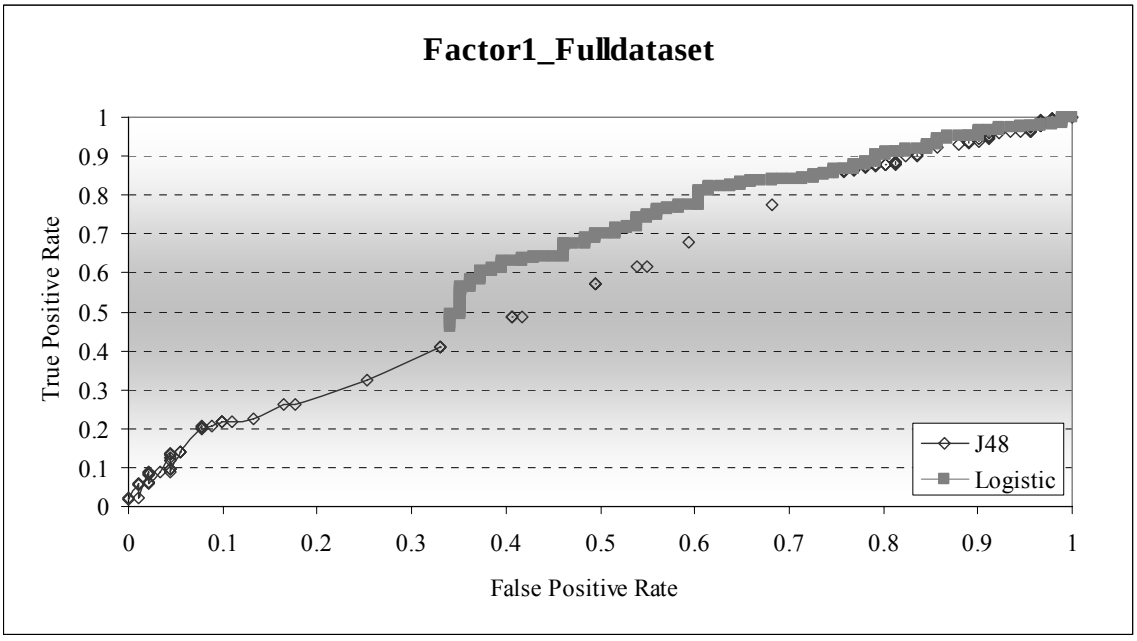

Figure 6. ROC Curves for the First Factor from the Full Dataset: Decision Tree and Logistic Regression

Figure 7 shows the decision tree as created by the *J48* algorithms with all of possible predicting items (full dataset). The top- level tree (root) node, which has the most predictive value, was the item spl13 ("I worry about what will happen to me"). It has two outgoing edges; one of them has a leaf node. For children who worry about what will happen to them, the item "How do you feel when you are at school?" and "I feel afraid or scared" have an impact on their positive thinking. More items that predict positive thinking of 10-12 year old children can be seen in descending nodes of the decision tree in Figure 7. Examples of decision tree rules are in Table 21.

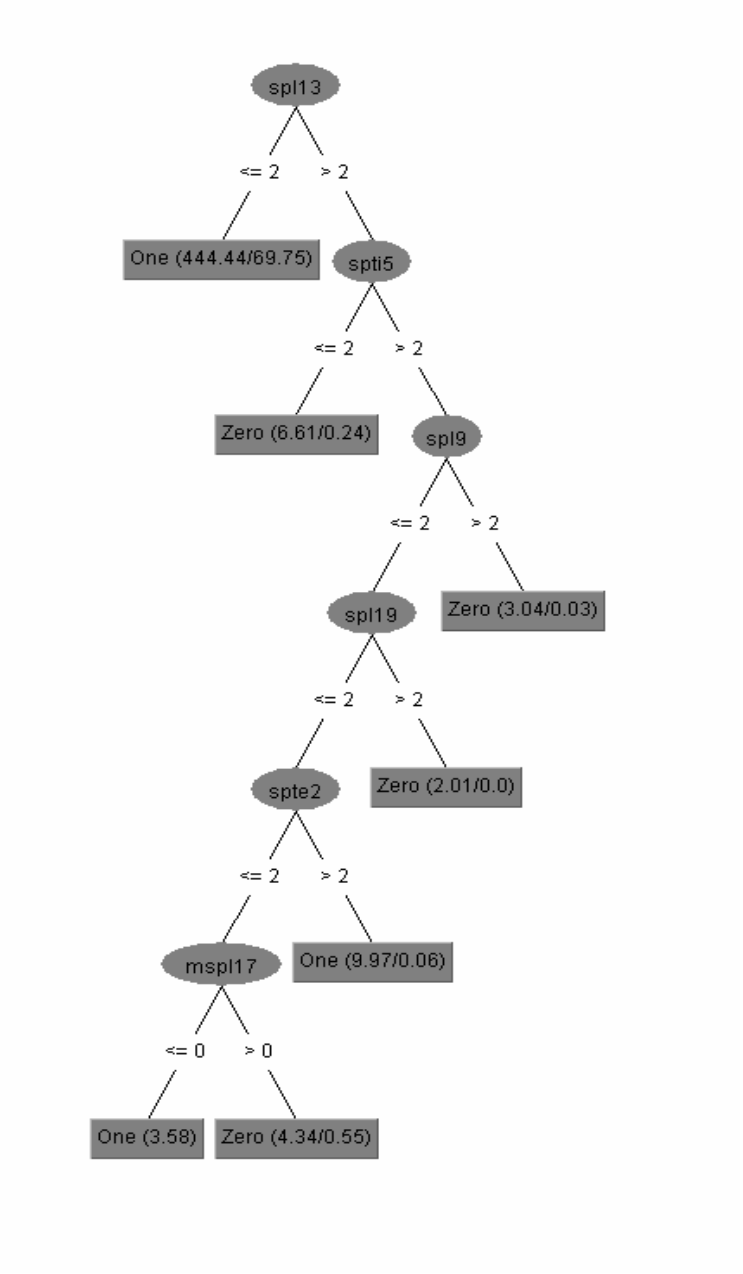

Figure 7. Decision tree (*J48*) of all the Predictors of the First Factor

Table 21. Examples of Decision Rules for Factor 1 (Positive Thinking) from the Full Dataset

FULL DATASET
Decision Rule: One = "Positive Thinking" and Zero = Lack of "Positive Thinking"
If children do not worry (never, almost never and seldom) about what will happen to them, THEN they do think positively (444.44/69.75)
If children worry (often and almost always) about what will happen to them, AND they are sad (<=2) when they are at school, THEN they do not think positively (6.61/0.24)
If children worry (often and almost always) about what will happen to them, AND they are happy (>2) when they are in school, AND feel afraid or scared (often and almost always), THEN they do not think positively (3.04/0.03)

Subset for Factor 1 "Positive Thinking"

To create subset, the ranking method *BestFit* which was sorted by the *CfsSubsetEval* algorithm, was used. The subset for the first factor named "Positive Thinking" included 29 items. The names of the items and descriptions are presented in Table 22.

Table 22. Names of Items in Subset for the first Factor "Positive Thinking"

Instrument	Items (like they appear in the data set)	Name of Items	Description
Pediatric Quality of Life Inventory Version 4.0. Child Report (ages 8-12)	lifsgædi	Overall Score for Quality of Life (Answered by the Children)	Numeric
	spl5	It is hard for me to take a bath or shower by myself	"0 through 4"
	spl7	I hurt or ache	"0 through 4"
	spl12	I have trouble sleeping	"0 through 4"
	spl13	I worry about what will happen to me	"0 through 4"
	spl19	It is hard to pay attention in class	"0 through 4"
	spl20	I forget things	"0 through 4"
	spl21	I have trouble keeping up with my schoolwork	"0 through 4"
	mspl16	Getting teased by other children (Answered by Mothers)	"0 through 4"
	mspl21	Forgetting things (Answered by mothers)	"0 through 4"
	mlifsgædi	Overall Score for Quality of Life (Answered by Mothers)	Numeric
	mlifsgædi1	Physical functioning (Answered by the Mothers)	Numeric
	fspl6	Getting teased by other children (Answered by Fathers)	"0 through 4"
	fspl20	Forgetting things (Answered by Fathers)	"0 through 4"
	flifsgædi	Overall Score for Quality of Life (Answered by Fathers)	Numeric
Friendship Quality Questionnaire-Revised (Short Form) (Boys or Girls)	spvi2	My friend and I get mad at each other a lot	"1 through 5"

Table 22. Continued

Instrument	Items (like they appear in the data set)	Name of Items	Description
	spvi3	My friend tells me I´m good at things	"1 through 5"
	spvi5	My friend and I make each other feel important and special	"1 through 5"
	spvi6	If my friend hurts my feeling, my friend says "I´m sorry"	"1 through 5"
	spvi27	My friends doesn't listen to me	"1 through 5"
	vval	Validation and Caring	Numeric
	vint	Intimate Disclosure	Numeric
	vconr	Conflict Resolution	Numeric
Connection to School	spte1	I feel safe in my school	"1 through 5"
	spte3	I feel like I am a part of this school	"1 through 5"
Feelings about School (FAS) (Short version)	spti1	How do you feel about going to school?	"1 through 5"
	spti3	How does your teacher feel about you?	"1 through 5"
	spti5	How do you feel when you are at school?	"1 through 5"
Demographic and Background Information (Parents)	maldurm	Your (mother) age	Numeric

With the subset described in Table 22, positive thinking was also classified with decision tree (*J48*) and logistic regression (*Logistic*). Accuracy, sensitivity, specificity, AUC, and the confusion matrix of the two classifiers are reported in Table 23.

Table 23. Accuracy, Sensitivity, Specificity, AUC, and Confusion Matrix of Subset for Factor 1

Subset						
	Accuracy	**Sensitivity**	**Specificity**	**AUC**	**Confusion Matrix**	
ZeroR	82.07%	-	-	-		
J48	78.69%	91.00%	22.35%	0.62	354	35
					66	19
Logistic	81.85%†	93.32%	29.41%	0.80	363	26
					60	25

†statistically better than the other classifier

The accuracy of the prediction in logistic regression performed statistically better than the accuracy of the decision tree; however, the sensitivity was not different between the classifiers. Estimated ROC curves for the two classifiers are presented in Figure 8, where the curve for the logistic regression performed better by being considerably closer to the upper left corner of the graph than the decision tree.

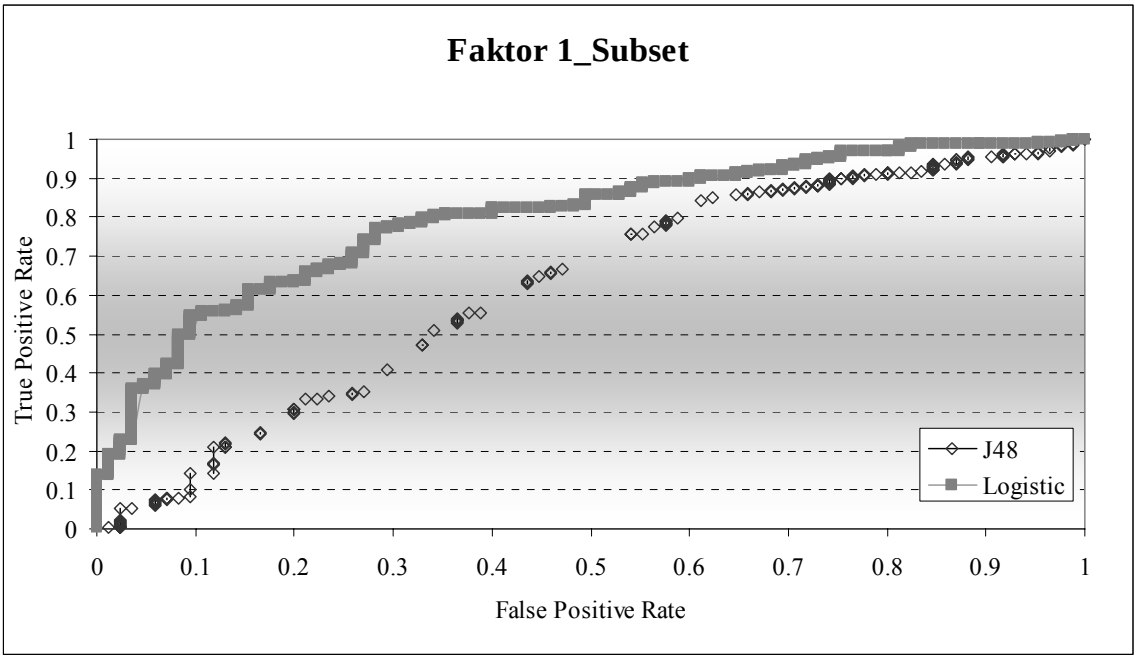

Figure 8. ROC Curves for the First Factor from the Subset: Decision Tree and Logistic Regression

Figure 9 shows the decision tree created by the *J48* algorithm. The top -level tree (root) node of the subset, which has the most predicting value, was the item spl13 ("I worry about what will happen to me"), which has two outgoing edges. For children who do not worry about what will happen to them, the item "Validation and Caring" and "I forget things" have an impact on their positive thinking. On the other hand, for children who do worry about what will happen to them, the item "How do you feel when you are at school?" and "It is hard to pay attention in class" have an impact on their positive thinking. More items that predict positive thinking of 10-12 year old children can be seen

in descending nodes of the decision tree in Figure 9. Examples of decision tree rules are in Table 24.

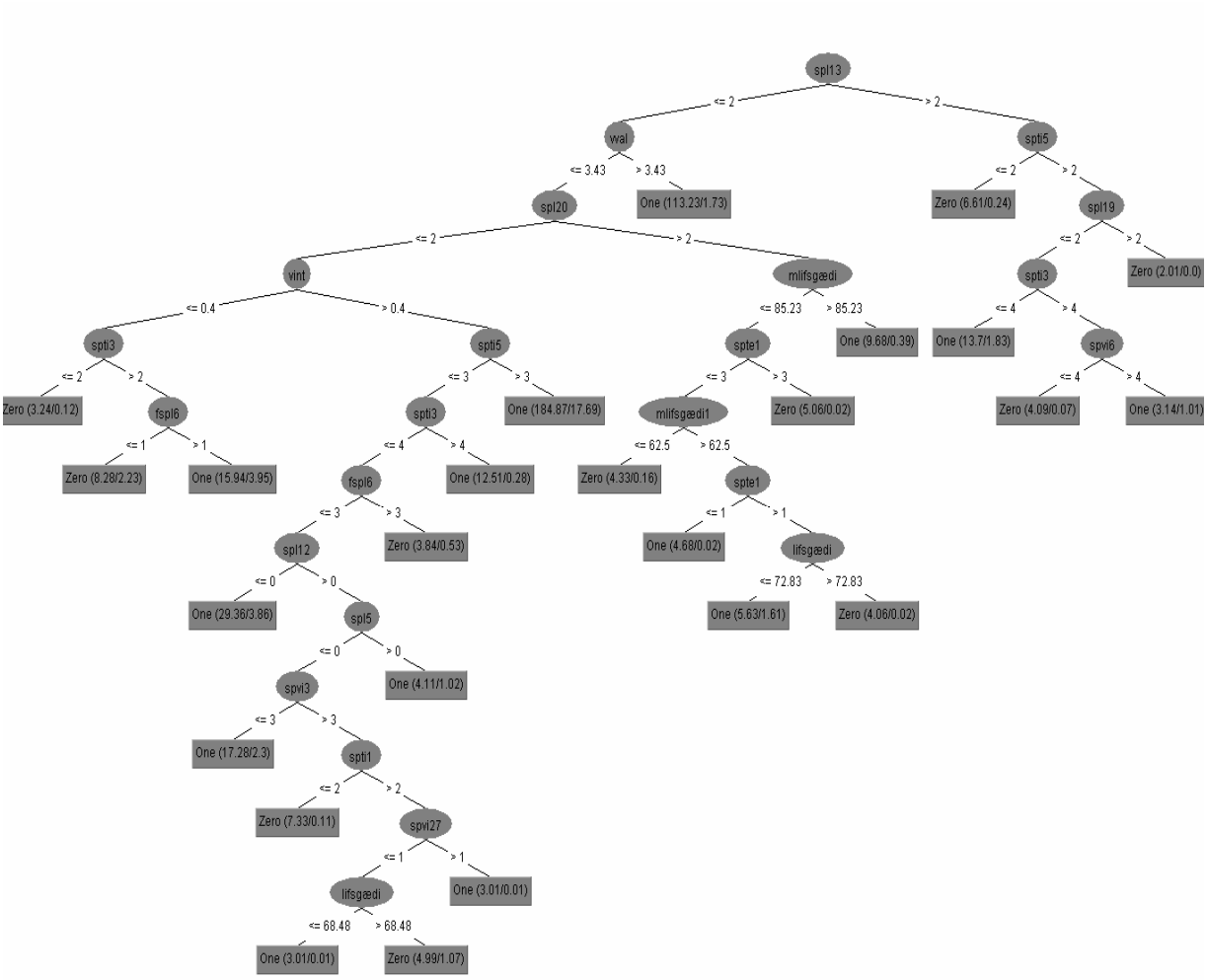

Figure 9. Decision Tree (*J48*) for the Subset of the First Factor

Table 24. Examples of Decision Rules for Factor 1 (Positive Thinking) from the Subset

SUBSET
Decision Rule: One = "Positive Thinking" and Zero = Lack of "Positive Thinking"
If children do not worry (never, almost never and seldom) about what will happen to them, AND they score high (> 3.43) on validation and caring[1] (min 0.29; max 4.00; mean 2.80), THEN they do think positively (113.23/1.73)
If children worry (often and almost always) about what will happen to them, AND they are sad (<=2) when they are at school, THEN they do not think positively (6.61/0.24)
If children worry (often and almost always) about what will happen to them, AND they are happy (>2) when they are in school, AND they find it hard (>2) to pay attention in class, THEN they do not think positively (2.01/0.00)

[1] For the Friendship Quality instrument the items for each subscale were summed up and then divided by the numbrs of items for each subscale

The *Logistic* algorithm showed that four statistically significant items in the subset in Table 22 predict positive thinking. When the children scored higher on the items"My friend tells me I'm good at things," "My friend and I make each other feel important and special," "If my friend hurts my feeling, my friend says "I'm sorry," and "Intimate Disclosure," they were more likely to think positively. The mean of the coefficients, standard deviation, and confidence intervals of the attributes in the subset from Table 22 are reported in Table 25.

Table 25. The Subset from the First Factor and the Coefficients from the Logistic Regression

Items (like they appear in the data set)	**Mean of the Coefficient (Logistic Regression)**	**Standard Deviation**	**[95% CI]**
lifsgædi	-0.0296	0.0248	[-0.0782, 0.0191]
spl5	-0.4221	0.2963	[-1.0029, 0.1587]
spl7	-0.0903	0.2466	[-0.5736, 0.3931]
spl12	-0.3537	0.1811	[-0.7087, 0.0013]
spl13	-0.2197	0.2159	[-0.6428, 0.2034]
spl19	-0.0808	0.1899	[-0.4531, 0.2915]
spl20	-0.2210	0.1292	[-0.4743, 0.0323]
spl21	-0.1442	0.2693	[-0.6721, 0.3836]
mspl16	-0.2624	0.2237	[-0.7008, 0.1761]
mspl21	0.0124	0.2113	[-0.4017, 0.4265]
mlifsgædi	0.0209	0.0327	[-0.0431, 0.0850]
mlifsgædi1	0.0000	0.0167	[-0.0326, 0.0327]
fspl6	-0.0738	0.2937	[-0.6494, 0.5018]
fspl20	-0.3370	0.2285	[-0.7849, 0.1110]
flifsgædi	0.0047	0.0143	[-0.0234, 0.0328]
spvi2	-0.4377	0.2382	[-0.9046, 0.0291]
spvi3*	0.8386	0.2075	[0.4319, 1.2454]
spvi5*	0.7186	0.1955	[0.3355, 1.1017]
spvi6*	0.5019	0.1849	[0.1395, 0.8643]

Table 25. Continued

Items (like they appear in the data set)	Mean of the Coefficient (Logistic Regression)	Standard Deviation	[95% CI]
spvi27	-0.0984	0.2170	[-0.5237, 0.3268]
vval	-2.0822	0.6042	[-3.2664, -0.898]
vint*	0.5161	0.2564	[0.0136, 1.0186]
vconr	-0.0163	0.2739	[-0.5532, 0.5205]
spte1	-0.1016	0.2024	[-0.4983, 0.2951]
spte3	-0.0443	0.1831	[-0.4031, 0.3145]
spti1	0.0880	0.2220	[-0.3471, 0.5231]
spti3	0.3202	0.1799	[-0.0324, 0.6728]
spti5	0.4057	0.2393	[-0.0633, 0.8748]
maldurm	-0.0392	0.0374	[-0.1126, 0.0341]

Summary

Neither the decision tree nor the logistic regression did very well for the full dataset; even though the logistic regression showed a better AUC. However, both classifiers did better on the subset than the full dataset, and the AUC for the logistic regression was 0.80, which is acceptable. The result from the decision tree (both the full dataset and the 29 item subset) showed that the most important item for both the full dataset and the subset was the "I worry about what will happen to me." However, the results from the logistic regression show that four items that are significant in predicting positive thinking all have to do with children's relationship with their friends.

Factor Two: "Diet and Sleep Habits"

Full Dataset

The full dataset (199 items, see Table 6) was used to classify "Diet and Sleep Habits" of 10-12 year old children (Factor 2) using the decision tree (*J48*) and logistic regression (*Logistic*). Accuracy, sensitivity, specificity, AUC, and the confusion matrix of the two classifiers are reported in Table 26.

Table 26. Accuracy, Sensitivity, Specificity, AUC and Confusion Matrix for the Full Dataset for Factor 2

Full Dataset						
	Accuracy	**Sensitivity**	**Specificity**	**AUC**	**Confusion Matrix**	
ZeroR	87.50%	-	-	-	-	
J48	85.17%	96.12%	8.47%	0.56	397	16
					54	5
Logistic	71.61%#	77.24%#	32.30%	0.54	319	94
					40	19

statistically worse than the other classifier

The accuracy and sensitivity of prediction using the logistic regression performed significantly worse than the decision tree. The AUC for neither classifier did well (see the estimated ROC curves in Figure 10).

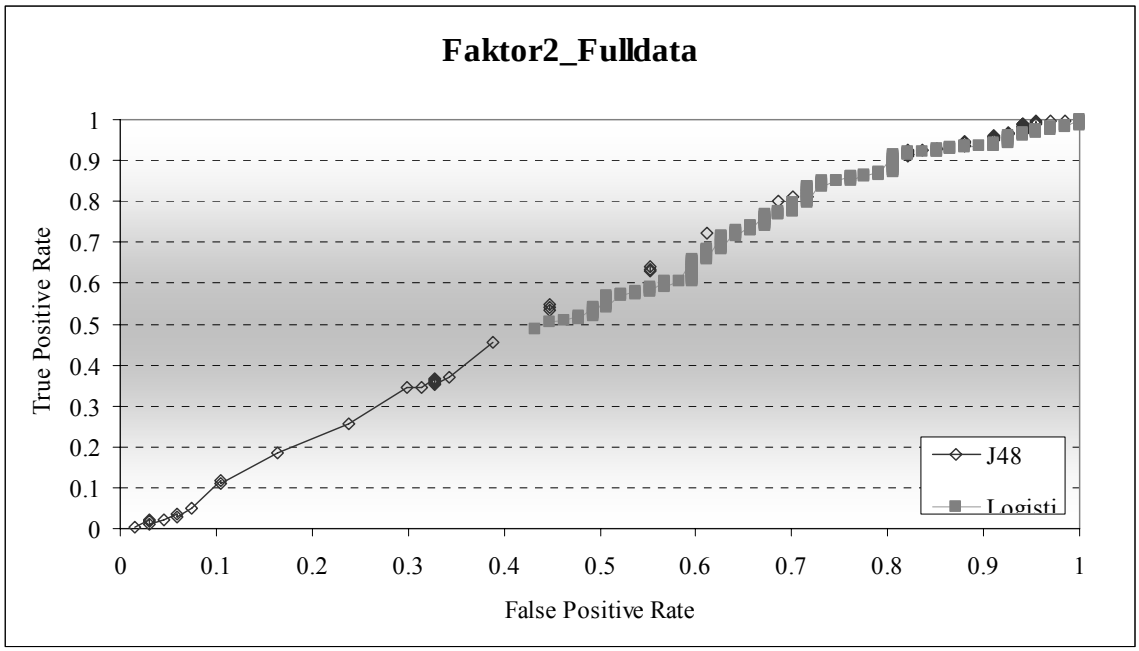

Figure 10. ROC Curves for the Second Factor from the Full Dataset: Decision Tree and Logistic Regression

Figure 11 shows the decision tree created by the *J48* algorithms using all possible predicting items (full dataset). The top-level tree (root) node, which has the highest predicting value, was the item spl12 "Trouble sleeping". For children who have trouble sleeping, examples of items that have an impact on their diet and sleep patterns are: "Do you have a hobby/hobbies?" "My friend and I always make up easily when we have a fight," and "Do you tease other children?" However, among children who do not have trouble sleeping, the items "It is hard for me to walk more than one block," "My friend and I live really close to each other," and "Do you tease other children?" was found to have an impact on their diet and sleep habits. More items that predict diet and sleep habits of 10-12 year old children can bee seen in descending nodes of the decision tree in

Figure 11. Moreover, examples of decision tree rules from the full dataset are in Table 27.

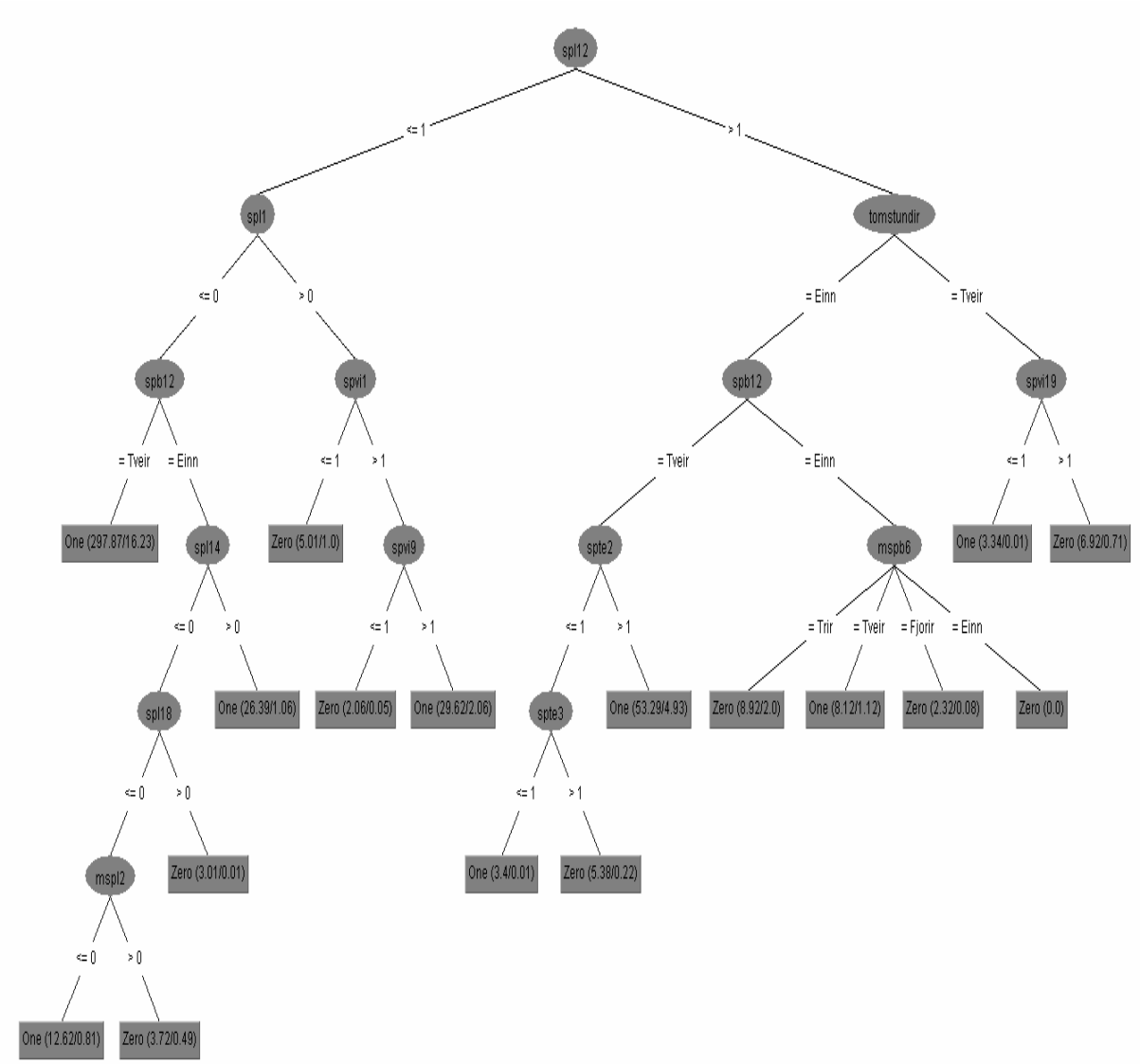

Figure 11. Decision Tree (*J48*) for all the Predictors for the Second Factor

Table 27. Examples of Decision Rules for Factor 2 (Diet and Sleep Habits) from the Full Dataset

FULL DATASET
Decision Rule: One = Good "Diet and Sleep Patterns" and Zero = Poor "Diet and Sleep Patterns"
If the child never has trouble sleeping, AND never finds it hard to walk more than one block, AND does not tease other children, THEN the child has a positive diet and sleep patterns (297.87/16.23)
If the child never has trouble sleeping, AND finds it hard (almost never, sometimes, often, and almost always) to walk more than one block, AND does not have a friend who lives close, THEN the child does not have a positive diet and sleep patterns (5.01/1.0)

Subset for Factor 2 "Diet and Sleep Habits"

To create subset, the ranking method *BestFit* which was sorted by the *CfsSubsetEval* algorithm, was used. The subset for the second factor named "Diet and Sleep Habits" included 21 items. The names of the items and descriptions are in Table 28.

Table 28. Names of Items in Subset for the Second Factor "Diet and Sleep Habits"

Instrument	**Items (like it appears in the data set)**	**Name of Items**	**Description**
Pediatric Quality of Life Inventory Version 4.0. Child Report (ages 8-12)	spl12	I have trouble sleeping	"0 through 4"
	mspl12	Trouble sleeping (Answered by Mothers)	"0 through 4"
	mspl16	Getting teased by other children (Answered by Mothers)	"0 through 4"
	mspl19	Paying attention in class (Answered by Mothers)	"0 through 4"
	mspl20	Forgetting things (Answered by Mothers)	"0 through 4"
	mspl21	Keeping up with schoolwork (Answered by Mothers)	"0 through 4"
	mspl22	Missing school because of not feeling well (Answered by Mothers)	"0 through 4"
Friendship Quality Questionnaire- Revised (Short Form) (Boys or Girls)	spvi8	If my friend and I get mad at each other, we always talk about how to get over it	"1 through 5"
	spvi11	When I´m mad about something that happened to me, I can always talk to my friend about it	"1 through 5"
	spvi18	My friend and I talk about the things that make us sad	"1 through 5"
	spvi21	If my friend and I are mad at each other, we always talk about what would help to make us feel better	"1 through 5"

Table 28. Continued

Instrument	Items (like they appear in the data set)	Name of Items	Description
Connection to School	spte7	How often do you have trouble getting along with other students	"1 through 5"
Feelings about School (FAS) (Short version)	spti1	How do you feel about going to school?	"1 through 5"
Demographic and Background Information (Children)	tomstundir	Do you have a hobby/hobbies?	Nominal
	einelTiadra	Do you bully other children?	Nominal
	spb7	Do you have hard time falling asleep at night?	Nominal
	spb12	Do you tease other children?	Nominal
	mspb4	The child´s origin? (Answered by Mothers)	Nominal
	mspb16	With whom does the child live with? (Answered by Mothers)	Nominal
	mspb17nam	What education have you completed? (Mark the highest degree you have completed) (Answred by Mothers)	Nominal

With the subset described in Table 28, diet and sleep habits were also classified with decision tree (*J48*) and logistic regression (*Logistic*). Accuracy, sensitivity, specificity, AUC and the confusion matrix of the two classifiers are reported in Table 29.

Table 29. Accuracy, Sensitivity, Specificity, AUC, and Confusion Matrix of Subset for Factor 2

Subset						
	Accuracy	**Sensitivity**	**Specificity**	**AUC**	**Confusion Matrix**	
ZeroR	87.50%	-	-	-		
J48	85.59%	97.09%	5.08%	0.56	401	12
					56	3
Logistic	86.02%	95.16%	22.03%	0.71	393	20
					46	13

statistically worse than the other classifier

No statistical difference was found in the accuracy and sensitivity of the two classifiers tested. Furthermore, the AUC for the logistic regression did substantially better than the decision tree. Estimated ROC curves for the two classifiers are presented in Figure 12.

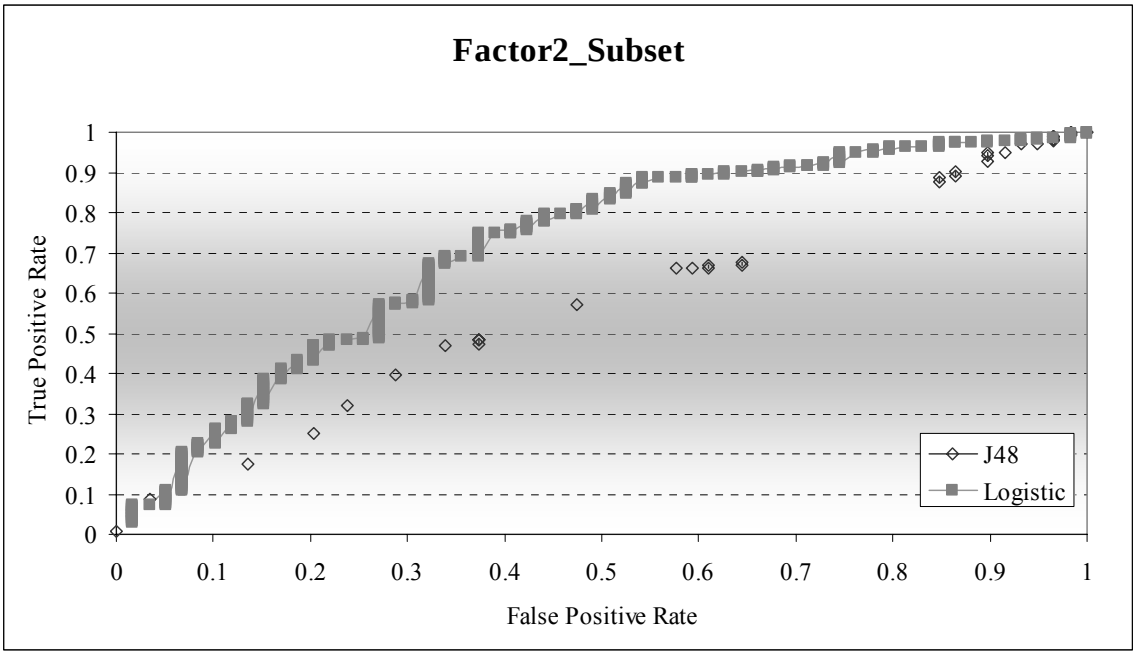

Figure 12. ROC Curves for the Second Factor from the Subset: Decision Tree and Logistic Regression

Figure 13 shows the decision tree as created using the *J48* algorithm. The top-level tree (root) node of the full dataset, which has the highest predicting value, was the item spl12 "Trouble Sleeping". It has two outgoing edges, and one has a leaf node. For children having trouble sleeping, the item "Do you have a hobby/hobbies?" and "Do you tease other children?" were found to have an impact on their diet and sleep habits. More items that predict diet and sleep habits of 10-12 year old children can be seen in descending nodes of the decision tree. Examples of decision tree rules from subset are in Table 30.

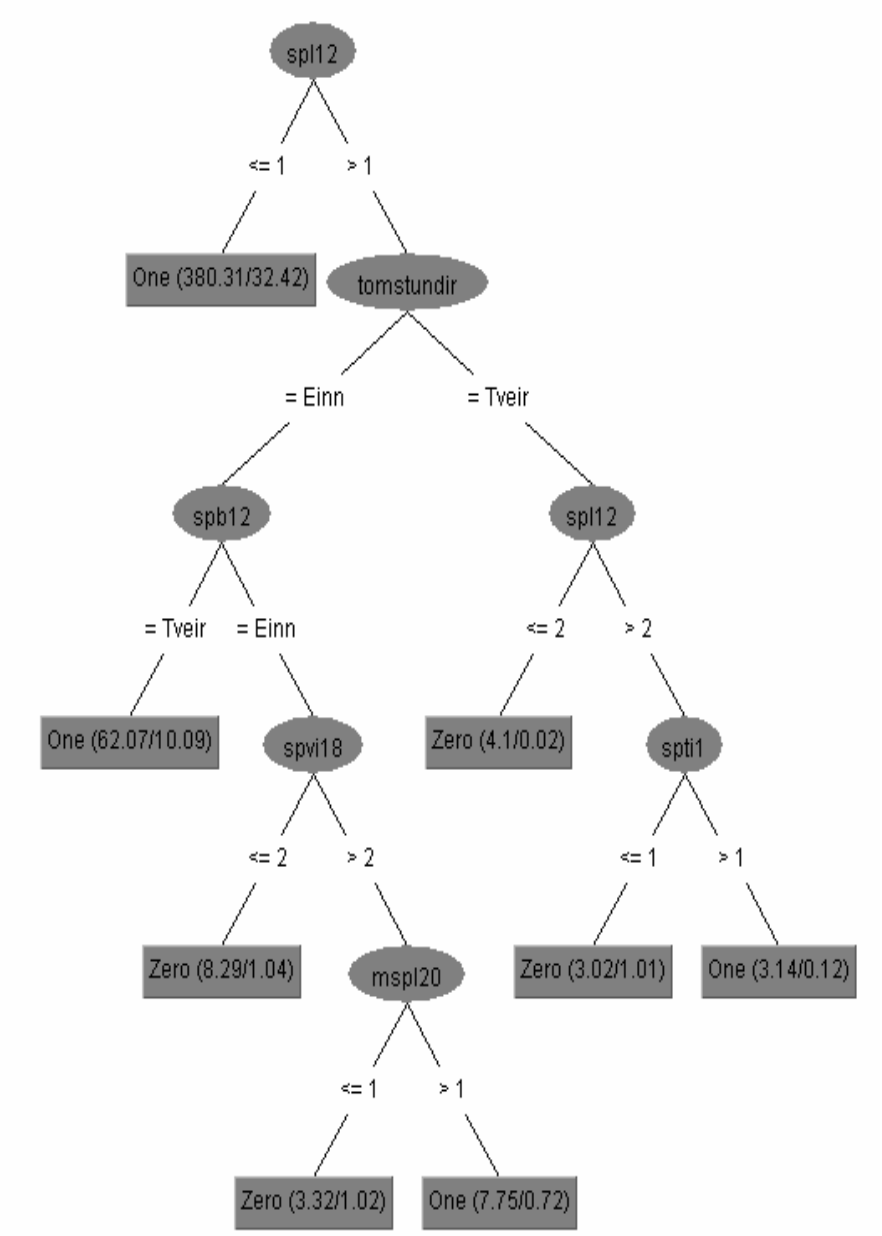

Figure 13. Decision tree (*J48*) of the Subset of the Second Factor

Table 30. Examples of Decision Rules for Factor 2 (Diet and Sleep Habits) from the Subset

SUBSET
Decision Rule: One = Good "Diet and Sleep Patterns" and Zero = Poor "Diet and Sleep Patterns"
If the child does not (never or almost never) have trouble sleeping, THEN the child has a positive diet and sleep patterns (62.07/10.09)
If the child has trouble sleeping (sometimes, often, and almost always), AND has hobby/hobbies, AND does not tease other children, THEN the child has a positive diet and sleep patterns (62.07/10.09)

The *Logistic* algorithm showed no statistically significant items in the subset in Table 28 to predict diet and sleep habits of the children. The mean of the coefficients, standard deviation, and confidence intervals of the items in the subset from Table 28 are reported in Table 31.

Table 31. The Subset from the Second Factor and the Coefficients from the Logistic Regression

Items (like they appear in the data set)	**Mean of the Coefficient (Logistic Regression)**	**Standard Deviation**	**[95% CI]**
tomstundir	-1.9661	0.6261	[-3.1932 , -0.739]
eineltiadra	-1.8195	1.4685	[-4.6978 , 1.0589]
spl12	-0.7049	0.3029	[-1.2987 , -0.1112]
spvi8	-0.0459	0.2470	[-0.5300 , 0.4383]
spvi11	0.2129	0.2178	[-0.2140 , 0.6398]
spvi18	0.1696	0.1760	[-0.1753, 0.5145]
spvi21	0.3806	0.2852	[-0.1783, 0.9395]
spvi22	-0.2700	0.2969	[-0.8519, 0.3119]
spte7	0.1876	0.2176	[-0.2388, 0.614]
spti1	0.2010	0.2305	[-0.2508, 0.6527]
spb7	-0.1653	0.3898	[-0.9294, 0.5987]
spb12	-0.1373	0.3772	[-0.8766, 0.6019]
mspl12	-0.2627	0.4528	[-1.1503, 0.6248]
mspl16	2.4377	1.5037	[-0.5095, 5.3850]
mspl19	-1.3383	0.6914	[-2.6934, 0.0168]
mspl20	-0.5392	0.3088	[-1.1444, 0.0661]
mspl21	-0.3057	0.3894	[-1.0689, 0.4576]
mspl22	-0.324	0.3066	[-0.9248, 0.2769]

Table 31. Continued

Items (like they appear in the data set)	Mean of the Coefficient (Logistic Regression)	Standard Deviation	[95% CI]
mspb4	-0.5373	0.3057	[-1.1365, 0.062]
mspb16	0.5275	0.2879	[-0.0368, 1.0917]
mspb17nm	-1.2689	1.1283	[-3.4803, 0.9426]

Summary

Both the decision tree and logistic regression performed very poorly for the full dataset, though the AUC for the decision tree showed slightly better results. The decision tree did not perform much better for the subset compared to the full dataset; however, the AUC of the logistic regression was 0.71, which is acceptable. The result from the decision tree (both the full dataset and the 21 attribute subset) showed that the item with the most predictive value for diet and sleep habits was "Trouble sleeping." The *Logistic* algorithm however, did not show any statistically significant items in the subset to predict diet and sleep habits.

Factor: Three "Seek Psycho- Social Support"

Full Dataset

The full dataset (199 items, see Table 6) was used to classify "Seek Psycho-Social Support" of 10-12 year old children (Factor 3) with decision tree (*J48*) and logistic regression (*Logistic*). Accuracy, sensitivity, specificity, AUC, and the confusion matrix of the two classifiers can bee seen in Table 32.

Table 32. Accuracy, Sensitivity, Specificity, AUC, and Confusion Matrix of Full Dataset for Factor 3

Full Dataset						
	Accuracy	**Sensitivity**	**Specificity**	**AUC**	**Confusion Matrix**	
ZeroR	66.74%	-	-	-	-	
J48	66.95%	55.84%	72.31%	0.61	86	68
					85	222
Logistic	58.53%[#]	45.45%	65.05%	0.56	70	84
					108	201

[#]statistically worse than the other classifier

The accuracy of the logistic regression performed significantly worse than the decision tree; however, the sensitivity of the two classifiers was not found to be statistically significant. The AUC for the decision tree did better than the logistic regression, even though neither classifier did very well. The estimated ROC curves for the two classifiers can be seen in Figure 14.

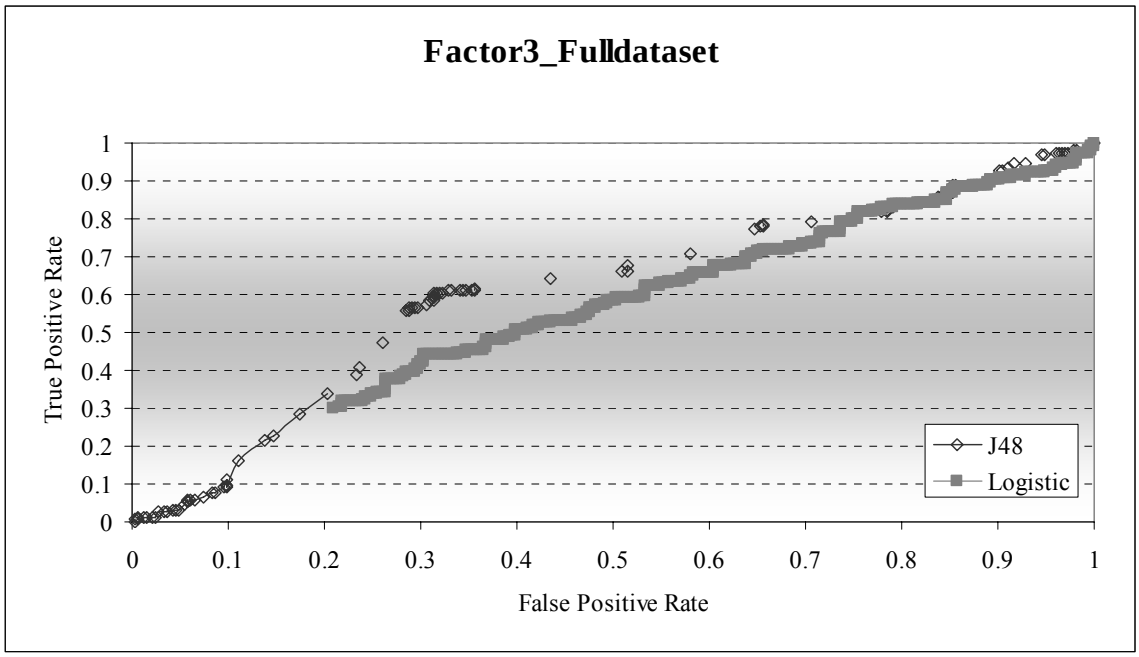

Figure 14. ROC Curves for the Third Factor from the Full Dataset: Decision Tree and Logistic Regression

Figure 15 shows the decision tree created using the *J48* algorithm with all the possible predicting items (full dataset). The top-level tree (root) node of the full dataset was the item spvi9 ("My friend and I are always telling each other about our problems"). For children who have friends who they can tell about their problems, the item "Do you bully other children?" and "It is hard for me to do chores around the house," have an impact on whether or not they seek psychosocial support. More items that predict if 10-12 year old children seek psychosocial support or not can be seen in descending nodes of the decision tree in Figure 15. Moreover, examples of decision tree rules from the full dataset are in Table 33.

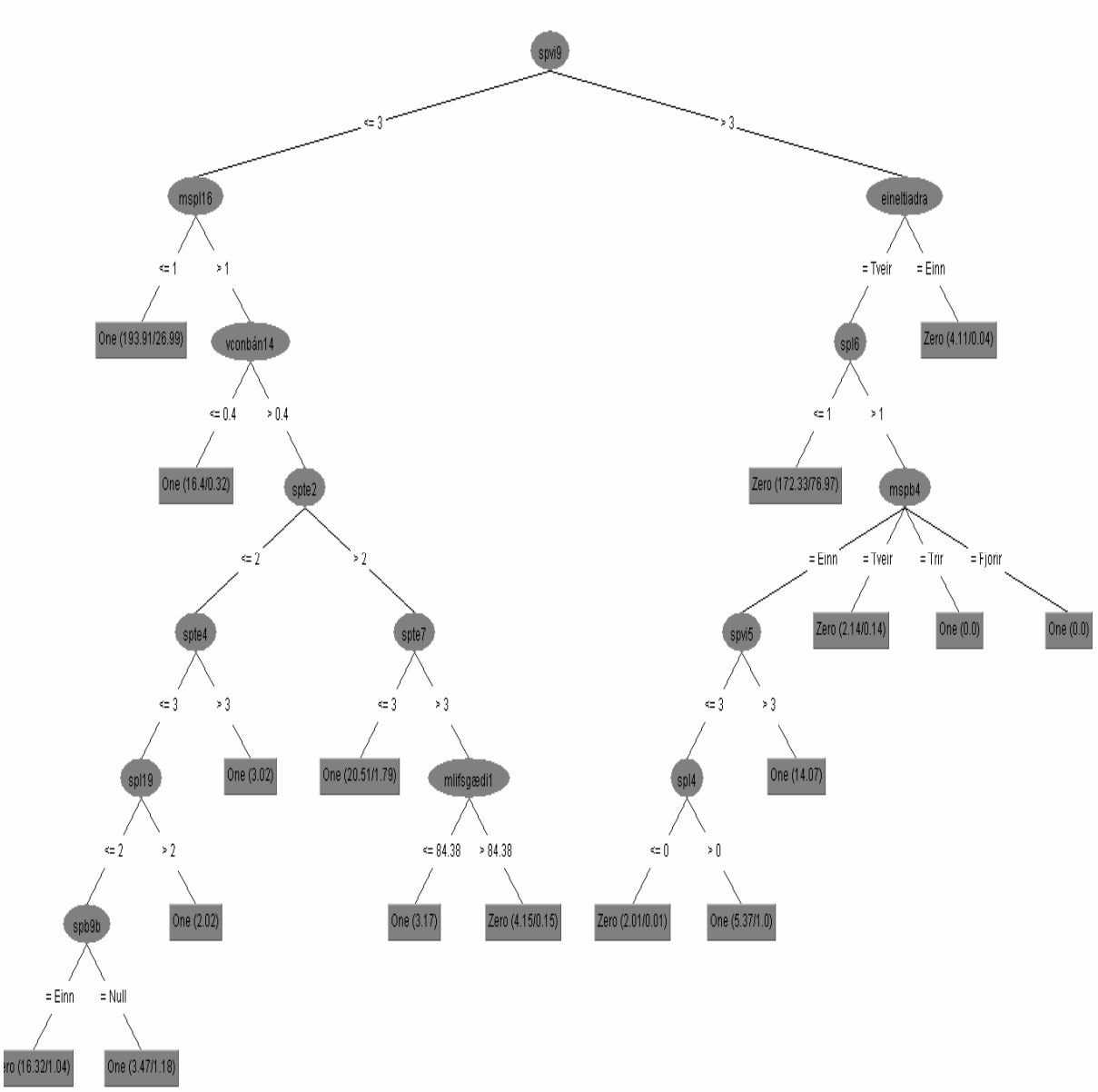

Figure 15. Decision Tree (*J48*) of all the Predictors of the Third Factor

Table 33. Examples of Decision Rules for Factor 3 (Seek Psycho – Social Support) from the Full Dataset

Full Dataset
Decision Rule: One = "Seek Psycho-Social Help" and Zero = Lack of "Seeking Psycho-Social Help"
If the child and his/her friend tell each other about their problems (pretty true or really true), AND the child bullies other children, THEN the child does not seek psychosocial help (4.11/0.04)
If the child and his/her friend do not (not at all true, a little true, or somewhat true) tell each other about their problems, AND the child never or almost never get teased by other children, THEN the child seeks psycho-social help (193.91/26.99)

Subset for Factor 3: "Seek Psycho-Social Support"

To create a subset, the ranking method *BestFit* which was sorted by the *CfsSubsetEval* algorithm, was used. The subset for the third factor named "Seek Psycho-Social Support" included 12 items. The names of the items and descriptions are in Table 34.

Table 34. Names of Items in Subset for the Third Factor "Seek Psycho-Social Support"

Instrument	**Items (like it appears in the data set)**	**Name of Items**	**Description**
Pediatric Quality of Life Inventory Version 4.0. Child Report (ages 8-12)	spl20	I forget things	"0 through 4"
	spl21	I have trouble keeping up with my schoolwork	"0 through 4"
Friendship Quality Questionnaire- Revised (Short Form) (Boys or Girls)	spvi9	My friend and I are always telling each other about our problems	"1 through 5"
	spvi18	My friend and I talk about the things that make us sad	"1 through 5"
	spvi28	My friend and I tell each other private things a lot	"1 through 5"
	vval	Validation and Caring	Numeric
	vhelp	Help and Guidance	Numeric
	vint	Intimate Disclosure	Numeric
Connection to School	spte4	I feel happy to be at this school	"1 through 5"
Demographic and Background Information (Children) (Svavarsdottir & Orlygsdottir, 2006a, 2006b).	kyn	Gender	Nominal variable
	mspl6	With whom does the child live with? (Answered by Mother)	Nominal
	fspb5	Does the child complain of stomach ache? (Answered by Father)	Nominal

With the subset described in Table 34, seeking psychosocial help was also classified with decision tree (*J48*) and logistic regression (*Logistic*). Accuracy, sensitivity, specificity, AUC, and the confusion matrix of the two classifiers are reported in Table 35.

Table 35. Accuracy, Sensitivity, Specificity, AUC, and Confusion Matrix of Subset for Factor 3

Subset						
	Accuracy	**Sensitivity**	**Specificity**	**AUC**	**Confusion Matrix**	
ZeroR	66.74%	-	-	-		
J48	68.68%	33.76%	86.08%	0.56	52	102
					44	266
Logistic	70.62%	43.50%	84.14%	0.73	67	87
					49	260

No statistical differences were found between the accuracy and sensitivity using the decision tree and logistic regression. The estimated ROC curves for the two classifiers are presented in Figure 16, where the curve for the logistic regression is closer to the upper left corner than the other one.

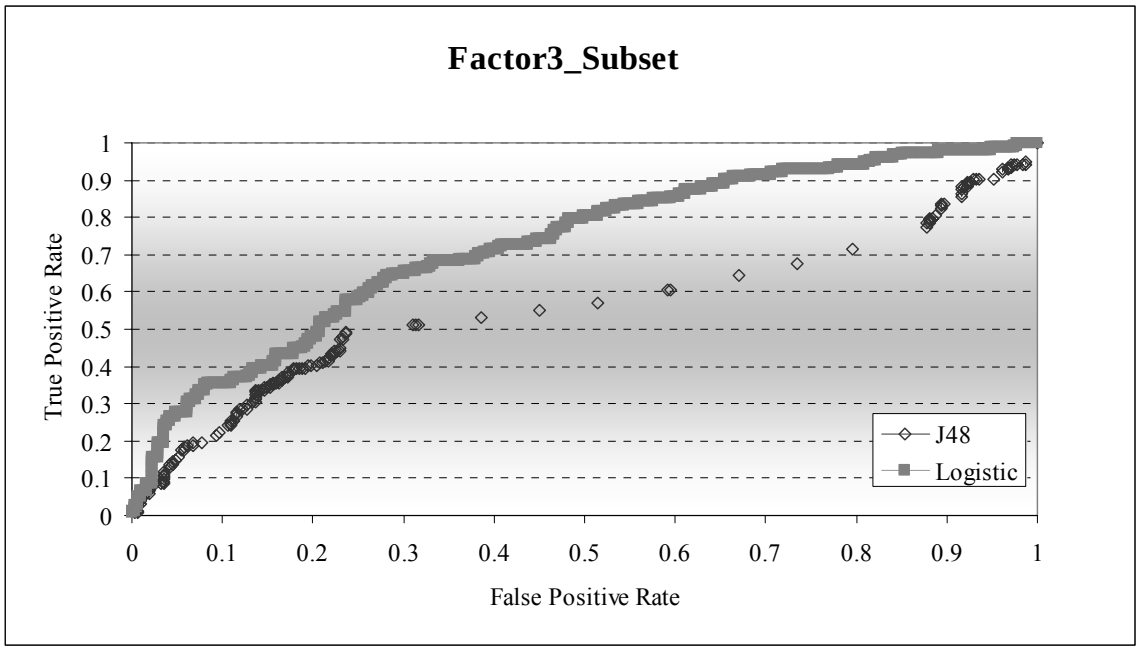

Figure 16. ROC Curves for the Third Factor from the Subset: Decision Tree and Logistic Regression

Figure 17 shows the decision tree created by the *J48* algorithm. The top-level tree (root) node of the full dataset was the item spvi9 ("My friend and I are always telling each other about our problems"), which has two outgoing edges and one has a leaf node. For children who have friends who they can tell about their problems, the items "With whom does the child live with?" and "I forget things" have an impact on if children seek psychosocial support or not. More items that predict if 10-12 year old children seek psychosocial support or not, can be seen in the descending nodes of the decision tree in Figure 17. Moreover, examples of decision tree rules from the subset are in Table 36.

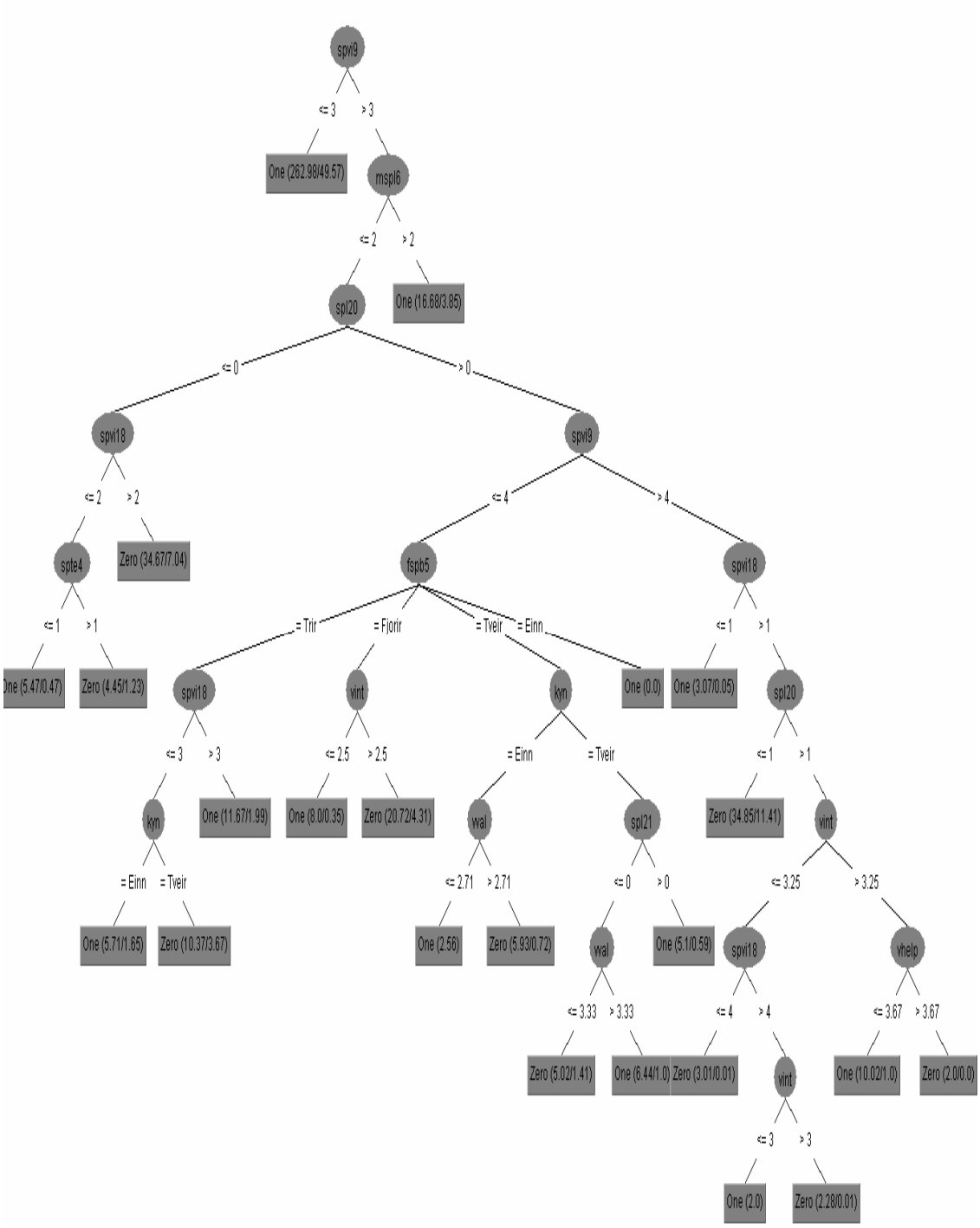

Figure 17. Decision Tree (*J48*) for the Subset of the Third Factor

Table 36. Examples of Decision Rules for Factor 3 (Seek Psycho-Social Support) from the Subset

Subset
Decision Rule: One = "Seek Psycho-Social Help" and Zero = Lack of "Seeking Psycho-Social Help"
If the child and his/her friend do not (not at all true, a little true, or somewhat true) tell each other about their problems, THEN the child seeks psycho-social support (262.98/49.57)
If the child and his/her friend tell each other about their problems (pretty true or really true), AND the child lives with one parent or parents share custody, THEN the child seeks psycho- social support (16.68/3.85)

The *Logistic* algorithm showed that two statistically significant items in the subset presented in Table 34 predict if children seek psychosocial support. When the children scored higher on the items: "My friend and I are always telling each other about our problems" and "My friend and I talk about the things that make us sad" they were more likely than others to seek psychosocial support. The mean of the coefficients, standard deviation, and confidence intervals of the attributes in the subset from Table 34 are reported in Figure 37.

Table 37. The Subset from the Third Factor and the Coefficients from the Logistic Regression

Items (like they appear in the data set)	**Mean of the Coefficient (Logistic Regression)**	**Standard Deviation**	**[95% CI]**
kyn	0.0735	0.2706	[-0.4569, 0.6039]
spl20	-0.2185	0.1374	[-0.4878, 0.0508]
spl21	-0.2515	0.2012	[-0.6458, 0.1428]
spvi9*	0.6416	0.1613	[0.3256, 0.9577]
spvi18*	0.3686	0.1333	[0.1074, 0.6298]
spvi28	0.1542	0.1155	[-0.0721, 0.3805]
spte4	-0.214	0.1046	[-0.4191, -0.009]
vval	-0.1707	0.2865	[-0.7322, 0.3909]
vhelp	0.2002	0.2441	[-0.2782, 0.6787]
vint	-0.5478	0.3665	[-1.2662, 0.1706]
mspl6	-0.2478	0.1271	[-0.4970, 0.0014]
fspb5	-0.0024	0.2351	[-0.4632, 0.4585]

Summary

For the full dataset, both the decision tree and logistic regression performed poorly, even though the AUC showed better result for the decision tree. However, for the subset of 12 attributes, the logistic regression performed better than the decision tree, with an AUC of 0.73 compared to 0.56. The most important item for the decision tree of both the full dataset and the subset was the item “My friend and I are always telling each

other about our problems." The two items that were statistically significant in the subset of the logistic regression were "My friend and I are always telling each other about our problems" and "My friend and I talk about the things that make us sad."

Factor Four: "Coping Behavior"

Full Dataset

The full dataset (199 items, see Table 6) was used to classify "Coping Behavior" of 10-12 year old school children (Factor 4) using decision tree (*J48*) and logistic regression (*Logistic*). Accuracy, sensitivity, specificity, and confusion matrix of the two classifiers can be seen in Table 38.

Table 38. Accuracy, Sensitivity, Specificity, AUC, and Confusion Matrix of Full Dataset for Factor 4

Full Dataset						
	Accuracy	**Sensitivity**	**Specificity**	**AUC**	**Confusion Matrix**	
ZeroR	75.94%	-	-	-	-	
J48	72.85%	19.27%	89.82%	0.58	21	88
					35	309
Logistic	60.26%[#]	42.20%[†]	65.99%	0.56	46	63
					117	227

[#] statistically worse than the other classifier
[†] statistically better than the other classifier

Sensitivity of both the decision tree and the logistic regression exceeded chance alone. The accuracy of the logistic regression did worse than the decision tree; however, the sensitivity of the logistic regression did statistically better than the decision tree. The AUC for the decision tree did better than the logistic regression; however, neither classifier did well as can be seen in the estimated ROC curves for the two classifiers in Figure 18.

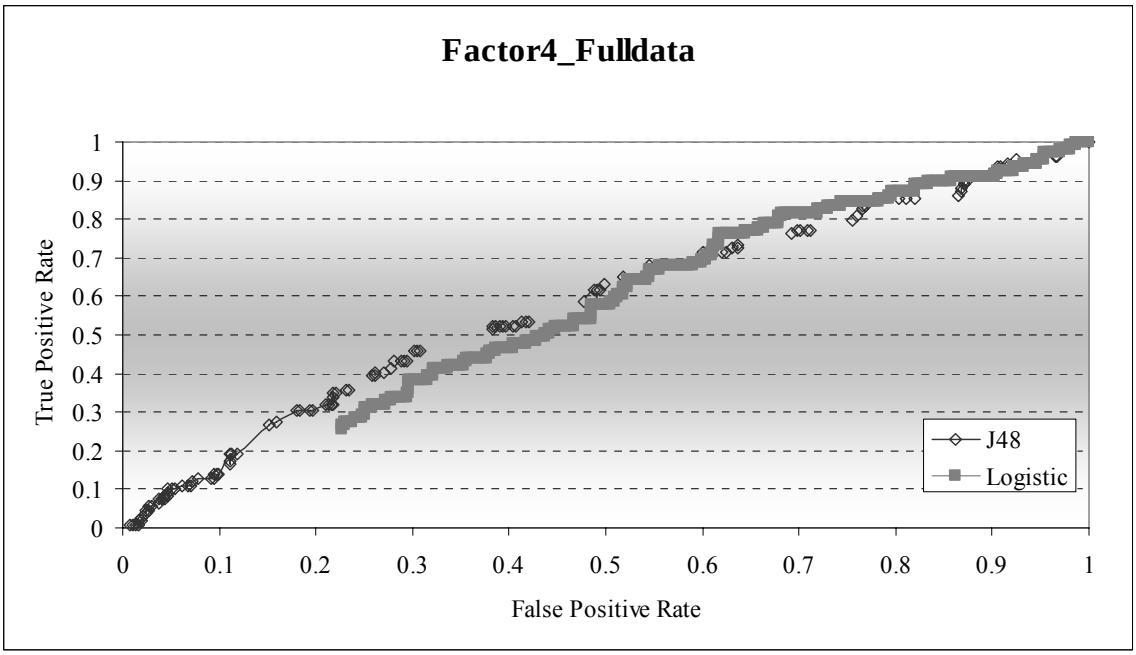

Figure 18. ROC Curves for the Fourth Factor from the Full Dataset: Decision Tree and Logistic Regression

Figure 19 shows the decision tree created by the *J48* algorithm. The top- level tree (root) node of the full dataset was the item vval ("Validation and Caring"). It has two outgoing edges and one has a leaf node. For children who score low in validation and caring, the items "Social functioning" (according to the mothers), "How do you feel about your teacher?" and "I miss school because of not feeling well," had an impact on the children's coping behavior. More items that predict coping behavior of 10-12 year old children can be seen in the descending nodes of the decision tree. Examples of decision tree rules are in Table 39.

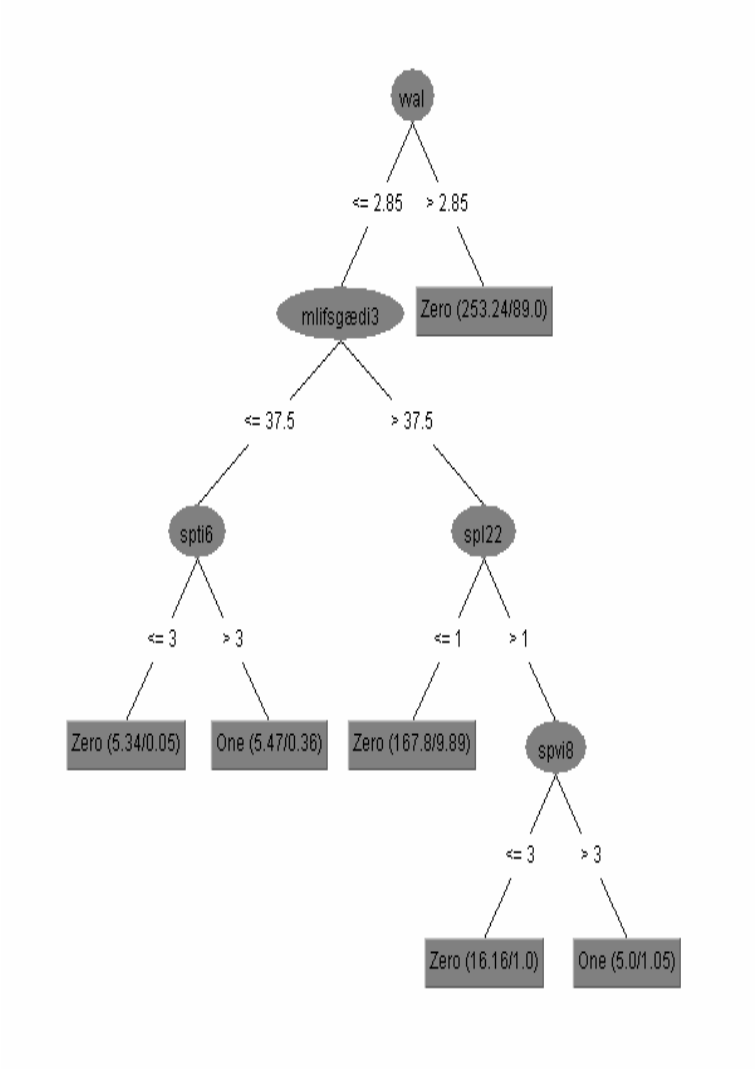

Figure 19. Decision Tree (*J48*) of all the Predictors of the Fourth Factor

Table 39. Examples of Decision Rules for Factor 4 (Coping Behavior) from the Full Dataset

Full Dataset
Decision Rule: One = Good "Coping Behavior" and Zero = Poor "Coping Behavior"
If the child scores > 2.85 in "Validation and Caring"[1] (min 0.4; max 4.0; mean 2.8), THEN the child has poor coping behavior (253.24/89.00)
If the child scores <= 2.85 in "validation and Caring"[1] (min 0.4; max 4.0; mean 2.8), AND low (<=37.5, min 0.00; max 100; mean 71.45) in social functioning (according to mothers, AND the child likes (>3) his/her teacher, THEN the child has good coping behavior (5.47/0.36)
If the child scores <= 2.85 in "validation and Caring"[1] (min 0.4; max 4.0; mean 2.8), AND low (<=37.5, min 0.00; max 100; mean 71.45) in social functioning (according to mothers, AND the child does not like (<=3) his/her teacher, THEN the child has poor coping behavior (5.34/0.05)

[1] For the Friendship Quality instrument the items for each subscale were summed up and then divided by the numbrs of items for each subscale

Subset for Factor 4: "Coping Behavior"

To create a subset, the ranking method *BestFit* which was sorted by the *CfsSubsetEval* algorithm, was used. The subset for the fourth factor named "Coping Behavior" included 20 items. The names of the items and descriptions are in Table 40.

Table 40. Names of Items in Subset for the Fourth Factor "Coping Behavior"

Instrument	**Items (like it appears in the data set)**	**Name of Items**	**Description**
Pediatric Quality of Life Inventory Version 4.0. Child Report (ages 8-12)	spl6	It is hard for me to do chores around the house	"0 through 4"
	spl19	It is hard to pay attention in class	"0 through 4"
	spl20	I forget things	"0 through 4"
	mspl6	Doing chores around the house (Answered by Mothers)	"0 through 4"
	mspl11	Feeling angry (Answered by Mothers)	"0 through 4"
	fspl20	Forgetting things (Answered by Fathers)	"0 through 4"
Friendship Quality Questionnaire-Revised (Short Form) (Boys or Girls)	spvi8	If my friend and I get mad at each other, we always talk about how to get over it	"1 through 5"
	spvi9	My friend and I are always telling each other about our problems	"1 through 5"
	spvi10	My friends make me feel good about my ideas	"1 through 5"
	spvi21	If my friend and I are mad at each other, we always talk about what would help to make us feel better	"1 through 5"
	spvi28	My friend and I tell each other private things a lot	"1 through 5"

Table 40. Continued

Instrument	Items (like they appear in the data set)	Name of Items	Description
	spvi29	My friend and I help each other with schoolwork a lot	"1 through 5"
	spvi30	My friend cares about my feeling	"1 through 5"
	vval	Validation and Caring	Numeric
	vhelp	Help and Guidance	Numeric
	vint	Intimate Disclosure	Numeric
Connection to School	spte3	I feel like I am a part of this school	"1 through 5"
Feelings about School (FAS) (Short version)	spti1	How do you feel about going to school?	"1 through 5"
Demographic and Background Information (Parents)	mspb17nam	What education have you completed? (Mark the highest degree you have completed) (Answered by Mothers)	Nominal

With the subset described in Table 40, coping behavior was classified using decision tree (*J48*) and logistic regression (*Logistic*). Accuracy, sensitivity, specificity, AUC and the confusion matrix of the two classifiers are reported in Table 41.

Table 41. Accuracy, Sensitivity, Specificity, AUC, and Confusion Matrix for Classification of Subset for Factor 4

Subset						
	Accuracy	**Sensitivity**	**Specificity**	**AUC**	**Confusion Matrix**	
ZeroR	75.94%	-	-	-		-
J48	77.48%	32.11%	91.86%	0.65	35	74
					28	316
Logistic	75.49%	27.52%	90.69%	0.73	30	79
					32	312

The accuracy and sensitivity were not statistically significant between the two classifiers. Moreover, the AUC for the logistic regression did better than the decision tree (see Table 41). Estimated ROC curves for the two classifiers are presented in Figure 20, where the curve for the logistic regression is closer to the upper left corner of the graph than the decision tree.

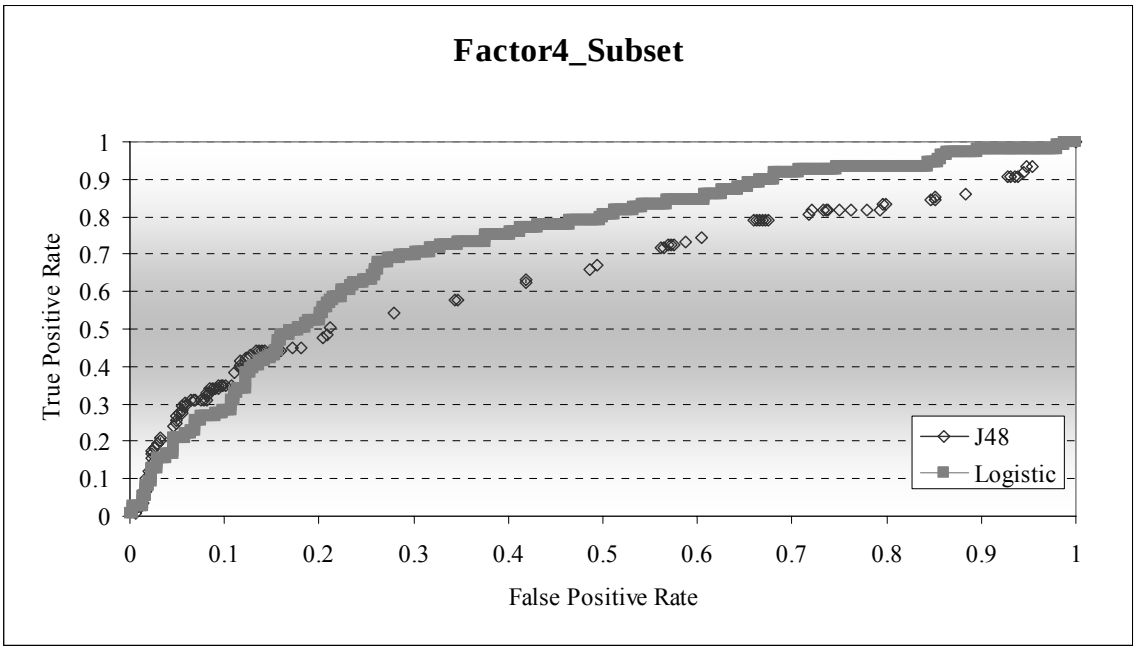

Figure 20. ROC Curves for the Fourth Factor from the Subset: Decision Tree and Logistic Regression

Figure 21 shows the decision tree created using the *J48* algorithm. The top-level tree (root) node of the subset was the same as for the full dataset, the item vval ("Validation and Caring"). It has two outgoing edges, and one of them has a leaf node. For children who score high in validation and caring, the items "My friend and I are always telling each other about our problems" and "It is hard to pay attention in class" make an impact on the children's coping behavior. More items that predict coping behavior of 10-12 year old children can be seen in the descending nodes of the decision tree. Examples of rules from the decision tree are in Table 42.

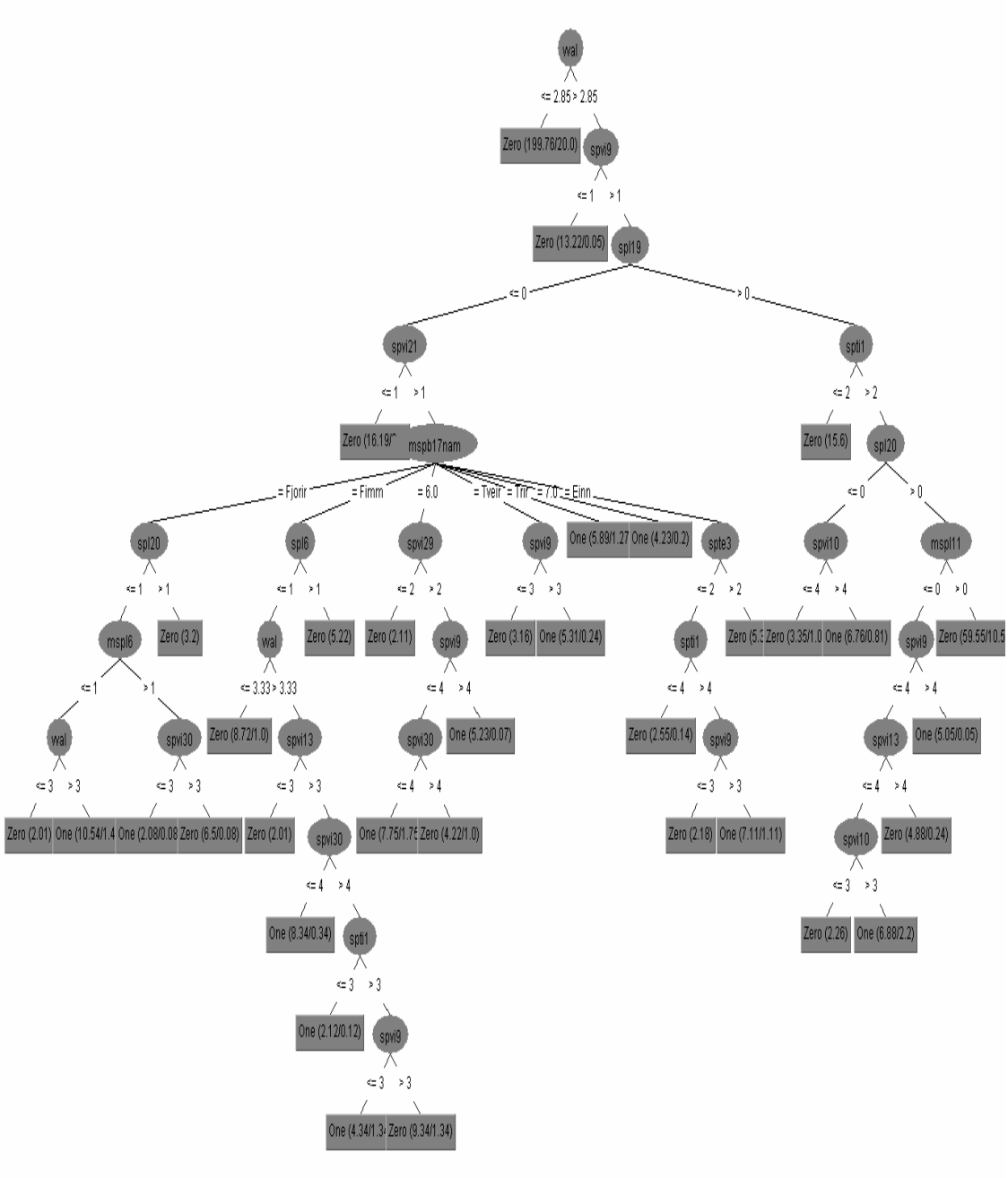

Figure 21. Decision Tree (*J48*) of the Subset of the Fourth Factor

Table 42. Examples of Decision Rules for Factor 4 (Coping Behavior) from the Subset

Subset
Decision Rule: One = Good "Coping Behavior" and Zero = Poor "Coping Behavior"
If the child scores <=2.85 in "Validation and Caring"[1] (min 0.4; max 4.0; mean 2.8), THEN the child has poor coping behavior (199.76/20.00)
If the child scores >2.85 in "Validation and Caring"[1] (min 0.4; max 4.0; mean 2.8), AND the child and his/her friend do not tell each other about their problems, THEN they have a poor coping behavior (13.22/0.05)

[1] For the Friendship Quality instrument the items for each subscale were summed up and then divided by the numbrs of items for each subscale

The *Logistic* algorithm showed that two statistically significant items in the subset presented in Table 40 predict coping behavior of children. When the children scored higher on the items, "My friends make me feel good about my ideas" and "If my friend and I are mad at each other, we always talk about what would help to make us feel better" they were more likely to have positive coping behavior. The mean of the coefficients, standard deviation, and confidence intervals of the attributes in the subset from Table 40 are reported in Table 43.

Table 43. The Subset from the Fourth Factor and the Coefficients from the Logistic Regression

Items (like they appear in the data set)	**Mean of the Coefficient (Logistic Regression)**	**Standard Deviation**	**[95% CI]**
spl6	-0.3749	0.2012	[-0.7692, 0.0193]
spl19	-0.1495	0.1957	[-0.5330, 0.2340]
spl20	-0.2903	0.1886	[-0.6600, 0.0794]
mspl6	-0.2599	0.1110	[-0.4774, -0.0423]
mspl11	-0.0716	0.1879	[-0.4398, 0.2966]
fspl20	-0.2401	0.2204	[-0.6720, 0.1918]
spvi8	0.1827	0.1665	[-0.1436, 0.5090]
spvi9	0.2988	0.1940	[-0.0815, 0.6792]
spvi10*	0.6547	0.2104	[0.2422, 1.0671]
spvi13	-0.2160	0.1836	[-0.5759, 0.144]
spvi21*	0.3446	0.1412	[0.0680, 0.6213]
spvi28	0.2035	0.2415	[-0.2698, 0.6767]
spvi29	0.2496	0.1699	[-0.0833, 0.5826]
spvi30	0.1080	0.2598	[-0.4012, 0.6171]
vval	-0.2050	0.4299	[-1.0477, 0.6377]
vhelp	-0.2235	0.3951	[-0.9979, 0.5508]
vint	-0.4571	0.4814	[-1.4006, 0.4864]
spte3	-0.0163	0.1513	[-0.3128, 0.2801]

Table 43. Continued

Items (like they appear in the data set)	**Mean of the Coefficient (Logistic Regression)**	**Standard Deviation**	**[95% CI]**
spti1	0.0786	0.1107	[-0.1383, 0.2955]
mspb17am	0.0807	0.3887	[-0.6811, 0.8425]

Summary

Neither classifier did well for the full data set, even though the ROC showed higher AUC for the decision tree. However, both classifiers performed better for the subset of 20 items, but the ROC of the logistic regression showed higher AUC with an AUC curve of 0.73.

The decision tree for the full dataset showed the decision rule: "if children score > 2.85 in "Validation and Caring," then the child has poor coping behavior," however, with the subset, the opposite decision rule was formed: "if children score <=2.85 in "Validation and Caring," then the child has poor coping behavior." The item with the most prediction value in the decision trees (full dataset and the subset) was "Validation and Caring." The two items that showed significant prediction for coping behavior from the logistic regression classification were "My friends make me feel good about my ideas" and "If my friend and I are mad at each other, we always talk about what would help to make us feel better."

Factor Five: "Health Habits"

Full Dataset

The full dataset (199 items, see Table 6) was used to classify "Health Habits" of 10-12 year old children (Factor 5) with decision tree (*J48*) and logistic regression (*Logistic*). Accuracy, sensitivity, specificity, AUC and the confusion matrix of the two classifiers are reported in Table 44.

Table 44. Accuracy, Sensitivity, Specificity, AUC, and Confusion Matrix of Full Dataset for Factor 5

Full Dataset						
	Accuracy	**Sensitivity**	**Specificity**	**AUC**	**Confusion Matrix**	
ZeroR	60.91%	-	-	-	-	
J48	63.55%	77.56%	41.72%	0.64	197	57
					95	68
Logistic	54.19%	59.05%[#]	46.62%	0.54	150	104
					87	76

[#] statistically worse than the other classifier

No statistical differences existed between the accuracy of the decision tree and logistic regression; however, the sensitivity of the regression was worse than that of the decision tree. The ROC curve of the decision tree was considerably closer to the upper left corner than the ROC curve of the logistic regression; the estimated ROC curves for the two classifiers are displayed in Figure 22.

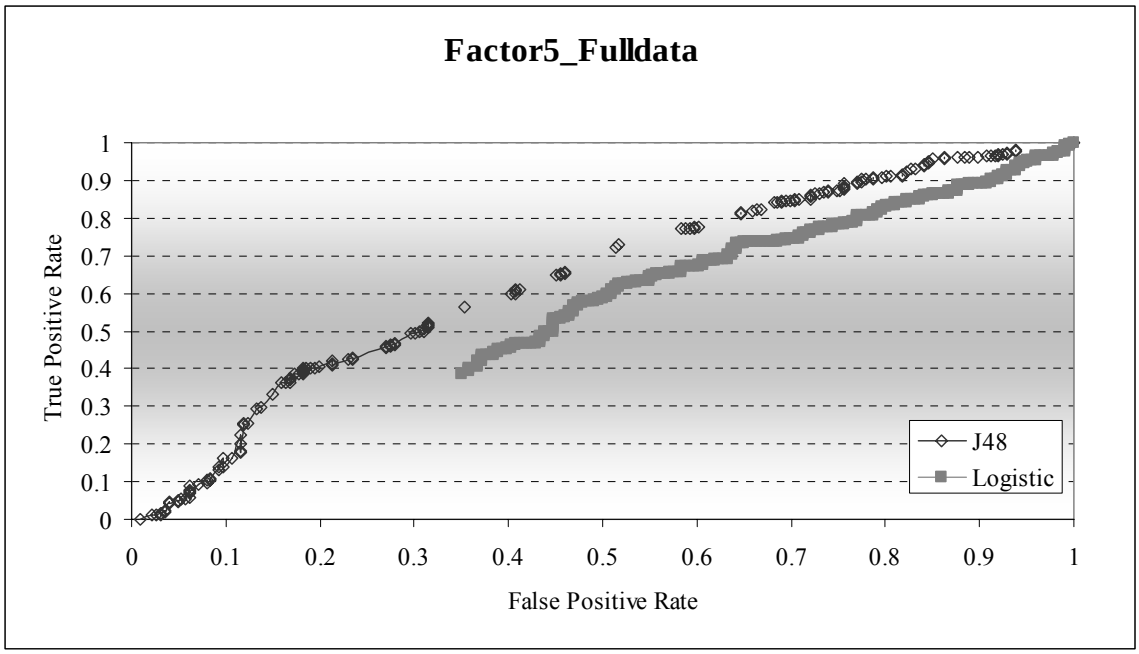

Figure 22. ROC Curves for the Fifth Factor from the Full Dataset: Decision Tree and Logistic Regression

Figure 23 shows the decision tree created using the *J48* algorithms with all of the possible predicting items (full dataset). The top-level tree (root) node, which has the highest predicting value, was the item "vint" ("Intimate Disclosure"); it has two outgoing edges. For children who score high on intimate disclosure, the item "It is hard for me to do chores around the house" has an impact on health habits. For children who score low on intimate disclosure, the item "My friend and I do special favors for each other," "School functioning" (according to their mothers), and "Quality of life" have an impact on their health habits. More items that predict health habits of 10-12 year old children can be seen in the descending nodes of the decision tree in Figure 23. Examples of rules from the decision tree are presented in Table 45.

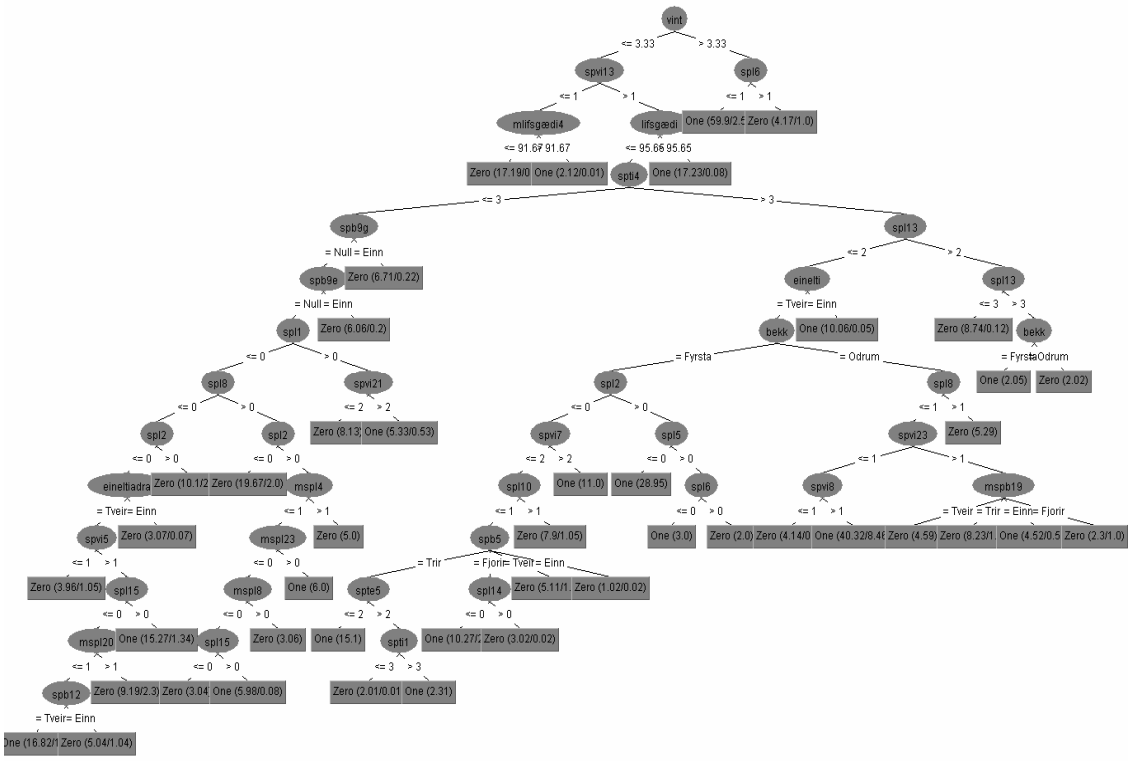

Figure 23. Decision Tree (*J48*) of all the Predictors of the Fifth Factor

Table 45. Examples of Decision Rules for Factor 5 (Health Habits) from the Full Dataset

Full Dataset
Decision Rule: One = Good "Health Habits" and Zero = Poor "Health Habits"
If the child scores >3.33 in Intimate Disclosure[1] (min 0.00; max 4.00; mean 2.11), AND the child finds is hard (almost never, sometimes, often, and almost always) to do chores around the house, THEN the child has poor health habits (4.17/1.00)
If the child scores high >3.33 in Intimate disclosure[1] (min 0.00; max 4.00; mean 2.11), AND the child does not find it hard to do chores around the house, THEN the child has good health habits (59.90/2.50)
If the child scores <=3.33 in Intimate Disclosure[1] (min 0.00; max 4.00; mean 2.11), AND the child and his/her friends do special favors for each other, AND the quality of life of the child is very high (>95.56) (min 42.5; max 100; mean 83,16), THEN the child has good health habits (17.23/0.08)

[1] For the Friendship Quality instrument the items for each subscale were summed up and then divided by the numbrs of items for each subscale

Subset for Factor 5

To create subset, the ranking method *BestFit* which was sorted by the *CfsSubsetEval* algorithm, was used. The subset for the fourth factor named "Health Habits" included 32 items. The names of the items and descriptions are in Table 46.

Table 46. Names of Items in Subset for the Fifth Factor "Health Habits"

Instrument	**Items (like it appears in the data set)**	**Name of Items**	**Description**
Pediatric Quality of Life Inventory Version 4.0. Child Report (ages 8-12)	lifsgædi	Overall Score for Quality of Life (Answered by Children)	Numeric
	spl6	It is hard for me to do chores around the house	"0 through 4"
	spl8	I have low energy	"0 through 4"
	spl19	It is hard to pay attention in class	"0 through 4"
	spl20	I forget things	"0 through 4"
	spl22	I miss school because of not feeling well	"0 through 4"
	mspl6	Doing chores around the house	"0 through 4"
	mspl11	Feeling angry (Answered by Mothers)	"0 through 4"
	fspl20	Forgetting things (Answered by Fathers)	"0 through 4"
	flifsgædi1	Physical functioning (Answered by Fathers)	Numeric
Friendship Quality Questionnaire-Revised (Short Form) (Boys or Girls)	spvi3	My friend tells me I´m good at things	"1 through 5"
	spvi5	My friend and I make each other feel important and special	"1 through 5"

Table 46. Continued

Instrument	Items (like it appears in the data set)	Name of Items	Description
	spvi6	If my friend hurts my feeling, my friend says "I´m sorry"	"1 through 5"
	spvi8	If my friend and I get mad at each other, we always talk about how to get over it	"1 through 5"
	spvi12	My friend and I help each other with chores or other things a lot	"1 through 5"
	spvi13	My friend and I do special favors for each other	"1 through 5"
	spvi15	I can always count on my friend to keep promises	"1 through 5"
	spvi17	When I´m having trouble figuring out something, I usually ask my friend for help and advice	"1 through 5"
	spvi18	My friend and I talk about the things that make us sad	"1 through 5"
	spvi21	If my friend and I are mad at each other, we always talk about what would help to make us feel better	"1 through 5"
	spvi23	My friend and I bug each other	"1 through 5"
	vval	Validation and Caring	Numeric
	vhelp	Help and Guidance	Numeric
	vint	Intimate Disclosure	Numeric
Connection to School	spte5	Teachers at this school treat students fairly	"1 through 5"

Table 46. Continued

Instrument	**Items (like it appears in the data set)**	**Name of Items**	**Description**
Feelings about School (FAS) (Short version)	spti	How do you feel about going to school?	"1 through 5"
	spti4	How fun are the things that you do in school?	"1 through 5"
	spti5	How do you feel when you are at school?	"1 through 5"
	spti6	How do you feel about your teacher?	"1 through 5"
Demographic and Background Information (Children)	kyn	Gender	Nominal Variables
	mspb21	How much does your spouse work? (Answered by Mothers)	Ordinal scale 0 through 4 (defined as numeric for Weka)
	fspb19	How much do you work? (Answered by Fathers)	Ordinal scale 0 through 4 (defined as numeric for Weka)

With the subset described in Table 46, health habits were also classified using decision tree (*J48*) and logistic regression (*Logistic*). Accuracy, sensitivity, specificity, AUC, and the confusion matrix of the two classifiers are reported in Table 47.

Table 47. Accuracy, Sensitivity, Specificity, AUC, and Confusion Matrix of Subset for Factor 5

Subset						
	Accuracy	**Sensitivity**	**Specificity**	**AUC**	**Confusion Matrix**	
ZeroR	60.91%	-	-	-	-	
J48	61.87%	71.26%	47.24%	0.64	181	73
					86	77
Logistic	66.90%†	77.95%†	49.69%	0.73	198	56
					82	81

† statistically better than the other classifier

The accuracy and sensitivity of the logistic regression were significantly better than for the decision tree. Furthermore, the ROC for the logistic regression was closer to the upper left corner than the ROC of the decision tree. Estimated ROC curves for the two classifiers are presented in Figure 24.

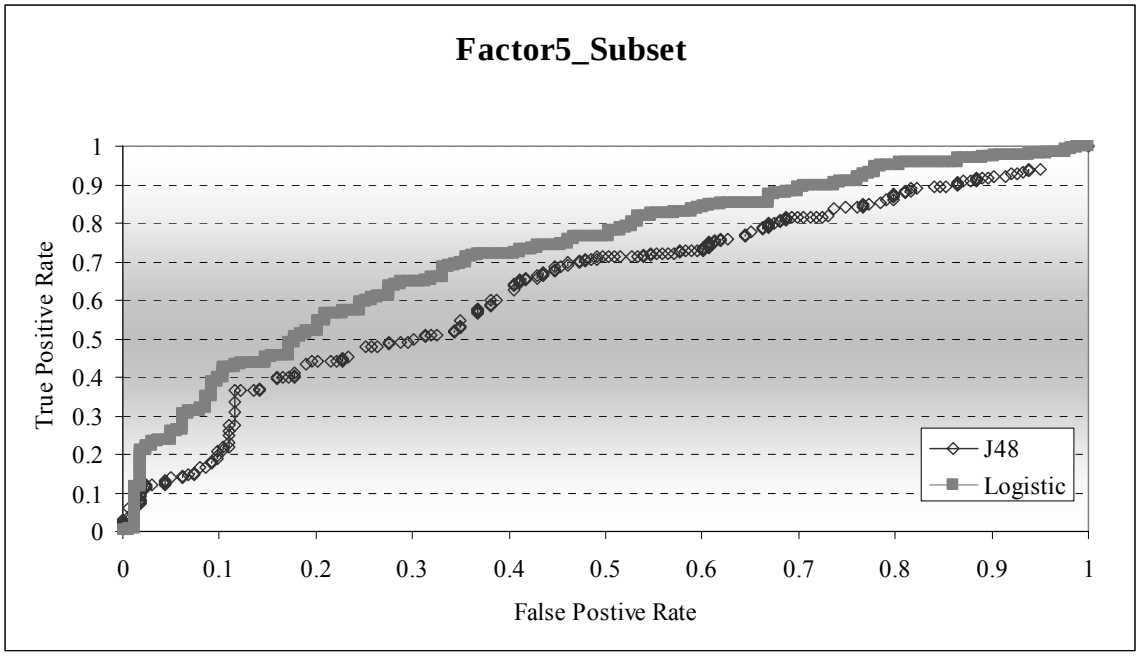

Figure 24. ROC Curves for the Fifth Factor from the Subset: Decision Tree and Logistic Regression

Figure 25 shows the decision tree created using the *J48* algorithm. The top-level tree (root) node for the subset was the item vint ("Intimate Disclosure") which has two outgoing edges. For children who score high on intimate disclosure, the item "It is hard for me to do chores around the house" has an impact on health habits. For children who score low on intimate disclosure, the item "My friend and I do special favors for each other," Quality of life, and "How fun are the things that you do in school?" have an impact on the children's health habits. More items that predict health habits of 10-12 year old children can be seen in descending nodes of the decision tree. Examples of decision tree rules from the subset are in Table 46.

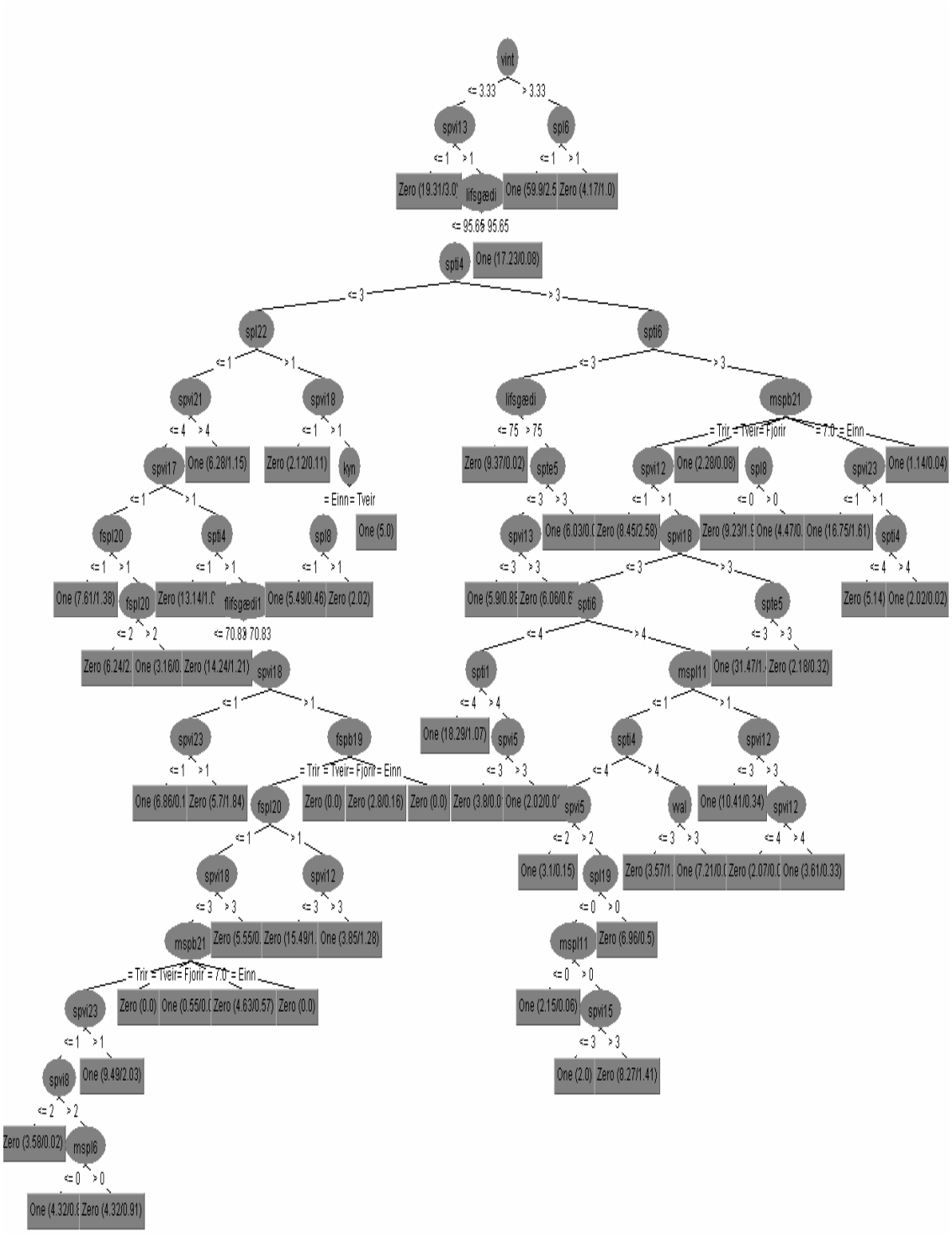

Figure 25. Decision Tree (*J48*) of the Subset of the Fifth Factor

Table 48. Examples of Decision Rules for Factor 5 (Health Habits) from the Subset

Subset
Decision Rule: One = Good "Health Habits" and Zero = Poor "Health Habits"
If the child scores >3.33 in Intimate Disclosure[1] (min 0.00; max 4.00; mean 2.11), AND the child finds it hard (almost never, sometimes, often, and almost always) to do chores around the house, THEN the child has poor health habits (4.17/1.00)
If the child scores >3.33 in Intimate Disclosure[1] (min 0.00; max 4.00; mean 2.11), AND the child does not find it hard (never) to do chores around the house, THEN the child has good health habits (59.90/2.50)
If the child scores <=3.33 in Intimate Disclosure[1] (min 0.00; max 4.00; mean 2.11), AND the child and his/her friends do special favors for each other, AND the quality of life of the child is very high (>95.56) (min 42.5; max 100; mean 83,16), THEN the child has good health habits (17.23/0.08)
If the child scores <=3.33 in Intimate Disclosure[1] (min 0.00; max 4.00; mean 2.11), AND the child and his/her friend do not do special favors for each others, THEN the child has poor health habits (19.31/3.00)

[1] For the Friendship Quality instrument the items for each subscale were summed up and then divided by the numbrs of items for each subscale

The *Logistic* algorithm showed that two statistically significant items in the subset presented in Table 42 predicted the health habits of children. When the children scored higher on the items "My friend and I talk about the things that make us sad" and "If my friend and I are mad at each other, we always talk about what would help us to make us feel better," they were more likely to have better health habits. The mean of the coefficients, standard deviation, and confidence intervals of the attributes in the subset from Table 46 are reported in Table 49.

Table 49. The Subset from the Fifth Factor and the Coefficients from the Logistic Regression

Items (like they appear in the data set)	**Mean of the Coefficient (Logistic Regression)**	**Standard Deviation**	**[95% CI]**
lifsgædi	-0.0173	0.0224	[-0.0612, 0.0266]
spl6	-0.3163	0.2258	[-0.7589, 0.1263]
spl8	-0.3832	0.1988	[-0.7727, 0.0064]
spl19	-0.2552	0.2615	[-0.7677, 0.2574]
spl20	-0.2378	0.2091	[-0.6476, 0.1720]
spl22	0.3143	0.2655	[-0.2061, 0.8347]
mspl6	-0.3394	0.1644	[-0.6615, -0.0172]
mspl11	0.0324	0.1954	[-0.3507, 0.4154]
fspl20	12.9277	11.9248	[-10.4449, 36.3003]
flifsgædi1	-0.7533	0.6580	[-2.0430, 0.5363]
spvi3	0.3079	0.2755	[-0.2320, 0.8478]
spvi5	0.2984	0.1905	[-0.0750, 0.6719]
spvi6	0.1743	0.1872	[-0.1926, 0.5412]
spvi8	0.1842	0.1939	[-0.1958, 0.5642]
spvi12	0.1789	0.1879	[-0.1893, 0.5471]
spvi13	0.2167	0.1667	[-0.1100, 0.5434]
spvi15	0.1561	0.1407	[-0.1197, 0.4319]
spvi17	-0.0636	0.1945	[-0.4448, 0.3176]
spvi18*	0.6099	0.1642	[0.2881, 0.9316]

Table 49. Continued

Items (like they appear in the data set)	Mean of the Coefficient (Logistic Regression)	Standard Deviation	[95% CI]
spvi21*	0.4833	0.1689	[0.1523, 0.8143]
spvi23	-0.174	0.1924	[-0.5511, 0.2031]
vval	-0.6220	0.5093	[-1.6203, 0.3763]
vhelp	-0.0015	0.3913	[-0.7684, 0.7654]
vint	-1.0436	0.3070	[-1.6453, -0.442]
spte5	0.0616	0.1353	[-0.2036, 0.3267]
spti	0.0348	0.1873	[-0.3324, 0.4020]
spti4	0.2732	0.2037	[-0.1261, 0.6724]
spti5	0.0386	0.1994	[-0.3522, 0.4295]
spti6	0.0975	0.1587	[-0.2136, 0.4086]
kyn	0.2779	0.2916	[-0.2936, 0.8494]
mspb21	-0.6917	0.6804	[-2.0252, 0.6418]
fspb19	-1.4990	0.8425	[-3.1503, 0.1523]

Summary

Even though neither the decision tree nor the logistic regression did very well for the full data set, the AUC for the decision tree performed better than the regression. However, the AUC for the logistic performed reasonably for the subset (0.73), and better than the AUC for the decision tree. According to the decision tree (both full dataset and

subset of 32 attributes), the most important item to predict health habits of the 10-12 year old school children was their intimate disclosure. The two items which the logistic regression predicted significantly the health habits of children were "My friend and I talk about the things that make us sad" and "If my friend and I are mad at each other, we always talk about what would help to make us feel better."

Overall Instrument

Full Dataset

The full dataset (199 items, see Table 6) was used to classify health promotion behavior for 10-12 year old children (overall instrument) using decision tree (*J48*) and logistic regression (*Logistic*). Accuracy, sensitivity, specificity, AUC and the confusion matrix of the two classifiers are reported in Table 50.

Table 50. Accuracy, Sensitivity, Specificity, AUC, and Confusion Matrix of Full Dataset for the Overall Instrument

Full Dataset						
	Accuracy	**Sensitivity**	**Specificity**	**AUC**	**Confusion Matrix**	
ZeroR	66.67%	-	-	-	-	
J48	68.26%	45.60%	79.60%	0.64	57	68
					51	199
Logistic	60.26%[#]	50.40%	65.20%	0.57	63	62
					87	163

[#] statistically worse than the other classifier

The accuracy of the logistic regression did statistically worse than the decision tree; however, there were no differences in sensitivity between the two classifiers. The

AUC for the decision tree did better than the logistic regression. The estimated ROC curves for the two classifiers can be seen in Figure 26.

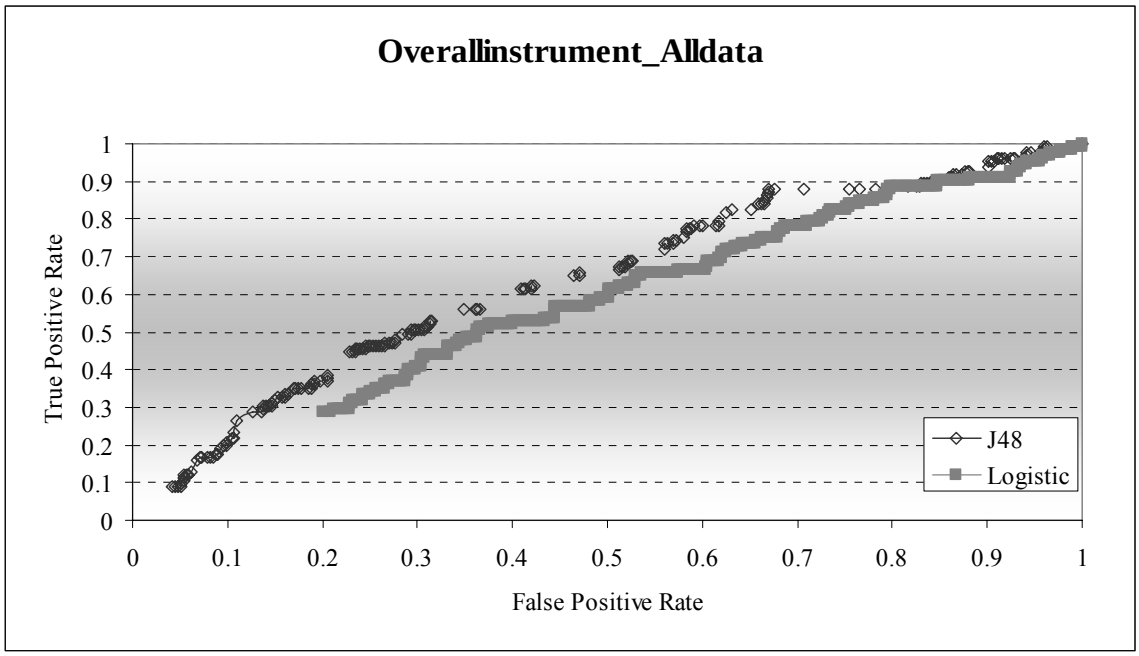

Figure 26. ROC Curves for the Overall Instrument from the Full Dataset: Decision Tree and Logistic Regression

Figure 27 shows the decision tree created by the *J48* algorithm with all the possible predicting items (full dataset). The toplevel tree (root) node of the full dataset was the item "Intimate Disclosure". It has two outgoing edges, and one of them has a leaf node. For the children who scored low on intimate disclosure, the item "How fun are the things that you do in school?" "If my friend and I get mad at each other, we always talk about how to get over it." and "My friends make me feel good about my ideas" had an impact on health promotion behavior of children. More items that predict 10-12 year

old children health promotion behavior can be seen in the descending nodes of the decision tree in Figure 27. Examples of decision tree rules from the full dataset are in Table 51.

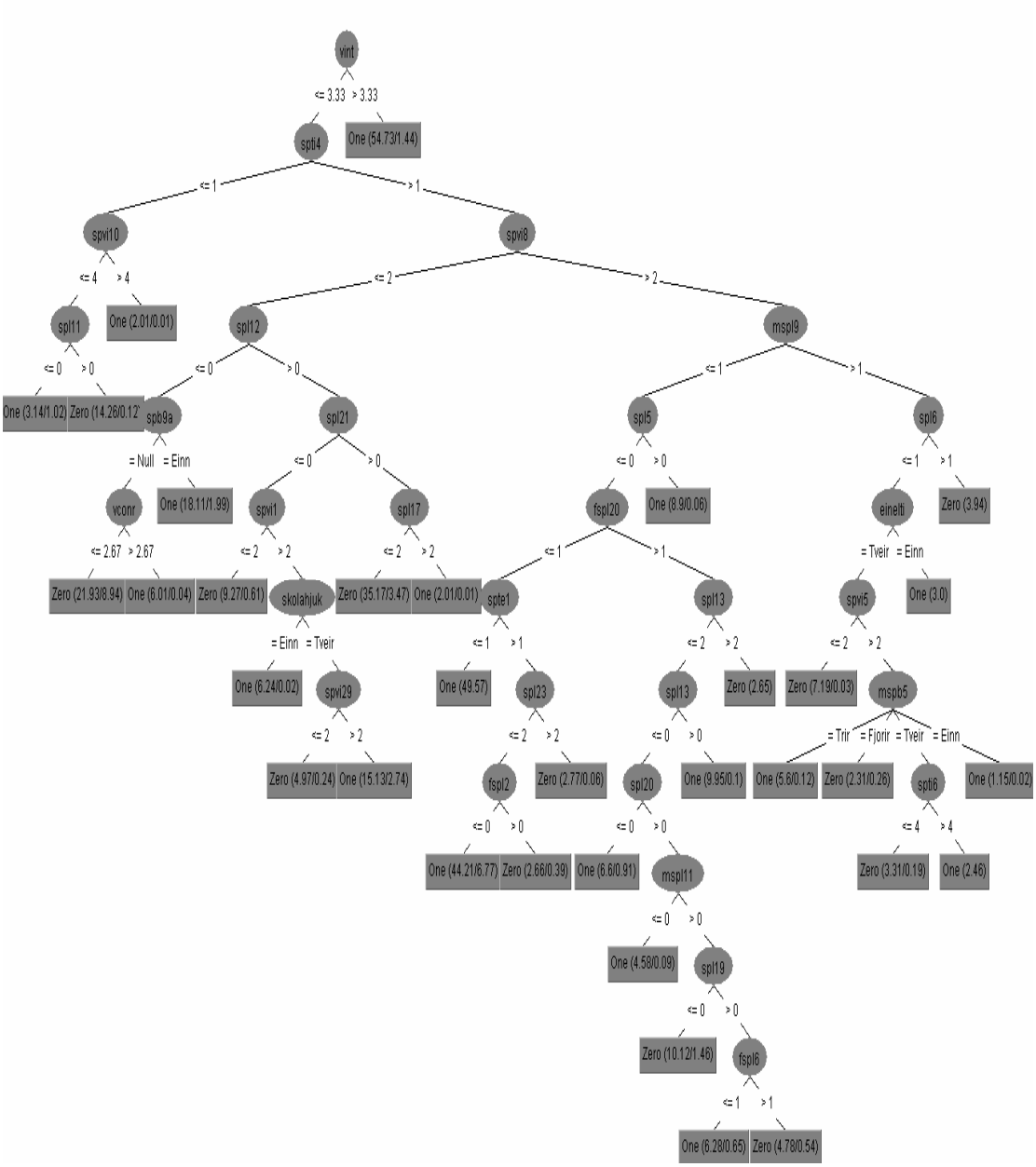

Figure 27. Decision Tree (*J48*) of all the Predictors for the Overall Instrument

Table 51. Examples of Decision Rules for the Overall Instrument from the Full Dataset

Full Dataset
Decision Rule: One = Good "Overall Health Promotion Behavior" and Zero = Poor "Overall Health Promotion Behavior"
If the child scores >3.33 in Intimate Disclosure[1] (min 0.00; max 4.00; mean 2.11), THEN the child has overall good health promotion behavior (54.73/1.44)
If the child scores <=3.33 in Intimate Disclosure[1] (min 0.00; max 4.00; mean 2.11), AND the child finds things at school not fun (<=1), AND the child's friend make him/her feel good (>4) about his/her idea, THEN the child has overall good health promotion behavior (2.01/0.01)

[1] For the Friendship Quality instrument the items for each subscale were summed up and then divided by the numbrs of items for each subscale

Subset for the Overall Instrument

To create subset, the ranking method *BestFit* which was sorted by the *CfsSubsetEval* algorithm, was used. The subset for the overall instrument included 34 items. The names of the items and descriptions are in Table 52.

Table 52. Names of Items in Subset for the Overall Instrument

Instrument	**Items (like it appears in the data set)**	**Name of Items**	**Description**
Pediatric Quality of Life Inventory Version 4.0. Child Report (ages 8-12)	lifsgædi	Overall Quality of Life (Answered by Children)	Numeric
	spl11	I feel angry	"0 through 4"
	spl12	I have trouble sleeping	"0 through 4"
	spl17	I cannot do things that other kids my age can do	"0 through 4"
	spl19	It is hard to pay attention in class	"0 through 4"
	spl20	I forget things	"0 through 4"
	spl21	I have trouble keeping up with my schoolwork	"0 through 4"
	msp15	Taking a bath or shower by him or herself (Answered by Mothers)	"0 through 4"
	mspl10	Feeling sad or blue (Answered by Mothers)	"0 through 4"
	mspl11	Feeling angry (Answered by Mothers)	"0 through 4"
	mspl13	Worrying about what will happen to him or her (Answered by Mothers)	"0 through 4"

Table 52. Continued

Instrument	Items (like they appear in the data set)	Name of Items	Description
	mspl21	Keeping up with schoolwork (Answered by Mothers)	"0 through 4"
	fspl6	Getting teased by other children (Answered by Fathers)	"0 through 4"
	fspl20	Forgetting things (Answered by Fathers)	"0 through 4"
Friendship Quality Questionnaire-Revised (Short Form) (Boys or Girls)	spvi3	My friend tells me I´m good at things	"1 through 5"
	spvi6	If my friend hurts my feeling, my friend says "I´m sorry"	"1 through 5"
	spvi8	If my friend and I get mad at each other, we always talk about how to get over it	"1 through 5"
	spvi9	My friend and I are always telling each other about our problems	"1 through 5"
	spvi10	My friends make me feel good about my ideas	"1 through 5"

Table 52. Continued

Instrument	Items (like they appear in the data set)	Name of Items	Description
	spvi21	If my friend and I are mad at each other, we always talk about what would help to make us feel better	"1 through 5"
	spvi24	My friend and I always come up with good ideas or ways to do things	"1 through 5"
	vval	Validation and Caring	Numeric
	vhelp	Help and Guidance	Numeric
	vint	Intimate Disclosure	Numeric
	voncr	Conflict Resolution	Numeric
Connection to School	spte1	I feel safe in my school	"1 through 5"
	spte3	I feel like I am a part of this school	"1 through 5"
Feelings about School (FAS) (Short version)	spti2	How much does your teacher care about you?	"1 through 5"
	spti3	How does your teacher feel about you?	"1 through 5"
	spti4	How fun are the things that you do in school?	"1 through 5"
	spti6	How do you feel about your teacher?	"1 through 5"
Demographic and Background Information (Parents)	tengsld	Connection of the person who answers the questionnaire to the child	Nominal Variable

In the subset described in Table 52 which includes 34 items, the health promotion behaviors were also classified with decision tree (*J48*) and logistic regression (*Logistic*). Accuracy, sensitivity, specificity, AUC, and the confusion matrix of the two classifiers are reported in Table 53.

Table 53. Accuracy, Sensitivity, Specificity, AUC, and Confusion Matrix for the Overall Instrument of the Subset

Subset						
	Accuracy	**Sensitivity**	**Specificity**	**AUC**	**Confusion Matrix**	
ZeroR	66.67%	-	-	-	-	
J48	68.00%	52.00%	76.00%	0.67	65	60
					60	190
Logistic	71.73%	53.60%	80.80%	0.77	67	58
					48	202

No statistical differences were found between the accuracy or sensitivity of the two classifiers. Furthermore, the AUC for the logistic regression did better than the decision tree. Estimated ROC curves for the two classifiers are present in Figure 28.

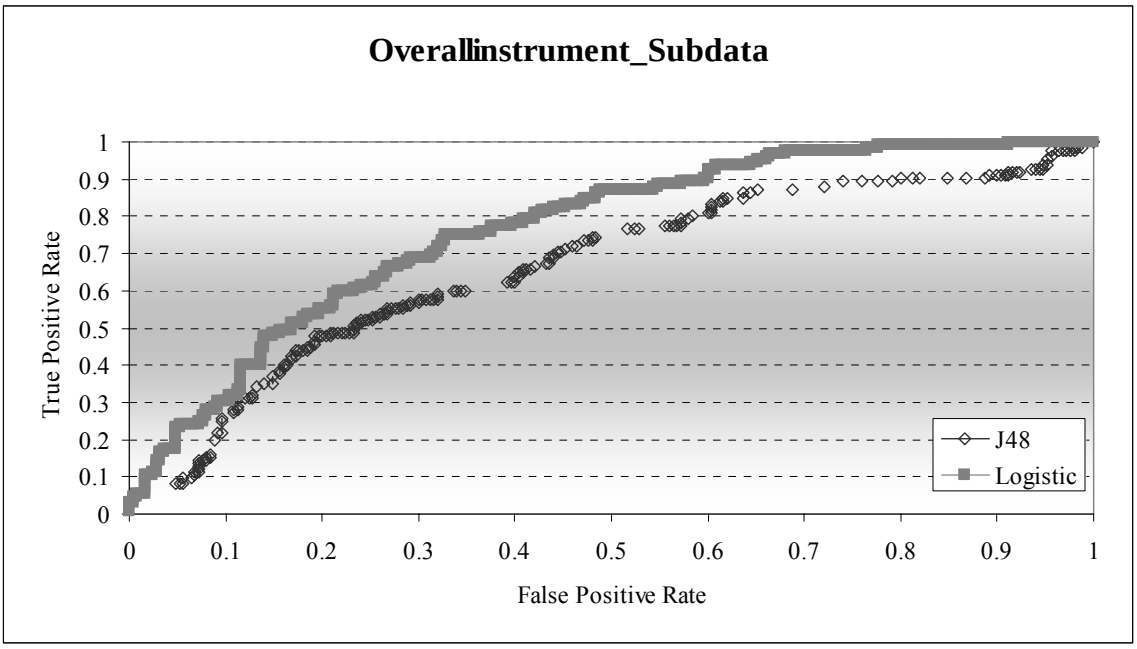

Figure 28. ROC Curves for the Overall Instrument from the Subset: Decision Tree and the Logistic Regression

Figure 29 shows the decision tree created using the *J48* algorithm from the subset. The top-level tree (root) node of the subset was the items "Intimate Disclosure."; the same as for the full dataset. It also has two outgoing edges, and one of them has a leaf node. For the children who scored low on intimate disclosure, the items "How fun are the things that you do in school?" "If my friend and I get mad at each other, we always talk about how to get over it," and ""My friends make me feel good about my ideas" had an impact on health promotion behavior of children. More items that predict 10-12 year old children health promotion behavior can be seen in the descending nodes of the decision tree in Figure 29. Moreover, examples of decision tree rules from the full dataset are in Table 54.

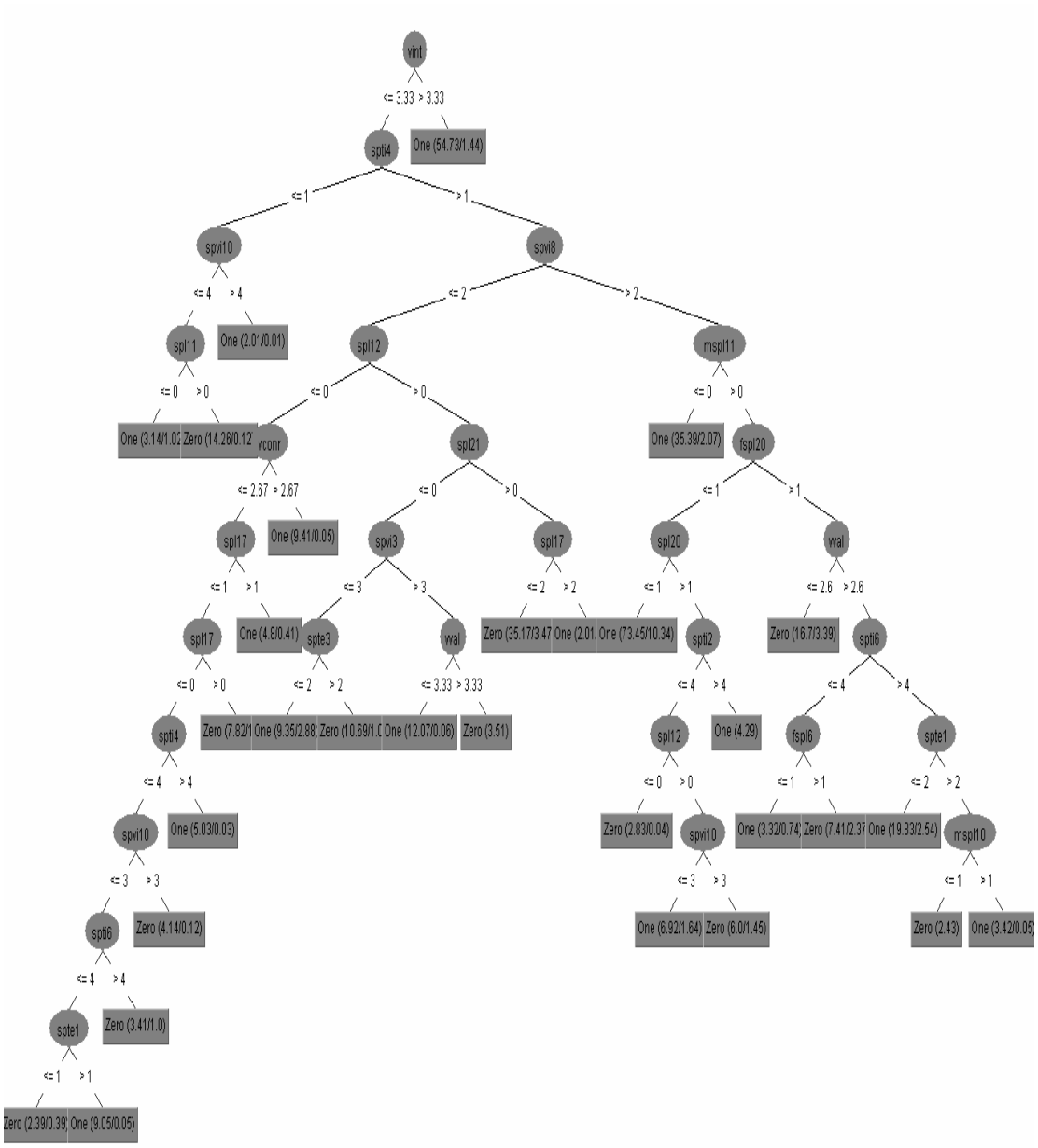

Figure 29. Decision Tree (*J48*) for the Overall Instrument of the Subset

Table 54. Example of Decision Rules for the Overall Instrument from the Subset

Subset
Decision Rule: One = Good "Overall Health Promotion Behavior" and Zero = Poor "Overall Health Promotion Behavior"
If the child scores >3.33 in Intimate Disclosure[1] (min 0.00; max 4.00; mean 2.11), THEN the child has overall good health promotion behavior (54.72/1.44)
If the child scores <=3.33 in Intimate Disclosure[1] (min 0.00; max 4.00; mean 2.11), AND the child finds things at school not fun (<=1), AND the child's friend make him/her feel good (>4) about his/her idea, THEN the child has overall good health promotion behavior (2.01/0.01)
If the child scores <=3.33 in Intimate Disclosure[1] (min 0.00; max 4.00; mean 2.11), AND the child finds things at school fun (>1), AND if the child and his/her friend get mad at each other they talk about (>2) how to get over it, AND the child never (<=0) feels angry (according to mother), THEN the child has overall good health promotion behavior (35.39/2.07)

[1] For the Friendship Quality instrument the items for each subscale were summed up and then divided by the numbrs of items for each subscale

The *Logistic* algorithm showed that four statistically significant items in the subset presented in Table 52 predict overall health promotion behavior of children. When the children scored higher on the items "Overall Quality of Life (Answered by Children)," "I have trouble sleeping," and "I have trouble keeping up with my schoolwork," and fathers score high on the attribute "Getting teased by other children (Answered by Fathers)," the children were more likely to have overall positive health promotion behavior. The mean of the coefficients, standard deviation, and confidence intervals of the attributes in the subset from Table 52 are reported in Table 55.

Table 55. The Subset from the Overall Instrument and the Coefficients from the Logistic Regression

Items (like they appear in the data set)	**Mean of the Coefficient (Logistic Regression)**	**Standard Deviation**	**[95% CI]**
lifsgædi*	0.0818	0.0412	[0.001, 0.1625]
spl11	0.3424	0.2297	[-0.1078, 0.7926]
spl12*	0.3593	0.1825	[0.0016, 0.7170]
spl17	0.5027	0.2881	[-0.0619, 1.0673]
spl19	0.2894	0.4393	[-0.5716, 1.1504]
spl20	0.4248	0.2321	[-0.0302, 0.8797]
spl21*	0.5547	0.2565	[0.0519, 1.0576]
msp15	0.0008	0.2037	[-0.3985, 0.4002]
mspl10	0.1489	0.3709	[-0.5782, 0.8759]
mspl11	0.1593	0.2742	[-0.3781, 0.6968]
mspl13	0.4035	0.3123	[-0.2085, 1.0155]
mspl20	-0.0253	0.3307	[-0.6735, 0.6229]
mspl21	0.0731	0.1087	[-0.1400, 0.2861]
fspl6*	0.4548	0.2160	[0.0314, 0.8782]
fspl20	0.5919	0.3866	[-0.1659,1.3497]
spvi3	-0.517	0.2118	[-0.9321, -0.1019]
spvi6	-0.2286	0.2264	[-0.6722, 0.2151]
spvi8	-0.3676	0.2402	[-0.8383, 0.1032]

Table 55. Continued

Items (like they appear in the data set)	**Mean of the Coefficient (Logistic Regression)**	**Standard Deviation**	**[95% CI]**
spvi9	-0.3781	0.3132	[-0.9920, 0.2358]
spvi10	-0.4705	0.2570	[-0.9742, 0.0333]
spvi18	-0.842	0.2731	[-1.3773, -0.3067]
spvi21	-0.3835	0.2395	[-0.8530, 0.0860]
spvi24	0.1691	0.2155	[-0.2533, 0.5916]
vval	0.9026	0.5452	[-0.1661, 1.9713]
vhelp	-0.2942	0.3692	[-1.0179, 0.4296]
vint	1.3841	0.7092	[-0.0058, 2.7741]
voncr	0.0034	0.4717	[-0.9212, 0.9280]
spte1	-0.0597	0.2678	[-0.5846, 0.4652]
spte3	0.0748	0.1911	[-0.2998, 0.4493]
spti2	-0.0073	0.2771	[-0.5504, 0.5358]
spti3	-0.2897	0.3220	[-0.9208, 0.3414]
spti4	0.2378	0.2410	[-0.2344, 0.7101]
spti6	-0.1425	0.1732	[-0.4820, 0.1971]
tengsld	-0.0591	0.0482	[-0.1536, 0.0354]

Summary

The decision tree performed statistically better than the logistic regression for the full dataset; however, the logistic regression did fairly well for the subset created by the automated attribute selection which resulted in a ROC curve with AUC of 0.77.

According to the results of the decision tree (both full dataset and the subset), the item with the most predictive value was "Intimate Disclosure." The four predictive items that were statistically significant in the logistic regression were "Overall Quality of Life (Answered by Children)," "I have trouble sleeping," "I have trouble keeping up with my schoolwork," and "Getting teased by other children (Answered by Fathers)."

Conclusion

The results of the data mining efforts using decision tree (*J48*) and logistic regression (*Logistic*) to predict health promotion behavior of 10-12 year old Icelandic children showed that with the full datasets (199 items) neither of the two classifiers performed very well. Nevertheless, the decision tree (*J48*) performed better than the logistic regression (*Logistic*) for all of the factors and the overall instrument except the first factor (Positive Thinking). The AUC for the decision tree ranged from 0.56 to 0.64, and the AUC for the logistic regression ranged from 0.54 to 0.61.

Both classifiers performed better for the subsets created by the *BestFit* algorithm for each of the five factors and the overall instrument, with the exception of the decision tree and the third factor (Seek Psycho-Social Help). However, the performances of the decision tree were only slightly better for the subsets than for the full dataset (AUC increased from 0.001 to 0.0671); on the other hand, the logistic regression performed substantially better for the subset than for the full dataset (AUC increased from 0.1653 to 0.1932). Moreover, the performances of the logistic regression for the subsets were respectable, and AUC ranged from 0.71 to 0.80.

The top level tree nodes for the decision trees, which were the item with the most predictive value, were the same for the full datasets and the subsets for all the five factors and the overall instrument. Two of the top level tree nodes were items from the instrument *Pediatric Quality of Life Inventory Version 4.0. Child Report (ages 8-12)* (Varni et al., 1999; Varni et al., 2001), and three of the top level tree nodes were subscales or an item from the instrument *Friendship Quality Questionnaire- Revised (Short Form) (Boys or Girls)* (Parker & Asher, 1993) (See Table 56).

Table 56. Top Level Tree Nodes of the Five Factors and the Overall Instrument

Factor	**Top Level Tree Node**	**Instrument**
Factor 1: "Positive Thinking"	spl13 "I worry about what will happen to me"	Pediatric Quality of Life Inventory Version 4.0. Child Report (ages 8-12)
Factor 2: "Diet and Sleep Habits"	spl12 "Trouble sleeping"	Pediatric Quality of Life Inventory Version 4.0. Child Report (ages 8-12)
Factor 3: "Seek Psycho-Social Help"	spvi9 "My friend and I are always telling each other about our problems"	Friendship Quality Questionnaire- Revised (Short Form) (Boys or Girls)
Factor 4: "Coping Behavior"	vval "Validation and caring"	Friendship Quality Questionnaire- Revised (Short Form) (Boys or Girls)
Factor 5: "Health Habits"	vint "Intimate disclosure"	Friendship Quality Questionnaire- Revised (Short Form) (Boys or Girls)
Overall Instrument "Health Promotion Behavior"	vint "Intimate disclosure"	Friendship Quality Questionnaire- Revised (Short Form) (Boys or Girls)

Only items from the instrument *Friendship Quality Questionnaire- Revised (Short Form) (Boys or Girls)* (Parker & Asher, 1993) were significant in predicting positive thinking (Factor 1), seek psycho-social help (Factor 2), coping behavior (Factor 4), and health habits (Factor 5) with logistic regression. However, no item was significant in predicting diet and sleep habits of children. Four items were found to be significant in predicting overall health promotion behavior of the 10-12 year old children; all of them were from the instrument *Pediatric Quality of Life Inventory Version 4.0. Child Report (ages 8-12)* (Varni et al., 1999; Varni et al., 2001).

Summary

Existing data from 480 Icelandic children and their parents were analyzed for the purpose of this secondary analysis. By evaluating the psychometric properties of the 21 item instrument School Children Health Promotion, a factor analysis identified 5 factors which were labeled: "Positive Thinking", "Diet and Sleep Habits", "Seek Psycho-Social Support", "Coping Behavior", and "Health Habits". Chronbachs α for the factors ranged from 0.57 to 0.75. The Cronbach´s α for the overall instrument was 0.86, which is well acceptable. Girls scored higher than boys on all the factors and most items; however, no difference between 5th and 6th grade students was found.

The classifiers, decision tree (*J48*) and logistic regression (*Logistic*), performed better for the subsets created by the *BestFit* algorithm for each of the five factors and the overall instrument, than they performed for the full datasets. Moreover, the performances of the logistic regression for the subsets were respectable, and AUC ranged from 0.71 to 0.80.

CHAPTER V

DISCUSSION

The purpose of this secondary data analysis was to evaluate the psychometric properties of the instrument *School-Children Health Promotion* and to describe and predict the self-report health promotion behaviors of 10-12 year old Icelandic school children. Existing data from 480 school children in 12 schools in Reykjavik, Iceland, and their parents were analyzed. Except for more girls than boys participating in the study, the demographics and background of the sample were similar to the Icelandic population as a whole (Hagstofa Islands, 2007b; Olafsson, 2005).

This chapter includes: a discussion of the psychometric properties of the *School-Children Health Promotion* instrument; the health promotion behaviors reported by the 10-12 year old Icelandic school children; the variables that predicted health promotion behaviors of 10-12 year old children; limitations of the study; implications for practice and future research; and a summary.

Psychometric Properties of the Instrument School-Children Health Promotion

An instrument to capture the broad spectrum of health promotion behaviors of Icelandic preadolescents has been lacking. Therefore, for the primary study, the Taiwanese instrument *Adolescent Health Promotion Scale* (Chen, Wang, Yang, & Liou, 2003) was shortened, modified, and translated into Icelandic and a new instrument, titled *School-Children Health Promotion,* was developed. As with any new instrument, the validity and reliability of the *School-Children Health Promotion* had to be established (Rattray & Jones, 2007). Content validity of the instrument was assured in the primary study by a three-phase process: 1) forward translation; 2) backward translation; and 3) pilot testing on school children and their parents (Rattray & Jones; 2007; Polit &

Hungler, 1995). Evidence of construct validity was obtained as a part of this secondary data analyses through exploratory factor analysis (Chen, Wang, Yang, & Liou, 2003; Rattray & Jones, 2007) and measurement of internal consistency reliability (Cronbach´s α) (Rattray & Jones, 2007). Cronbach´s α for the overall instrument was measured in the primary study and for each of the instrument's factors in this secondary analysis. The results of the secondary analyses of the instrument *School-Children Health Promotion* indicate that it is in general a valid and reliable instrument for measuring self reported health promotion behaviors of 10-12 year old Icelandic children.

In the primary study on quality of life, the new Icelandic instrument included 22 of the 40 items (6 subscales) on the Taiwanese instrument. The Taiwanese items that were excluded did not apply to Icelandic children or to 10-12 year old children, since the Taiwanese instrument was developed for older adolescents. Of the 22 items on the Icelandic instrument, one item that had to do with physical activity, "Participate in physical education class at school weekly," was excluded from this secondary analysis. When psychometrical properties of the items were evaluated, it was evident that this item should be excluded because both skew and kurtosis exceed +/- 2.0. This can probably be explained by the fact that according to Icelandic law, all 10-12 year old children participate in physical education at school (Log um grunnskola nr. 66/1995). Therefore, further analysis of the instrument included 21 items.

The factor analysis of the 21 item instrument, *School-Children Health Promotion*, identified five factors (subscales). They were labeled: "Positive Thinking," "Diet and Sleep Pattern," "Seek Psycho-social Support," "Coping Behavior," and "Health Habits". Four of the five factors had loadings above 0.3 (see Table 10). Furthermore, two of the five factors had no crossloading; however, the three factors that did crossload did so only with one other factor. Therefore, the five factors can be considered strong and stable (Costello & Osborne, 2005; Kline, 1994).

Since there were substantial modifications to the Taiwanese instrument in developing the new Icelandic instrument for the primary study, its factor structure was not expected to be similar to the original Taiwanese structure. Nevertheless, there were some similarities noted when factor structure of the 21 item Icelandic instrument *School-Children Health Promotion* was compared to the factor structure of the same 21 items of the original 6 subscale Taiwanese instrument *Adolescent Health Promotion Scale*. The three item Icelandic factor, "Positive Thinking", matched three items of the Taiwanese factor "Life-Appreciation" (originally 8 items) and the factor "Seek Psycho-Social Help" was the same as four items of the Taiwanese factor "Social Support" (originally 7 items) (See Appendix I).

The internal consistency reliability, Cronbach´s α, for the overall Icelandic instrument was 0.86, which is considered very good. For the first ("Positive Thinking") and the third factor ("Seek Psycho-Social Help"), Cronbach´s α were between 0.70 and 0.80. A Chronbach's α above 0.70 is generally considered to be acceptable (DeVillis, 1991; Pedhazur & Schmelkin, 1991). However, the second factor ("Diet and Sleep Habits") and fourth factor ("Coping Behavior") had Cronbach´s α ´s between 0.65 and 0.70 which is minimally acceptable (DeVellis, 1991). Moreover, the Cronbach´s α for the fifth factor ("Health Habits") was lower than generally acceptable with a value of 0.57 (DeVellis, 1991).

When instruments are in the early stages of development, such as the current *School-Children Health Promotion* instrument, lower reliability coefficients can be allowed as the instrument will be further developed (Pedhazur & Schmelkin 1991). The reliability of the fifth factor was not satisfactory in this secondary analysis, even though the variance of the five items within the factor was low (see Table 14). However, a possible reason for low reliability may be the unclear, lengthy, multifactorial, and ambiguous wording of some of the items; for example: "Brush my teeth and use dental floss in the morning and at nights" and "Include five food groups in each meal (dairy,

meat/fish, vegetables, fruit, and corn)", which both actually include multiple issues in each item (DeVillis, 1991; Rattray & Jones, 2007). Future studies that focus on improving this low reliability are needed.

Description of the Self Reported Health Promotion Behaviors of 10-12 Year old Icelandic Children

After evaluating the psychometric properties of the instrument, *School-Children Health Promotion*, the investigator was able to describe self-reported health promotion behaviors of Icelandic 10-12 year old school children. This secondary analysis is the first Icelandic research, known to the researcher, to study health promotion behavior of this age group. When comparing health promotion behavior between genders, the results indicate that girls scored higher than boys on all factors, which is consistent with results of other studies (Lydheilsustod, n.d; Ravens-Sieberer, Kökönyei, & Thomas, 2004; Robinson & Thomas, 2004; Steingrimsdottir, Valdimarsdottir, & Jonsson, 2006). This difference was significant for all factors except the "Coping Behavior." On the other hand, the significant difference between the grades seen in many studies was not found for any of the factors in this secondary analysis (Borup, 1998a, 1998b; Borup & Holstein, 2004, 2006; Hackett, Gibbon, Sratton, & Hamill, 2002; Hart, Bishop, & Truby, 2002; Lydheilsustod, n.d.; Lytle, Seifert, Greenstein, & McGovern, 2002; Thorsdottir & Gunnarsdottir, 2006). The reason for this lack of difference between age groups in this study is most likely that children in these two grades are too close in age and development to differ significantly in the areas measured.

When the difference between genders was examined based on grades, girls scored only significantly higher than boys on the factor "Positive Thinking" in 6th grade. So even though girls in 5th grade score higher on "Positive Thinking" than boys, the difference was not significant. No other Icelandic study focusing on positive thinking of preadolescents has been published. However, the studies that have looked at quality of

life of this age group have found this same gender difference. A cross-sectional study on 2 to 17 year old Nordic children showed that girls ages 2 to 12 scored higher than boys on the interpersonal domain, which focused, for example, on self-esteem (Berntsson, & Köhler, 2001). Moreover, 10 to 12 year old girls scored higher than boys on the HRQOL instrument, which consisted of four subscales including one on emotional functioning (Svavarsdottir & Orlygsdottir, 2006a). On the other hand, when 13 to 15 year old Norwegian adolescents were asked about their happiness, no gender difference was observed (Natvig, Albrektsen, & Qvarnstrom, 2003). However, in the same study, the adolescents in the older age group scored as if they were happier than the younger ones. This age difference was not observed on positive thinking in this current secondary analysis between 5th and 6th grade students.

The children's self-reported score on the three items that make up the factor "Diet and Sleep Habits" were high (see Table 14), indicating that Icelandic preadolescents have healthy nutritional- and sleeping habits. Even though girls scored significantly higher than boys on the factor, the boys scored higher than the girls on the individual item "Eat breakfast daily," although the difference between genders on that item was not statistically significant. This is consistent with the results of an Icelandic study that showed that boys are more likely to eat breakfast every day/most days than girls (Lydheilsustod, n.d). A reason for this high scoring may be education provided by school nurses and that parents are still influential with regards to nutrition and sleep habits of children in this age group.

In Iceland, school nurses are located in most elementary schools and provide care for students with the goal of giving them the best physical, social, and emotional environment in which to grow up (Midstod heilsuverndar barna, n.d.; Thorsteinsdottir, Hedinsdottir, Halldorsdottir, Davidsdottir & Barkardottir, 2000). Children may have to cope with many stressful events at school, with their peers, or within their family life. When school nurses are present in the school, children can go to them for help with

whatever problems they may be experiencing. This may be a particularly important role for school nurses who work with children from unstable backgrounds, since it is known that children from less stable backgrounds have been found to have lower general well being (measured as life satisfaction, parental bonding, relational development, problems, risky habits, and future family life) than children from well functioning nuclear families (Sprujt, DeGod & Vandervalk, 2001). The attention and care children receive from school nurses should be based on the individual needs of each child (Mäenpää, Paavilainen, & Åstedt-Kurki, 2007), thereby maximizing the impact of the school nurse on the children that need it. Therefore, it could be helpful for school nurses to administer a screening instrument to measure the children's quality of life once a year or every other year. Screening could be an effective way for school nurses to identify children who are in need of special support and be responsive to children's need for psychosocial support. Findings from this study indicate that boys may be in more need of interventions that involve communication to others (seek psycho-social help) since they are less likely than girls to seek it on their own.

Currently, Icelandic school nurses give the same attention to both genders during the preadolescents' years; however, a Danish study showed that girls profit more from direct dialogue with the school health nurse than do boys (Borup, 1998a). In a Finish study using grounded theory, 6th grade students found it usually easy to tell personal matters to the school nurse, and they found it important to have access to the school nurse at all times when they are at school (Mäenpää et al., 2007). This is not consistent with the low scoring of the item "Discuss my health concern with the school nurse" of the *School-Children Health Promotion* instrument. Even though school health nurses are available in most Icelandic elementary schools, most are only present part of the school day (R.O. Erlendsdottir, personal communication, March 13, 2007), and, therefore, are not always available to talk and listen to the thoughts of the children as needed. This is unfortunate considering results from a US study indicating that students utilize the

service of full time school health nurses better than those working part time (Telljohann, Price, Dake, & Durgin, 2004).

The children scored low on the item "Search for health information" on the *School-Children Health Promotion* instrument, indicating that the children in this age group are in general not searching for information on health related topics. A good forum for health information may be an interactive website with age appropriate health information. Currently, no such information source is available for Icelandic children. Most children have access to computers at school, in libraries and at home. In the year 2007, 94% of Icelandic homes had access to the Internet (Hagtidindi, 2007). Availability of reliable information, especially for health related topics, is extremely important, especially since preadolescents are often taking their first steps in surfing the Internet (often without parental knowledge) and do not have the capability to critically examine the information they receive on the Internet. Therefore, a reliable, interactive, age appropriate health information site might prove to be a valuable addition to the currently available educational material. Moreover, such a site might provide information about most frequently visited topics by each age group, and adding an interactive component for question and comment would further help develop and maintain the site, to maximize the effect.

As previously mentioned, the differences in health promotion behavior between 5th and 6th grade students were not obvious in this secondary data analysis. The only item to show statistically significant difference between the grades was the question "Drink at least 6-8 glasses of water daily." Here the 5th graders were more likely to drink the recommended amount of water daily than their older peers. This contradicts the results of a previous Icelandic study which found no difference in the water consumption of children in the 6th, 8th and 10th grade regardless of gender (Hardardottir & Hansdottir, 2006). In Iceland, both 5th and 6th grade classrooms are usually located in the same building and some children even have the same teacher in both grades. Thus, better

access to water in school for the younger age group can not account for this difference in water consumption. Therefore, there is no obvious explanation for these results, other than they may indicate increasing soda consumption in the older group, which has been observed in the last few years in Iceland among young adolescents (Thorsdottir and Gunnarsdottir 2006). At this time one can only recommend further study to clarify this discrepancy.

The children scored high on health promotion behaviors that are part of the educational material of the *The Six H´s of Health* framework; for example, hours of sleep each night, nutritional habits and as well as oral hygiene of the children. However, this high frequency of children claiming to be brushing their teeth and using dental floss twice a day may not be consistent with the high prevalence of cavities observed in Icelandic children (Bjarnason, et al., 2006), which is the highest among the Nordic countries. The explanation for this high prevalence may be that school dentists do not exist any longer in Iceland, and the socialized health care system only subsidizes a small part of the cost of dental visits for children (Lydheilsustod, 2007). This inconsistency between the results of this secondary analysis and prevalence of cavities in Iceland is most likely explained by a flaw in the wording of the item asking about dental hygiene as discussed earlier in this chapter.

Prediction of Health Promotion Behavior of 10-12 year old Icelandic School Children

Data cleaning and data preparation is the most time consuming part of the KDD process, since the quality of the data analyzed is fundamental to the KDD process. The data used in this secondary analysis were already collected for research purposes as has been previously described. It had been cleaned for errors and abnormal outliers before it was handed to the current investigator. Moreover, one of the data preparation tasks explained in Chapter III, was to take the outcome measures, the total score and scores for

the individual factors of the *School-Children Health Promotion* instrument, and convert them into binary variables. By calculating the cutoff points between positive health promotion behavior and lack of health promotion behavior as described, it can easily be replicated for different samples in future work. The five different answering options (Likert type scale) were split into categories that were meaningful in the context of health promotion. "Never", "Rarely", or "Sometimes" were used to indicate negative health promotion behavior, and "Usually" and "Always" for positive health promotion behavior. Different approaches of assigning categories may very likely have resulted in different results, for example if "Sometimes" were used to indicate positive health promotion behavior. However, for the purpose of this secondary analysis it was considered important that the children in the positive health promotion behavior category were using good health promotion behaviors and therefore the answer "Sometimes" was conservatively found to be more appropriate for the classification of negative health promotion behavior.

Applied to the full datasets of 199 items, the two data mining classifiers, decision tree (*J48*) and logistic regression (*Logistic*), were used to predict the scores on the five factors and the overall score of the *School Children Health Promotion* instrument. This study is the first to apply the KDD process on existing data to detect previously unrecognized patterns of health promotion behavior of Icelandic preadolescents.

When using the full dataset to predict the five factors and the overall *School Health Promotion* instrument, neither classifier performed very well. However, the decision tree algorithm (*J48*) performed better than the logistic regression (*Logistic*) on four out of five factors and the overall instrument. The reason for this better performance with the full dataset may be that the decision tree algorithm selects items naturally by choosing the items that provide the most information and ignores irrelevant and redundant items (Tan et al., 2006).

The automated attribute selector *BestFit* was used to create a subset of items from the full datasets of each of the five factors and the overall instrument. The size of the 6 subsets varied from 12 to 34 attributes, but smaller data sets are usually preferred to create an efficient and effective classifier (Jonsdottir et al., 2008). When using the subsets to predict the five factors and the overall instrument, both classifiers performed better than they did for the full datasets. However the increase in the performance of the decision tree with the subsets of items compared with the entire dataset is minimal. That might be due to the relatively small sample size for a data mining study, even though the health care literature has reported studies using decision tree (*J48* algorithm) with even smaller samples (Jonsdottir et al., 2008; Sigurdardottir et al., 2007). On the other hand, the results of the logistic regression were noteworthy with AUC´s ranging from 0.71 to 0.80, which is comparable with results from other nursing data mining studies (Goodwin, Iannacchione, Hammond, Crockett, Maher, & Schlitz, 2001; Poynton & Daniel, 2006). As evident in other studies, the factor with the highest AUC, Factor 1 (Positive Thinking), did not have the best accuracy, sensitivity, or specificity (Jonsdottir et al., 2008).

The subsets of the five factors and the overall instrument consisted mostly of items from the instruments filled out by the children themselves regarding their quality of life and friendship. Few items were about background and demographic information. The few features of the subsets that included responses from the parents were all from the instrument *Demographic and Background Information (Parents)* (Svavarsdottir & Orlygsdottir, 2006a, 2006b); however, none were from the *Pediatric Quality of Life Inventory Version 4.0. Parent Report for Children (ages 8-12)* (Varni et al., 1999; Varni et al., 2001). This is consistent with the literature that shows low parent-child agreement on quality of life, especially in a population of healthy children (Creneens, Eiser, & Blades, 2006; Eiser & Morse, 2001). Currently, Icelandic school health nurses have access to basic demographic and background information for the children in the school

computer information system. This information is obtained from parents and children; however, information from the children themselves, besides basic background and demographic information, may be most useful to promote better health promotion behavior of 10-12 year old Icelandic children. For example can information about friendship of children and children's QoL be valuable for nurses to help them predict the need for health promotion intervention (Contento, Williams, Michela, & Franklin, 2006; Corsano, Majorano, & Champretavy, 2006; Grimm, Harnack, & Story, 2004; Lindberg & Swanberg, 2006; Settertobulte & de Matos, 2004a, 2004b; Wold & Anderssen, 1992).

The items that were found to be most predictive using the decision tree (*J48*) for the first factor (Positive Thinking) (see decision rules in Table 23) were: "I worry about what will happen to me," an item from the *Pediatric Quality of Life Inventory Version 4.0. Parent Report for Children (ages 8-12)* (Varni et al., 1999; Varni et al., 2001), and "Validation and Caring," which is a subscale of the instrument *Friendship Quality Questionnaire-Revised* (Short Form) (Boys or Girls) (Parker & Asher, 1993). The subscale "Validation and Caring" includes 7 items. Three of the items are features which predicted significantly positive thinking of the preadolescents in the logistic regression ("My friend tells me I'm good at things," "My friend and I make each other feel important and special," and "If my friend hurts my feeling, my friend says "I'm sorry"). This relationship between friendship and positive thinking is consistent with results from other reported studies. An Italian study of 11-19 year old children (Corsano, Majorano, & Champretavy, 2006) showed that the ones who had good relationships with their friends experienced better psychological well-being than other children. Another European study found that the relationships children had with their peers, teachers, and schools could have protective effects on their general well being (Lindberg & Swanberg, 2006). Moreover, it has also been reported that adolescents who receive support from their friends are happier than others (Natvig, Albrektsen, & Qvarnstrom, 2003).

The item with the highest predictive value in the decision tree for diet and sleep habits was "I have trouble sleeping." Having a hobby, which included participation in sports, was also predictive of children's diet and sleep habits, which is consistent with results that show association between participation in sports and adequate sleeping (Singh, Kogan, Siahpush, & van Dyck, 2008). The factor "Diet and Sleep Habits" was the only one in this secondary analysis for which the logistic regression had no significant predicting items.

Relationships between friends become more important to children as they grow older (Rubin, Dwyer, Booth-LaForce, Kim, Burgess, & Rose-Krasnor, 2004). The feature "My friend and I are always telling each other about our problems" had the highest predictive value in the decision tree for seeking psychosocial support. That same feature was one of two that predicted significant seeking psychosocial support in the logistic regression. The other feature that was significant in the logistic regression was "My friend and I talk about the things that make us sad." Moreover, results indicate that when children experience validation from their friends and find it easy to solve conflicts with them, they are more likely to be able to cope than other children. The feature with the most predictive value in the decision tree was "Validation and Caring." One of two features that predicted significant coping behavior in the logistic regression was the feature "My friend makes me feel good about my ideas," which is one of the features that make up the subscale "Validation and Caring." The other feature that predicted coping behavior significantly in the logistic regression was "If my friend and I are mad at each other, we always talk about what would help to make us feel better." Even though no studies were found in the nursing literature that focused on friendship and psychosocial support and coping of children in the general population of 10-12 year old children, a review of literature of other disciplines revealed some relevant studies. An US psychology study on 828 5th graders showed that good relationships with friends predicted social and emotional adjustment skills (Rubin, et al., 2004). A Canadian study

on 13-18 year old adolescents showed that 81% of children in the study sought help for coping with emotional problems from their friends. The girls in that study were more likely to go to their friends for support than boys (Schonert-Reichl, & Muller, 1996). However, the data mining results of this secondary analysis did not show difference between genders.

Association between friendship and health risk behavior is well reported in the literature (Carter, McGee, Taylor, & Williams, 2007; Settertobulte & de Matos, 2004a, 2004b) and an affiliation with a group of friends has been shown to influence eating, exercising, and weight control behavior of 14-19 year old adolescents (Mackey & La Greca, 2007). However, less is known about the relationship between friendship and health habits of preadolescents. Therefore, the result of the decision tree in predicting "Health Habits" was interesting, since it showed the feature with the highest predictive value of Health Habits in these preadolescents is intimate disclosure to friends. The two features that were significant in predicting Health Habits in the logistic regression were items of intimate disclosure between friends, "My friend and I talk about the things that make us sad" and "If my friend and I are mad at each other, we always talk about what would help us to make us feel better". Additionally, intimate disclosure to friends was also the feature with the highest predictive value for the overall instrument of health promotion behavior. However, the significant features in the logistic regression model to predict overall health promotion behavior were the overall quality of life of children, their trouble of sleeping or keeping up with schoolwork, and if they were teased by other children. The association between friendship and health habits has to be examined further in future studies.

In summary, the strongest predictors for the five factors of the instrument *School-Children Health Promotion* (Svavarsdottir & Orlygsdottir, 2006a, 2006b), were items from the *Friendship Quality Questionnaire- Revised* (Short Form) (Boys or Girls) (Parker & Asher, 1993), and the *Pediatric Quality of Life Inventory Version 4.0. Parent Report*

for Children (ages 8-12) (Varni et al., 1999; Varni et al., 2001). However, for the purpose of this study, no attempts were made to control for confounding variable, like for example the item "I have trouble sleeping" which was a part of the full dataset, and was predictive for the factor "Diet and Sleep Habits". Features from both these instruments were from the Microsystem in the Model of Predictors of Health Promotion Behavior of 10-12 Year old Children, as reported on Figure 3 in the Chapter II of this dissertation. This importance of items that have to do with direct interactions (Microsysem) demonstrates the value that the immediate environment has on children. Items from the other environmental systems (Mesosystem, Macrosystem, in addition to Biodemographic factors) in the model were not found to be predictors of health promotion behavior of 10-12 year old Icelandic children.

There are few studies in the school nursing literature that focus on friendships of preadolescents and the outcome measures of this secondary analysis. School nurses need to go outside the nursing literature for information focusing on the relationship between friendship and health promotion behavior of preadolescents (Rubin et al., 2004; Schonert-Reichl, & Muller, 1996). Moreover, a special focus on friendship is currently not available in the school nursing educational material of *The Six H´s of Health* framework used in Icelandic schools. As the results of this secondary analysis indicate that friendship is of importance with regards to health promotion behavior, further studies on the effect friendship has on health promotion behavior of Icelandic children in the 10-12 year old age group are clearly needed to acquire information that can be used in development of interventions to carry out in Icelandic schools.

Limitations

Several limitations of this cross-sectional, secondary analysis should be noted. As discussed earlier in this chapter, the children in the two grades under study are very close in age and development, perhaps too close to demonstrate significant differences that

have been described in other studies (Borup, 1998a; 1998b; Borup & Holstein, 2004, 2006; Hackett, Gibbon, Sratton, & Hamill, 2002; Hart, Bishop, & Truby, 2002; Lydheilsustod, n.d.; Lytle, Seifert, Greenstein, & McGovern, 2002; Thorsdottir & Gunnarsdottir, 2006). Moreover, the data used in this secondary analysis had already been collected for the purpose of the primary study which looked at the quality of life of preadolescents (Svavarsdottir & Orlygsdottir, 2006a, 2006b). As such, the instruments (variables) and study design were not set up to quantify health promotion behavior of preadolescent children. This restricted the development of the Model of Predictors of Health Promotion Behavior of 10-12 Year old Children, since possibly important predictive variables, for example variables related family support- and/ role modeling (Microsystem), could not be included in the model (Berntsson & Köhler, 2001; Berntsson, Köhler, & Vuille, 2006; Spruijt, DeGoede, & Vandervalk, 2001). Moreover, like described in Chapter II, the Exosystem was not available for this secondary analysis. Possible variables that could be predictive for health promotion behavior from the Exosystem would be school policies guiding the work of the school health nurses in each school. This could possibly have resulted in loss of information about what is predictive for health promotion behavior.

Another limitation was the low participation rate in the primary study, 45% for the children, 47% for the mothers and 37% for the fathers. The explanation for that might be the many people (an investigator and a school nurse in each school) were involved in data collection. Data were not only collected from the children and their parents but also teachers (Svavarsdottir & Orlygsdottir, 2006b). Although the sample size was sufficient for evaluation of the basic psychometric properties of the instrument *School-Children Health Promotion* and description of health promotion behavior of 10 - 12 year old Icelandic school children, a larger sample would have given better accuracy in predicting the health promotion behavior with data mining classification.

Implication for Practice and Future Research

The results of this study provide valuable information on health promotion behaviors of preadolescent children ages 10-12 that can be used both in practice and for future research. Further development of the instrument *School-Children Health Promotion* has to be performed to address the construct limitation of the primary study. An updated version of the *School-Children Health Promotion* instrument would allow investigators to include additional items without the restrictions of the primary study. For example, the only item focusing on physical exercise in *School-Children Health Promotion* ("Participate in physical education class at school weekly") had to be excluded from analysis as described earlier. Items focusing on physical exercise should be included in the next version of this developing instrument. The children should be asked about non-voluntary exercise like the physical education mandated in Icelandic schools and whether children walk to school or not, and voluntary exercise such as extra curricular physical activity and play with friends after school and at weekends. Physical exercise is an important part of health promotion behavior in every person's life, but less than 50% of boys and 40% of girls in Iceland exercise as much as recommended for their age group (Steingrimsdottir et al., 2006). Items focusing on sedentary lifestyle (for example, time spent watching television and/or using computer/video games) might also be included in a future instrument. The sedentary lifestyle of preadolescents is increasing, which is a problem that school nurses need to address (Steingrimsdottir, Valdimarsdottir, & Jonsson, 2005).

Since the internal consistency of the fifth factor, "Health Habits," was lower than the other factors, a future study would be needed to look at ways to enhance its internal consistency, as described earlier in this chapter. Since this factor includes different health habits, future work may include adding additional items so that this single factor would become three factors, hygiene, nutrition and ergonomics. Examples of nutritional items to be included in a separate factor are ones that ask about children's soft drink- and

sugar consumption which is an increasing problem in Icelandic society (Steingrimsdottir, Valdimarsdottir, & Jonsson, 2006; Thorsdottir, 2005; Thorsdottir & Gunnarsdottir, 2006).

The content validity of an enhanced version of this instrument would involve a panel of experts to come to consensus on the appropriate additional items to be added to the current version and pilot testing with school children. Moreover, an exploratory factor analysis has to be conducted again by carrying out a study with adequate sample size, to establish construct validity of the enhanced version. To confirm the findings, a confirmatory factor analysis in another study should be performed to see if the instrument has the same structure in different samples (Costello & Osborne, 2005).

Once the *School-Children Health Promotion* instrument has been further refined, the next step will be to use it in research and clinical practice. An example of a valuable project using the enhanced version would be a longitudinal study conducted in the schools on children from the age of 10 through 15 years old, to examine how health promotion behavior change with increased age and development. The proposed additions to the instrument *School-Children Health Promotion* would cover all five *H´s* (Healthy nutrition, Have a rest, Happiness, Hygiene, and Healthy Exercise) of the *The Six H´s of Health* framework, the educational material available to preadolescents provided by their school nurse. The instrument could be used to measure the effectiveness of the *The Six H´s of Health* framework in promoting health habits to 10-12 year old school children (Midstod heilsuverndar barna, n.d.).

In addition to the revised instrument, a shorter, clinical screening version of the instrument might be developed. School health nurses could use this version to screen children's health promotion behaviors and, when needed, develop interventions to improve a child's health promoting behaviors. That way, school health nurses can focus their time and resources on groups of students and/or individual students who are in most need of improving their health promotion behavior.

Although the sample under study in this secondary data analysis can be considered fairly compatible/representative of the Icelandic population, future studies of health promotion behavior of Icelandic school children have to take into consideration that the composition of the population in Iceland is changing. From 2004, when the data collection for the primary study took place, to 2006, prevalence of people with foreign citizenship living in Iceland increased from 3.6% to 6.0% and is still increasing (Hagstofa Islands, 2008). Health promotion behavior of these children is still unknown.

Summary

A psychometric evaluation of the instrument *School Children Health Promotion* was performed for the purpose of this secondary analysis. The goal was to capture the broad spectrum of health promotion behaviors of 10-12 year old Icelandic children. The results indicated that the instrument, which included 21 items and five factors, was in general valid and reliable for measuring self reported health promotion behavior of 10-12 year old Icelandic school children.

This secondary analysis describes differences in health promotion behavior between genders. Girls have better health promotion behavior than boys. An important venue for future studies may be to develop better gender sensitive interventions for school health nurses to use for health promotion education. A difference in health promotion behavior was not found between the two grades, most likely because the children who participated in this study were too close in age and development to differ significantly.

The result of this study showed that it is possible to predict self-reported health promotion behavior of 10-12 year old Icelandic school children using data mining classification. Decision tree (*J48*) and logistic regression (*Logistic*) classifiers were used to predict health promotion behavior of 10-12 year old children. The best classifier for the task was *Logistic* when applied to the subsets created by the *BestFit* algorithm. The

strongest predicting features for health promotion behavior had to do with validation and caring in friendship, intimate disclosure between friends, and quality of life. Results of this secondary analysis indicate that friendship is of importance with regards to health promotion behavior. However, friendship is not emphasized in the educational material The *Six H´s of Health* framework used by Icelandic school nurses for health education. Further studies on the effect friendship has on health and health promotion behavior of Icelandic children in the 10-12 year old age group are clearly needed.

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APPENDIX A INSTRUMENT: SCHOOL CHILDREN HEALTH PROMOTION

Svavarsdóttir, E.K., and Örlygsdóttir, B., 2004.
University of Iceland, Faculty of Nursings.

School-children Health Promotion

Read the questions carefully and put X in appropriate box

1. Discuss my concerns with others	❑ Never ❑ Rarely ❑ Sometimes ❑ Usually ❑ Always
2. Express my caring and warmth to others	❑ Never ❑ Rarely ❑ Sometimes ❑ Usually ❑ Always
3. Talk about my troubles with others	❑ Never ❑ Rarely ❑ Sometimes ❑ Usually ❑ Always
4. Enjoy keeping in touch with relatives	❑ Never ❑ Rarely ❑ Sometimes ❑ Usually ❑ Always
5. Make an effort to feel happy and content	❑ Never ❑ Rarely ❑ Sometimes ❑ Usually ❑ Always
6. Make an effort to like myself	❑ Never ❑ Rarely ❑ Sometimes ❑ Usually ❑ Always
7. Make an effort to know what's important for me	❑ Never ❑ Rarely ❑ Sometimes ❑ Usually ❑ Always

8. Search for health information	❑ Never ❑ Rarely ❑ Sometimes ❑ Usually ❑ Always
9. Discuss my health concerns with the school nurse	❑ Never ❑ Rarely ❑ Sometimes ❑ Usually ❑ Always
10. Brush my teeth and use dental floss in the morning and at nights	❑ Never ❑ Rarely ❑ Sometimes ❑ Usually ❑ Always
11. Make an effort to moderate my body weight	❑ Never ❑ Rarely ❑ Sometimes ❑ Usually ❑ Always
12. Make an effort to stand or sit straight	❑ Never ❑ Rarely ❑ Sometimes ❑ Usually ❑ Always
13. Wash my hands before meals	❑ Never ❑ Rarely ❑ Sometimes ❑ Usually ❑ Always
14. Make an effort to determine the source of each stress that occurs	❑ Never ❑ Rarely ❑ Sometimes ❑ Usually ❑ Always
15. Make an effort to spend time daily to rest	❑ Never ❑ Rarely ❑ Sometimes ❑ Usually ❑ Always
16. Make schedules and set priorities	❑ Never ❑ Rarely ❑ Sometimes ❑ Usually ❑ Always

17. Sleep 8-10 hours each night	❑ Never ❑ Rarely ❑ Sometimes ❑ Usually ❑ Always
18. Eat three regular meals daily	❑ Never ❑ Rarely ❑ Sometimes ❑ Usually ❑ Always
19. Eat breakfast daily	❑ Never ❑ Rarely ❑ Sometimes ❑ Usually ❑ Always
20. Include five food groups in each meal (dairy, meat/fish, vegetables, fruit, and corn)	❑ Never ❑ Rarely ❑ Sometimes ❑ Usually ❑ Always
21. Drink at least 6-8 glasses of water daily	❑ Never ❑ Rarely ❑ Sometimes ❑ Usually ❑ Always
22. Participate in physical education class at chool weekly	❑ Never ❑ Rarely ❑ Sometimes ❑ Usually ❑ Always

Erla Kolbrún Svavarsdóttir og Brynja Örlygsdóttir, 2004.
Hjúkrunarfræðideild Háskóla Íslands.

Heilsuefling skólabarna

Lesið spurningarnar vel og setjið X í viðeigandi reit

1. Tala um áhyggjur mínar við aðra	❑ Aldrei ❑ Sjaldan ❑ Stundum ❑ Oftast ❑ Alltaf
2. Læt væntumþykju og hlýju mína í ljós við aðra	❑ Aldrei ❑ Sjaldan ❑ Stundum ❑ Oftast ❑ Alltaf
3. Tala um vandamál mín við aðra	❑ Aldrei ❑ Sjaldan ❑ Stundum ❑ Oftast ❑ Alltaf
4. Finnst gaman að vera í sambandi við ættingja mína	❑ Aldrei ❑ Sjaldan ❑ Stundum ❑ Oftast ❑ Alltaf
5. Legg mig fram um að vera hamingjusamur/söm og ánægð/ur	❑ Aldrei ❑ Sjaldan ❑ Stundum ❑ Oftast ❑ Alltaf
6. Legg mig fram um að vera sátt/ur við sjálfan/n mig	❑ Aldrei ❑ Sjaldan ❑ Stundum ❑ Oftast ❑ Alltaf
7. Legg mig fram um að vita hvað er mikilvægt fyrir mig	❑ Aldrei ❑ Sjaldan ❑ Stundum ❑ Oftast ❑ Alltaf

8. Leita að upplýsingum um heilbrigði	❑ Aldrei ❑ Sjaldan ❑ Stundum ❑ Oftast ❑ Alltaf
9. Ræði áhyggjur sem ég hef af heilsu minni við skólahjúkrunarfræðing	❑ Aldrei ❑ Sjaldan ❑ Stundum ❑ Oftast ❑ Alltaf
10. Busta tennurnar og nota tannþráð á morgnanna og kvöldin	❑ Aldrei ❑ Sjaldan ❑ Stundum ❑ Oftast ❑ Alltaf
11. Legg mig fram um að vera hæfilega þung/ur	❑ Aldrei ❑ Sjaldan ❑ Stundum ❑ Oftast ❑ Alltaf
12. Legg mig fram um að standa og sitja með beint bak	❑ Aldrei ❑ Sjaldan ❑ Stundum ❑ Oftast ❑ Alltaf
13. Þvæ mér um hendur fyrir mat	❑ Aldrei ❑ Sjaldan ❑ Stundum ❑ Oftast ❑ Alltaf
14. Legg mig fram við að átta mig á því af hverju ég verð stressaður/uð	❑ Aldrei ❑ Sjaldan ❑ Stundum ❑ Oftast ❑ Alltaf
15. Legg mig fram um að finna tíma á hverjum degi til að hvíla mig	❑ Aldrei ❑ Sjaldan ❑ Stundum ❑ Oftast ❑ Alltaf
16. Skipulegg tíma minn og forgangsraða	❑ Aldrei ❑ Sjaldan ❑ Stundum ❑ Oftast ❑ Alltaf

17. Sef 8-10 klukkustundir á hverri nóttu	❑ Aldrei ❑ Sjaldan ❑ Stundum ❑ Oftast ❑ Alltaf
18. Borða reglulega þrjár máltíðir á dag	❑ Aldrei ❑ Sjaldan ❑ Stundum ❑ Oftast ❑ Alltaf
19. Borða morgunmat á hverjum degi	❑ Aldrei ❑ Sjaldan ❑ Stundum ❑ Oftast ❑ Alltaf
20. Borða eitthvað úr fæðuflokkunum fimm á hverjum degi (mjólkurmat, kjöt/fisk, grænmeti, ávexti, og korn)	❑ Aldrei ❑ Sjaldan ❑ Stundum ❑ Oftast ❑ Alltaf
21. Drekk að minnsta kosti 6-8 glös af vatni á dag	❑ Aldrei ❑ Sjaldan ❑ Stundum ❑ Oftast ❑ Alltaf
22. Fer í leikfimi í skólanum í hverri viku	❑ Aldrei ❑ Sjaldan ❑ Stundum ❑ Oftast ❑ Alltaf

APPENDIX B INSTRUMENT: BACKGROUND INFORMATION

Erla Kolbrún Svavarsdóttir and Brynja Örlygsdóttir, 2004.
University of Iceland, Faculty of Iceland.

Background Information (Children)

1. How old are you?:_____years old

2. What grade are you in?
   - 5th grade
   - 6th grade

3. Are you a:
   - Boy
   - Girl

4. Do you have stomach ache?
   - Always
   - Sometimes
   - Seldom
   - Never

5. Do you have headache?
   - Always
   - Sometimes
   - Seldom
   - Never

6. Do you feel dizzy?
   - ❑ Always
   - ❑ Sometimes
   - ❑ Seldom
   - ❑ Never

7. Do you have hard time falling asleep at night?
   - ❑ Always
   - ❑ Sometimes
   - ❑ Seldom
   - ❑ Never

8. Do you have a hobby/hobbies? (for example extracurricular music lessons, sport for example)
   - ❑ Yes
   - ❑ No

9. If you answered "yes" in question 8, what hobby/ies do you have?
   - ❑ Music (for example playing instruments, singing, or choir)
   - ❑ Sport (for example swimming, soccer, basketball, handball, badminton, karate etc.)
   - ❑ Dance or ballet
   - ❑ Linguistic studies
   - ❑ Chess
   - ❑ Drama
   - ❑ Boy or girl scout
   - ❑ Other, what?_____

10. Have you been teased by other children?
    - ❑ Yes
    - ❑ No

11. If you answered “yes” in question 10, how often were you teased by other children last week?
    - ❑ Often a day
    - ❑ Every day (ones a day)
    - ❑ Few times a week
    - ❑ Ones a week
    - ❑ Less than ones a week

12. Do you tease other children?
    - ❑ Yes
    - ❑ No

13. If you answered “yes” in question 12, how often did you tease other children last week?
    - ❑ Often a day
    - ❑ Every day (ones a day)
    - ❑ Few times a week
    - ❑ Ones a week
    - ❑ Less than ones a week

14. If you answered “yes” in question 12, why do you tease other children?

---

15. Have you been bullied by other children?
    - ❑ Yes
    - ❑ No

16. If you answered “yes” in question 14, how often were you bullied by other children last week?
    - ❑ Often a day
    - ❑ Every day (ones a day)
    - ❑ Few times a week
    - ❑ Ones a week
    - ❑ Less than ones a week

17. Do you bully other children?
    - ❑ Yes
    - ❑ No

18. If you answered “yes” in question 17, how often did you bully other children last week?
    - ❑ Often a day
    - ❑ Every day (ones a day)
    - ❑ Few times a week
    - ❑ Ones a week
    - ❑ Less than ones a week

19. If you answered “yes” in question 17, why do you bully other children?

---

20. Have you visited the school nurse last week?
    - ❑ Yes
    - ❑ No

21. If you answered “yes” in question 20, how often did you go to the school nurse last week?
    - ❑ Often a day
    - ❑ Every day (ones a day)
    - ❑ Few times a week
    - ❑ Ones a week
    - ❑ Less than ones a week

22. If you answered “yes” in question 20, why did you visit the school nurse?

Erla Kolbrún Svavarsdóttir og Brynja Örlygsdóttir, 2004.
Hjúkrunarfræðideild Háskóla Íslands.

Bakgrunnsupplýsingar

1. Hvað ertu gamall/gömul?:_____ára

2. Í hvaða bekk ert þú?
   - ❑ 5. bekk
   - ❑ 6. bekk

3. Ertu
   - ❑ Strákur
   - ❑ Stelpa

4. Er þér illt í maganum?
   - ❑ Alltaf
   - ❑ Stundum
   - ❑ Sjaldan
   - ❑ Aldrei

5. Er þér illt í höfðinu?
   - ❑ Alltaf
   - ❑ Stundum
   - ❑ Sjaldan
   - ❑ Aldrei

6. Svimar þig?
   - ❑ Alltaf
   - ❑ Stundum
   - ❑ Sjaldan
   - ❑ Aldrei

7. Áttu erfitt með að sofna á kvöldin?
   - ❑ Alltaf
   - ❑ Stundum
   - ❑ Sjaldan
   - ❑ Aldrei

8. Stundar þú einhverja tómstundariðju? (svo sem tónlistarnám, íþróttir, o.s.frv. utan skóla)
   - ❑ Já
   - ❑ Nei

9. Ef „já" i spurningu 8, hvaða tómstundir stundar þú?
   - ❑ Tónlist (hljóðfæranám, söng, eða kór)
   - ❑ Íþróttir (svo sem sund, fótbolta, körfubolta, handbolta, badminton, karate og fleira)
   - ❑ Dans eða ballett
   - ❑ Tungumálanám
   - ❑ Skák
   - ❑ Leiklist
   - ❑ Skátstarf
   - ❑ Annað, hvað?_____

10. Er þér strítt af öðrum krökkum?
    - ❑ Já
    - ❑ Nei

11. Ef þú svarar „já" í spurningu 10, hversu oft var þér strítt af öðrum krökkum síðastliðna viku?
    - ❑ Oft á dag
    - ❑ Daglega (einu sinni á dag)
    - ❑ Nokkrum sinnum í viku
    - ❑ Einu sinni í viku
    - ❑ Sjaldnar

12. Stríðir þú öðrum krökkum?
    - ❑ Já
    - ❑ Nei

13. Ef þú svarar „já" í spurningu 12, hversu oft stríddir þú öðrum krökkum síðastliðna viku?
    - ❑ Oft á dag
    - ❑ Daglega (einu sinni á dag)
    - ❑ Nokkrum sinnum í viku
    - ❑ Einu sinni í viku
    - ❑ Sjaldnar

14. Ef þú svarar „já" í spurningu 12, af hverju stríðir þú öðrum krökkum?

---

15. Ert þú lagður/lögð í einelti af öðrum krökkum?
    - ❑ Já
    - ❑ Nei

16. Ef þú svarar „já" í spurningu 14, hversu oft varst þú lagður/lögð í einelti af öðrum krökkum síðastliðna viku?
    - ❑ Oft á dag

- Daglega (einu sinni á dag)
- Nokkrum sinnum í viku
- Einu sinni í viku
- Sjaldnar

17. Leggur þú aðra krakka í einelti?
    - Já
    - Nei

18. Ef þú svarar „já" í spurningu 17, hversu oft lagðir þú aðra krakka í einelti síðastliðna viku?
    - Oft á dag
    - Daglega (einu sinni á dag)
    - Nokkrum sinnum í viku
    - Einu sinni í viku
    - Sjaldnar

19. Ef þú svarar „já" í spurningu 17, af hverju leggur þú aðra krakka í einelti?

---

20. Hefur þú farið til skólahjúkrunarfræðingsins síðastliðna viku?
    - Já
    - Nei

21. Ef þú svarar „já” í spurningu 20, hversu oft hefur þú farið til skólahjúkrunarfræðingsins síðastliðna viku?
    - ❑ Oft á dag
    - ❑ Daglega (einu sinni á dag)
    - ❑ Nokkrum sinnum í viku
    - ❑ Einu sinni í viku
    - ❑ Sjaldnar

22. Ef þú svarar „já” í spurningu 17, af hverju fórst þú til skólahjúkrunarfræðingsins?

_____

_____

Erla Kolbrún Svavarsdóttir and Brynja Örlygsdóttir, 2004
University of Iceland, Faculty of Nursing.

Background Information (Parents)

1. Age of your child:_____years old

2. The child´s grade:
   - 5th grade
   - 6th grade

3. The child´s gender:
   - Boy
   - Girl

4. The child´s origin?
   - Both parents are Icelandic
   - One parent is Icelandic
   - Both parents are of foreign origin
   - If parents are of foreign origin, what country are they from

     _____

5. Does the child complain of stomach ache?
   - Always
   - Sometimes
   - Seldom
   - Never

6. Does the child complain of headache?
   - ❑ Always
   - ❑ Sometimes
   - ❑ Seldom
   - ❑ Never

7. Does the child experience dizziness?
   - ❑ Always
   - ❑ Sometimes
   - ❑ Seldom
   - ❑ Never

8. Does the child have difficulty falling asleep at night?
   - ❑ Always
   - ❑ Sometimes
   - ❑ Seldom
   - ❑ Never

9. Does the child have a chronic disease (or diseases)? (mark everything that applies):
   - ❑ asthma
   - ❑ diabetes
   - ❑ ADD
   - ❑ Learning disabilities
   - ❑ delayed development
   - ❑ seizure/epilepsy
   - ❑ migraine
   - ❑ other, what?_____

10. Gender of the person who answers this questionnaire:
    - ❑ Woman
    - ❑ Male

11. Connection of the person who answers the questionnaire to the child:
    - ❑ Mother
    - ❑ Father
    - ❑ Stepmother
    - ❑ Stepfather
    - ❑ Other connection, what?_____

12. Your age:_____years old

13. Age of your spouse:_____years old

14. Number, connection and age of other children in the household:

i.
ii.
iii.
iv.
v.
vi.

15. What is your current marital status?
    - ❑ Married
    - ❑ Co-habiting
    - ❑ Single parent
    - ❑ Separated
    - ❑ Divorced
    - ❑ Divorced and re-married (or co-habiting)
    - ❑ Widow/widower
    - ❑ How long have you lived with your current spouse_____years

16. With whom does the child live with?
    - ❑ Both biological parents
    - ❑ One biological parent and a foster parent
    - ❑ Foster parents
    - ❑ With one parent
    - ❑ Parents have shared custody (child has 2 homes)

17. What education have you completed? (Mark the highest degree you have completed)
    - ❑ Elementary school
    - ❑ Work related education, other than vocational degree
    - ❑ Vocational degree
    - ❑ Highschool degree
    - ❑ Bachelors degree
    - ❑ Master's or a doctoral degree
    - ❑ Other education, what?_____

18. What is your main job?
    (write)_____

19. How much do you work?
    - ❑ Do not work outside the home
    - ❑ Part time work
    - ❑ Full time work
    - ❑ Full time work in one place and part time work in another

20. What is your spouse main job? (write)_____

21. How much does your spouse work?
    - ❑ Does not work outside the home
    - ❑ Works part time
    - ❑ Works full time
    - ❑ Works full time in one place and part time in another work

22. How much did you earn last month before taxes? (Everything included: payments for cars; overtime; moonlightning etc)

    Total salary before taxes:_____Icelandic krónur a month

Erla Kolbrún Svavarsdóttir og Brynja Örlygsdóttir, 2004
Hjúkrunarfræðideild Háskóla Íslands.

Bakgrunnsupplýsingar

1. Aldur barns:_____ára

2. Bekkjardeild barns:
   - ❑ 5. bekkur
   - ❑ 6. bekkur

3. Kyn barns:
   - ❑ Strákur
   - ❑ Stelpa

4. Hver er uppruni barns?
   - ❑ Báðir foreldrar eru íslenskir
   - ❑ Annað foreldri er íslenskt
   - ❑ Báðir foreldrar eru af erlendum uppruna
   - ❑ Ef foreldrar eru af erlendum uppruna, frá hvaða landi

     _____

5. Kvartar barnið um magaverk?
   - ❑ Alltaf
   - ❑ Stundum
   - ❑ Sjaldan
   - ❑ Aldrei

6. Kvartar barnið um höfuðverk?
   - ❑ Alltaf
   - ❑ Stundum
   - ❑ Sjaldan
   - ❑ Aldrei

7. Svimar barnið?
   - ❑ Alltaf
   - ❑ Stundum
   - ❑ Sjaldan
   - ❑ Aldrei

8. Á barnið í erfiðleikum með að sofna á kvöldin?
   - ❑ Alltaf
   - ❑ Stundum
   - ❑ Sjaldan
   - ❑ Aldrei

9. Er barnið með langvinnan sjúkdóm? (merkið við allt sem við á):
   - ❑ astma
   - ❑ sykursýki
   - ❑ ofvirkni/athyglisbrest
   - ❑ námserfiðleika
   - ❑ þroskafrávik (seinkun á þroska)
   - ❑ krampa/flogaveiki
   - ❑ mígreni
   - ❑ annað, hvað?_____

10. Kyn þess sem svarar:
    - ❑ Kona
    - ❑ Karl

11. Tengsl þess sem svarar við barn:
    - ❑ Móðir
    - ❑ Faðir
    - ❑ Stjúpmóðir
    - ❑ Stjúpfaðir
    - ❑ Önnur tengsl, hver?_____

12. Aldur þinn:_____ára

13. Aldur maka:_____ára

14. Fjöldi, tengsl og aldur annarra barna á heimilinu:

i.
ii.
iii.
iv.
v.
vi.

15. Hver er núverandi hjúskaparstaða þín?
    - ❑ Gift(ur)
    - ❑ Í sambúð
    - ❑ Einstætt foreldri
    - ❑ Fráskilin(n) að borði og sæng
    - ❑ Skilin(n) eftir sambúðarslit
    - ❑ Fráskilin(n) og gift (eða í sambúð)
    - ❑ Ekkja/ekkill
    - ❑ Lengd núverandi sambúðar_____ár

16. Hjá hverjum býr barnið?
    - ❑ Báðum lífforeldrum
    - ❑ Lífforeldri og fósturforeldri
    - ❑ Fósturforeldrum
    - ❑ Hjá öðru foreldri
    - ❑ Foreldrar eru með sameiginlegt forræði (barn hefur 2 heimili)

17. Hvaða námi hefur þú lokið? (Merktu við hæstu gráðu sem þú hefur lokið að fullu)
    - ❑ Almennu námi (t.d. grunnskólaprófi, landsprófi, gagnfræðaprófi)
    - ❑ Starfsnámi, öðru en iðnnámi (t.d. tölvu-eða sjúkraliðanámi, námi í lögregluskóla)
    - ❑ Iðnnámi (t.d. almennu iðnnámi, sveinsprófi, meistaraprófi)
    - ❑ Bóklegu framhaldsnámi (t.d. stúdentsprófi, samvinnuprófi, verslunarprófi)
    - ❑ BA eða BS gráðu
    - ❑ MA, MS eða doktorsgráðu
    - ❑ Öðru námi,
      hverju?_____

18. Hvert er aðalstarf þitt? (skrifið)_____

19. Hvert er starfshlutfall þitt?
    - ❑ Vinn ekki utan heimilis
    - ❑ Vinn hlutastarf
    - ❑ Er í fullu starfi
    - ❑ Er í fullu starfi á einum stað og vinn annars staðar að auki

20. Hvert er aðalstarf maka þíns?
    (skrifið)_____

21. Hvert er starfshlutfall maka þíns?
    - ❑ Vinnur ekki utan heimilis
    - ❑ Vinnur hlutastarf
    - ❑ Er í fullu starfi
    - ❑ Er í fullu starfi á einum stað og vinnur annars staðar að auki

22. Hversu mikið hafðir þú í heildarlaun í síðasta mánuði fyrir skatt, svona um það bil? (Öll aukavinna: Aukavinna, yfirborganir, bílastyrkur og annað meðtalið)

    Heildarlaun alls fyrir skatt: _____krónur á mánuði

APPENDIX C INSTRUMENT: QUALITY OF LIFE

PedsQL ™

Pediatric Quality of Life Inventory

Version 4.0

Child Report (ages 8-12)

DIRECTIONS

On the following page is a list of things that might be a problem for you. Please tell us **how much of a problem** each one has been for you during the **past ONE month** by circling:

0 if it is **never** a problem

1 if it is **almost never** a problem

2 if it is **sometimes** a problem

3 if it is **often** a problem

4 if it is **almost always** a problem

There are no right or wrong answers. If you do not understand a question, please ask for help.

In the past **ONE month**, how much of a **problem** has this been for you…

ABOUT MY HEALTH AND ACTIVITIES (problems with…)	**Never**	**Almost Never**	**Some-times**	**Often**	**Almost Always**
1. It is hard for me to walk more than one block	**0**	**1**	**2**	**3**	**4**
2. It is hard for me to run	**0**	**1**	**2**	**3**	**4**
3. It is hard for me to do sports activity or exercise	**0**	**1**	**2**	**3**	**4**
4. It is hard for me to lift something heavy	**0**	**1**	**2**	**3**	**4**
5. It is hard for me to take a bath or shower by myself	**0**	**1**	**2**	**3**	**4**
6. It is hard for me to do chores around the house	**0**	**1**	**2**	**3**	**4**
7. I hurt or ache	**0**	**1**	**2**	**3**	**4**
8. I have low energy	**0**	**1**	**2**	**3**	**4**
ABOUT MY FEELINGS (problems with…)	**Never**	**Almost Never**	**Some-times**	**Often**	**Almost Always**
9. I feel afraid or scared	**0**	**1**	**2**	**3**	**4**
10. I feel sad or blue	**0**	**1**	**2**	**3**	**4**
11. I feel angry	**0**	**1**	**2**	**3**	**4**
12. I have trouble sleeping	**0**	**1**	**2**	**3**	**4**
13. I worry about what will happen to me	**0**	**1**	**2**	**3**	**4**
HOW I GET ALONG WITH OTHERS (problems with…)	**Never**	**Almost Never**	**Some-times**	**Often**	**Almost Always**
14. I have trouble getting along with other kids	**0**	**1**	**2**	**3**	**4**
15. Other kids do not want to me be my friends	**0**	**1**	**2**	**3**	**4**
16. Other kids tease me	**0**	**1**	**2**	**3**	**4**
17. I cannot do things that other kids my age can do	**0**	**1**	**2**	**3**	**4**
18. It is hard to keep up when I play with other kids	**0**	**1**	**2**	**3**	**4**

ABOUT SCHOOL (problems with…)	Never	Almost Never	Some-times	Often	Almost Always
19. It is hard to pay attention in class	**0**	**1**	**2**	**3**	**4**
20. I forget things	**0**	**1**	**2**	**3**	**4**
21. I have trouble keeping up with my schoolwork	**0**	**1**	**2**	**3**	**4**
22. I miss school because of not feeling well	**0**	**1**	**2**	**3**	**4**
23. I miss school to go to the doctor or hospital	**0**	**1**	**2**	**3**	**4**

Erla Kolbrún Svavarsdóttir og Brynja Örlygsdóttir, 2004.

Hjúkrunarfræðideild Háskóla Íslands.

Könnun á lífsgæðum skólabarna

Höfundur: JW Varni, 1998

Hér að neðan er spurt um hvort og hversu oft þú átt erfitt með ýmsar athafnir og tilfinningar. Vinsamlegast segðu okkur hversu erfið eftirtalin atriði hafa verið fyrir þig undanfarinn **MÁNUÐ** með því að setja X í viðeigandi reit.

0 ef það er **Aldrei** erfitt

1 ef það er **Eiginlega aldrei** erfitt

2 ef það er **Stundum** erfitt

3 ef það er **Oft** erfitt

4 ef það er **Næstum alltaf** erfitt

það eru engin svör rétt eða röng.

Ef þú skilur ekki spurningu, vinsamlegast leitaðu eftir hjálp.

Undanfarinn **MÁNUÐ,** hversu erfið hafa eftirtalin atriði verið fyrir þig

Um heilsufar mitt og athafnir	**Aldrei**	**Eiginlega aldrei**	**Stundum**	**Oft**	**Næstum alltaf**
1. Það er erfitt fyrir mig að ganga lengra en eina götulengd	**0**	**1**	**2**	**3**	**4**
2. Það er erfitt fyrir mig að hlaupa	**0**	**1**	**2**	**3**	**4**
3. Það er erfitt fyrir mig að stunda íþróttir eða aðra reglubundna hreyfingu	**0**	**1**	**2**	**3**	**4**
4. Það er erfitt fyrir mig að lyfta einhverju þungu	**0**	**1**	**2**	**3**	**4**
5. Það er erfitt fyrir mig að fara í bað eða sturtu sjálf/ur	**0**	**1**	**2**	**3**	**4**
6. Það er erfitt fyrir mig að hjálpa til við heimilisstörfin	**0**	**1**	**2**	**3**	**4**
7. Ég er með verki eða óþægindi	**0**	**1**	**2**	**3**	**4**
8. Ég er þróttlítil/l (hef litla orku)	**0**	**1**	**2**	**3**	**4**
Um tilfinningar mínar	**Aldrei**	**Eiginlega aldrei**	**Stundum**	**Oft**	**Næstum alltaf**
9. Ég er hrædd/ur eða óttaslegin/n	**0**	**1**	**2**	**3**	**4**
10. Ég er leið/ur eða döpur/dapur	**0**	**1**	**2**	**3**	**4**
11. Ég er reið/ur	**0**	**1**	**2**	**3**	**4**
12. Ég á erfitt með að sofa	**0**	**1**	**2**	**3**	**4**
13. Ég hef áhyggjur af því hvað verður um mig	**0**	**1**	**2**	**3**	**4**
Hvernig mér semur við aðra	**Aldrei**	**Eiginlega aldrei**	**Stundum**	**Oft**	**Næstum alltaf**
14. Ég á erfitt með að láta mér semja við aðra krakka	**0**	**1**	**2**	**3**	**4**
15. Aðrir krakkar vilja ekki vera vinir mínir	**0**	**1**	**2**	**3**	**4**
16. Aðrir krakkar stríða mér	**0**	**1**	**2**	**3**	**4**
17. Ég get ekki gert það sem aðrir krakkar á mínum aldri geta	**0**	**1**	**2**	**3**	**4**
18. Það er erfitt að halda í við aðra krakka í leik	**0**	**1**	**2**	**3**	**4**

Undanfarinn **MÁNUÐ,** hversu erfið hafa eftirtalin atriði verið fyrir þig

Um skólann	**Aldrei**	**Eiginlega aldrei**	**Stundum**	**Oft**	**Næstum alltaf**
19. Það er erfitt að halda athyglinni vakandi í kennslustundum	**0**	**1**	**2**	**3**	**4**
20. Ég gleymi (hlutum)	**0**	**1**	**2**	**3**	**4**
21. Ég á erfitt með að fylgja námsefninu	**0**	**1**	**2**	**3**	**4**
22. Ég missi úr skólanum vegan þess að mér líður ekki vel	**0**	**1**	**2**	**3**	**4**
23. Ég missi úr skólanum vegan þess að ég þarf að fara til læknis eða á spítala	**0**	**1**	**2**	**3**	**4**

PedsQL ™

Pediatric Quality of Life Inventory

Version 4.0

Parent Report for **Children (ages 8-12)**

DIRECTIONS

On the follwing page is a list of things that might be a problem for **your child**. Please tell us **how much of a problem** each one has been for **your child** during the **past ONE month** by circling:

0 if it is **never** a problem

1 if it is **almost never** a problem

2 if it is **sometimes** a problem

3 if it is **often** a problem

4 if it is **almost always** a problem

There are no right or wrong answers. If you do not understand a question, please ask for help.

In the past **ONE month**, how much of a **problem** has your child had with …

PHYSICAL FUNCTIONING (problems with…)	**Never**	**Almost Never**	**Some-times**	**Often**	**Almost Always**
1. Walking more than one block	**0**	**1**	**2**	**3**	**4**
2. Running	**0**	**1**	**2**	**3**	**4**
3. Participating in sports activity or exercise	**0**	**1**	**2**	**3**	**4**
4. Lifting something heavy	**0**	**1**	**2**	**3**	**4**
5. Taking a bath or shower by him or herself	**0**	**1**	**2**	**3**	**4**
6. Doing chores around the house	**0**	**1**	**2**	**3**	**4**
7. Having hurts or aches	**0**	**1**	**2**	**3**	**4**
8. Low energy level	**0**	**1**	**2**	**3**	**4**
EMOTIONAL FUNCTIONING (problems with…)	**Never**	**Almost Never**	**Some-times**	**Often**	**Almost Always**
9. Feeling afraid or scared	**0**	**1**	**2**	**3**	**4**
10. Feeling sad or blue	**0**	**1**	**2**	**3**	**4**
11. Feeling angry	**0**	**1**	**2**	**3**	**4**
12. Trouble sleeping	**0**	**1**	**2**	**3**	**4**
13. Worrying about what will happen to him or her	**0**	**1**	**2**	**3**	**4**
SOCIAL FUNCTIONING (problems with…)	**Never**	**Almost Never**	**Some-times**	**Often**	**Almost Always**
14. Getting along with other children	**0**	**1**	**2**	**3**	**4**
15. Other kids not wanting to be his or her friend	**0**	**1**	**2**	**3**	**4**
16. Getting teased by other children	**0**	**1**	**2**	**3**	**4**
17. Not able to do things that other children his or her age can do	**0**	**1**	**2**	**3**	**4**
18. Keeping up when playing with other children	**0**	**1**	**2**	**3**	**4**
SCHOOL FUNCTIONING (problems with…)	**Never**	**Almost Never**	**Some-times**	**Often**	**Almost Always**
19. Paying attention in class	**0**	**1**	**2**	**3**	**4**
20. Forgetting things	**0**	**1**	**2**	**3**	**4**
21. Keeping up with schoolwork	**0**	**1**	**2**	**3**	**4**
22. Missing school because of not feeling well	**0**	**1**	**2**	**3**	**4**

Erla Kolbrún Svavarsdóttir og Brynja Örlygsdóttir, 2004.

Hjúkrunarfræðideild Háskóla Íslands.

Lífsgæði skólabarna: Könnun fyrir foreldra

Hér að neðan er spurt um hvort og hversu oft barnið þitt á erfitt með ýmsar athafnir og tilfinningar. Vinsamlegast segðu okkur hversu erfið eftirtalin atriði hafa verið fyrir barnið þitt undanfarinn **MÁNUÐ** með því að setja X í viðeigandi reit.

0 ef það er **Aldrei** erfitt

1 ef það er **Eiginlega aldrei** erfitt

2 ef það er **Stundum** erfitt

3 ef það er **Oft** erfitt

4 ef það er **Næstum alltaf** erfitt

Það eru engin svör rétt eða röng.

Ef þú skilur ekki einhverja spurningu, vinsamlegast leitaðu eftir hjálp.

Hversu erfið hafa eftirtalin atriði verið fyrir barnið þitt undanfarinn **MÁNUÐ**

Um heilsufar og athafnir (erfiðleikar með...)	**Aldrei**	**Eiginlega aldrei**	**Stundum**	**Oft**	**Næstum alltaf**
1. Að ganga lengra en eina götulengd	**0**	**1**	**2**	**3**	**4**
2. Að hlaupa	**0**	**1**	**2**	**3**	**4**
3. Að taka þátt í íþróttum eða annarri reglubundinni hreyfingu	**0**	**1**	**2**	**3**	**4**
4. Að lyfta einhverju þungu	**0**	**1**	**2**	**3**	**4**
5. Að fara sjálf/ur í bað eða sturtu	**0**	**1**	**2**	**3**	**4**
6. Að taka þátt í heimilisstörfunum	**0**	**1**	**2**	**3**	**4**
7. Er með verki eða óþægindi	**0**	**1**	**2**	**3**	**4**
8. Er þróttlítil/l (lítið orkustig)	**0**	**1**	**2**	**3**	**4**
Um tilfinningar	**Aldrei**	**Eiginlega aldrei**	**Stundum**	**Oft**	**Næstum alltaf**
9. Er hrædd/ur eða óttaslegin/n	**0**	**1**	**2**	**3**	**4**
10. Er leið/ur eða döpur/dapur	**0**	**1**	**2**	**3**	**4**
11. Er reið/ur	**0**	**1**	**2**	**3**	**4**
12. Á erfitt með að sofa	**0**	**1**	**2**	**3**	**4**
13. Hefur áhyggjur af því hvað verður um hana/hann	**0**	**1**	**2**	**3**	**4**
Um félagslega virkni	**Aldrei**	**Eiginlega aldrei**	**Stundum**	**Oft**	**Næstum alltaf**
14. Semur við önnur börn	**0**	**1**	**2**	**3**	**4**
15. Önnur börn vilja ekki vera vinir hennar/hans	**0**	**1**	**2**	**3**	**4**
16. Er strítt af öðrum börnum	**0**	**1**	**2**	**3**	**4**
17. Getur ekki gert það sem önnur börn á hennar eða hans aldri geta	**0**	**1**	**2**	**3**	**4**
18. Heldur í við önnur börn í leik	**0**	**1**	**2**	**3**	**4**

Um virkni í skóla	Aldrei	Eiginlega aldrei	Stundum	Oft	Næstum alltaf
19. Heldur athyglinni vakandi í kennslustundum	**0**	**1**	**2**	**3**	**4**
20. Gleymir (hlutum)	**0**	**1**	**2**	**3**	**4**
21. Fylgir námsefninu	**0**	**1**	**2**	**3**	**4**
22. Missir úr skóla vegna þess að henni/honum líður ekki vel	**0**	**1**	**2**	**3**	**4**
23. Missir úr skóla til að fara til læknis eða á spítala	**0**	**1**	**2**	**3**	**4**

APPENDIX D INSTRUMENT: FRIENDSHIP QUALITY

Erla Kolbrún Svavarsdóttir and Brynja Örlygsdóttir, 2004.
University of Iceland, Faculty of Iceland

Friendship Quality

Think about one of your best friend when you read the questions and put a circle around the appropriate answer

1.My friend and I live really close to each other				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
2.My friend and I get mad at each other a lot				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
3.My friend tells me I´m good at things				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
4.If other kids were talking behind my back, my friend would always stick up for me				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
5.My friend and I make each other feel important and specia				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
6.If my friend hurts my feeling, my friend says "I´m sorry"				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
7.I can think of some times when my friend has said mean things about me to other kids				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5

8. If my friend and I get mad at each other, we always talk about how to get over it				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
9.My friend and I are always telling each other about our problems				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
10.My friends makes me feel good about my ideas				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
11.When I´m mad about something that happened to me, I can always talk to my friend about it				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
12.My friend and I help each other with chores or other things a lot				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
13.My friend and I do special favours for each other				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
14.My friend and I argue a lot				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
15.I can always count on my friend to keep promises				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5

16.My friend and I go to each other's house after school and on weekends				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
17. When I´m having trouble figuring out something, I usually ask my friend for help and advice				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
18. My friend and I talk about the things that make us sad				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
19.My friend and I always make up easily when we have a fight				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
20. My friend and I fight				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
21. If my friend and I are mad at each other, we always talk about what would help to make us feel better				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
22. If I told my friend a secret, I could trust my friend not to tell anyone else				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
23. My friend and I bug each other				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5

24. My friend and I always come up with good ideas or ways to do things				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
25. My friend and I loan each other things all the time				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
26. My friend and I always get over our arguments really quickly				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
27. My friends doesn't listen to me				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
28. My friend and I tell each other private things a lot				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
29. My friend and I help each other with schoolwork a lot				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5
30. My friend cares about my feeling				
Not at all true	A little true	Somewhat true	Pretty true	Really true
1	2	3	4	5

Erla Kolbrún Svavarsdóttir og Brynja Örlygsdóttir, 2004.
Hjúkrunarfræðideild Háskóla Íslands.

Vinátta (strákar)

Hugsaðu um einn af bestu vinum þínum þegar þú lest spurningarnar og settu hring um viðeigandi svar

1.Ég og vinur minn eigum heima mjög nálægt hvor öðrum				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
2.Ég og vinur minn verðum oft reiðir út í hvorn annan				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
3.Vinur minn segir að ég geri hluti vel				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
4.Vinur minn mundi alltaf verja mig, ef að aðrir krakkar væru að baktala mig				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
5.Ég og vinur minn látum hvorn annan við finnast við vera mikilvægir og sérstakir				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5

6.Ef að vinur minn særir tilfinningar mínar (lætur mér líða illa), þá segir hann „fyrirgefðu”				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
7.Ég man eftir nokkrum skiptum þar sem vinur minn talaði illa um mig við aðra krakka				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
8.Ef að ég og vinur minn verðum reiðir út í hvorn annan, þá tölum við alltaf um það hvernig við eigum að komast yfir það				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
9.Ég og vinur minn segjum hvor öðrum alltaf frá vandamálum okkar				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
10.Vinur minn lætur mér líða vel með hugmyndir mínar				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
11.Þegar ég er reiður vegna einhvers sem kom fyrir mig, get ég alltaf talað um það við vin minn				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5

12.Ég og vinur minn hjálpum hvor öðrum oft við tiltekin heimilisverk				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
13.Ég og vinur minn gerum hvor öðrum oft sérstaka greiða				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
14.Ég og vinur minn rökræðum mikið (skiptumst á skoðunum)				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
15.Ég get alltaf treyst því að vinur minn standi við loforð				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
16.Ég og vinur minn förum heim til hvors annars eftir skóla og um helgar				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
17.Þegar ég á erfitt með að ráða fram úr einhverju, bið ég vin minn venjulega um hjálp og ráð				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
18.Ég og vinur minn tölum um það sem gerir okkur dapra				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5

19.Ég og vinur minn eigum alltaf auðvelt með að sættast eftir að við höfum rifist				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
20.Ég og vinur minn rífumst				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
21.Ef að ég og vinur minn erum reiðir út í hvorn annan, tölum við alltaf um hvað gæti hjálpað okkur að líða betur				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
22.Ef að ég segði vini mínum leyndarmál, þá gæti ég treyst vini mínum til að segja ekki neinum öðrum frá því				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
23.Ég og vinur minn förum í taugarnar hvor á öðrum				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
24.Ég og vinur minn fáum alltaf góðar hugmyndir til að gera eitthvað				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
25.Ég og vinur minn erum alltaf að lána hvor öðrum eitthvað				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5

26.Ég og vinur minn jöfnum okkur mjög fljótt eftir rifrildi				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
27.Vinur minn hlustar ekki á mig				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
28.Ég og vinur minn segjum hvor öðrum mikið af persónulegum málum				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
29.Ég og vinur minn hjálpum hvor öðrum oft með heimaverkefnin				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
30.Vini mínum er annt um tilfinningar mínar				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5

Erla Kolbrún Svavarsdóttir og Brynja Örlygsdóttir, 2004.
Hjúkrunarfræðideild Háskóla Íslands.

Vinátta (stelpur)

Hugsaðu um eina af bestu vinkonum þínum þegar þú lest spurningarnar og settu hring um viðeigandi svar

1.Ég og vinkona mín eigum heima mjög nálægt hvor annarri				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
2.Ég og vinkona mín verðum oft reiðar út í hvor aðra				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
3.Vinkona mín segir að ég geri hluti vel				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
4.Vinkona mín mundi alltaf verja mig, ef að aðrir krakkar væru að baktala mig				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
5.Ég og vinkona mín látum hvor aðra við finnast við vera mikilvægar og sérstakar				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5

6.Ef að vinkona mín særir tilfinningar mínar (lætur mér líða illa), þá segir hún „fyrirgefðu”				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
7.Ég man eftir nokkrum skiptum þar sem vinkona mín talaði illa um mig við aðra krakka				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
8.Ef að ég og vinkona mín verðum reiðar út í hvor aðra, þá tölum við alltaf um það hvernig við eigum að komast yfir það				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
9.Ég og vinkona mín segjum hvor annarri alltaf frá vandamálum okkar				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
10.Vinkona mín lætur mér líða vel með hugmyndir mínar				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
11.Þegar ég er reið vegna einhvers sem kom fyrir mig, get ég alltaf talað um það við vinkonu mína				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5

12.Ég og vinkona mín hjálpum hvor annarri oft við tiltekin heimilisverk				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
13.Ég og vinkona mín gerum hvor annarri oft sérstaka greiða				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
14.Ég og vinkona mín rökræðum mikið (skiptumst á skoðunum)				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
15.Ég get alltaf treyst því að vinkona mín standi við loforð				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
16.Ég og vinkona mín förum heim til hvor annarrar eftir skóla og um helgar				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
17.Þegar ég á erfitt með að ráða fram úr einhverju, bið ég vinkonu mina venjulega um hjálp og ráð				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
18.Ég og vinkona mín tölum um það sem gerir okkur daprar				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5

19.Ég og vinkona mín eigum alltaf auðvelt með að sættast eftir að við höfum rifist				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
20.Ég og vinkona mín rífumst				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
21.Ef að ég og vinkona mín erum reiðar út í hvor aðra, tölum við alltaf um hvað gæti hjálpokkur að líða betur				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
22.Ef að ég segði vinkonu minni leyndarmál, þá gæti ég treyst vinkonu minni til að segja ekk neinum öðrum frá því				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
23.Ég og vinkona mín förum í taugarnar hvor á annarri				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
24.Ég og vinkona mín fáum alltaf góðar hugmyndir til að gera eitthvað				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
25.Ég og vinkona mín erum alltaf að lána hvor annarri eitthvað				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5

26.Ég og vinkona mín jöfnum okkur mjög fljótt eftir rifrildi				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
27.Vinkona mín hlustar ekki á mig				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
28.Ég og vinkona mín segjum hvor annarri mikið af persónulegum málum				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
29.Ég og vinkona mín hjálpum hvor annarri oft með heimaverkefnin				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5
30.Vinkonu minni er annt um tilfinningar mínar				
Alls ekki rétt	Dálítið rétt	Að einhverju leyti rétt	Að mestu leyti rétt	Hárrétt
1	2	3	4	5

APPENDIX E INSTRUMENT: CONNECTION TO SCHOOL

Erla Kolbrún Svavarsdóttir and Brynja Örlygsdóttir, 2004.
University of Iceland, Faculty of Nursing.

Connection to School

Read the questions and put a X with appropriate answer

1. I feel safe in my school	❑ Strongly agree ❑ Agree ❑ Neither agree/disagree ❑ Disagree ❑ Strongly disagree
2. I feel close to people in this school	❑ Strongly agree ❑ Agree ❑ Neither agree/disagree ❑ Disagree ❑ Strongly disagree
3 I feel like I am a part of this school	❑ Strongly agree ❑ Agree ❑ Neither agree/disagree ❑ Disagree ❑ Strongly disagree
4. I feel happy to be at this school	❑ Strongly agree ❑ Agree ❑ Neither agree/disagree ❑ Disagree ❑ Strongly disagree
5. Teachers at this school treat students fairly	❑ Strongly agree ❑ Agree ❑ Neither agree/disagree ❑ Disagree ❑ Strongly disagree
6. How often have you had trouble getting along with other teachers	❑ Never ❑ Just a few times ❑ About once a week ❑ Almost everyday ❑ Everyday
7. How often do you have trouble getting along with other students	❑ Never ❑ Just a few times ❑ About once a week ❑ Almost everyday ❑ Everyday

Erla Kolbrún Svavarsdóttir og Brynja Örlygsdóttir, 2004.
Hjúkrunarfræðideild Háskóla Íslands.

Tengsl barna við skólann

Lesið spurningarnar vel og setjið X við viðeigandi svar

1. Mér finnst ég vera örugg/ur í skólanum	❑ Mjög sammála ❑ Sammála ❑ Hvorki sammála né ósammála ❑ Ósammála ❑ Mjög ósammála
2. Mér finnst ég vera náin/n fólkinu í skólanum	❑ Mjög sammála ❑ Sammála ❑ Hvorki sammála né ósammála ❑ Ósammála ❑ Mjög ósammála
3. Mér finnst eins og ég tilheyri skólanum	❑ Mjög sammála ❑ Sammála ❑ Hvorki sammála né ósammála ❑ Ósammála ❑ Mjög ósammála
4. Ég er ánægð/ur með að vera í þessum skóla	❑ Mjög sammála ❑ Sammála ❑ Hvorki sammála né ósammála ❑ Ósammála ❑ Mjög ósammála
5. Kennararnir í þessum skóla koma fram við nemendur af sanngirni	❑ Mjög sammála ❑ Sammála ❑ Hvorki sammála né ósammála ❑ Ósammála ❑ Mjög ósammála
6. Hversu oft hefur þú átt í erfiðleikum í samskiptum við aðra kennara?	❑ Aldrei ❑ Nokkrum sinnum ❑ Um það bil einu sinni í viku ❑ Næstum því daglega ❑ Á hverjum degi
7. Hversu oft hefur þú átt í erfiðleikum með samskiptum við aðra nemendur?	❑ Aldrei ❑ Nokkrum sinnum ❑ Um það bil einu sinni í viku ❑ Næstum því daglega ❑ Á hverjum degi

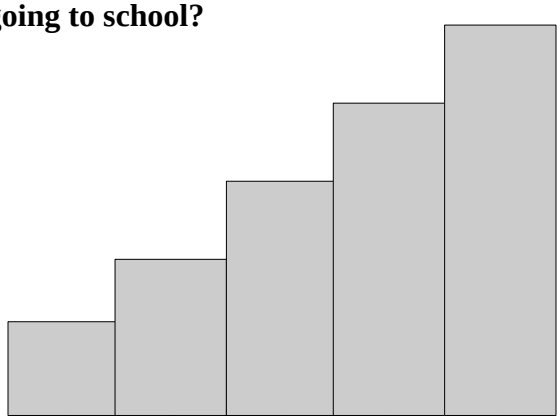
APPENDIX F INSTRUMENT: FEELINGS ABOUT SCHOOL

Erla Kolbrún Svavarsdóttir and Brynja Örlygsdóttir, 2004.
University of Iceland, Faculty of Nursing.

Feelings about School

Please put a circle around the number that explains best your feelings.

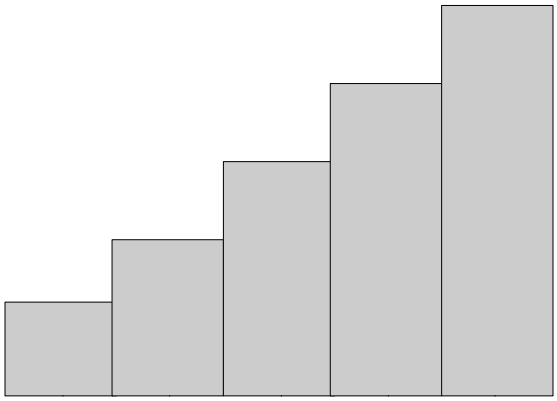
1. How do you feel about going to school?



1 2 3 4 5

Don´t like at all like a lot

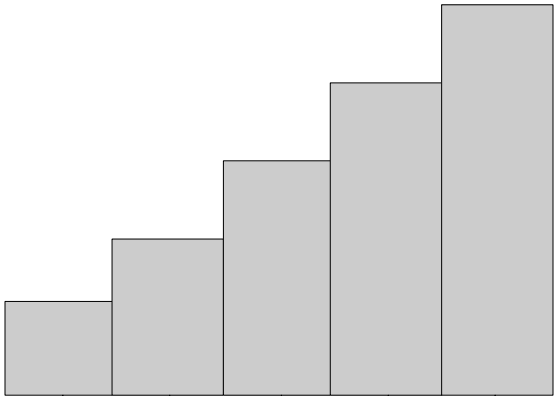
2. How much does your teacher care about you?



1 2 3 4 5

Doesn´t care at all cares a lot

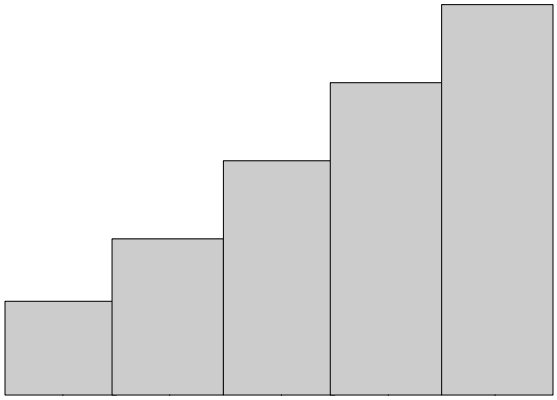
3. How does your teacher feel about you?



1 2 3 4 5

Doesn´t like at all likes me a lot

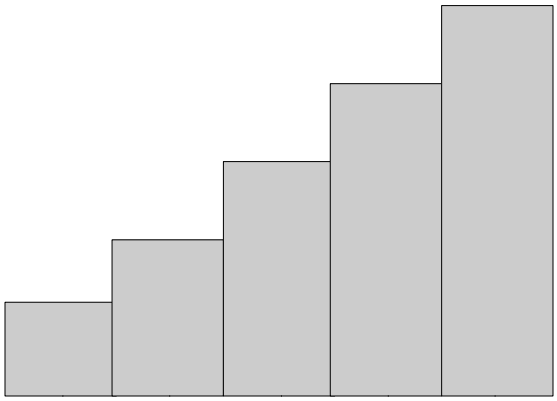
4. How fun are the things that you do in school?



1 2 3 4 5

Not fun at all very fun

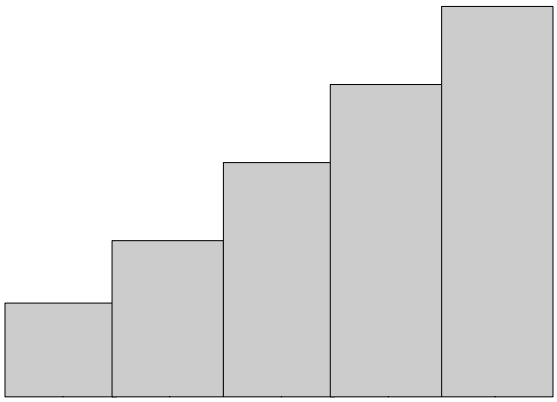
5. How do you feel when you are at school?



1 2 3 4 5

Sad all the time happy all the time

6. How do you feel about your teacher?



1 2 3 4 5

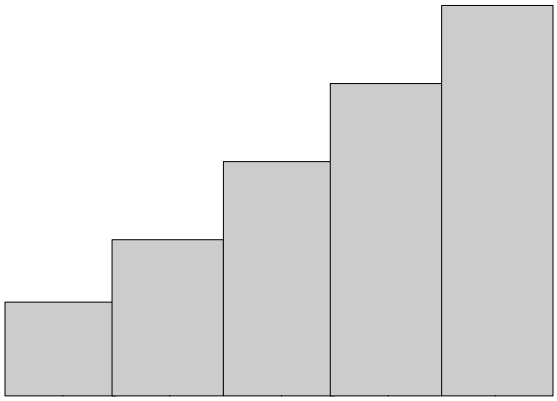
Don´t like at all like a lot

Erla Kolbrún Svavarsdóttir og Brynja Örlygsdóttir, 2004.
Hjúkrunarfræðideild Háskóla Íslands.

Tilfinningaleg líðan skólabarna

Vinsamlegast setjið hring utan um þá tölu sem lýsir tilfinningum þínum best.

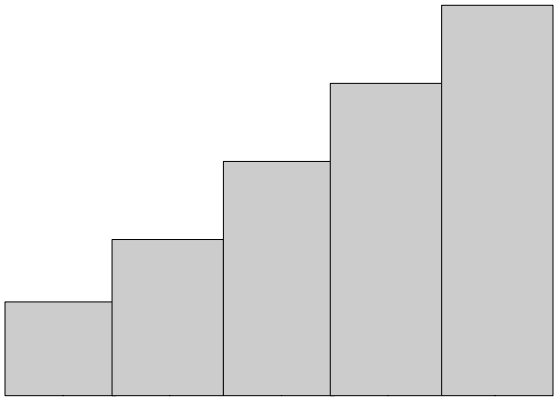
1. Hvernig líður þér við tilhugsunina að fara í skólann?



1 2 3 4 5

Líkar það alls ekki Líkar það mjög vel

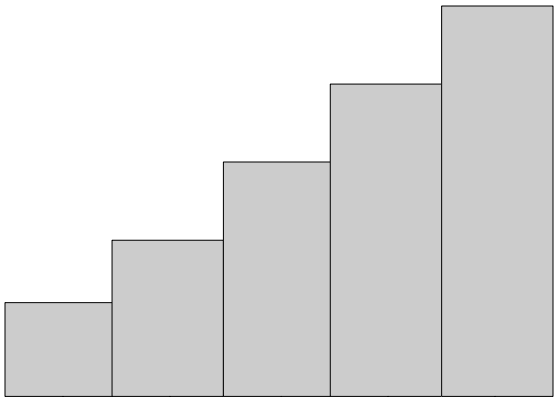
2. Hversu vænt þykir kennaranum þínum um þig?



1 2 3 4 5

Þykir alls ekki vænt um mig þykir mjög vænt um mig

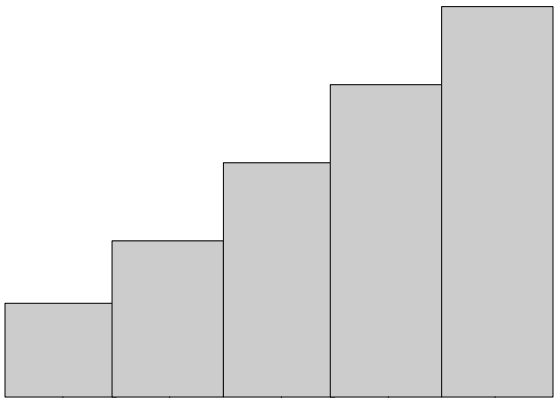
3. Hvað finnst kennaranum þínum um þig?



1 2 3 4 5

Líkar alls ekki við mig Líkar mjög vel við mig

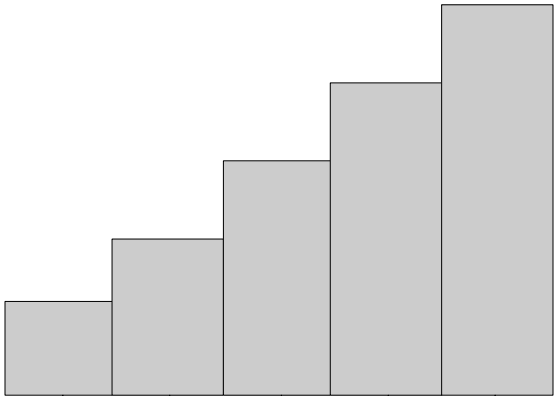
4. Hversu skemmtilegt er það sem þú gerir í skólanum?



1 2 3 4 5

Alls ekki skemmtilegt Mjög skemmtilegt

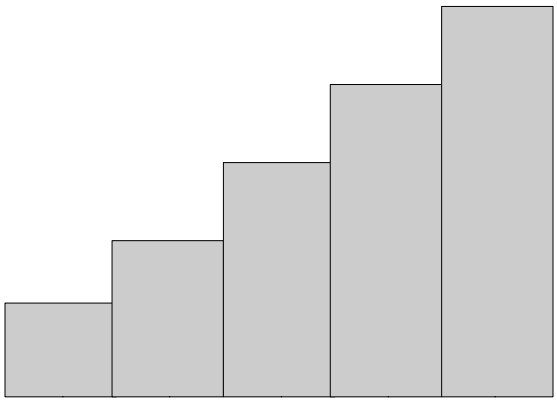
5. Hvernig líður þér þegar þú ert í skólanum?



1 2 3 4 5

Ég er alltaf leið/ur Ég er alltaf ánægð/ur

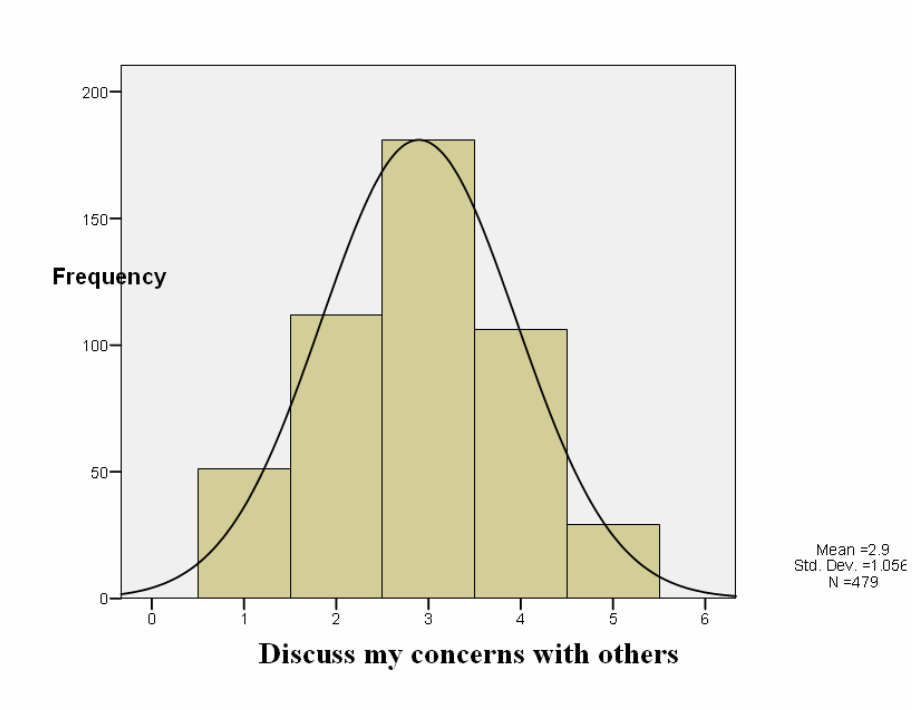
6. Hvað finnst þér um kennarann þinn?



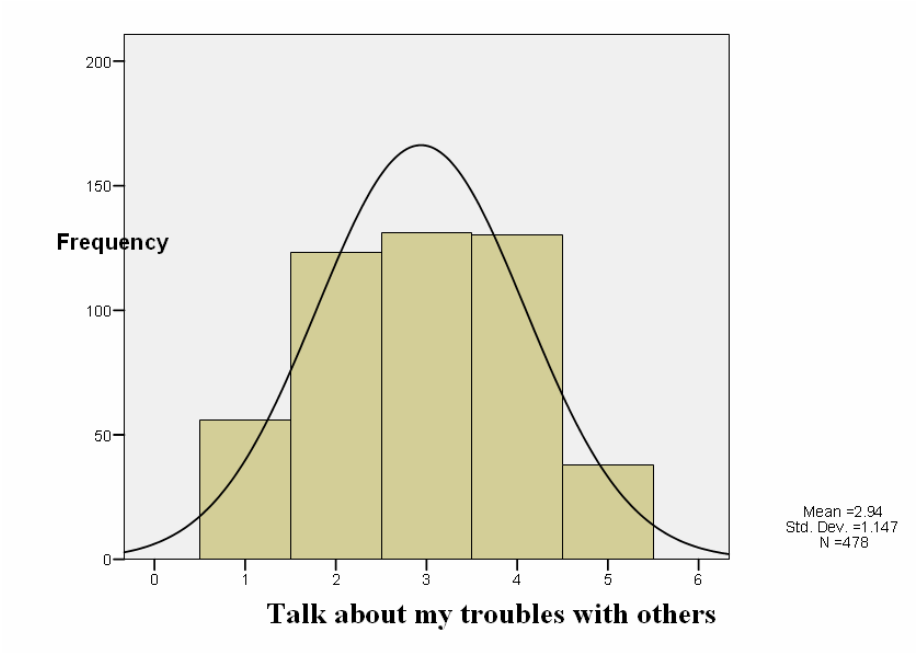
1 2 3 4 5

Líkar alls ekki við hann/hana Líkar mjög vel við hann/hana

APPENDIX G HISTOGRAMS FOR THE 22 ITEMS OF THE INSTRUMENT SCHOOL-CHILDREN HEALTH PROMOTION


Frequency
200
150
100
50
0
0
1
2
3
4
5
6
Mean =2.9
Std. Dev. =1.056
N =479
Discuss my concerns with others


Frequency
200
150
100
50
0
0
1
2
3
4
5
6
Mean =3.64
Std. Dev. =1.036
N =473
Express my caring and warmth to others


Frequency
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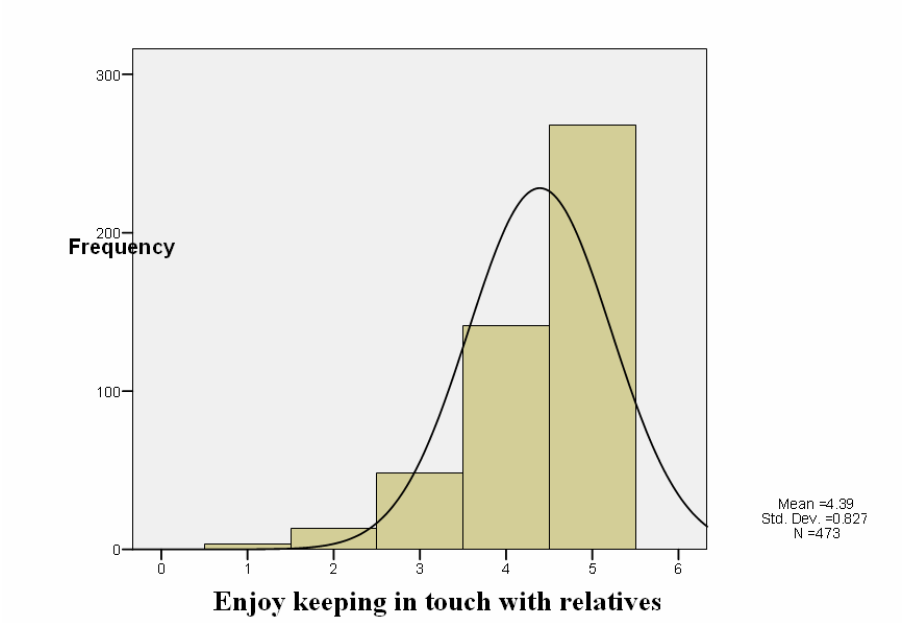
2
3
4
5
6
Mean =2.94
Std. Dev. =1.147
N =478
Talk about my troubles with others


Frequency
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200
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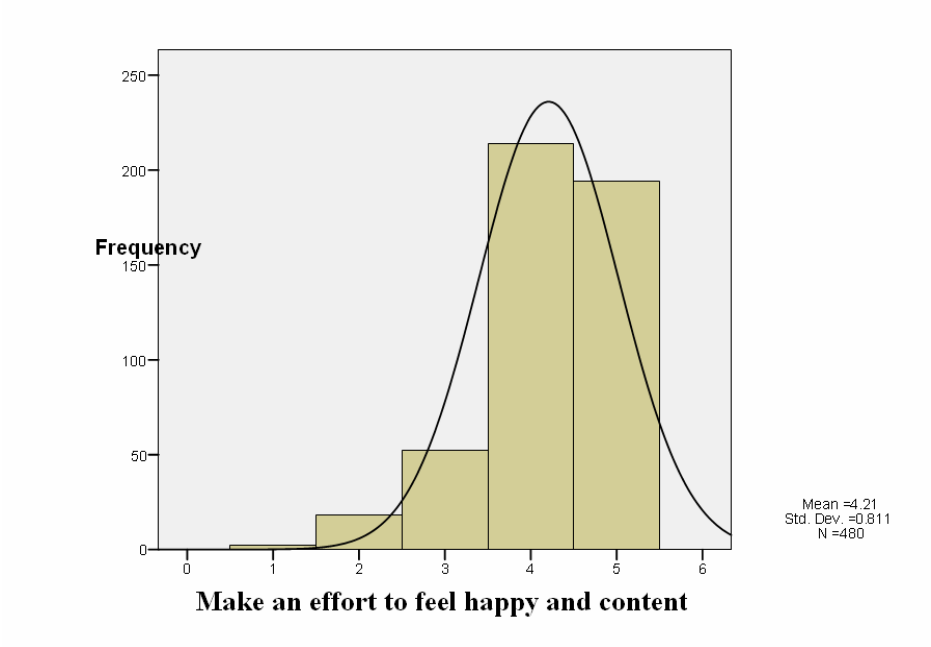
1
2
3
4
5
6
Mean =4.39
Std. Dev. =0.827
N =473
Enjoy keeping in touch with relatives


Frequency
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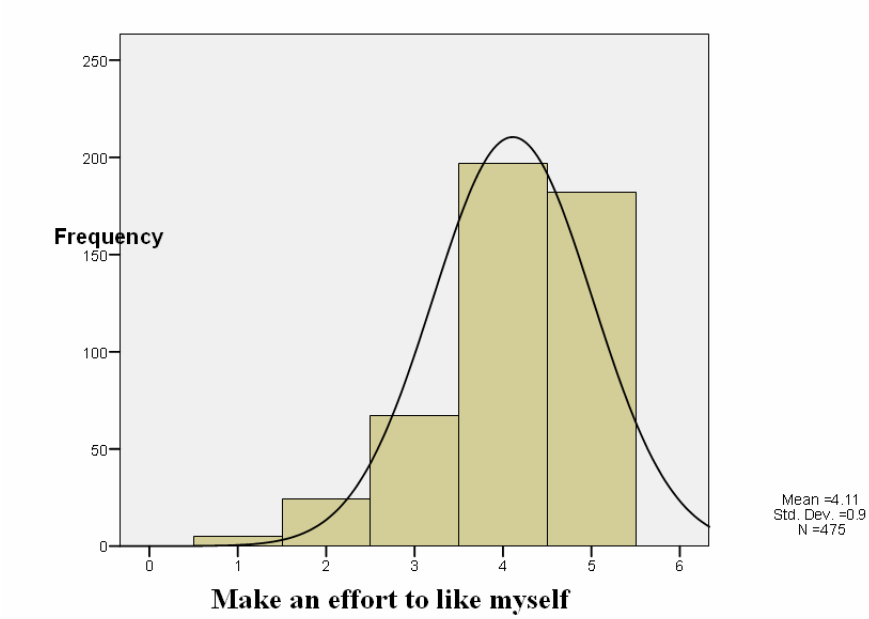
200
150
100
50
0
0
1
2
3
4
5
6
Mean =4.21
Std. Dev. =0.811
N =480
Make an effort to feel happy and content


Frequency
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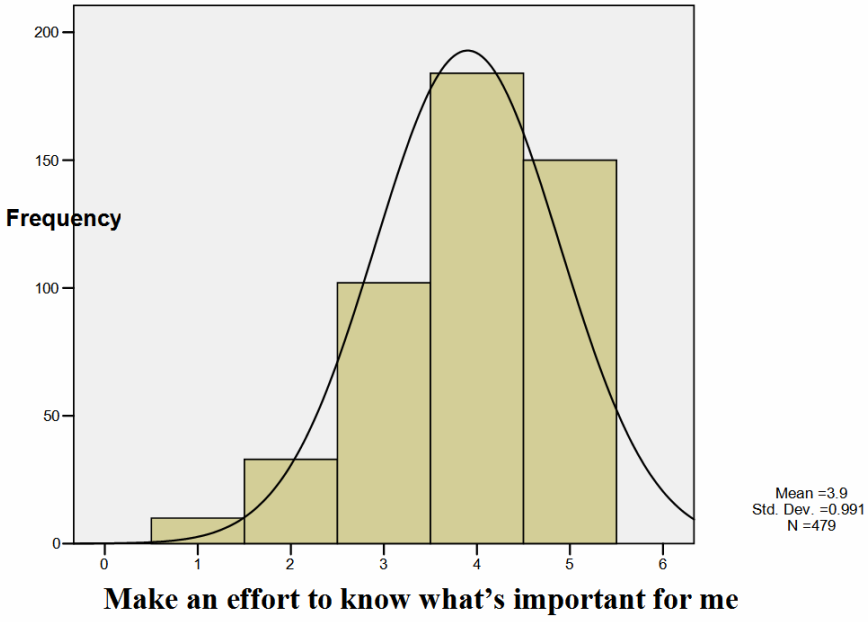
200
150
100
50
0
0
1
2
3
4
5
6
Mean =4.11
Std. Dev. =0.9
N =475
Make an effort to like myself


Frequency
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50
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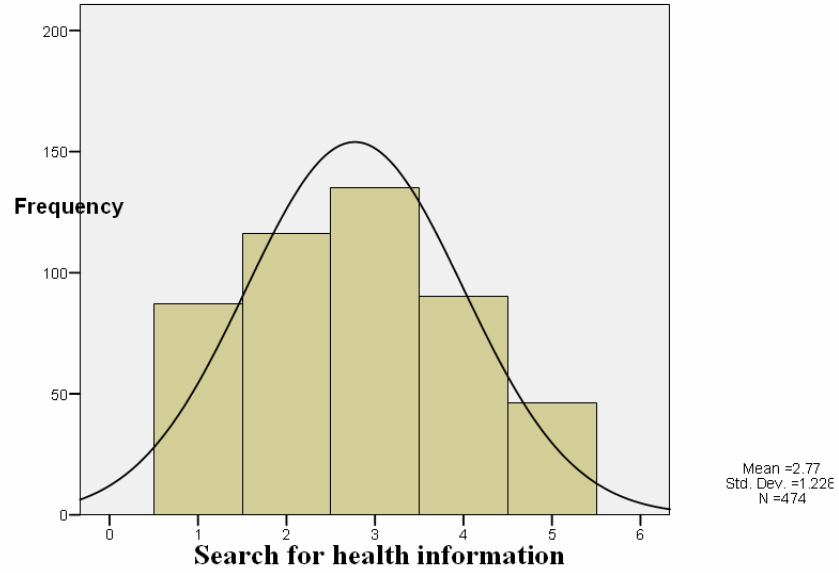
0
1
2
3
4
5
6
Mean =3.9
Std. Dev. =0.991
N =479
Make an effort to know what's important for me


Frequency
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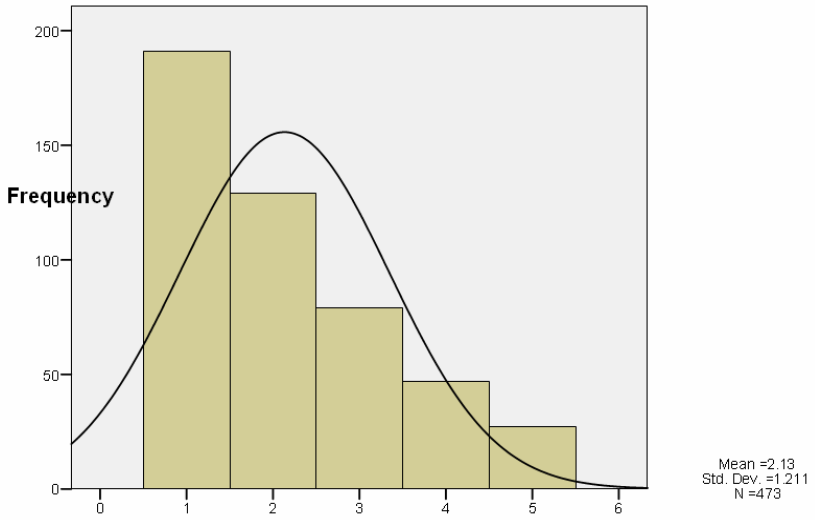
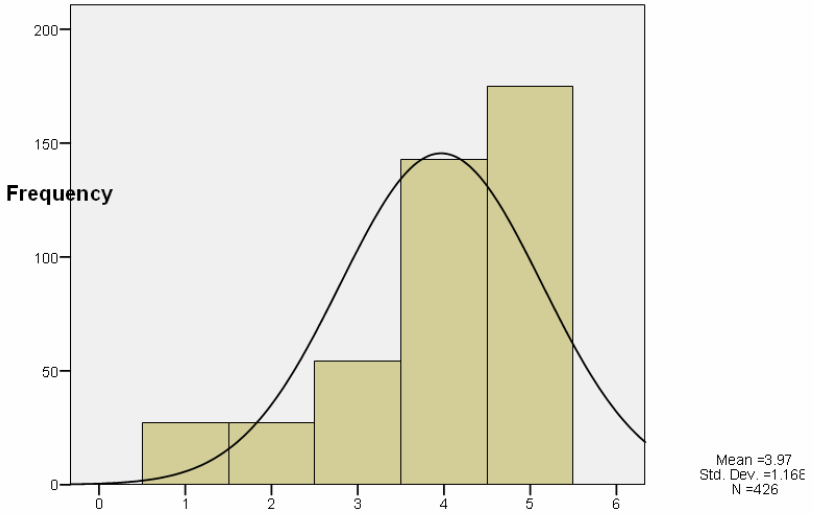
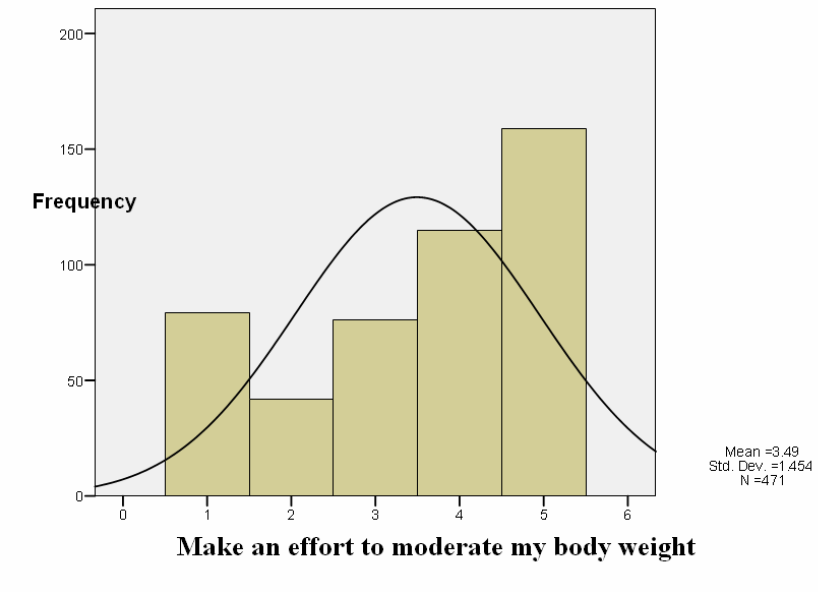
100
50
0
0
1
2
3
4
5
6
Mean =2.77
Std. Dev. =1.22E
N =474
Search for health information

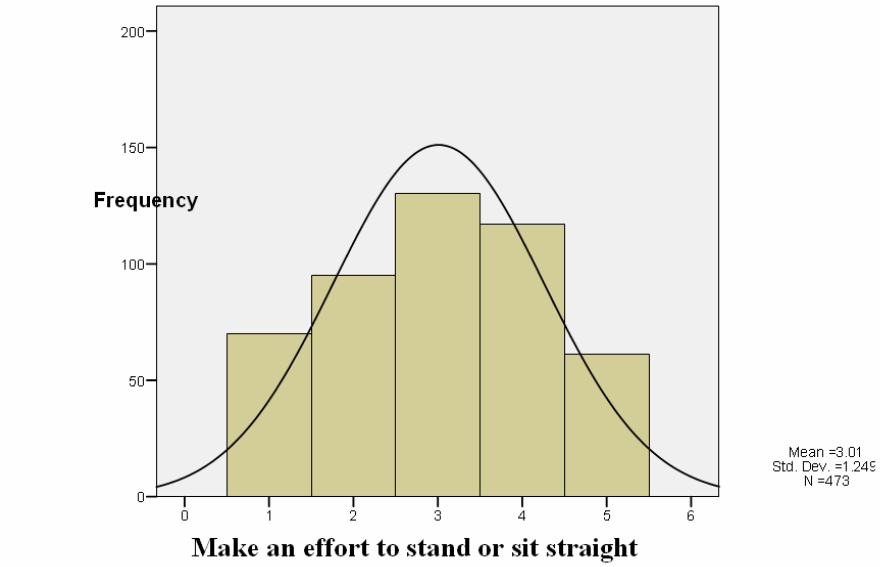


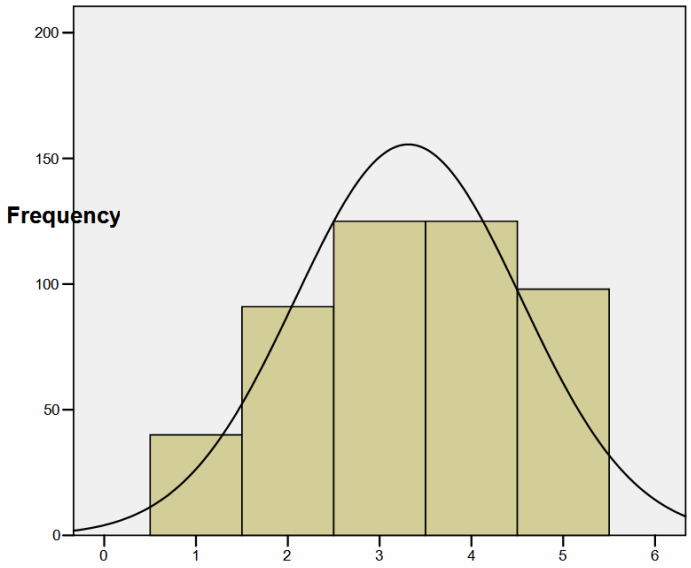
Discuss my health concerns with the school nurse



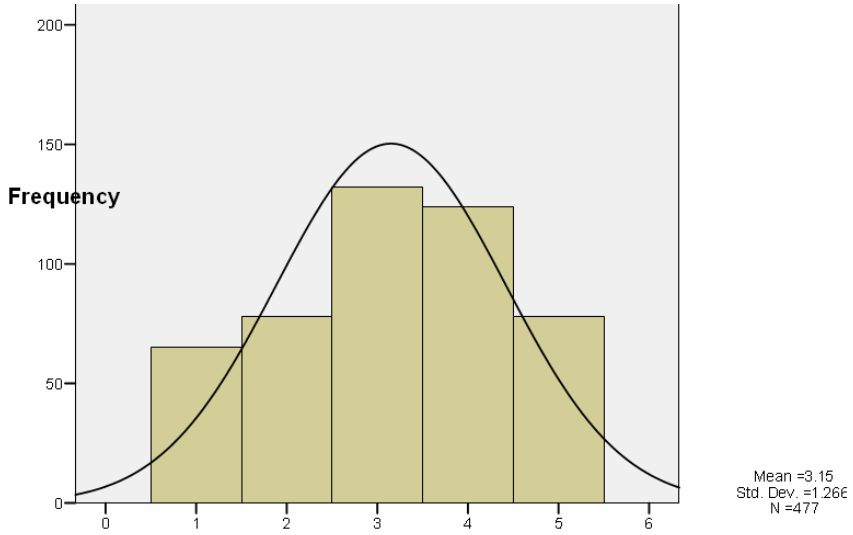
Brush my teeth and use dental floss in the morning and at nights


Frequency
200
150
100
50
0
0
1
2
3
4
5
6
Mean =3.49
Std. Dev. =1.454
N =471
Make an effort to moderate my body weight

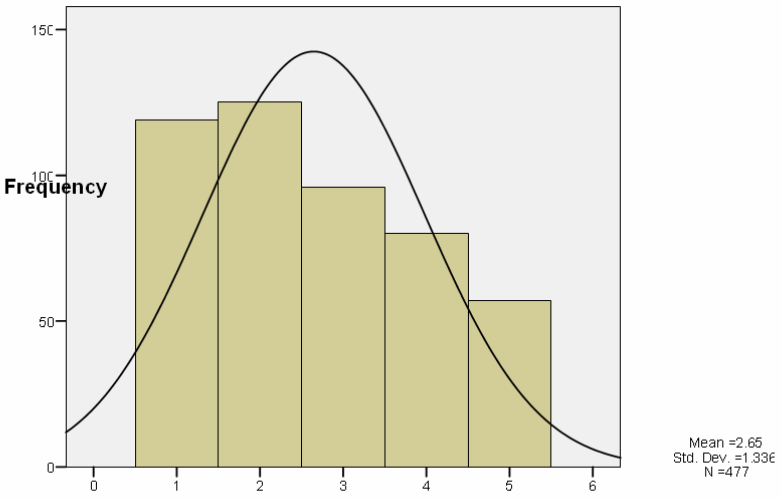

Frequency
200
150
100
50
0
0
1
2
3
4
5
6
Mean =3.01
Std. Dev. =1.245
N =473
Make an effort to stand or sit straight



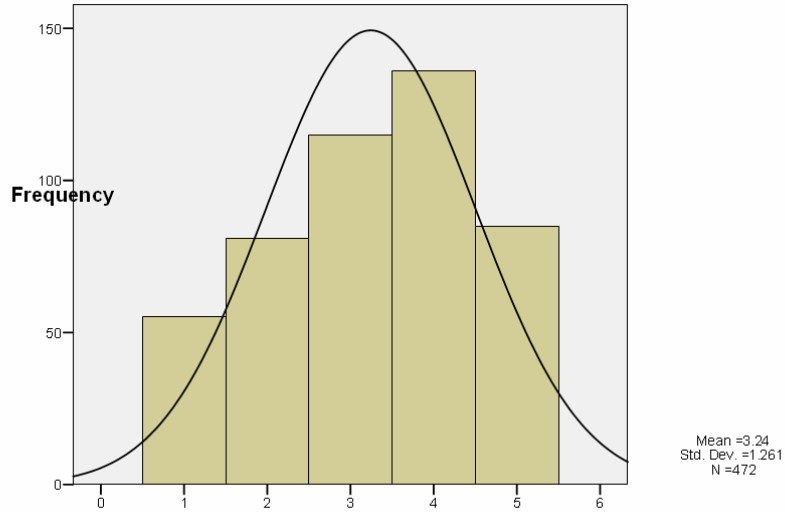
Wash my hands before meals



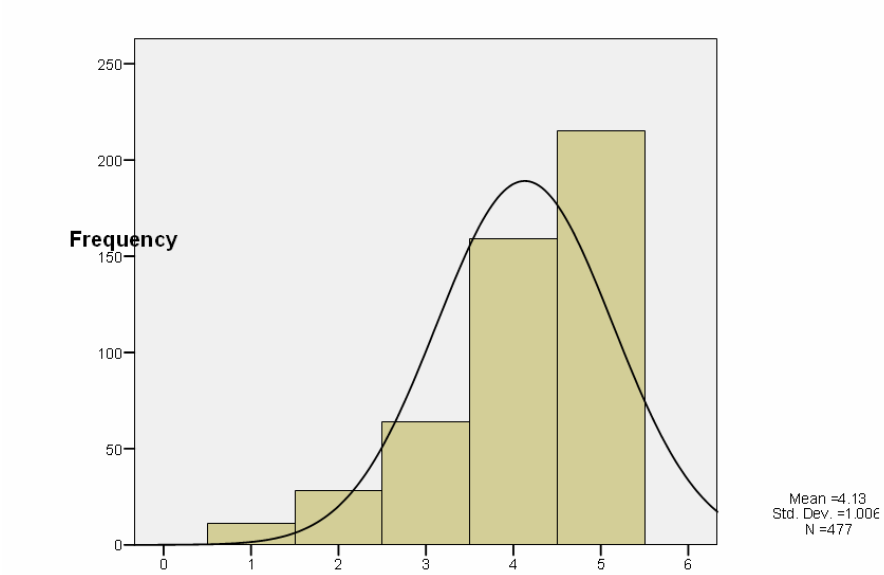
Make an effort to determine the source of each stress that occurs

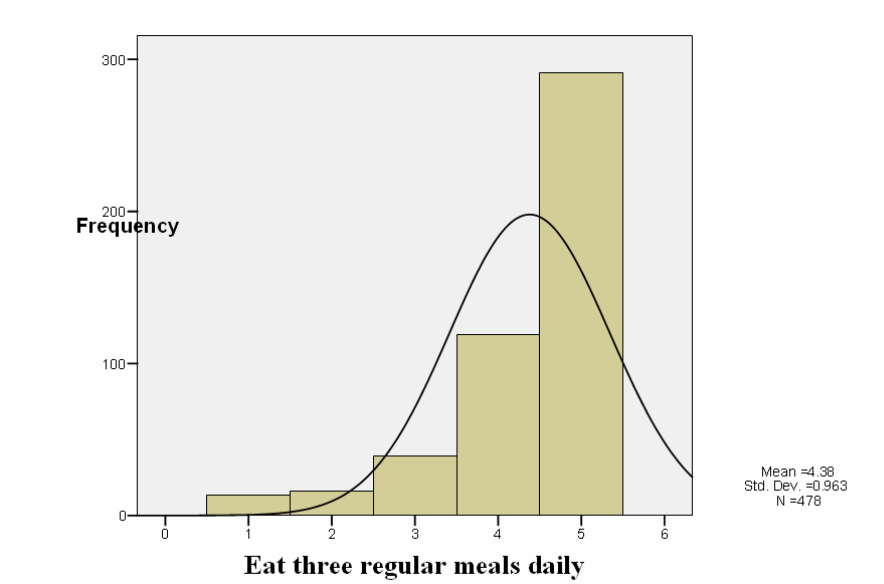


Make an effort to spend time daily to rest



Make schedules and set priorities


Frequency
250
200
150
100
50
0
0
1
2
3
4
5
6
Mean =4.13
Std. Dev. =1.006
N =477
Sleep 8-10 hours each night


Frequency
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200
100
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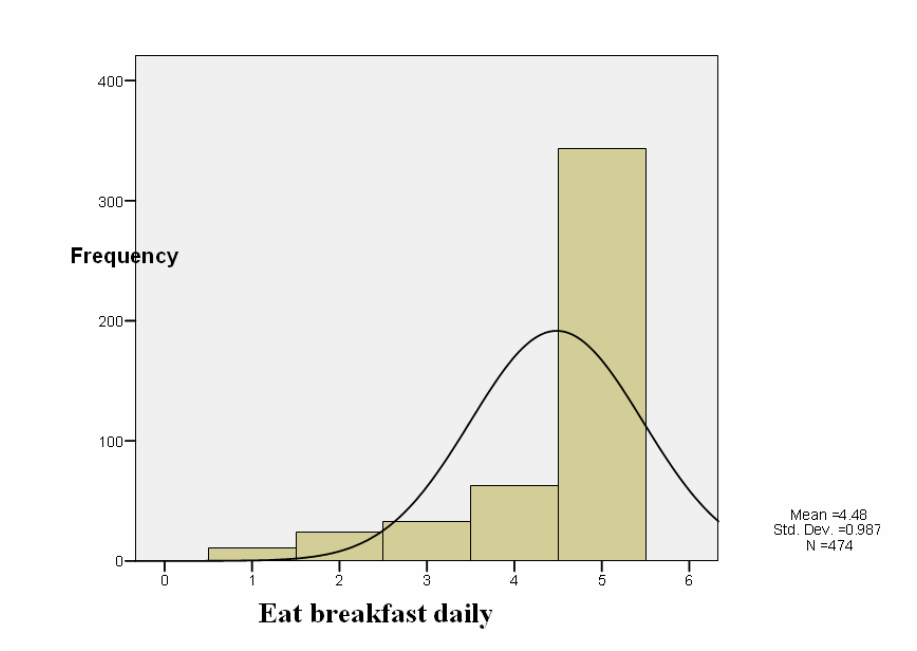
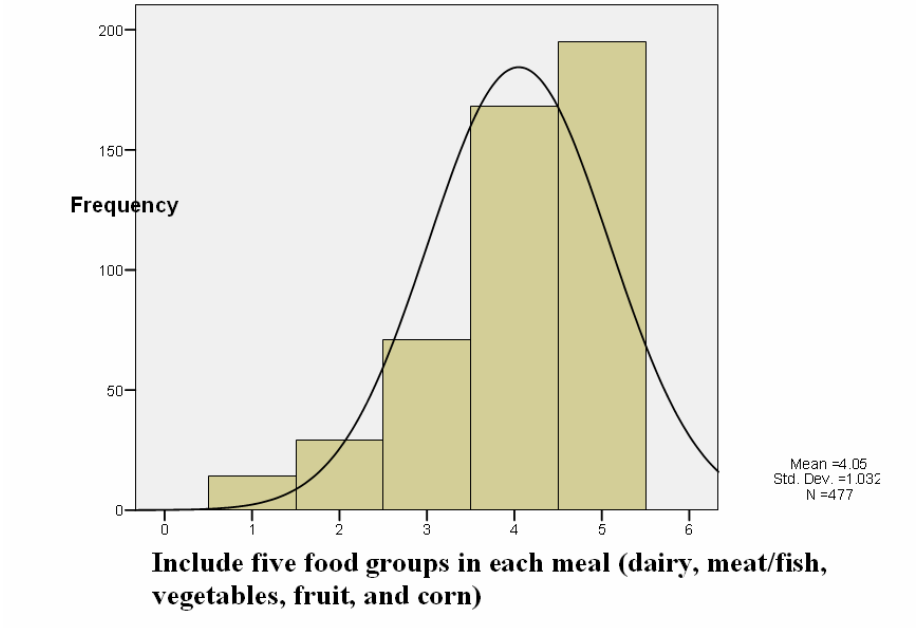
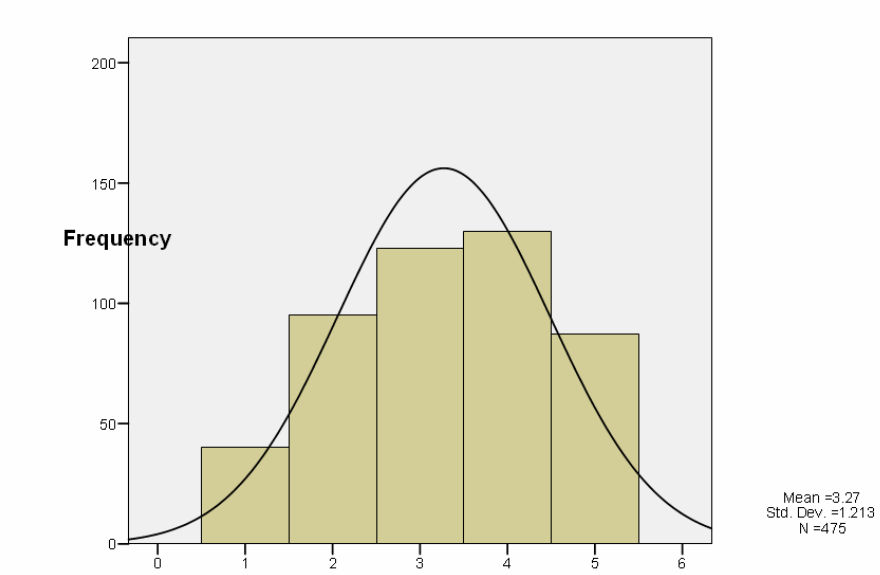
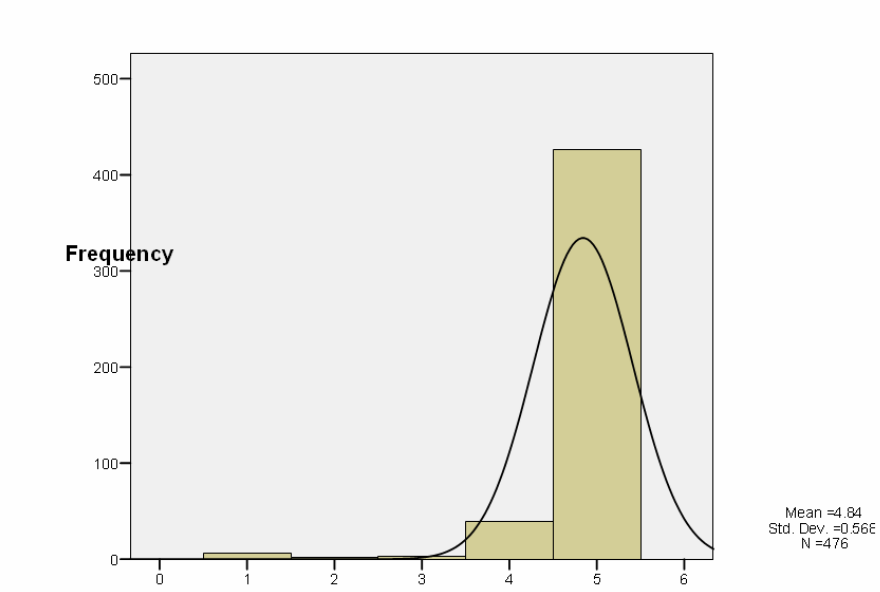
1
2
3
4
5
6
Mean =4.38
Std. Dev. =0.963
N =478
Eat three regular meals daily


Frequency
400
300
200
100
0
0
1
2
3
4
5
6
Mean =4.48
Std. Dev. =0.987
N =474
Eat breakfast daily


Frequency
200
150
100
50
0
0
1
2
3
4
5
6
Mean =4.05
Std. Dev. =1.032
N =477
Include five food groups in each meal (dairy, meat/fish, vegetables, fruit, and corn)

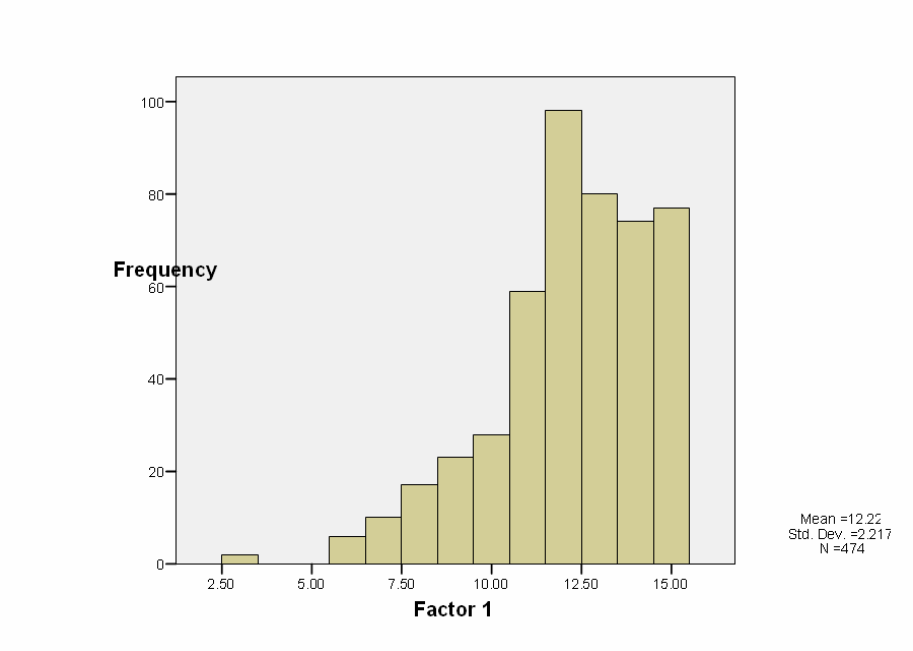


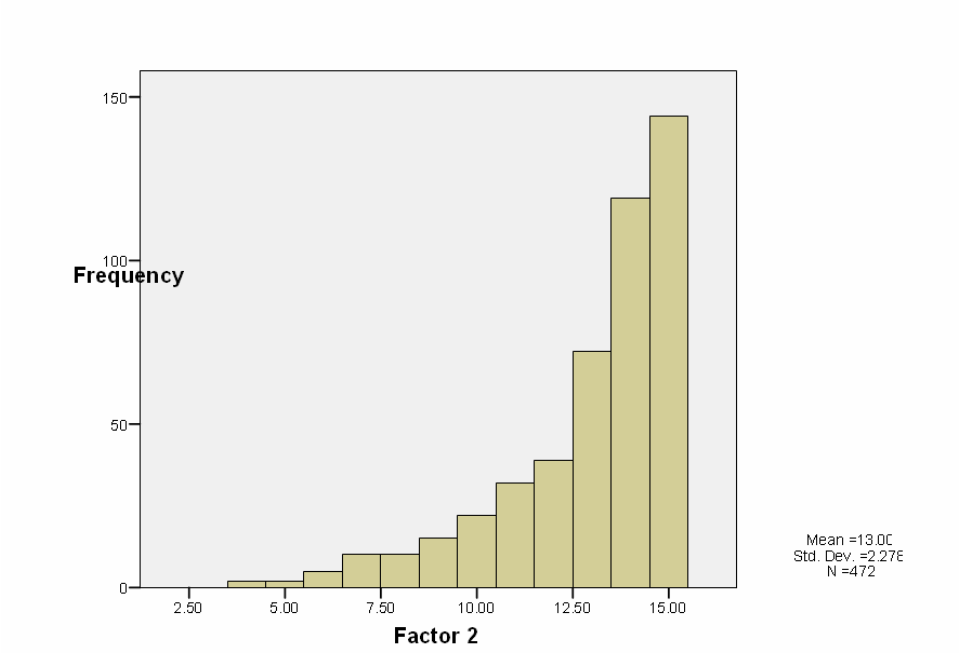
Drink at least 6-8 glasses of water daily

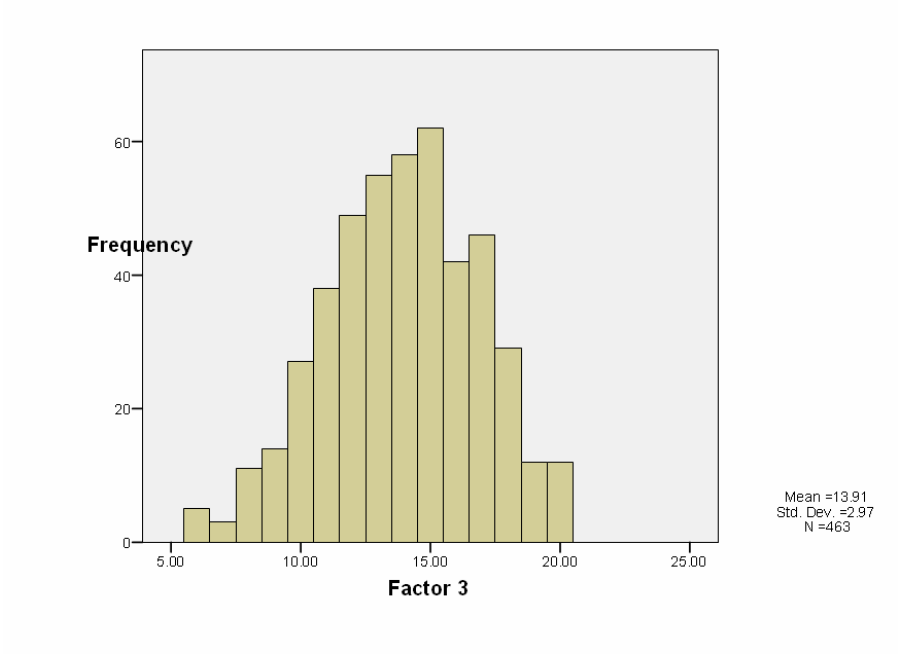


Participate in physical education class at school weekly

APPENDIX H HISTOGRAMS FOR THE 5 FACTORS OF THE INSTRUMENT SCHOOL-CHILDREN HEALTH PROMOTION AND THE OVERALL INSTRUMENT


Frequency
100
80
60
40
20
0
2.50
5.00
7.50
10.00
12.50
15.00
Factor 1
Mean =12.22
Std. Dev. =2.217
N =474


Frequency
150
100
50
0
2.50
5.00
7.50
10.00
12.50
15.00
Factor 2
Mean =13.00
Std. Dev. =2.278
N =472


Frequency
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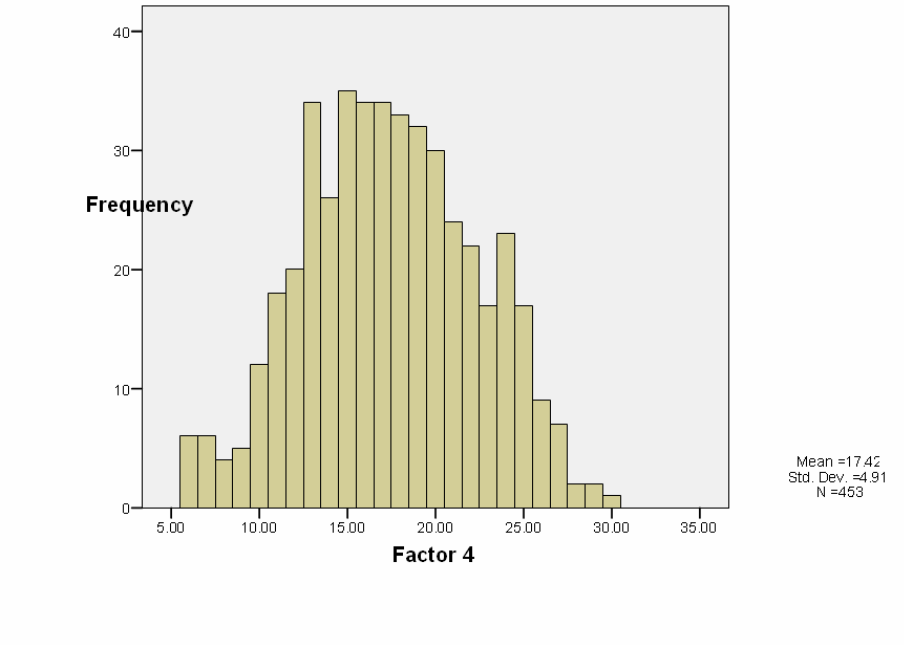
40
20
0
5.00
10.00
15.00
20.00
25.00
Factor 3
Mean =13.91
Std. Dev. =2.97
N =463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30
20
10
0
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10.00
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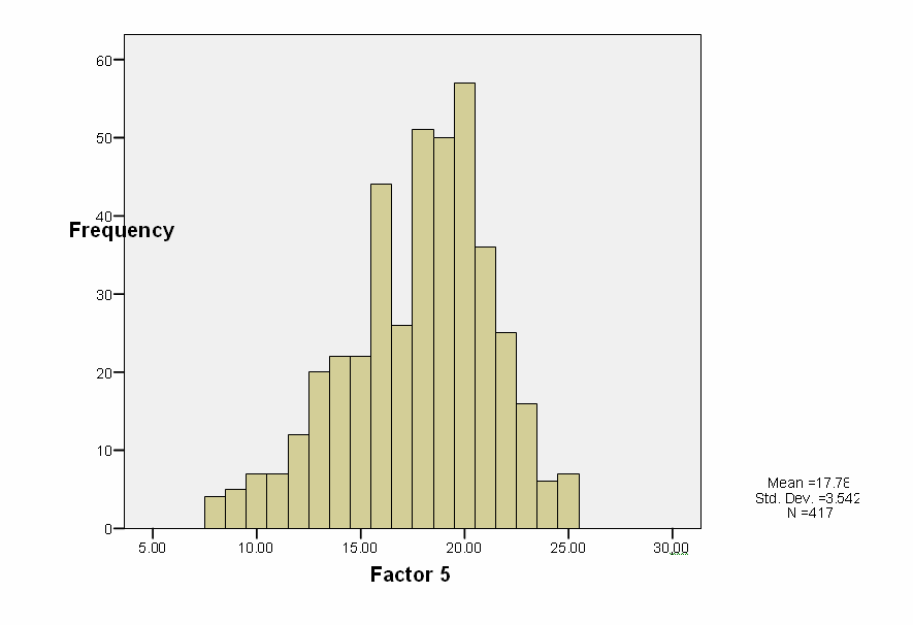
30.00
35.00
Factor 4
Mean =17.42
Std. Dev. =4.91
N =453


Frequency
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50
40
30
20
10
0
5.00
10.00
15.00
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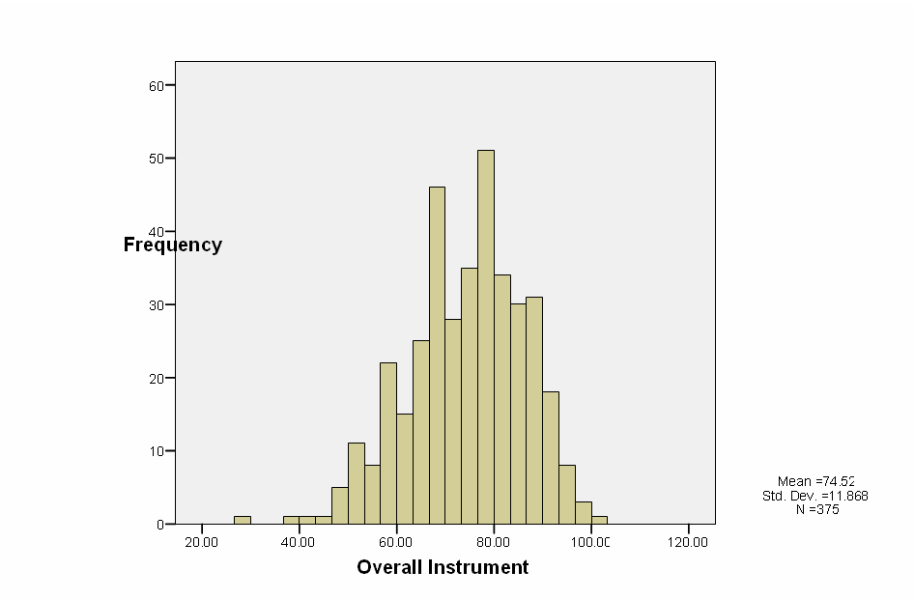
25.00
30.00
Factor 5
Mean =17.76
Std. Dev. =3.542
N =417


Frequency
60
50
40
30
20
10
0
20.00
40.00
60.00
80.00
100.00
120.00
Overall Instrument
Mean =74.52
Std. Dev. =11.868
N =375

APPENDIX I THE FACTOR STRUCTURE OF THE ICELANDIC INSTRUMENT SCHOO-CHILDREN HEALTH PROMOTION COMPARED TO THE STRUCTURE OF 21 OF THE ORIGINAL TAIWANESE INSTRUMENT ADOLESCENT HEALTH PROMOTION SCALE

School-Children Health Promotion		Adolescent Health Promotion Scale	
Name of Factors	**Name of Items**	**Name of Factors**	**Name of Items**
Positive Thinking	6. Make an effort to like myself	Life-Appreciation	6. Make an effort to like myself
	5. Make an effort to feel happy and content		5. Make an effort to feel happy and content
	7. Make an effort to know what's important for me		7. Make an effort to know what's important for me
Diet and Sleep Habits	19. Eat breakfast daily	Nutrition Behavior	19. Eat breakfast daily
	18. Eat three regular meals daily		18. Eat three regular meals daily
	17. Sleep 8-10 hours each night		21.Drink at least 6-8 glasses of water daily
			20. Include five food groups in each meal (dairy. meat/fish. vegetables. fruit. and corn)
Seek Psycho-social Support	1. Discuss my concerns with others	Social Support	1. Discuss my concerns with others
	3. Talk about my troubles with others		3. Talk about my troubles with others
	2. Express my caring and warmth to others		2. Express my caring and warmth to others
	4. Enjoy keeping in touch with relatives		4. Enjoy keeping in touch with relatives
Coping Behavior	14. Make an effort to determine the source of each stress that occurs	Stress Management	14. Make an effort to determine the source of each stress that occurs
	15. Make an effort to spend time daily to rest		15. Make an effort to spend time daily to rest
	11. Make an effort to moderate my body weight		16. Make schedules and set priorities
	16. Make schedules and set priorities		17. Sleep 8-10 hours each night
	8. Search for health information		
	9. Discuss my health concerns with the school nurse		

School-Children Health Promotion		Adolescent Health Promotion Scale	
Name of Factors	**Name of Items**	**Name of Factors**	**Name of Items**
Health Habits	13.Wash my hands before meals	Health Responsibility	11. Make an effort to moderate my body weight
	21.Drink at least 6-8 glasses of water daily		8. Search for health information
	10. Brush my teeth and use dental floss in the morning and at nights		9. Discuss my health concerns with the school nurse
	20. Include five food groups in each meal (dairy. meat/fish. vegetables. fruit. and corn)		13.Wash my hands before meals
	12. Make an effort to stand or sit straight		10. Brush my teeth and use dental floss in the morning and at nights
			12. Make an effort to stand or sit straight