

Jorma Tynjälä

**SLEEP HABITS, PERCEIVED  
SLEEP QUALITY AND TIREDNESS  
AMONG ADOLESCENTS**

A Health Behavioural Approach



UNIVERSITY OF JYVÄSKYLÄ

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*To my father's memory*

## ABSTRACT

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Yhteenveto

Diss.

The aim of the present study was to investigate 11, 13 and 15-year-old adolescents' sleep habits, sleep difficulties, perceived tiredness, perceived sleep quality and factors affecting them. This study is part of a larger, comparative, WHO-coordinated project on the health and lifestyle of school children (Health Behaviour of School Aged Children – A WHO Cross-National Survey, the HBSC-Study). International data (n=41,809) from the 1986 HBSC-Study and Finnish data from the 1990 (n=2,996) and 1994 (n=4,187) HBSC-Study were used in this thesis. Another aim was to test scales for the measurement of perceived alertness and sleep quality among 15-year-olds in the Jyväskylä follow-up study in 1996-97 (n=475, 202 of whom were 15-year-olds). The studies were class inquiries where pupils answered a questionnaire during a class period. Basic statistical methods such as crosstabulations, Pearson product moment correlations, analysis of variance as well as more sophisticated methods like logit-regression analyses and structural equation models in the framework of LISREL were used.

International comparisons in the 1986 HBSC-Study indicated that sleeping habits, difficulty in falling asleep and morning tiredness varied significantly between countries. Finnish school children had the second shortest sleep duration at night after the Israeli youth and together with Norwegian school children they were most tired on school mornings.

Investigation of the Finnish data in the 1990 HBSC-Study revealed that unhealthy (irregular) sleeping habits, sleep difficulties and tiredness emerged with increasing age. Age and in some cases gender were important explanatory factors of sleeping habits and sleep difficulties. Other sociodemographic factors or pupils' educational expectations (high school vs. occupational school) were far less correlated or did not correlate with sleep habits and sleep difficulties.

The Finnish data of the 1994 HBSC-Study revealed that subjective tiredness was a very common phenomenon among adolescents. Structural equation models among 15-year-olds showed that sleep habits, use of psychoactive substances (mainly alcohol and tobacco) and perceived tiredness were statistically significantly correlated. Among 15-year-old boys a good home atmosphere was the most important contributing factor to good perceived sleep quality. A health promotive lifestyle (good sleep hygiene and infrequent use of addictive substances) and good self-perception also had significant correlations with good perceived sleep quality. In 15-year-old girls a good home atmosphere, good self-perception and a health promotive lifestyle played an equally important role in associations with subjective sleep quality.

The results of the Jyväskylä follow-up study indicated that the scales for perceived alertness and sleep quality had good internal consistency and that the confirmatory factor models seemed to be rather independent of the time of data collection. It is recommended that the scales be tested in the school health care system in order to evaluate health promotion needs concerning school children's sleep quality and alertness.

Keywords: adolescents, health behaviour, sleep difficulties, sleep habits, sleep quality, tiredness

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Jorma Tynjälä

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## LIST OF ORIGINAL PUBLICATIONS

The thesis is based on the following papers which will be referred to in the text by their Roman numerals I-V:

- I Tynjälä, J., Kannas, L. & Välimaa, R. (1993). How young Europeans sleep. *Health Education Research*, 8, 69-80.
- II Tynjälä, J. & Kannas, L. (1993). Sleeping habits of Finnish school children by sociodemographic background. *Health Promotion International*, 8, 281-289.
- III Tynjälä, J. (1993). Suomalaisten nuorten lepotottumukset ja univaikeudet sekä koulutusorientaatio [Sleeping habits, sleep difficulties and educational expectations among Finnish school children]. In: S. She-meikka & A. Nissinen (Eds.) *The Yearbook of the Health Education Research 1992*. Helsinki: Reports of the Ministry of Social Affairs and Health, 1993:1, 99-113. (In Finnish with an English abstract p. 109)
- IV Tynjälä, J., Kannas, L. & Levälähti, E. (1997). Perceived tiredness among adolescents and its association with sleep habits and use of psychoactive substances. *Journal of Sleep Research*, 6, 189-198.
- V Tynjälä, J., Kannas, L., Levälähti, E. & Välimaa, R. (1999). Perceived sleep quality and its precursors in adolescents. *Health Promotion International*. In print.

In addition, some unpublished results are presented.

## LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
BMS	Mean Square Between subjects
CNS	Central Nervous System
DIMS	Disorder of Initiating and Maintaining Sleep
DOES	Disorder of Excessive Sleepiness (Somnolence)
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders, 4 <sup>th</sup> edition
DSPS	Delayed Sleep Phase Syndrome
EDS	Excessive Daytime Somnolence (Sleepiness)
EEG	Electroencephalogram
EMG	Electromyogram
EOG	Electro-oculogram
GLIM	Generalized Linear Interactive Modelling
HBSC-Study	Health Behavior of School Aged Children - A WHO Cross-National Survey
ICC	Intraclass Correlation Coefficient
ICSD	International Classification of Sleep Disorders
LISREL	Linear Structural Equation Modeling
MCA	Multiple Classification Analysis
MSLT	Multiple Sleep Latency Test
NREM, Non-REM	Non-Rapid Eye Movement sleep (sleep stages S1, S2, S3 and S4)
PPS	Probability Proportional to Size
REM	Rapid Eye Movement sleep
SAD	Seasonal Affective Disorder
SPSS	Statistical Package for the Social Sciences
SWS	Slow-Wave Sleep
WHO	World Health Organization
WLS	Weighted Least Squares
WMS	Mean Square Within subjects

# 1 INTRODUCTION

There was surprisingly little research information on the sleep habits and sleep disorders of Finnish adolescents in the 1980s, when gathering data for the present study was initiated. International research on the matter from a health behavioural viewpoint was also scarce. This was a startling finding given that sleep is very important for our well-being. Although some results have been published in the 1990s the need for cross-cultural comparisons and widening the perspective is obvious.

The western way of living seems to be at a turning point: sleeping and a good night's sleep are not adequately valued. More and more people stay up too late and do not get enough sleep, resulting in tiredness and weakened ability to perform well in work places and schools. Hobbies and leisure-time activities such as watching TV or videotapes and surfing on the Internet appear to take place mostly late at night and thus decrease the time reserved for sleeping. Concurrently, parental control over their children's bedtimes has waned. Bearing in mind that among adolescents, late hours, especially during weekends, may also involve use of alcohol, it is no wonder that adolescents feel tired and school work seems difficult.

A good night's sleep is one of the constituents of good mental, physical and social health. For example, high self-esteem or a positive self-concept is more typical of young persons with good sleep quality (e.g. Price et al. 1978, Healey et al. 1981, Kirmil-Gray et al. 1984, see also Hyyppä et al. 1991). In contrast, poor sleep is associated with behavioural and emotional problems and poor reported health, poor physical fitness and numerous psychosomatic symptoms. Sleep difficulties and poor sleep may also be signs of stress or indicators of health compromising lifestyle. (Price et al. 1978, Rimpelä & Rimpelä 1983, Carskadon 1990b, Weydahl 1991, Morrison et al. 1992, Mahon 1994, 1995, King et al. 1996, Pilcher et al. 1997, Vignau et al. 1997, see also Hyyppä et al. 1991.) Several studies attest that poor sleep is also associated with problems in social relationships, problems with handling troubles, problems at school, disturbances in sleeping environment and such psychological states as anxiety, depression, tension and worry (Price et al. 1978, Morrison et al. 1985, Kahn et

al. 1989, Weydahl 1991, Mahon 1994, 1995, Pilcher et al. 1997, Vignau et al. 1997). The possibility of a continuum of adolescent insomnia to adult insomnia has also been suggested (Bixler et al. 1979, Morrison et al. 1985).

Several studies have indicated that better health resources, such as sufficient sleep and healthy sleep habits are associated with better school performance (Rimpelä et al. 1990b, Wolfson & Carskadon 1996, Hofman & Steenhof 1997, Wolfson & Carskadon 1998). Students with higher grades have reported healthier sleeping patterns – more sleep, earlier bedtimes and wake-up times – than students with poor grades. In addition, Pilcher and Walters (1997) found in their study that sleep-deprived college students performed significantly worse in a cognitive task than non-deprived participants. However, the sleep-deprived group estimated their concentration, effort and performance significantly higher than the non-deprived students. Pilcher and Walters (1997) concluded that the students were not aware of the extent to which sleep deprivation negatively affects their ability to complete cognitive tasks.

In the twentieth century the average sleep duration among adolescents has decreased by about 1 – 1 ½ hours (Terman & Hocking 1913, Webb 1969, Partinen 1982, Rimpelä & Rimpelä 1983, Hicks & Pellegrini 1991, Tynjälä & Liinamao 1995), reflecting possible change in adolescents' lifestyle and the way they use their time. Flusshaire (1990) has concluded that sleep has lost its value in our culture. Why sleep when there exist many other more interesting activities? In the 1990's examples of these "other activities" are watching TV and videotapes and using the Internet. This "replacement" of sleep with other activities has raised the question of the existence of widespread sleep deprivation. This topic has been under lively discussion among sleep researchers with some researchers agreeing with this conclusion (e.g. Webb & Agnew 1975, Bonnet & Arand 1995) and some against it (e.g. Harrison & Horne 1995). In a recently published book Kronholm (Hyyppä & Kronholm 1998) considers the matter from both angles. His recommendation is not to shorten sleep for the purpose of being more efficient but to "listen to one's body". If you are not alert enough, you should try to sleep longer.

In recent years adolescents' sleep habits and sleep difficulties have been explored in a growing number of studies. However, little comparative international data on young people's sleeping habits and difficulties are available. In Finland, sleeping habits and disorders among young children and adolescents have been the subject of detailed investigation in the Adolescent Health and Lifestyle Survey (Rimpelä & Rimpelä 1983) and in the survey conducted in the city of Tampere (Saarenpää-Heikkilä et al. 1995, Saarenpää-Heikkilä & Koivikko 1995). However, the sleep related data from these studies that have been published are either rather old, used limited number of questions concerning sleep habits and sleep problems, or the samples were not nationally representative.

The aims of the present study were to determine how 11, 13 and 15-year-old Finnish adolescents sleep, what factors are associated with adolescents' sleep habits, sleep disorders and perceived tiredness and what factors are significant for good sleep. The study also compared Finnish adolescents' sleep behaviour with that of adolescents living in many other European countries and Canada. Data from the 1986, 1990 and 1994 HBSC-Study (Health Behaviour in



School-Aged Children – A WHO Cross-National Survey) were used for this purpose. An additional goal was to test scales for measuring adolescents' alertness and sleep quality and to test the reliability of sleep related questions. For these purposes data from the Jyväskylä follow-up study in 1996-97 and data from the test-retest study in 1997 were used. This study is the first survey of the sleep habits, sleep disorders and related matters among Finnish school children conducted using such a large set of questions and nationally representative samples.

This research may be defined as health education research. Kannas (1988) has divided health education research into 1) theoretical study of health education; 2) health behaviour research; 3) evaluation research in health education – including a) study of health education practices and b) experimental development of health education; and 4) social research in health education. The present work may be categorised as health behaviour research because one purpose of the present study was to describe the nature and prevalence of sleep related matters (sleep habits, sleep difficulties, tiredness, sleep quality) among school children. In addition, more analytical research methods were used to investigate sleep related matters and factors associated with them, such as selected lifestyle indicators, social factors and psychological factors. (Kannas 1988, see also Aarø et al. 1986.) The present work may be seen as health behaviour research that supports health education as defined in the report "Development of Health Education in Finland in the 1990s" ("Terveyskasvatuksen kehittäminen Suomessa 1990-luvulla"), as it involves, for instance, monitoring sleep habits and sleep difficulties among adolescents (Terveyskasvatuksen neuvottelukunta 1995). The research theme of this work is also intertwined with the traditions of social medicine. Additionally, the present work is related to health promotion and health education at school and at home, suggesting needs and implications in the area of sleep habits, sleep difficulties and related matters among school children.

## **2 HEALTH RELEVANCE OF SLEEP: SYSTEM THEORETICAL PERSPECTIVE ON ADOLESCENTS' HEALTH**

Sleep may be seen as an integral part of a broader system of human health. System theoretical approaches describe health as complicated interactions between human's internal and external systems. In system theoretical approaches health is generally considered as a state of equilibrium between these systems. Equilibrium theories of health have a long tradition, originating from the ancient Greeks Hippocrates and Galenos, who put forward a view that the key to health is a balance between six factors: air, nutrition, exercise and rest, sleep and wake, metabolism and emotions (Hyyppä 1997).

Purola (1972) first introduced system theoretical approach to Finland. In his model health is constituted in the process of interaction between the following subsystems: 1) individual's psycho-biological system, 2) individual's social connections and 3) individual's awareness. The psycho-biological system is the individual's internal natural system which is related to and interacts with the individual's external natural and social systems, receiving and perceiving influences and information from them and emitting influences to them. Disease in the traditional medical sense is defined as a disorder in the psycho-biological system. In a broader system theoretical approach to health, illness is a disorder in the equilibrium between the state of the individual internal system and the state of his/her external system of social connections. Therefore the subsystem of awareness, i.e. interpreting and understanding internal and external signals and responding properly to them is regarded as an important element in the equilibrium of health. (Purola 1972.)

During the last decade, discussions of the equilibrium model of health have emphasised the relationship between people's capabilities and their personal goals (e.g. Pörn 1984, Nordenfeld 1986, Pörn 1988, 1990). A person is regarded healthy if his/her capabilities are adequate relative to his/her goals; a person is ill or unhealthy if this is not the case. This idea may be seen, for

example, in conclusion made by Hyyppä and colleagues (1991) that good sleepers are psychologically capable of maintaining a self-esteem which is in functional balance with their life-goals and mental well-being.

Rimpelä (1991) has presented a system theoretical model of adolescents' health (Figure 1). Rimpelä regards health as a resource. According to him, we get basic health resources at birth as genetic and social heritage. Two different and competing processes affect health: health consuming factors and health enhancing factors. Health resources are the outcome of the contest between these two factors. Essential elements in the model are nutrition, physical strain and rest, mental strain and relaxation and social relationships. In addition, environment and nature, for instance, the social and cultural environment, are active in the model. The role of sleep is not explicitly expressed in Rimpelä's model but it is well-grounded to include it in the model as a part of physical strain and rest and as a part of mental strain and relaxation, because sleep is necessary for good health from both the physiological and psychological viewpoint (e.g. Adam & Oswald 1983, Baker 1985, Hyyppä 1985).

An important aspect of Rimpelä's model is the balance between different elements. If the balance is disturbed, we receive psychological and psychosomatic signals. Normally individuals attempt to keep this balance, for example, by having an afternoon nap when they feel tired or eating when they feel hungry. One of Rimpelä's important ideas is that individuals may interpret these signals erroneously, for example, daytime sleepiness may be regarded as the need for coffee instead of interpreting it as a consequence of sleep deprivation and irregular sleep habits. These misinterpretations of signals consume individuals' health resources. Alcohol and tobacco are "isolated" with a long dashed-line in the graphic presentation of the model. This means that they do not belong to the model itself because they are not preconditions for good health. An individual can live without these substances. In the worst case, these substances may replace sleep and rest and other health enhancing activities. In addition, excessive use of these substances may permanently lower the level of our health resources. In order to keep health resources at a satisfactory level, it is important to teach adolescents to interpret signals, such as psychosomatic symptoms, properly and to behave in a health enhancing manner. (Rimpelä 1991.) (Figure 1)

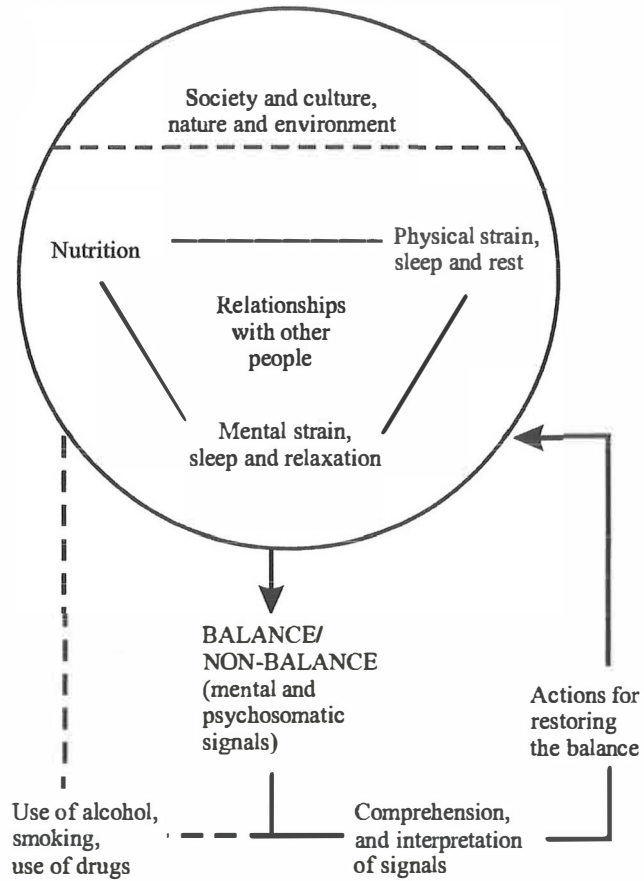


FIGURE 1 The role of sleep and rest in a system theoretical model of health as a resource (modified from Rimpelä 1991)

### 3 SLEEP AS A PHYSIOLOGICAL AND BEHAVIOURAL PHENOMENON

From a behavioural viewpoint, sleep is a reversible state of perceptual disengagement from and unresponsiveness to the environment. Sleep is a complex amalgam of physiological and behavioural processes. Two separate states of sleep have been defined on the basis of a constellation of physiological parameters: non-rapid eye movement (Non-REM, NREM) and rapid eye movement (REM) sleep. REM sleep is not subdivided, but NREM sleep consists of four stages. These divisions for both REM and NREM sleep are based on electrographic parameters (EEG, EOG and EMG). The most common feature of REM sleep is the burst of rapid eye movements. The mental activity of REM sleep is related to dreaming, based on vivid dream recall that is reported after 80% of arousals from this sleep state – REM sleep is a highly activated brain in a paralysed body. Stages of NREM sleep (1-4) represent sleep “depth” or physiological intensity. NREM stage 1 occurs at sleep onset or may follow arousal from sleep during stages 2, 3, 4 and REM; stage 1 represents 4-5% of total nocturnal sleep. NREM stage 2 usually accounts for 45-55% of nocturnal sleep time. Stage 1, and sometimes stage 2, of NREM sleep is called “light sleep”. NREM stage 3 usually comprises 4-6% of total sleep time, while NREM stage 4 represents 12-15% of total sleep time. A combination of NREM stage 3 and 4 is called slow-wave sleep (SWS). (Baker 1985, Thorpy 1990, Hansotia 1997.)

Sleep cycle or NREM-REM-sleep cycle is a period during sleep composed of a NREM-sleep period and the subsequent REM-sleep period. Each NREM-REM-sleep couplet is equal to one cycle. A normal sleep cycle lasts approximately 90 minutes (varies usually between 70 and 120 minutes), and 6.5 – 8.5 hours of sleep generally consists of four to six cycles. Slow wave sleep, SWS, predominates in the first third of the night, REM sleep in the last third of the night. Wakefulness within sleep usually accounts for less than 5% of the night. NREM-sleep is usually 75-85% of sleep, and REM-sleep 20-25% of sleep. (Baker 1985, Thorpy 1990, Hansotia 1997.)

The sleep-wake alteration in humans is an example of a circadian rhythm, which requires about 24 hours to complete. Other examples of circadian

rhythms are body temperature, endocrine secretions and metabolism. To entrain (synchronise) the circadian rhythm to the 24-hour cycle regulated by the sun, so called "zeitgebers" (environmental time cues) such as sunlight, noise, social interaction, alarm clock and meal times are necessary. Circadian cycling is sometimes complicated by many circadian rhythms within the same body. If this synchronising does not occur daily, these different cycles may diverge. Such uncoupling develops when environmental time cues (zeitgebers) are weak. This results in conflicting rhythms and makes sleeping variable and difficult. An example of a circadian rhythm sleep disturbance in adolescence is delayed sleep phase syndrome (DSPS). (Thorpy 1990, Hansotia 1997.) DSPS means inability to fall asleep at the customary bedtime, an inability to rise at a reasonable hour in the morning and frequent napping (Anders & Eiben 1997).

The function of sleep is not known despite many efforts. Many theories have been proposed, but none of them is adequately supported by empirical evidence (Baker 1985, Rechtschaffen 1998). Several theories are based on the assumption that restorative processes occur during sleep (Adam & Oswald 1983, see also Hyypä 1985). These theories suggest e.g. that sleep is a time for 1) replenishment of high-energy phosphate compounds, 2) increased protein synthesis, 3) accelerated mitotic division, 4) enhanced neurotransmitter synthesis, 5) tissue restoration. Among the information-processing functions attributed to REM-sleep are sorting, retrieval, storage and discarding of superfluous information collected during wakefulness. Many theories of sleep focus also on the psychological benefits derived from the opportunity to replay and re-enact events of the previous waking day, or from the past, in dreams. The most defensible statement concerning sleep functions is that sleep prevents the symptoms of sleep deprivation and decreases the tendency for sleep to occur when it is not wanted. (Baker 1985.) Rechtschaffen (1998) emphasises that we may need to sleep, not because we have been awake, but because sleep is a biological necessity in its own right. From a psychological point of view, we need sleep to maintain psychological balance (Hyypä 1985).

Sleep need is individual in nature. Every person has a specific natural sleep requirement, but the sleep need may change as a result of ageing, drug and alcohol use, changes in lifestyle, illness, etc. (Arajärvi 1981, Baker 1985). However, in a large scale epidemiological study in California sleeping 7-8 hours a night had the most favourable health effects in terms of mortality with adults sleeping less than 6 hours or more than 9 hours per night having higher mortality rates (Belloc & Breslow 1972, Belloc 1973). In the follow-up study 9.5 years later, the researchers concluded that short or long sleep length predicted mortality as well as smoking, frequent use of alcohol and obesity (Breslow & Enstrom 1980). In the same follow-up study, Wiley and Camacho (1980) concluded that cigarette smoking, alcohol consumption, physical exercise, hours of sleep per night and weight in relation to height were significantly associated with overall health outcomes. In another study, in which the association of seven health practices, defined by Belloc and Breslow (1972), and mental health was studied among university students, the best predictors were found to be moderate exercise and regular sleep (Duncan et al. 1995).

## 4 SLEEP QUALITY AND SLEEP DISORDERS

### 4.1 Sleep quality

Different definitions of the concept of sleep quality are used in the literature. For example, in 1967 Monroe defined good and poor sleepers in a university community (mean age 25 years). Good sleepers were those who usually fell asleep in less than 10 minutes and never in more than 15 minutes; as a rule, never woke up during the night; and as a rule, had no subjective difficulty in falling or remaining asleep. The minimum requirements of poor sleepers were the following: it usually took 60 minutes or longer to fall asleep and always more than 30 minutes; they usually woke up at least once during the night; and they usually experienced considerable subjective difficulty in falling asleep, independently of how long it took to fall asleep.

In Finland, Hyyppä and colleagues (1991) have defined criteria for good, intermediate and poor sleepers among the adult population in age groups 30 to 70 years. They defined the good sleeper as a person whose sleep was sufficiently deep, uninterrupted, long and serene; in addition he/she did not snore and had no EDS (excessive daytime sleepiness, for example, compulsive sleepiness and/or feeling more tired than workmates in the daytime). Poor sleepers were those whose sleep latency was more than 50 minutes and/or who had habitual insomnia and/or more than two awakenings per night and/or morning irritability and/or habitual snoring and EDS. Those who were not categorised in either sleeper group were regarded as intermediate sleepers. According to these criteria, 20% were poor sleepers, 47% were good sleepers, and the rest were intermediate sleepers. (Hyyppä et al. 1991.)

Carskadon and colleagues (1976) and Price and colleagues (1978) used adolescents' self-reports in classifying sleep quality. Adolescent chronic poor sleepers were determined in the following way: 45 minutes or longer to fall asleep on three or more nights a week; or one or more awakenings a night followed by 30 minutes or more of wakefulness occurring on three or more

nights a week; or three or more awakenings a night on three or more nights a week. Occasional poor sleepers included those who complained of some kind of sleep disorders but whose self-reported sleep was below the criteria for inclusion as a chronic poor sleeper. Good sleepers included students reporting no difficulty in sleeping. (Carskadon et al. 1976, Price et al. 1978.) According to these criteria, 13% of the adolescent population suffered from chronic insomnia, and an additional 38% complained of occasional poor sleep (Price et al. 1978).

The National Public Health Institute in Finland has monitored Finnish adults' (aged 15 to 64 years) health behaviour on a yearly basis since 1979 with nationally representative samples. In the age group 15-24 (more specifically, age group 15-24 in 1979; age group 15-19 in 1980-85; and age group 15-24 in 1986-98), the proportion of persons reporting insomnia during one month preceding the survey varied from 9.2% to 14.5% in men and 12.9% to 21.8% in women between 1979 and 1984 (in 1985 and later the structure of the question was slightly different). The corresponding figures between 1985 and 1998 were 5.7% to 15.2% in men and 12.2% to 19.2% in women. (Puska & Airaksinen 1979, Puska & Smolander 1980, 1982, 1983a, b, Puska & Piha 1984, Piha et al. 1986a,b, Niemensivu et al. 1988a, b, Berg et al. 1990a, b, 1991, 1993a, b, Helakorpi et al. 1994, 1995, 1996, 1997, 1998.)

The role of good sleep hygiene seems to be important in relation to good sleep quality (Hyyppä 1991). Sleep hygiene means the conditions and practices that promote continuous and effective sleep, such as, regularity of bedtime and wake-up time, restriction of alcohol and caffeine beverages prior to bedtime, employment of exercise and environmental factors so that they enhance, not disturb, restful sleep (Thorpy 1990). Kirmil-Gray and colleagues (1984) have suggested that chronic or occasional poor sleepers have a tendency for greater shifts in bedtime and waketimes from weekdays to weekends compared to good sleepers. Manni and colleagues (1997) supported the role of good sleep hygiene in relation to sleep quality. They concluded in their study of 17-year-old Italian secondary school children that poor sleep was associated with female gender, many emotional factors (worries, anxiety and depression), poor sleep hygiene and arousal related parasomnia.

Another study among university students indicated that health and well-being measures were better related to sleep quality than sleep quantity. Poor sleep quality correlated significantly with increased physical health complaints and with increased feelings of tension, depression, anger, fatigue and confusion. (Pilcher et al. 1997.)

To sum up, quality of sleep is a complicated matter interacting with the other elements comprising quality of life. Vuori and colleagues (1988) list important sleep related factors: a) social and psychological factors composed of living conditions, family, work, personality, psychological status, stress management and human relations, b) health status including perceived health, clinical health and drug consumption, c) sleeping conditions consisting of external conditions, disturbances and bed and d) lifestyle and living habits composed of physical activity, exercise, dietary and eating habits, coffee consumption, smoking, alcohol consumption and weight reduction. Though some of these factors may be more adult than adolescent related many of them are discussed in the present study.



## 4.2 Sleep disorders

In the older classification of sleep disorders determined by the Association of Sleep Disorders Centers (1979), disorders of initiating and maintaining sleep were called DIMS, also referred to as insomnia, and excessive somnolence was called DOES (disorders of excessive somnolence). These concepts are still used for research purposes (see e.g. Hyyppä et al. 1997).

DSM-IV (Diagnostic and Statistical Manual of Mental Disorders, 4<sup>th</sup> edition) classifies sleep disorders into four categories: primary sleep disorders, sleep disorders related to another mental disorder, sleep disorders due to a general medical condition and substance-induced sleep disorders (American Psychiatric Association 1994). According to Anders and Eiben (1997), DSM-IV criteria are more appropriate for classifying sleep disorders in adults than in children.

The International Classification of Sleep disorders: Diagnostic and Coding Manual (Association of Sleep Disorders Centres 1990) divides sleep disorders into dyssomnias and parasomnias. Dyssomnias are sleep disorders characterised by insufficient, excessive or inefficient sleep (Anders & Eiben 1997). In other words, they are disorders that result in difficulty in either initiating or maintaining sleep or involve excessive sleepiness (Mindell 1993). Dyssomnias are divided into three subcategories: intrinsic dyssomnias – e.g. sleep apnea and narcolepsy – originate from causes within the body, extrinsic dyssomnias – most commonly disorders of initiating and maintaining sleep – require external factors to produce and maintain the disorder, and circadian rhythm dyssomnias that are characterised by inappropriate timing of sleep within the 24-hour day – such as delayed sleep phase syndrome, DSPS. (Anders & Eiben 1997.)

Parasomnias are divided into arousal disorders, sleep-wake transition disorders, REM parasomnias and miscellaneous parasomnias (Association of Sleep Disorders Centres 1990). Parasomnias include disorders that disrupt sleep after it has been initiated but do not result in complaints of insomnia or excessive sleepiness, for example, sleep terrors, sleepwalking and enuresis (e.g. Thorpy 1990, Mindell 1993, Almqvist 1996). In this study the main focus was on dyssomnias, more specifically on extrinsic dyssomnias.

## 4.3 Insomnia and its causes

Insomnia consists of impairment of sleep onset, sleep maintenance or premature final morning awakening (e.g. Bixler et al. 1979, Morrison et al. 1985). Non-restorative sleep may also be added to the list (e.g. Ohayon et al. 1997). However, insomnia is usually referred to only as disorders of initiating and maintaining sleep, DIMS (Baker 1985, Thorpy 1990). Insomnia is also ubiquitously employed to indicate any and all gradations and types of sleep loss (Thorpy 1990). In this study the focus was on disorders of initiating sleep and maintaining sleep.

Kales and colleagues (1976) have suggested that the mechanism underlying insomnia is a function of the internalisation of psychological disturbances; these unresolved and internalised psychological conflicts lead to emotional arousal and, in turn, physiological activation during sleep. Healey and colleagues (1981) supported the finding in their study of the role of life-stress events at the onset of insomnia among an adult population. They concluded that chronic insomniacs experienced a greater number of stressful life events during the year their insomnia began compared to previous or subsequent years and compared to good sleepers. During childhood, insomniacs reported more childhood illnesses, more problems related to eating and sleeping and more frequent discontent with their families. Also, prior to the onset of insomnia, they had less satisfying relationships with their parents as well as problems in other interpersonal relations and in their self-concepts. Poor sleepers internalised and somatised their reactions to stressful life events rather than externalising their response through overt behaviour. These personality characteristics, internalising and somatising stress, also support the conception that insomnia can result from physiologic arousal caused by inadequate coping responses to stressful life events. (Healey et al. 1981, see also Monroe 1967, Bürgin 1986, Lozoff & Zuckerman 1988, Vignau et al. 1997.) The arousal theory of insomnia was also supported in a population based study of 35- to 55-year-old Finns (Kronholm 1993). The association of negative life events and sleep disturbances has also been reported by Cernovsky (1984).

Many other studies suggest psychological causes of insomnia such as anxiety and depression. Depression is highly associated with early morning awakenings and the inability to return to sleep, while anxiety correlates with falling asleep upon retirement. (Morrison et al. 1985, see also Lozoff & Zuckerman 1988, Dahl 1998.) Wagner and colleagues (1983) studied the association of insomnia and Erikson's developmental theory among college students: they found strong support for the hypothesised relationship between insomnia and incomplete resolution of the adolescent crisis (i.e. identity versus role confusion). Nevertheless, adolescent insomnia has been largely overlooked. It is associated with fatigue, depression, low self-esteem, poor performance, poor concentration and irritability. All these elements may affect students' functioning in school as well as their personal lives. (Morrison et al. 1985) Fear of school has also been mentioned as a factor in insomnia among school children (Arajärvi 1981). Ferber (1990) suggests that insomnia coupled with problems with waking may imply a circadian phase shift abnormality or a 'school-refusal' variant.

In addition to psychological origins of insomnia, behavioural and physical causes also may be behind insomnia among adolescents. Behavioural causes include habits and patterns not conducive to sound sleep such as person's lifestyle and personal problems (e.g. irregular bedtimes and rising hours, long daytime naps and excessive consumption of foods and drinks containing caffeine). Physical causes are primarily of medical concern and are related to, for example, allergies, asthma or the side effects of alcohol, prescribed medications and illegal drugs. (Morrison et al. 1985.)

According to retrospective studies, insomnia in the adolescent years seems to continue in the later stages of life. Many who have suffered from poor sleep for 20 years have reported that their problems began during their teens (Price et

al. 1978). In their study of insomnia, Bixler and colleagues (1979) reported that the mean age of onset of insomnia was 37 years. However, 7% of their respondents reported that insomnia began before the age 10 and 11% remembered that the problem started between ages 11 and 20.

#### 4.4 Prevalence of sleep problems

Research into gender and age differences in relation to sleep problems during adolescence has produced conflicting results. In some studies girls have reported more problems with sleep than boys (e.g. Rimpelä & Rimpelä 1983, Weinstein et al. 1983, Kirmil-Gray et al. 1984, Manni et al. 1997, Vignau et al. 1997) and in some studies boys more than girls (e.g. Abe & Suzuki 1985). In many studies gender differences have been small or have not existed in sleep problems (e.g. Dollinger 1982, Klackenberg 1982, Bearpark & Michie 1987, Fischer & Wilson 1987, Morrison et al. 1992, Yarcheski & Mahon 1994). Ferber (1990) reported that schedule-dependent sleep problems tend to increase as youngsters move on from middle childhood through preadolescence and into adolescence. Yarcheski and Mahon (1994) suggested in their study of sleep disturbances in different phases of adolescence that problems with sleep are more prevalent in middle adolescence (age group 15-17) than in late adolescence (age group 18 to 21); there were no statistically significant differences between early (age group 12 to 14) and middle adolescence. Sleep problems also seem to be relatively persistent over time from ages 13 to 15 (Morrison et al. 1992). Hofman and Steenhof (1997) found no age differences (years 12 to 18) in sleep quality among Dutch adolescents. However, Levy and colleagues (1986) noted that sleep quality decreased among adolescents from age 12 to 18.

Many studies provide evidence that poor sleep quality is associated with problems in social relationships, problems with handling troubles, problems at school, disturbances in the sleeping environment, poor reported health, poor physical fitness, poor sleeping habits, a lack of exercise, a health compromising lifestyle, low self-esteem or self-concept and such psychological states as anxiety, depression, tension and worry (Price et al. 1978, Healey et al. 1981, Rimpelä & Rimpelä 1983, Kirmil-Gray et al. 1984, Shapiro et al. 1984, Kahn et al. 1989, Carskadon 1990b, Ferber 1990, Weydahl 1991, Mahon 1994, 1995, Wang et al. 1994, King et al. 1996, Pilcher et al. 1997, Vignau et al. 1997, see also Hyyppä et al. 1991).

Several studies have also investigated the association of sleep disorders and seasonal affective disorder (SAD). SAD is a condition characterised by recurrent fall and winter depressions that remit during spring and summer time. Among children and adolescents typical features of SAD are irritability, fatigue, school difficulties (deteriorating school performance), sadness and hypersomnolence. The prevalence of SAD is 2-5% in children and adolescents, and bright light therapy has been used with good results for this problem. (Rosenthal et al. 1986, Pihlajamäki & Saarijärvi 1998.)

Sleeping difficulties in children and adolescents have been shown to vary in different socio-economic groups. Low education and low socio-economic

atus of the parents is correlated with sleep problems in adolescents (Simonds & Parraga 1982, Kahn et al. 1989). Aro et al. (1987) reported that Finnish children aged 14-16 from working class families showed slightly more psychosomatic symptoms – including sleep problems. In addition, children from non-contact families had more psychosomatic symptoms compared to children from contact families. Symptoms were also more prevalent in families with a higher number of children. In a study conducted by Kahn and colleagues (1989) family structure has also been reported to be an important explanatory factor in sleep problems.

In a study of Finnish military recruits, the majority of the respondents (84%) stated that they generally slept peacefully in civilian life. Smoking and use of alcohol correlated with restless nocturnal sleep. (Partinen 1982.) Quality of sleep seems to be better in younger age groups. In a Finnish study of sleep quality among adults, 9% of persons in the age group 15-24 complained of poor sleep quality whereas in the age group 45-64 the corresponding proportion was 32% (Partinen and Rimpelä 1982).

In a study of Finnish adolescents Tynjälä and Liinamo (1995) found that even though most 15-year-olds slept well during the school week, 10-15% of adolescents had problems with their sleep. They reported either waking too early in the morning and not being able to fall asleep again, that they had been awake during the night because of worries, that their sleep had not been continuous or they had had unpleasant dreams. (Tynjälä & Liinamo 1995.) In the Adolescent Health and Lifestyle Survey (Rimpelä & Rimpelä 1983), in 1977 and 1979, at most 10% of 15 to 19-year-olds (girls slightly more often than boys) reported difficulties in falling asleep or problems with nocturnal awakenings “rather often” or “perpetually”. Between 1985 and 1997 this proportion varied among 14-18-year-olds from 15% to 19% in boys and from 20% to 25% among girls (Rimpelä et al. 1997) indicating an increase in sleep difficulties.

To summarise, it seems that the studies of sleep problems in young people focus mainly on the relationships between the sleep problems and certain socio-demographic factors such as age and gender. There are also studies which describe associations from a bivariate bases between sleep and (individual) indicators of health or between sleep and (individual) health habits. As a result of these studies it can be concluded that sleep problems in young people are associated with a great variety of factors related to an individual himself or herself or to his or her environment. A more holistic research approach to sleep problems and associated factors is almost lacking (cf. Wolfson & Carskadon 1998), although this kind of sleep research has been carried out among the adult population (e.g. Hyypä et al. 1991, Kronholm 1993).

## 5 SLEEP PATTERNS AND SLEEPINESS IN ADOLESCENTS

### 5.1 Sleep patterns

Sleep pattern means an individual's schedule of going to bed and waking up as well as his/her nap behaviour. This concept may also refer to time and duration of sleep interruptions. (Thorpy 1990.) This study investigated adolescents' bedtime and wake-up time. Their nap behaviour was also studied.

Carskadon (1990b) summarises key factors affecting the development of adolescent sleep patterns. Due to physical and endocrinological maturation, puberty itself imposes a burden of increased daytime sleepiness with no change in nocturnal sleep (e.g. Anders et al. 1980, Carskadon & Dement 1987, Carskadon 1990b). Parental involvement in setting bedtimes wanes, but in the morning parents become more involved in waking up their teenagers. Curfews and school schedules also affect adolescents' sleep patterns as school often begins earlier during adolescence and getting to school may take longer than before. Part-time work has a significant impact on teenagers' sleep patterns: working students stay up later and sleep less on both school nights and weekend nights than students who do not work. The high-work group also reported more symptoms of daytime sleepiness, and they reported greater use of caffeine, alcohol and tobacco. (Carskadon 1990b, see also Carskadon 1990a.)

The development of circadian rhythms may play an important role in the sleep phase delay that teenagers commonly experience. This delay may be simply caused by teenagers' desire to stay up late. Another reason for the sleep phase delay may be peer influence and socialisation. All of these factors affect sleep patterns with the result that many adolescents do not get enough sleep. One important consequence is daytime sleepiness. Other related problems are mood and behaviour problems, increased vulnerability to drugs and alcohol and development of major disorders of the sleep/wake cycle. (Carskadon 1990b, see also Carskadon 1990a.)

Carskadon and colleagues (1993) have also found that biological factors (pubertal maturation) greatly affected the phase preference – the tendency to delay bedtime – in younger children (age 11-12). Hofman and Steenhof (1997) confirmed Carskadon's (1990b) results but also suggested that the delay in bedtime may be related more closely to environmental factors, such as influence of peer group, than with internal factors – 'morning' type vs. 'evening' type (these are chronotypes and refer to individual differences in circadian rhythm). In any event, this might be the case in older adolescents for whom parental control is decreasing. However, investigation of sleep behaviours among adolescents of the morning type (larks) and the evening type (owls) has revealed that owls have more irregular sleep habits than larks. (e.g. Webb & Bonnet 1978, Carskadon et al. 1993, Hofman & Steenhof 1997, Park et al. 1997.) In Finland, Rintahaka (1991) suggested that in the adolescent years social reasons (e.g. desire to meet and spend time with friends) may cause disorders of the sleep/wake rhythm and sleep inadequacy which result in daytime sleepiness that manifests itself as restlessness, hyperactivity, poor concentration, tendency to fall asleep and problems with school work.

Ferber (1990) describes inappropriate sleep schedules in middle childhood and adolescence and categorises them in the following way:

- a) Time spent in bed is greater than sleep requirement – the problem is in inappropriate parental expectations and/or desires.
- b) Sleep phase delay, usually called delayed sleep phase syndrome – DSPS, which is one of the most common schedule problems found in children and adolescents at all ages. In DSPS the sleep phase of the youngster is shifted to such a late hour that the child is neither ready to go to sleep nor to wake up at desired times (e.g. Ferber 1989). DSPS was first introduced by Weitzman and colleagues in 1981, and it is associated with behavioural and educational difficulties (such as lower academic performance), chronic sleep loss and daytime sleepiness (Lack 1986, Thorpy et al. 1988, Anders & Eiben 1997).
- c) Motivated sleep phase delay. Child or adolescent 'is unable to' get up for school and often absences become the rule, but he/she is able to wake up early at weekends and go fishing or skiing, for example.
- d) Insufficient sleep with a typical history of the absence of difficulty in falling asleep coupled with some difficulty in waking up and often some daytime tiredness. There are numerous reasons for this problem, for example, long individual sleep requirement, required early waking due to long distance to school and 'voluntary early waking' because of different reasons.
- e) Irregular schedules and poor sleep hygiene.
- f) Pacemaker problem. In this case the central nervous system is not functioning normally and the development of normal sleep-wake rhythm is disturbed. (Ferber 1990.)

## 5.2 Sleep duration and sleeping habits

From a historical perspective, the average sleep length among children and adolescents has decreased during the 20<sup>th</sup> century (Figure 2). Terman and Hocking (1913) reported sleep durations among Californian school children and adolescents at the beginning of the century (1911-1912). The average sleep duration was 10 hours in age group 11-12 and almost 9 hours in 15-16-year-olds. Among 18-19-year-olds the corresponding figure was about 8  $\frac{3}{4}$  hours and among university students about 7  $\frac{3}{4}$  hours. Webb (1969) reported a reduction of about 1  $\frac{1}{2}$  hours in the average sleep duration of children aged 8 to 17 years between the periods of 1910 to 1911 and 1963. Over the twenty-year period (1969 – 1989), the median sleep duration reported by American college students has dropped by one hour. In 1969 the median was about 7  $\frac{3}{4}$  hours, in 1979 about 7 hours and 10 minutes and in 1989 about 6  $\frac{3}{4}$  hours. (Hicks & Pellegrini 1991.)

In the study of Finnish recruits, the average sleep length of nocturnal sleep before military service was about 8  $\frac{3}{4}$  hours in age group 17-18 (Partinen 1982). In the Adolescent Health and Lifestyle Survey (Rimpelä and Rimpelä 1983), Finnish adolescents slept about 9  $\frac{1}{2}$  hours a night during the school week when they were 12 years old, 9 hours at age 14-16, and 8  $\frac{1}{2}$  hours at age 18. In addition, about every third 12-year-old went to bed at 21.00 or earlier during the school week and only every tenth went to bed at 22.30 or later. The bedtimes became later with age. Almost 90% of 12-year-olds woke up between 6.30 and 7.30 in the morning during the school week. The proportion of adolescents sleeping later in the morning also increased with age. (Rimpelä & Rimpelä 1983.) In another Finnish study (Tynjälä & Liinamo 1995), 11-year-olds slept about 9 hours, 13-year-olds about 8  $\frac{1}{2}$  hours and 15 year-olds about 8 hours a night during the school week; during weekends and holidays sleep durations were 1 – 1  $\frac{1}{2}$  hours longer. Among 11-year-olds about 40% went to bed at 22.30 or later during school week and for 15-year-olds, over 80% of boys and almost 80% of girls belonged to this group. About 90% of boys and 95% of girls woke up at 7.30 or earlier in the morning. (Tynjälä & Liinamo 1995.) (Figure 2)

The trends in sleep duration presented in the Figure 2 represent different cultures, American students on the one hand, and Finnish adolescents on the other. When we interpret these findings it should be noted that factors related to sleep patterns and sleep duration, such as parental control, curfews and so on, may vary between the cultures. However, the trends seem to follow the same pattern: the sleep length of an average night's sleep among young people is shorter than during previous decades.

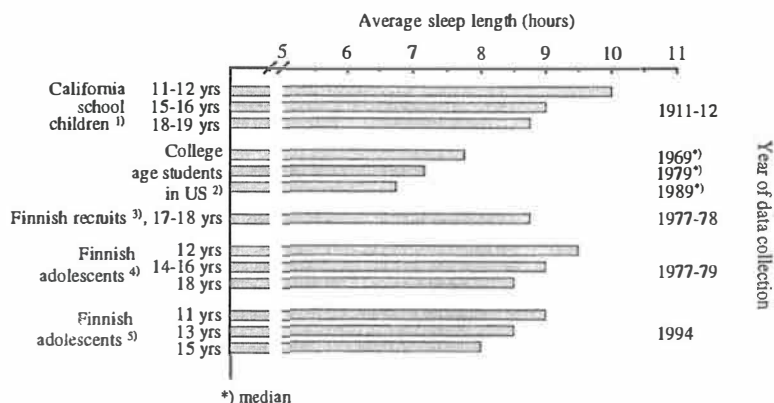


FIGURE 2 Average sleep length among adolescents during the 20<sup>th</sup> century – examples of studies in the United States and Finland: 1) Terman and Hocking 1913, 2) Hicks and Pellegrini 1991, 3) Partinen 1982, 4) Rimpelä and Rimpelä 1983, 5) Tynjälä and Liinamo 1995

Sleep rhythm generally becomes more irregular during adolescence. The proportion of those who go to bed late and sleep less increases. Irregularity of sleep habits seems to be more typical of boys than girls. Sleep duration is shorter during school nights than during weekends or holidays. (e.g. Carskadon et al. 1983, Lugaresi et al. 1983, Rimpelä & Rimpelä 1983, Rugg-Gunn et al. 1984, Carskadon 1990b, Andrade et al. 1993, Tynjälä & Liinamo 1995, Hofman & Steenhof 1997.) Studies on gender differences in sleep duration have produced conflicting results. Yarcheski and Mahon (1994) reported that boys slept more than girls but Levy and colleagues (1986) got opposite results. However, longitudinal studies have shown that the total sleep time, if allowed to sleep, of boys in their adolescent years (10-18) seems to remain constant, and that there is only a slight reduction among girls at age 16 (Carskadon et al. 1983). Sleep habits seem to correlate with each other but not with sleep disorders. For example, more regular bedtime is associated with earlier bedtime and longer sleep duration. In addition, sleep habits, such as irregular and late bedtimes, seem to correlate strongly with smoking and frequent use of alcohol. (Rimpelä & Rimpelä 1983)

### 5.3 Sleepiness and tiredness in young people

Sleepiness, somnolence and drowsiness mean difficulty in maintaining alert wakefulness in the sense that the individual falls asleep, if not actively kept awake. Sleepiness is not simply a feeling of physical tiredness or listlessness. The concept 'excessive sleepiness' is used when sleepiness occurs in inappropriate circumstances. The International Classification of Sleep Disorders (ICSD) divides sleepiness into mild, moderate and severe, which can be measured by Multiple Sleep Latency Test (MSLT). The mild form of sleepiness produces a



minor impairment, the moderate form a moderate impairment and the severe form a marked impairment in social and occupational functions. (Association of Sleep Disorders Centres 1990, Thorpy 1990.)

According to Hyyppä (1992a), the word 'väsymys' in the Finnish language is not an exact equivalent of the concept "sleepiness, somnolence" defined by ICSD. A better expression in Finnish could be "liiallinen uneliaisuus" (excessive drowsiness) because the word "väsymys" may refer to "fatigue", "tiredness", "exhaustion" or "weariness". (Hyyppä 1992a.) Alertness may be understood as a state opposite to sleepiness, and tiredness may be understood as an equivalent of sleepiness (see Anch et al. 1988). In addition, tiredness may be understood as an equivalent of lowered alertness (<http://www.hnrc.fi/Unitutk.htm> 1998). In the present study, the focus was on adolescents' self-reports of tiredness, and the concept of tiredness was used predominantly instead of sleepiness.

Dahl (1998) summarises differential diagnoses of sleepiness in adolescents in the following way: a) inadequate amount of sleep due to late-night schedules combined with early morning school schedules and difficulties in falling asleep or awakenings at night (insomnia); b) disturbed nocturnal sleep because of sleep apnea syndrome, frequent nocturnal arousals, medical problems disturbing sleep, use of drugs and/or alcohol, withdrawal from drugs and alcohol or restless legs/periodic limb movement disorder; c) increased need for sleep because of narcolepsy, idiopathic CNS hypersomnolence, some cases of depression or Kleine-Levin syndrome; e) sleep/wake schedule problems caused by erratic sleep/wake schedule, circadian and scheduling disorders or delayed sleep-phase syndrome (DSPS). (see also Rintahaka 1991, Saarenpää-Heikkilä & Koivikko 1995.)

According to Anders and colleagues (1978, 1980) the beginnings of a chronic sleep deficit originate at age 12 when the difference in sleep duration between school nights and non-school nights becomes significant, but sleep length remains relatively stable on non-school nights. This sleep deficit cumulatively affects daytime functioning at a later age. Daytime sleepiness is not a common problem in preadolescence or early adolescence, but the period of middle-to-late adolescence may signal important changes in sleep patterning, sleepiness, and daytime functioning. At this point adolescents experience more daytime sleepiness even if nocturnal sleep amounts remained unchanged (Carskadon & Dement 1987, Carskadon 1990b). Daytime sleepiness at college age may be the result of chronic sleep deficits dictated by social pressures. (Anders et al. 1978, 1980.)

Epstein and colleagues (1998) examined school starting time and its effects on daytime functioning in 10 to 12-year-old children in Israel. They concluded that early starting time of school negatively affects total sleep time and, as a consequence, has a negative effect on daytime functioning. It also results in, for instance, complaints of daytime fatigue and sleepiness and problems with attention and concentration in school. Their results also support Webb and Agnew's (1975) position that, at least in some segments of the population, chronic sleep deprivation indeed exists and is largely due to the contemporary lifestyle. (Epstein et al. 1998, see also Carskadon et al. 1998.)

A wish for more sleep was quite prevalent among adolescents aged 10 to 14 in a longitudinal study conducted by Strauch and Meier (1988). In their study, the frequency of wishing for more sleep varied between 54% and 75% but the individual consistency on five measurements at two-year intervals was only 15%, indicating the state dependency of the wish for more sleep. A wish for more sleep was systematically associated with a syndrome of morning-tiredness and a wish to stay longer in bed. It also took longer for adolescents in the group wishing more sleep to become alert in the morning. Strauch and Meier (1988) concluded that a substantial proportion of adolescents seem to have difficulties adapting to the general sleep time reduction occurring in adolescence. Durrer and Strauch (1998) have continued the follow-up study which now includes nine measurements at two-year intervals, the study population being 18 years older than at the beginning of the study. The main result of this long-lasting follow-up study is that a chronic sleep deficit is apparent in those periods of the life span when a decline in sleep duration takes place simultaneously with an increased sleep need. (see also Morrison et al. 1992.)

Sleepiness (tiredness) is a common psychosomatic symptom among adolescents and it seems to increase with age (e.g. Anders et al. 1980, Rimpelä & Rimpelä 1983, Rimpelä et al. 1990a, Niemelä et al. 1994, Kannas et al. 1995, Saarenpää-Heikkilä et al. 1995, Välimaa et al. 1995, see also Welstein et al. 1983). In a San Marino Study (Lugaresi et al. 1983), every fifth 10-19-year-old adolescent reported sleepiness and it peaked in the age group 15-16, in which every third adolescent complained of it. In general, sleepiness seems to be more common among girls than among boys (e.g. Carskadon et al. 1983, Lugaresi et al. 1983, Welstein et al. 1983). However, interesting results have been reported concerning gender differences in tiredness even in the same research project. In the Adolescent Health and Lifestyle Survey (Rimpelä et al. 1997) in 1981 and 1987 about every fifth and in 1995 and 1997 every fourth 14-18-year-old boy and girl reported to be "a little" or "far more" tired during the daytime than their school mates and friends. Results concerning tiredness or faintness as psychosomatic symptoms revealed clear gender differences: about every third 14-18-year-old girl and about every fifth boy reported tiredness or faintness at least once a week between survey years 1985 and 1987. In addition, the proportion of alert pupils in the mornings declined between 1981 and 1987 among high school aged (age 16-18) students, but the proportion of perpetually tired adolescents did not change between 1981 and 1987: about every fifth 12-18-year-old adolescent felt "seldom" or "never" alert in the morning. (Rimpelä et al. 1990a, b, Rimpelä et al. 1997.)

In another study, every other 15-year-old Finnish adolescent reported waking up refreshed and energetic in the morning and every third felt "a little" or "far more" tired during the daytime than their friends (Tynjälä & Liinamaa 1995). In a longitudinal study among 13-year-olds, it was also found that sleepiness on school mornings occurred at a time of the day that corresponded to sleep on non-school days (Andrade et al. 1993).

Sleepiness is associated, for example, with poor sleep hygiene, disorders in the sleep/wake cycle, insomnia, substance use, behavioural problems, poor concentration, poor school performance, psychosocial stress, poor relationships with other people, failure of life-management, tendency toward depression and

hormonal factors in adolescent years (e.g. Lugaresi et al. 1983, Montgomery 1983, Rimpelä & Rimpelä 1983, Morrison et al. 1985, Chen 1986, Strauch & Meier 1988, Hyyppä et al. 1989, Carskadon 1990b, Rintahaka 1991, Hyyppä 1992b, Morrison et al. 1992, Hyyppä 1993, Lexcen & Hicks 1993, Phillips & Danner 1995, Saarenpää-Heikkilä & Koivikko 1995). In the Adolescent Health and Lifestyle Survey (Rimpelä & Rimpelä 1983), tiredness in the morning was associated with irregular and late bedtime, short sleep duration, difficulties in initiating sleep and maintaining sleep, poor subjective health, poor physical condition, psychosomatic symptoms and addictive behaviour.

On the whole, sleepiness or tiredness is a multidimensional phenomenon. It is a natural consequence of physical and mental strain and is associated with many health habits and indicators of health. During puberty need for sleep increases just because of biological maturation. Adolescents are, however, not always able to match this increased need for sleep and their usual sleep duration. The basic problem among adolescents may be that they do not sleep enough due to many social and other reasons, which results in tiredness. In the adolescent years the proportion of tired children increases, and tiredness seems to be more typical of girls than of boys. Changes in sleep patterns during this century suggest that time for sleep has been reduced among adolescents and that this may predict that the proportion of tired adolescents is also increasing.

## 6 AIMS OF THE STUDY

The purpose of this thesis is two-folded. First, it will describe sleep habits, sleep difficulties, sleep quality and tiredness among adolescents from a health behavioural perspective, including comparisons of young people's sleep between Finland and other countries as well as analyses of the relationships between sleep and different background factors, health habits and lifestyle. Second, the thesis will present the results of a study which tested the reliability of sleep related questions and the results of a study which tested a sleep quality scale and an alertness scale developed in connection with and on the basis of the first mentioned studies and other national and international studies of adolescents' sleep quality and tiredness. The purpose for developing the scales is to provide more comprehensive and accurate measures for further studies and health promotion among adolescents.

More specifically, the aims of the thesis are:

1. To describe young people's sleep habits and sleep difficulties and their associations with selected health indicators, health habits and leisure time activities in Finland as compared to other, mostly European countries. (I)
2. To describe and analyse sleeping habits and sleep difficulties by sociodemographic background in Finnish adolescents. (II)
3. To describe and analyse sleeping habits and sleep difficulties and their association with students' educational expectations among Finnish adolescents. (III)
4. To describe and analyse perceived tiredness and its associations with sleeping habits and use of psychoactive substances in Finnish adolescents. (IV)
5. To describe perceived sleep quality and analyse its precursors in Finnish adolescents (V)
6. To test the reliability of sleep related questions among 13- and 15-year-olds (the test-retest study) and scales for the measurement of perceived alertness and sleep quality among 15-year-olds using a follow-up design (the Jyväskylä follow-up study)

The Roman numerals in parenthesis refer to the original publications listed at the beginning of the thesis. The results concerning aim number 6 have not been previously published. The results of the test-retest study are presented in chapter 7 and results of the Jyväskylä follow-up study in chapter 8.

## 7 METHODS

### 7.1 Health Behaviour of School Aged Children Study (the HBSC-Study)

This study used the data from a larger, comparative, WHO-coordinated project on the health and lifestyle of school children (Health Behaviour of School Aged Children – A WHO Cross-National Survey, the HBSC-Study). The major goal of the HBSC-Study is to gain insights into and to increase our understanding of the lifestyles and health behaviours of young people (Aarø et al. 1986). The empirical work in this research project is based on surveys among school children. Surveys are carried out at regular intervals – usually every fourth year – in an increasing number of European countries. The main idea for the empirical work is to develop national and international information systems on the health and lifestyles of young people. The aim is to utilise the information collected both in practice, for example in school health education and school health care, and for scientific purposes. An important goal of this research project is to influence health promotion and health education both within schools and among young people in general. (Aarø & Wold 1986.)

Surveys were carried out in 1984, 1986, 1990, 1994, and 1998, and there will be a new survey in 2002. The number of countries, mostly on the European continent, has increased from 4 (in 1984) to 28 (in 1998), and the number of pupils has increased from about 13,000 (1984) to 128,000 (1998).

In this study international and national data were used from the 1986 survey (I) and in addition, national data from the surveys held in 1990 (II, III) and 1994 (IV, V).

## 7.2 Sampling procedure in the HBSC-Study

In every survey year and in each country sampling followed an international research protocol agreed upon by every participating country. Samples had to be comprised of pupils within three age groups. The mean ages in the age groups had to be as close as possible to 11.5, 13.5 and 15.5 years, with 90 per cent of the pupils falling within 6 months of these means. The sample sizes had to be at least 1,000 pupils in each age group and approximately 3,000 pupils in each country. These samples had to be statistically representative of pupils in each age group in the whole country. Sampling units should be based on actual classroom units. Stratification by regions, type of municipalities or other relevant criteria was accepted. If a country had a heterogeneous population due to the size of the country, many ethnic groups, cultures or languages, it was suggested that the study be carried out in smaller geographical areas than in the whole country. In this case, each area surveyed had to have a total population of at least one million and had to constitute a meaningful administrative unit from the viewpoint of health promotion among adolescents. (Aarø & Wold 1986.)

The sample overview of the international data file from the 1986 survey is presented in Tables 1-2. Table 1 shows that the final sample sizes and date of data collection varied considerably between countries and that in three countries the data had to be weighted. In addition, the mean ages varied slightly between countries with differences of, at most, about 6 months in each age group. Pupils in Wales were the oldest in all three age groups. (Table 2)

TABLE 1 Sample overview and date of administration in the 1986 HBSC-Study (Wold 1998: personal communication)

Country	Final sample size	Unweighted sample size after cleaning	Date of administration
Austria	3339	3220 <sup>*)</sup>	June 1986
Belgium (French-speaking part only)	3593	3575	March 1986
Finland (Finnish-speaking only)	3289	3219	Jan-Feb 1986
Hungary	4466	4461	Feb 1986
Israel	3071	2928	March-June 1986
Norway	4022	3955	Nov-Dec 1985
Scotland	4935	4760 <sup>*)</sup>	Nov 1986
Spain	2840	2476	Dec 1986
Sweden	3026	2933	Nov-Dec 1985
Switzerland	6416	3746 <sup>*)</sup>	April-May 1986
Wales	6581	6536	March-April 1986
Total	45578	41809	

<sup>\*)</sup> Data had to be weighted after the final cleaning process.

TABLE 2 Mean age (years and decimals) by grade, gender and country in the 1986 HBSC-Study

Country	Boys			Girls		
	Grade 1	Grade 2	Grade 3	Grade 1	Grade 2	Grade 3
Austria	11.4	13.4	15.3	11.3	13.4	15.3
Belgium (French-speaking part only)	11.5	13.5	15.5	11.5	13.5	15.5
Finland (Finnish-speaking only) <sup>*)</sup>	11.7	13.7	15.7	11.7	13.6	15.6
Hungary	12.0	14.0	16.0	11.9	14.0	15.9
Israel	11.6	13.6	15.5	11.5	13.5	15.5
Norway	11.5	13.5	15.5	11.4	13.4	15.4
Scotland	11.4	13.5	15.5	11.4	13.4	15.5
Spain <sup>**) )</sup>	11.6	13.6		11.6	13.6	
Sweden	11.5	13.5	15.5	11.5	13.5	15.5
Switzerland	11.6	13.6	15.5	11.6	13.6	15.5
Wales	12.0	14.0	16.0	12.0	14.0	16.0
Total	11.7	13.6	15.6	11.6	13.6	15.6

\*) In Finland Grade 1 represents pupils in the 5<sup>th</sup> grade, Grade 2 represents 7<sup>th</sup> graders and Grade 3 represents pupils in the 9<sup>th</sup> grade.

\*\*) The oldest age group was not represented in the Spanish sample.

### 7.3 Sampling in Finland in 1986, 1990 and 1994 in the HBSC-Study

The populations in each survey consisted of pupils in the 5<sup>th</sup>, 7<sup>th</sup> and 9<sup>th</sup> grades attending normal education in the Finnish-speaking compulsory comprehensive school. These grades correspond to the age groups 11, 13 and 15. Therefore there were three samples from three different populations. An optimal (targeted) sample size in each age group was 1,000 in 1986, 1,500 in 1990 and 1,300 in 1994 (Aarø & Wold 1986, King & Coles 1992, King et al. 1996). These optimal sample sizes were the minimum requirements. In Finland, the optimal sample size in 1994 included 1,700 pupils from each grade.

The sampling method was the same in each survey year, and the Institute for Educational Research in Jyväskylä was responsible for the sampling procedure. Nationally representative samples were chosen from the Finnish school register by using a special sampling program. The sample frame was the number of pupils in each class level. This computer program picked the schools using cluster sampling in such a way that the size of schools was taken into consideration (probability proportional to size of school, PPS). Within the school the class was randomly selected. In only a few cases was more than one class per school selected in the sample. (Törmäkangas 1994, Tynjälä & Törmäkangas 1995.)

In each survey year the strata were based on province division. The strata were the northern part of Finland (the provinces of Lappi and Oulu), the central part of Finland (the provinces of Vaasa, Keski-Suomi, Kuopio, Mikkeli, and Pohjois-Karjala), the southern part of Finland (the provinces of Uusimaa, Turku

and Pori, Häme and Kymi) and the capital city area (cities of Helsinki, Espoo, Vantaa and Kauniainen). The other basis of stratum was the division between urban and rural communes. Because there were no rural communes in the capital city area, the final number of the strata of the Finnish-speaking population was seven. (Törmäkangas 1994, Tynjälä & Törmäkangas 1995.)

Additional samples were made in every survey year in case some selected schools did not want to participate in the survey. The substitution was made on the basis of province division and type of commune (rural/urban). The procedure was simple: if a school in the original sample refused or did not return questionnaires in a requested time, the first school from the extra list from the same province and of the same commune type was chosen. (Törmäkangas 1994, Tynjälä & Törmäkangas 1995.)

Information about the Finnish sample in the 1986, 1990 and 1994 surveys is presented in more detail in Tables 3-7. The total number of schools participating in the survey was 150 in 1986 and 1990. In 1994 206 schools took part in the survey. In the first two surveys more than 3000 pupils filled in the questionnaire, and over 4000 pupils answered the questions in the 1994 survey. The mean ages of respondents were about the same in 1990 and 1994 but in the 1986 survey the children were little younger. During the data cleaning process (see chapter 7.7) a small number of cases were dropped from the data. This proportion was the biggest in the 1986 survey (70 cases) but decreased to 48 cases in the 1994 survey. Response rates were very high in all three survey years, and losses consisted of pupils absent from school on the data collection day. (Tables 3-7)

TABLE 3 Number of schools<sup>1)</sup>, losses<sup>2)</sup> and schools from the extra list 1986, 1990 and 1994 in Finland

Year and grade	Sample n	Loss n	Extra schools n	Total n
1986				
5 <sup>th</sup>	63	5	4	62
7 <sup>th</sup>	42	-	-	42
9 <sup>th</sup>	46	1	1	46
<i>Total n</i>	151	6	5	150
1990				
5 <sup>th</sup>	63	4	4	63
7 <sup>th</sup>	42	4	3	41
9 <sup>th</sup>	46	4	4	46
<i>Total n</i>	151	12	11	150
1994				
5 <sup>th</sup>	79	6	6	79
7 <sup>th</sup>	63	4	4	63
9 <sup>th</sup>	64	6	6	64
<i>Total n</i>	206	16	16	206

<sup>1)</sup> In 1986 and 1990 the same schools were used in the sample.

<sup>2)</sup> The selected school refused, did not exist any longer or did not return the questionnaires.



TABLE 4 Number of pupils in the sample, respondents and number of pupils in the final cleaned data in 1986<sup>1)</sup>, 1990 and 1994<sup>2)</sup> in Finland

Year and grade	BOYS			GIRLS			ALL		
	Sample n	Respondents <sup>3)</sup> n	Cleaned data n	Sample n	Respondents <sup>3)</sup> n	Cleaned data n	Sample n	Respondents <sup>3)</sup> n	Cleaned data n
<b>1986</b>									
5 <sup>th</sup>	636	605	588	627	605	596	1263	1210	1184
7 <sup>th</sup>	540	483	475	526	468	462	1066	951	937
9 <sup>th</sup>	616	568	549	579	560	549	1195	1128	1098
<i>Total n</i>	<i>1792</i>	<i>1656</i>	<i>1612</i>	<i>1732</i>	<i>1633</i>	<i>1607</i>	<i>3524</i>	<i>3289</i>	<i>3219</i>
<b>1990</b>									
5 <sup>th</sup>	640	606	591	588	566	554	1228	1172	1145
7 <sup>th</sup>	496	472	462	489	465	461	985	937	923
9 <sup>th</sup>	517	471	463	506	468	465	1023	939	928
<i>Total n</i>	<i>1653</i>	<i>1549</i>	<i>1516</i>	<i>1583</i>	<i>1499</i>	<i>1480</i>	<i>3236</i>	<i>3048</i>	<i>2996</i>
<b>1994</b>									
5 <sup>th</sup>	935	891	869	897	852	845	1832	1743	1714
7 <sup>th</sup>	690	638	631	692	649	648	1382	1287	1279
9 <sup>th</sup>	657	582	576	701	623	618	1358	1205	1194
<i>Total n</i>	<i>2282</i>	<i>2111</i>	<i>2076</i>	<i>2290</i>	<i>2124</i>	<i>2111</i>	<i>4572</i>	<i>4235</i>	<i>4187</i>

1) In 1986 data collection was administered in January-February; in 1990 and 1994 in March-May.

2) In 1994 the difference between original sample (in each age group the optimum sample size was 1700) and actual sample was caused by the fact that the most recent information about the schools was based on statistics from school year 1989/90. This did not influence the bias in the sample but the sampling error was about 1% higher.

3) Difference between the sample and respondents (loss) consisted of pupils absent from school on the data collection day.

TABLE 5 Mean age (years and decimals; standard deviation in parenthesis) by gender, grade and survey year in Finland

Survey year	Boys			Girls		
	Grade 5	Grade 7	Grade 9	Grade 5	Grade 7	Grade 9
1986	11.7 (.3)	13.7 (.3)	15.7 (.3)	11.7 (.3)	13.6 (.3)	15.6 (.3)
1990	11.7 (.3)	13.8 (.3)	15.8 (.3)	11.7 (.3)	13.8 (.3)	15.8 (.3)
1994	11.8 (.3)	13.8 (.3)	15.8 (.3)	11.8 (.3)	13.8 (.3)	15.8 (.3)

TABLE 6 Response rates, percentage ( $=n_{\text{respondents}}/n_{\text{sample}} \times 100$ ), in Finland by gender, grade and survey year

Survey year	Boys			Girls			Total %
	Grade 5 %	Grade 7 %	Grade 9 %	Grade 5 %	Grade 7 %	Grade 9 %	
1986	95.1	89.4	92.2	96.5	89.0	96.7	93.3
1990	94.7	95.2	91.1	96.3	95.1	92.5	94.2
1994	95.3	92.5	88.6	95.0	93.8	88.9	92.6

TABLE 7 Number of pupils in the final cleaned data and percentage ( $=n_{\text{cleaned}}/n_{\text{sample}} \times 100$ ) in Finland by gender, grade and survey year

Survey year	Boys			Girls			Total n
	Grade 5	Grade 7	Grade 9	Grade 5	Grade 7	Grade 9	
1986 n (%)	588 (92.5)	475 (88.0)	549 (89.1)	596 (95.1)	462 (87.8)	549 (94.5)	3219 (91.3)
1990 n (%)	591 (92.3)	462 (93.1)	463 (89.6)	554 (94.2)	461 (94.3)	465 (91.9)	2996 (92.6)
1994 n (%)	869 (92.9)	631 (91.4)	576 (87.7)	845 (94.2)	648 (93.6)	618 (88.2)	4187 (91.6)

## 7.4 Data collection in Finland in the HBSC-Study

The questionnaires were mailed to schools with instructions on how to carry out the data collection in classrooms. Schools were asked not to collect the data on Monday morning or late on Friday afternoon. Teachers supervising the data collection were asked to provide the number of pupils absent from school on the data collection day. In grade 5 pupils had one class period to fill in the questionnaire. In grades 7 and 9 pupils had two consecutive class periods to answer the questions because they had two separate questionnaires complete, the main questionnaire and another questionnaire inquiring, among other things, about pupils' maturation, sexual behaviour and knowledge of and attitudes towards AIDS and related matters. In the 1986 survey all grades had only one questionnaire and one class period to answer the questionnaire. Pupils responded anonymously to the standardised questionnaire with a teacher overseeing the process. At the end of the class period each pupil put their questionnaire(-s) into an envelope, sealed it and gave the envelope to the teacher. The teacher put the envelopes into a bigger envelope (provided with the address and prepaid postage cost) and sent the package to the researchers in Jyväskylä (Department of Health Sciences, University of Jyväskylä). In Jyväskylä these packages were opened and necessary information, such as package arrival date and number of respondents and pupils absent from the class, was registered. In addition, pupils' questionnaires were numbered for later checking, if necessary.

After this the questionnaires were sent to the Computer Centre at the University of Jyväskylä for coding and preliminary data file formation.

## **7.5 General structure of the questionnaires in the HBSC-Studies in 1986, 1990 and 1994**

In each survey year the questionnaires included core questions, questions with special focus and national questions. Core questions were repeated in each survey year, and they contained selected demographic questions (such as year of birth, month of birth, family structure, father's and mother's occupation, place of residence), behavioural questions relevant to major health problems (smoking, use of alcohol, dental hygiene, eating habits, physical activity and behaviours related to risk of injury) and psychosocial aspects of health and psychosomatic complaints, including a question about difficulty in initiating sleep. Questions with special focus varied between survey years, for example, in 1986 there were more questions than usual about physical activity in the questionnaire, whereas in 1994 the emphasis was on school as a working environment and risk-taking behaviour related to injuries. In each survey year every country was allowed to include as many questions of national interest as necessary. In 1990 the national questions in Finland concerned adolescents' sleep habits and sleep difficulties. Most of the questions included were pre-categorised, and the questionnaires for each new survey were piloted in each country before the actual data collection. (e.g. Wold et al. 1994, see also Piette et al. 1993.)

Several procedures were carried out to ensure comparability between countries. In each survey year the international questionnaire was written in English. In non-English speaking countries, a standardised procedure for translating the questionnaire had to be followed. This procedure included a) translation into the national language(s) by two independent translators and subsequent agreement between the translators on a single version, b) translation of this agreed national version back into English for comparison with the standard international questionnaire. Any deviations from the standard international questionnaire identified by this process had to be altered or reported to the responsible coordinator of the HBSC project. (Piette et al. 1993.)

## **7.6 Sleep related measurements in the HBSC-Studies in Finland in 1986, 1990 and 1994**

Questions of major interest in this study – sleep habits, sleep difficulties and perceived tiredness (such as bedtime, wake-up time, difficulty in falling asleep and perceived morning tiredness) are presented in Appendix 1. All sleep related questions used in the international version of the questionnaire in the 1986 HBSC-Study were included in the Finnish questionnaire. In Finland national questions about sleep habits, sleep difficulties and perceived tiredness were

included in the 1990 and 1994 survey (Appendix 1). The relevance of these sleep questions was tested in several pilot surveys, in most cases, in the city of Jyväskylä (e.g. Harju-Kivinen & Kannas 1995).

Questions about sleeping habits, sleep difficulties and perceived tiredness were operationalised in virtually the same way as in earlier studies in Finland (e.g. Partinen 1982, Partinen & Rimpelä 1982, Rimpelä & Rimpelä 1983, Hyypä & Kronholm 1987, Urponen et al. 1988) or elsewhere (e.g. Monroe 1967, Bixler et al. 1979, Welstein 1983, Kirmil-Gray et al. 1984). The national sleep questions used in the 1990 and 1994 study mainly originated in the Sleep Habit Questionnaire developed in the UKK Institute for Health Promotion Research (Urponen et al. 1988) and in the Adolescent Health and Lifestyle Survey (Rimpelä & Rimpelä 1983, see also Ahlström et al. 1979).

Sleeping habits were measured by bedtime and morning wake-up time during the school week (or weekends), bedtime regularity and frequency of taking naps. The length of sleep time during the school week or weekends/holidays was calculated by adding up the hours from the time of going to bed to the moment of waking up in the morning. Sleep problems/sleep quality and perceived tiredness were determined by questions about difficulties in falling asleep and by inquiring how well or badly pupils slept (general sleep quality), how often they felt tired on school mornings (morning tiredness) or during the day (daytime tiredness), how quickly they fell asleep in the evening (sleep latency), how often they woke up during the night (night awakening, nocturnal awakening), how often they woke up in the morning without being able to fall asleep again despite wanting to (early morning awakening) and for what reason they woke up during the night.

## **7.7 Data file preparation in Finland and other participating countries in the HBSC-Study**

In each country the preliminary national data file was sent to the HBSC International Data Bank in Bergen, Norway, where national data files were checked and cleaned. The cleaning process consisted of the following actions:

- 1) Deletion of cases with missing answers on gender or grade
- 2) Whenever applicable, recording of missing values into valid answers based on logical conditions
- 3) Deletion of cases with a large proportion (more than 25 per cent) of missing values on a set of key variables (Nutbeam & Aarø 1991)
- 4) Checking and correction of probable inconsistencies
- 5) Deletion of students who fell outside the age range of plus/minus one year from mean age within the actual grade
- 6) Deletion of cases to reduce the proportion of cases outside the range of plus/minus ½ year to 10%.

(Aarø & Wold 1986, King & Coles 1992, Wold et al. 1994, King et al. 1996.)

After the cleaning process the national data file and international data file were sent to each participating country. In Finland the Department of Health Sciences at the University of Jyväskylä has been the national coordinating centre since the first survey in 1984.

## 7.8 Statistical methods

The association between nominally scaled variables was analysed using cross-tabulations, and its statistical significance was tested with Chi-square test. In describing associations between at least ordinally scaled variables Pearson product moment correlation coefficients or polychoric correlation coefficients were calculated. Polyserial correlation coefficients were calculated between ordinally scaled variables and intervally scaled variables. Analysis of variance (ANOVA) was used to test means of continuous variables, such as sleep time, among different classifying, nominally scaled or ordinally scaled, variables. Multiple classification analysis (MCA) was done in conjunction with ANOVA where no interaction emerged between the classifying (explanatory) variables. Student's t-test and oneway analysis of variance were used to test the differences of group means in different subgroups. Logit-regression analyses were used in studying whether pupil's sleep habits and sleep problems could be simultaneously explained by selected background variables such as pupil's gender, future school orientation and father's occupation (Aitkin et al. 1990). The internal consistency of the sum indexes was tested with Cronbach's Alpha. Analyses were executed with SPSS/PC (version 4) program or SPSS Windows (version 6) program, except the logistic regression analyses which were done with the GLIM program (version 3.77). Additional statistical methods used to estimate reliability are described in the following chapter.

Structural equation models were used to test factor structures and analyse the associations between factors and variables. The analyses were based on polychoric and polyserial correlation coefficients and were done using the generally weighted least squares (WLS) estimation method. The equivalence of the regression coefficients or the factor loadings were tested with sequential Chi-square tests. Analyses were done with LISREL for Windows (version 8.12a or 8.20) and PRELIS for Windows (version 2.12a or 2.20). (see Jöreskog & Sörbom 1993.)

## 7.9 The test-retest (reliability) study in 1997

Reliability is a measure of the extent to which measurements of individuals obtained at different occasions yield similar results (e.g. Streiner & Norman 1995). Test-retest procedures measure reliability in terms of the stability of an instrument (Berger & Patchner 1988). This additional study was done in order to test questions of sleep habits, sleep problems and tiredness (sleepiness). The questions were the same as in the 1986, 1990 and 1994 HBSC-Surveys (I-V). Addi-

tionally, many questions from the national surveys and questions from the international surveys were applied (e.g. Rimpelä & Rimpelä 1983, Strauch & Meier 1988). (Appendix 2)

The data of the reliability study consisted of responses of 13- and 15-year-old pupils in one comprehensive school in Jyväskylä. The first data were collected in mid-April 1997, and the study was reimplemented one week later with the same pupils. Pupils completed a standardised questionnaire during a class period. Identification of pupils was made by asking them to put their signature on the questionnaire both times they filled it in. Altogether 68 pupils answered the questionnaire in the two measurements (Table 8).

TABLE 8 Number of respondents in the test-retest study among 13- and 15-year-olds boys and girls (n=68)

	First measurement		Second measurement		Respondents that answered in both measurements	
	13-year-olds	15-year-olds	13-year-olds	15-year-olds	13-year-olds	15-year-olds
Boys	26	20	26	19	23	19
Girls	15	15	14	16	11	15
Total	41	35	40	35	34	34

Mean age of boys in the 7<sup>th</sup> grade was 13.9 years (standard deviation 0.3 years) and of girls 13.8 years (0.3). In the 9<sup>th</sup> grade the mean age of boys was 15.9 years (0.4) and of girls 15.9 years (0.3).

Reliability in the test-retest study was assessed in different ways. The stability rate was calculated between measurements. It is simply the proportion of subjects that show stability on test and retest, for example, what per cent of respondents stayed in the same response category and how many respondents moved by one (or more) category(ies) either upwards or downwards (Figure 3). Pearson product moment correlation coefficients, Kappa coefficients and intra-class correlation coefficients (ICC) were also calculated. Kappa coefficients were calculated to determine interobserver agreement between measurements. ICC measures the average similarity of the subjects' actual scores on the two ratings, not merely the similarity of their relative standings on the two. (Shrout & Fleiss 1979, Berger & Patchner 1990, Streiner & Norman 1995, McDowell & Newell 1996, Torsheim et al. 1996, Pett 1997.) Analyses were done with SPSS Windows (version 8).

The calculation of ICC coefficients is a complex matter in an interrater reliability study, because there are three possible options for calculations. According to Shrout and Fleiss (1979), the decision between the three main cases should be based on the following. Case 1: judges are randomly selected from a larger population and each target is rated by a different set of judges; Case 2: judges randomly selected from a larger population and each judge rates each target; Case 3: the set of judges is the only possible set of judges and each judge

rates each target. In addition, under each case the final form of ICC depends also on whether the unit of analysis is an individual rating or the mean of several ratings. (Shrout & Fleiss 1979.)

The study in question is a repeated measures study with two measurements in which the same pupils answered the same pre-categorised questions with a between measures interval of one week. This dictates the form for the ICC. Since in a self-questionnaire study each target is rated by one's own judgement the set of judges is considered to be different for every target and therefore Case 1 is used. The unit of analysis is an individual rating which further specifies the form of ICC used in the study in question. The form of the ICC yields from one-way ANOVA table and is defined by mean squares BMS and WMS in the following way

$$ICC = \frac{BMS - WMS}{BMS + WMS}$$

where BMS is the mean square between targets and WMS the mean square within target. (Shrout & Fleiss 1979.) ICC, Kappa and Pearson coefficients are presented in Table 9.

Stability rates in the test-retest study indicate that the proportion of subjects showing perfect stability – no shifts between response categories – between measurements show substantial inter-item variation, from over 90% in the item “Daytime tiredness compared to others” to about 40% in the indicator of “Feeling of tiredness”. Typical perfect stability rates were between 60-70%. Most response shifts were minor, i.e. respondents' answers differed by only one category. (Figure 3)

Estimates of stability in the framework of Pearson, ICC and Kappa coefficients indicated that the Kappa values were lower than the values of the other two. There were minor or no difference at all between the ICC and Pearson coefficients. Gender differences were also found in many of the items studied. Most of the items show fair test-retest stability, i.e. Kappa coefficients are in the range 0.4-0.6 and the ICC and Pearson coefficients in the range 0.6-0.8 (Fleiss 1971, see also McDowell & Newell 1996). (Table 9)

Pearson coefficients and ICC coefficients were also calculated for two scales measuring sleep quality (composed of three items) and alertness (composed of five items). Table 10 indicates that on average sumscores exhibit slightly higher test-retest reliability than the items individually.

TABLE 9 Test-retest reliability of questions measuring sleep habits, sleep difficulties/sleep quality and alertness among 13- and 15-year old pupils. Kappa coefficients could not be calculated if there were a different number of categories in either of the measurements (the test-retest study, n=68)

Item (number of categories)	BOYS			GIRLS			ALL		
	ICC	Kappa	Pearson r	ICC	Kappa	Pearson r	ICC	Kappa	Pearson r
Napping (5)	0.71	-	0.71	0.79	-	0.80	0.75	0.52	0.75
Bedtime regularity (4)	0.54	-	0.57	0.72	0.51	0.71	0.60	0.49	0.61
Bed time during school week (11)	0.85	-	0.85	0.74	-	0.77	0.82	-	0.82
Bedtime on Friday evenings (15)	0.79	-	0.80	0.94	-	0.94	0.85	-	0.85
Bed time on Saturday evenings (15)	0.81	-	0.81	0.86	-	0.86	0.84	-	0.84
Difficulty in falling asleep (5)	0.83	0.34	0.83	0.72	0.49	0.71	0.79	0.41	0.79
Sleep latency (5)	0.85	0.66	0.85	0.77	0.49	0.77	0.82	0.61	0.82
Wake-up time on school mornings (7)	0.56	-	0.57	0.87	0.75	0.89	0.78	0.68	0.79
Nocturnal awakenings (5)	0.71	0.41	0.71	0.87	0.49	0.87	0.75	0.44	0.75
Wake-up time on weekends and holidays (15)	0.88	-	0.88	0.91	-	0.91	0.89	-	0.89
Calmness of sleep (5)	0.80	0.63	0.81	0.42 <sup>1)</sup>	0.45 <sup>2)</sup>	0.43 <sup>1)</sup>	0.65	0.57	0.64
Difficulty in waking up (4)	0.40 <sup>2)</sup>	0.35	0.40 <sup>2)</sup>	0.74	0.45	0.78	0.54	0.39	0.54
Tiredness on school mornings (4)	0.57	0.44	0.61	0.74	0.55	0.74	0.64	0.48	0.65
Feeling of sufficient sleep (4)	0.84	0.59	0.84	0.49 <sup>2)</sup>	0.32 <sup>1)</sup>	0.48 <sup>1)</sup>	0.73	0.50	0.72
Waking up refreshed and energetic (4)	0.81	0.58	0.81	0.77	0.64	0.77	0.80	0.61	0.80
Feeling of tiredness (5)	0.53	0.21	0.55	0.80	-	0.83	0.62	0.28	0.63
Daytime tiredness (5)	0.73	0.35	0.74	0.84	0.37	0.83	0.77	0.36	0.77
Daytime tiredness compared to others (3)	0.80	0.79	0.80	0.94	0.91	0.94	0.86	0.84	0.86
Late for school because of feeling too tired (4)	0.67	0.46	0.69	0.86	0.81	0.88	0.75	0.60	0.75

1)  $p < .05$ , 2)  $p < .01$ . If not marked 1) or 2),  $p < .001$



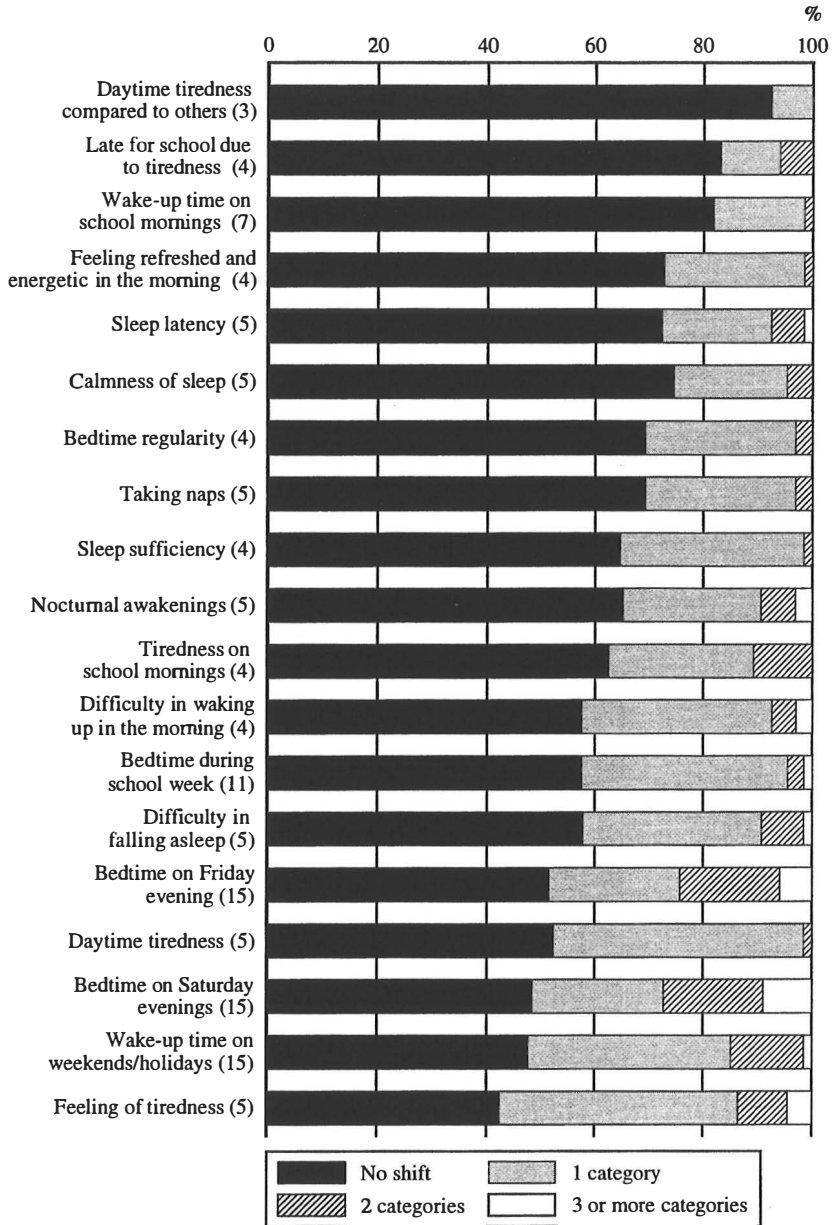


FIGURE 3 Transfers between measurements in the test-retest study (13- and 15-year-old boys and girls, n=68). Number of response categories are presented in parenthesis

TABLE 10 Test-retest coefficients of sumscores of sleep quality and alertness among 13- and 15-year-old pupils (the test-retest study, n=68). All coefficients:  $p < .001$

Sumscore	Pearson r			ICC		
	Boys	Girls	All	Boys	Girls	All
<i>Sleep quality</i> (sleep latency, difficulty in falling asleep and nocturnal awakenings; range 0-12)	0.90	0.74	0.86	0.90	0.75	0.85
<i>Alertness</i> (difficulty in waking up, morning tiredness, sleep sufficiency, waking up re-freshed and energetic, daytime tiredness; range 0-15)	0.89	0.82	0.86	0.89	0.82	0.86

## 7.10 The Jyväskylä follow-up study in 1996-97

The purpose of the Jyväskylä follow-up study in 1996-97 was to investigate certain health related (including sleep habits, sleep disturbances and alertness) and school related matters and their seasonal variation among 13- and 15-year-old pupils during a school year. In this thesis the follow-up data were used to study the possible existence of an alertness dimension (factor) and a sleep quality dimension (factor) among 15-year-olds. More specifically, the purpose was to test the reliability of the scale for each dimension. The scales included questions from the 1986, 1990 and 1994 HBSC-Surveys (I-V), selected questions from the national surveys and questions from the international surveys (e.g. Rimpelä & Rimpelä 1983, Strauch & Meier 1988) (Appendix 2). Items of the scales are presented in Appendix 7.

The same pupils were examined four times: in September 1996 (week 39), December 1996 (week 49), February 1997 (week 8) and April 1997 (week 17). Identification of pupils during the research process was made by asking them to put their signature on the questionnaire each time they filled it in. The data were collected in four comprehensive schools in Jyväskylä using a standardised questionnaire which pupils answered during a class period. After the four measurements a total of 475 pupils had taken part in the study, and the response rate was 65% (Table 11). Among these, 143 boys and 130 girls were in grade 7. The corresponding figures in the 9<sup>th</sup> grade were 83 and 119, respectively. In September 1996 pupils' mean ages were 13.2 years (standard deviation was 0.5 years), 13.2 years (0.4), 15.3 years (0.3) and 15.3 years (0.3).

TABLE 11 Respondents and response rate<sup>1)</sup> in different phases in the Jyväskylä follow-up study in 1996-97

	September 1996	December 1996	February 1997	April 1997
Number of respondents	717	615 <sup>1)</sup>	549 <sup>1)</sup>	475 <sup>1)</sup>
Number of pupils in schools	774	754	754	729
Cumulative response rate, % <sup>2)</sup>	93	82	73	65

1) Number of pupils who had participated in the survey also in previous measurement(s)

2) Percentage of pupils who had participated in all previous measurement(s)

## **8 RESULTS**

### **8.1 Young people's sleep in Finland as compared with other countries (I)**

The first article was based on the 1986 international HBSC data. The objective was to describe sleeping habits and sleeping disorders in Finland as compared with several, mostly European countries. The article focused on sleeping habits such as bedtime and wake-up time during school week, sleep disorders (difficulty in initiating sleep) and feeling of tiredness on school mornings in 11, 13 and 15-year-old children. The associations of selected health behaviours and leisure time lifestyle behaviours with sleeping habits were also investigated. In addition, the correlation between sleeping habits and difficulties with self-reported health status was another major interest.

Sleeping habits varied between age groups and between countries. The older the pupils were, the later was their bedtime. In all age groups, bedtimes varied only by one hour between different countries – Hungarian and Swiss children had the earliest and Spanish children the latest bedtime on school nights. In Hungary children in all age groups went to bed before 22 o'clock, whereas in Spain children even in the youngest age group went to bed at about 22.30. Sleep length during the school week decreased with age in every country. Swiss children had the longest and Israeli and Finnish children the shortest sleep duration on school nights. Swiss children slept about 10 hours per school night at age 11, while Israeli and Finnish children of the same age slept about an hour less. (Figure 4)

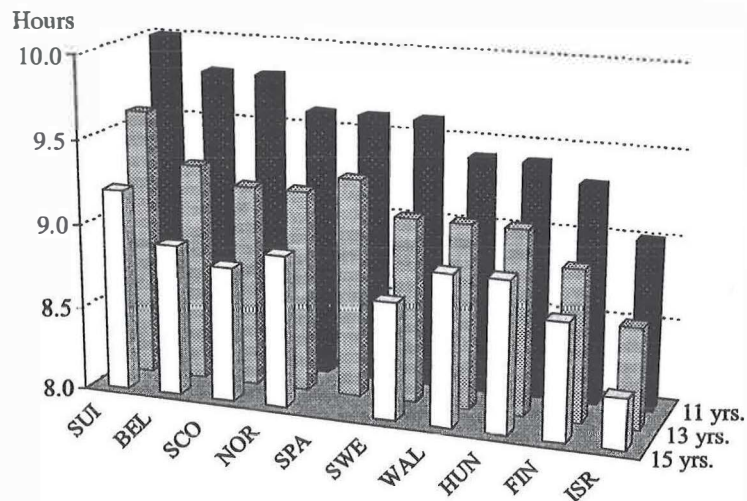


FIGURE 4 Averages of duration of sleep (in hours and decimals) on school nights by age groups and countries in 1986 HBSC-Survey (in Spain the oldest age group was not included in the sample). Abbreviations: SUI = Switzerland, BEL = Belgium (French speaking part only), SCO = Scotland, NOR = Norway, SPA = Spain, SWE = Sweden, WAL = Wales, HUN = Hungary, FIN = Finland, ISR = Israel

Sleep difficulties (difficulty in initiating sleep) varied between countries and between age groups. Difficulty in initiating sleep was most prevalent in the youngest age group in every participating country. Differences between 13- and 15-year-olds were small in most of the countries studied. Overall, Finnish children had more problems with falling asleep than children in other countries.

Gender differences in sleeping habits, sleep difficulties and tiredness on school mornings were small. However, in some countries boys were tired somewhat more often on school mornings than girls, and in almost every country girls were more likely to report difficulties in falling asleep.

Perceived tiredness on school mornings varied between countries and age groups. On the whole, the older the pupils were, the more often they reported tiredness on school mornings. Norwegian and Finnish school children were most often tired and Hungarian and Spanish children least often tired on school mornings: in Norway and in Finland every third, but in Hungary less than every tenth, 15-year-old pupil reported being tired on almost every school morning.

Investigation into the correlations between health habits, leisure time activities and bedtime revealed that in the majority of the countries late bedtime associated significantly and consistently with frequent use of psychoactive substances (tobacco and alcohol), with high levels of watching TV and videotapes and with numerous evenings spent with friends outside home. In addition, indicators of perceived health correlated in most countries significantly and relatively consistently with difficulties in initiating sleep.

## 8.2 Sleeping habits and sleep difficulties by sociodemographic background (II)

The second article was based on the 1990 Finnish HBSC data. The objective was to examine whether there are differences in sleeping habits and sleeping difficulties between selected sociodemographic background indicators such as gender, age group, parents' socio-economic status (indicated by father's occupation), living environment (urban v. rural) and geographical region (southern, central and northern part of Finland).

Adolescents generally had healthy sleeping habits, but with age irregular sleeping habits as well as sleep difficulties became more common. Age and in some cases gender were important determinants of sleeping habits and sleep difficulties. The other sociodemographic variables showed far weaker association with sleeping habits and sleep difficulties.

As adolescents got older, their sleeping habits became more irregular and their bedtimes later. This was more typical of boys than girls. Similarly, the habit of taking naps was more common among older adolescents. Girls took naps more often than boys. Sleep time during school nights did not vary by gender in any age group. Analyses of variance (ANOVA) indicated that sleep time decreased with age, that pupils in rural areas slept longer and that farmer's children slept longer than those from the other occupational groups (Table 12).

Investigation of sleep difficulties showed that most pupils slept well but there was a small minority who had some sleep difficulties. Taken together, age group or gender differences in sleep difficulties were not as clear as in the case of sleeping habits. About 10 to 20% of the pupils in all age groups reported having experienced difficulties in falling asleep at least two times a week or their sleep latency was more than 30 minutes or their quality of sleep was at most "satisfactory". Morning and daytime tiredness increased and early morning awakenings decreased as pupils got older. Daytime tiredness also seemed to be more common among 11- and 13-year-old girls than among boys of the same age. Lighting or noise conditions were given as the most important reason for nocturnal awakenings in all age groups and in both sexes – about every third respondent reported this problem.

TABLE 12 Sleep time during school nights (mean hours and decimals as deviation from the grand mean) by age, living environment and father's occupation (MCA analysis based on ANOVA)

Grand mean of sleep time = 9.00 hours	Unadjusted			Adjusted independents	
	n	Deviation	Eta	Deviation	Beta
Age group					
11	1018	.28		.29	
13	809	-.16		-.15	
15	745	-.22		-.22	
			.37		.38***
Living environment					
Urban era	1562	-.06		-.06	
Rural era	1010	.10		.09	
			.13		.12***
Father's occupation					
White collar	1257	-.01		.01	
Blue collar	1150	-.01		-.03	
Farmers	165	.12		.11	
			.05		.05*
Multiple R <sup>2</sup> = .16					

\* p<0.05; \*\*\* p<.001.

### 8.3 Sleep habits, sleep difficulties and educational expectations (III)

In this article, results gained in the 1990 Finnish survey concerning sleeping habits and sleep difficulties were presented by gender and age group. In the oldest age group, sleeping habits and sleep difficulties were examined with logit-regression analyses using concurrently pupils' gender, educational expectations (college vs. occupational education) and father's occupation as the independent explanatory factors.

In general, differences in sleeping habits and sleep difficulties were greater between age groups than between the sexes. Sleeping habits were less healthy among older pupils, and they also had more sleep difficulties. Boys' sleeping habits were more irregular, for example, they went to bed more irregularly and later than girls in the oldest age group. Most of the 11-15-year-old pupils had regular sleep habits and they slept well, but 5-10 per cent of adolescents had problems with their sleeping habits, such as very irregular bedtime, and sleep difficulties, for example, daily problems with initiating sleep, nocturnal awakenings and daytime tiredness. In the oldest age group, the logit-regression analyses indicated that pupils' gender was the best explanatory factor of sleeping habits and that it also correlated with sleep difficulties. The father's occupational status correlated only with nocturnal awakenings. Pupils' educational expectations did not correlate with sleeping habits or sleep difficulties.

## 8.4 Perceived tiredness, sleep habits and use of psychoactive substances (IV)

The fourth article was based on the 1994 Finnish HBSC data. The first objective was to describe the prevalence of perceived tiredness among 11, 13 and 15-year-olds. The second objective was to investigate, with the help of structural equation models within the framework of LISREL, how perceived tiredness, sleep habits (e.g. bedtime regularity, bedtime during school week) and use of psychoactive substances (alcohol, tobacco and coffee) were interrelated among 15-year-olds.

Perceived tiredness – indicated both by tiredness on school mornings and feeling of tiredness during the six months preceding the survey – increased with age. Gender differences were not so apparent, but boys were somewhat more tired on school mornings (Figure 5) and girls more often reported feeling of tiredness. Prevalences in morning tiredness in the three surveys (1986, 1990 and 1994) may not be comparable due to differences in time of data collection (see caption of Figure 5). Comparison of the 1990 and 1994 results shows similar pattern in all age groups and in both sexes: the proportion of perpetually tired (tired on 4-5 school mornings a week) pupils increased (Figure 5). The preliminary results of the 1998 HBSC-Study (Tynjälä et al. 1998b) show a similar trend.

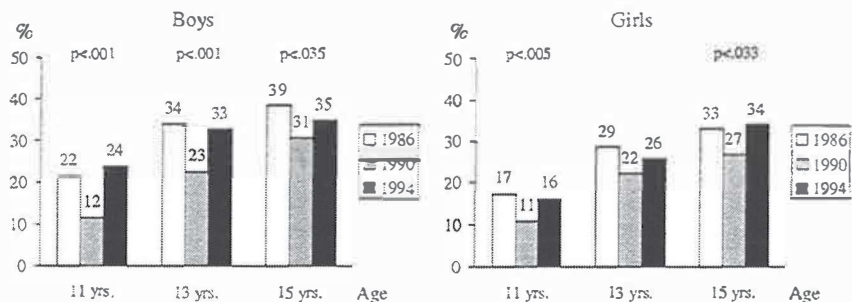


Figure 5 Tiredness on school mornings (on 4-5 mornings a week) by age group, gender and survey year (in 1986 the survey data were collected in January-February and in 1990 and in 1994 in March-May)

The structural equation models for 15-year-olds indicated that interrelationships between perceived tiredness, sleep habits and use of psychoactive substances were statistically significant in both sexes (Figure 6). In the structural equation model for boys, sleep habits and use of psychoactive substances explained 24% of the variance of perceived tiredness. Perceived tiredness and use of psychoactive substances explained 42% of the variance of sleep habits, and the other two factors explained 26% of the variance of the use of psychoactive substances. The corresponding model for girls indicated that sleep habits and

the use of psychoactive substances explained 20% of the variation in their perceived tiredness. Perceived tiredness and use of psychoactive substances explained 16% of the variance of sleep habits, and the other two factors explained 12% of the variance of the use of psychoactive substances.

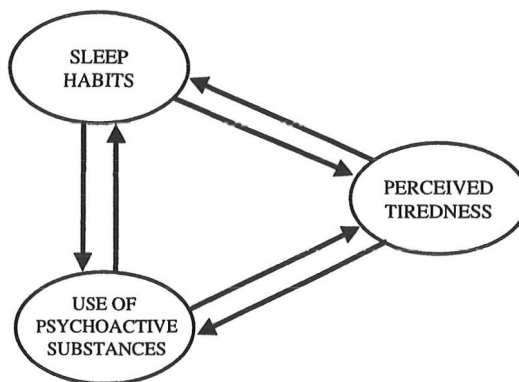


FIGURE 6 Association of sleep habits, use of psychoactive substances and perceived tiredness among 15-year-olds: a simplified presentation (arrows describe statistically significant associations in the regression model; see IV, Figures 1 and 2)

## 8.5 Perceived sleep quality and its precursors (V)

The fifth article was based on the 1994 Finnish HBSC data. The first objective was to describe 11, 13 and 15-year-old adolescents' self reports on how well they sleep (how often they had difficulties in falling asleep, how often they woke up at night and how well in general they slept). The second objective was to investigate possible associations of factors such as self-perception, social relationships, addictive behaviour, sleep hygiene and physical activity with perceived sleep quality in 15-year-olds.

There were no or only slight gender or age group differences in the indicators of sleep quality. About 90% felt that they slept "rather well" or "very well". However, almost every third pupil had had difficulties in falling asleep at least once a week and 5% reported this problem occurring almost every night. In addition, almost every fifth pupil had had nocturnal awakenings every week.

Structural equation models were used to analyse associations of selected behavioural, social and psychological factors with perceived sleep quality among 15-year-olds. The models may be characterised more as interrelationship types than as explanatory types. The analyses were executed separately for boys and girls.

In the model for 15-year-old boys, home atmosphere was the most significant element in relation to subjective sleep quality. Self-perception and health



habits (sleep hygiene and addictive behaviour) were equally important but not as important as home atmosphere. Home atmosphere, self-perception and health habits explained 22% of the variance in perceived sleep quality. Subjective sleep quality together with home atmosphere explained 11% of the variance of self-perception and 14% of the variance of health habits. According to the goodness-of-fit statistics of the model, the fit to the data was good. (Figure 7)

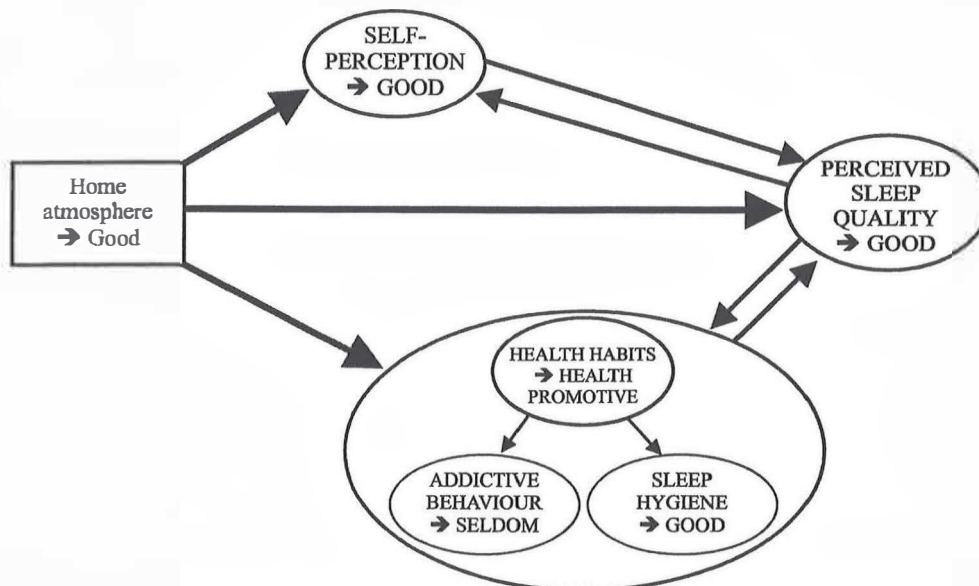


FIGURE 7 Precursors of sleep quality among 15-year-old boys: a simplified presentation (arrows' line thickness describe relative significance of the association; see V, Figure 1)

In the model for 15-year-old girls home atmosphere, self-perception and health habits (sleep hygiene and addictive behaviour) were equally important elements, and together with leisure time physical activity they explained 30% of the variance of perceived sleep quality. Subjective sleep quality together with home atmosphere and leisure time physical activity explained 27% of variance of self-perception. Perceived sleep quality, home atmosphere and self-perception explained 8% of the variance of leisure time physical activity. In addition, subjective sleep quality and home atmosphere explained 29% of the variance of health habits. Self-perception and leisure time physical activity had also significant interrelationship with each other. According to the goodness-of-fit statistics of the model, the fit to the data was not as good as in the boys' model. Except for the Chi-square value and its p-value, all the other parameters of goodness of the model were statistically adequate. (Figure 8)

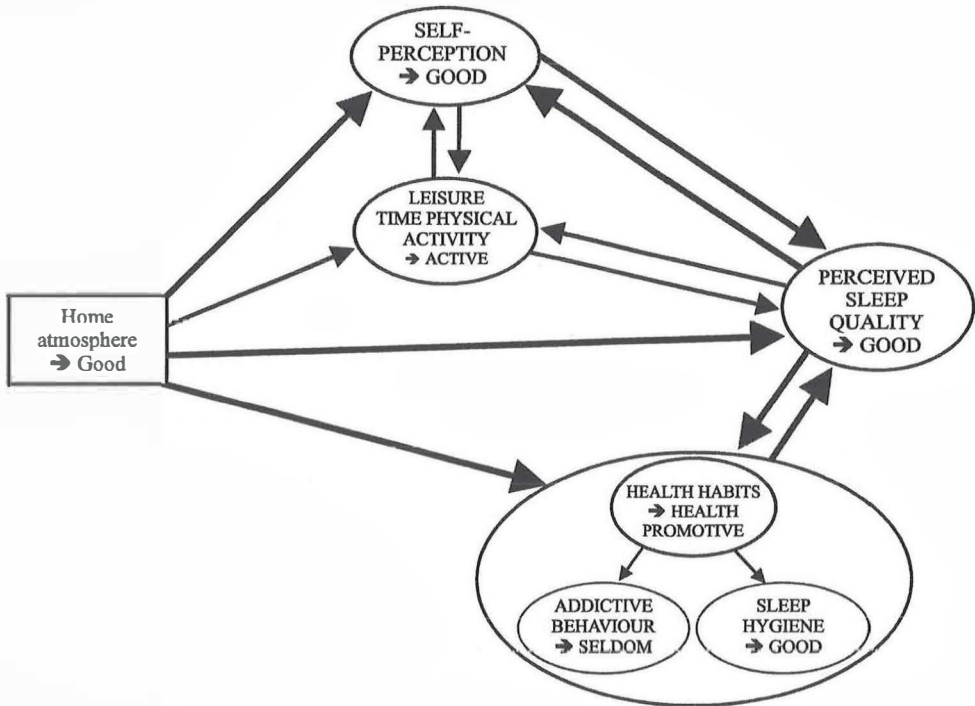


FIGURE 8 Precursors of sleep quality among 15-year-old girls: a simplified presentation (arrows' line thickness describe relative significance of the association; see V, Figure 2)

There were differences in the structural equation models between 15-year-old boys and girls. Among boys home atmosphere was the most important element in associations with perceived sleep quality. Among girls of the same age self-perception, health habits and home atmosphere were equally important in associations with subjective sleep quality. In addition, leisure time physical activity was significant only in the girls' model.

## 8.6 Reliability of scales for perceived alertness and sleep quality (the Jyväskylä follow-up study)

The aim of the Jyväskylä follow-up study in 1996-97 was to test the reliability of scales for the measurement of perceived alertness and for the measurement of sleep quality. These scales were tested at different time points during the school year: in September 1996 (third week), in December 1996 (first week), in February 1997 (third week) and in April 1997 (third week). The results concern the data of 15-year-olds.

The perceived alertness scale consisted of five items (Table 13, Appendix 7). The sumscore of these items varied from 0 to 15, higher values indicating

better alertness. Internal consistency was calculated with Cronbach's Alpha. Statistical parameters for the alertness scale are presented in Table 13. The Cronbach Alpha values varied from 0.79 to 0.85 in boys and from 0.86 to 0.89 in girls. In boys the variable "difficulty in waking up in the morning" had the lowest item-total correlation, 0.38 (in the September measurement). In girls all item-total correlations were at least 0.60 in all measurements. (Table 13)

TABLE 13 Internal consistency and corrected item-total correlations of the alertness scale at different times of the school year among 15-year-old boys (n=79) and girls (n=117)

Item	Corrected item-total correlation			
	September 1996 boys/girls	December 1996 boys/girls	February 1997 boys/girls	April 1997 boys/girls
Tiredness on school mornings	.70/.76	.71/.83	.67/.73	.74/.76
Sleep sufficiency	.59/.66	.69/.63	.54/.74	.49/.74
Difficulty in waking up in the morning	.38/.61	.70/.71	.68/.67	.61/.73
Feeling refreshed and energetic in the morning	.69/.76	.67/.74	.69/.74	.64/.72
Daytime tiredness	.46/.62	.52/.66	.64/.60	.68/.71
Cronbach Alpha	.79/.86	.85/.88	.84/.87	.83/.89

The perceived sleep quality scale consisted of three items (Table 14, Appendix 7). The last two items are part of the psychosomatic symptoms pattern. The sumscore of these items varied from 0 to 12, higher values indicating better perceived sleep quality. Statistical parameters for the sleep quality scale are presented in Table 14. The Cronbach Alpha values varied from 0.74 to 0.84 in boys and from 0.75 to 0.80 in girls. In both sexes the variable "sleep latency" had the lowest item-total correlation: among boys in the April measurement ( $r = 0.47$ ) and among girls in the December measurement ( $r = 0.49$ ). (Table 14)

TABLE 14 Internal consistency and corrected item-total correlations of the sleep quality scale at different times of the school year among 15-year-old boys (n=81) and girls (n=112)

Item	Corrected item-total correlation			
	September 1996 boys/girls	December 1996 boys/girls	February 1997 boys/girls	April 1997 boys/girls
Difficulty in falling asleep	.76/.71	.71/.69	.71/.69	.74/.70
Nocturnal awakenings	.69/.55	.59/.60	.64/.53	.52/.66
Sleep latency	.69/.55	.68/.49	.51/.62	.47/.58
Cronbach Alpha	.84/.77	.81/.75	.78/.77	.74/.80

Polychoric correlations and confirmatory factor models at four different points in time during the school year are presented in Appendices 3-6. The models were done separately for boys and girls. According to the goodness-of-fit statistics of the models, the statistical fit to the data was satisfactory. In addition, the alertness factor and the sleep quality factor correlated statistically significantly with each other, except among boys in December 1996. The correlation indicates that good sleep quality also suggests good alertness. Reliability coefficients ( $R^2$ ) were all at least 0.29, that is, the factor structure could explain at least 29% of the variance in the variable in question. (Appendices 3-6)

In summary, evaluation of the internal consistency and results of the confirmatory factor analyses suggest that both the alertness scale and the sleep quality scale are acceptable in the statistical sense. In addition, internal consistency and factor models seem to be rather independent of the time of data collection.

## 9 DISCUSSION

### 9.1 Main results

During adolescence children's sleep habits change; they go to bed later and bedtimes become more irregular. Moreover, older adolescents' sleep duration is shorter than that of preadolescents. The difference in sleep duration between school nights and weekend nights is often considerable, which suggests that adolescents compensate for short sleep during school nights by sleeping longer at weekends. These age related changes in adolescents' sleep habits conflict with the fact that during adolescence the need for sleep, in fact, increases due to rapid biological maturation (e.g. Anders et al. 1980, Carskadon & Dement 1987, Carskadon 1990b). Therefore short sleep length during school nights may result in sleep deprivation and tiredness and poor functioning the next day.

Tiredness (sleepiness) seems to be quite a typical phenomenon in adolescence. In addition to irregular sleep habits, tiredness seems to be associated – more strongly among boys than girls – with frequent use of psychoactive substances such as alcohol and tobacco. In contrast, good home atmosphere, health promotive lifestyle and good self-perception are important constituents of good sleep quality and alertness among adolescents.

Interrelationships between sleep habits, the use of psychoactive substances and perceived tiredness (IV) among 15-year-old Finns proved to be reciprocal, that is, each corner of this “triangle” – e.g. sleep habits – had effect on the other two corners – the use of psychoactive substances and perceived tiredness. In this thesis the emphasis was on perceived tiredness. The other two factors, sleep habits and the use of psychoactive substances, explained at least 20% of the variance of perceived tiredness in both sexes. Statistical models indicated that when inquiring about adolescents' tiredness it is important to ask about their sleep habits and use of psychoactive substances because they may be important reasons for perceived tiredness.

Other studies have indicated that adolescents' sleep rhythm is also affected by their circle of friends and the pressures exerted by it, which may strictly regulate bedtimes. Part-time jobs, sport activities and hobbies can also reduce the hours reserved for sleep. In addition, the habit of taking naps as well as later bedtimes at weekends and holidays can contribute to the problem of sleepiness and lead to erratic sleeping schedules (Carskadon 1990b, Dahl 1998). In Finland further research should attempt to elaborate the relationships between adolescents' tiredness and different behavioural factors. The association of tiredness and school performance would also be worth investigating (cf. Wolfson & Carskadon 1996, Hofman & Steenluf 1997, Wolfson & Carskadon 1998). Further research should also take into account some additional factors, for example, the role of beverages and foods containing caffeine (high energy drinks, cola drinks, chocolate, etc.) as well as the amount and scheduling of time spent watching television and videotapes and using the Internet.

Structural equation modelling made it possible to specify which elements of the psychoactive substance usage factor were significant with regard to perceived tiredness (cf. Lexcen & Hicks 1993, Aarø et al. 1995). Regarding the use of psychoactive substances, smoking and frequent and excessive use of alcohol were all equally important in the boys' psychoactive substance use factor, whereas smoking was the most important element in the girls' substance use.

The role of alcohol is important in relation to sleep. Use of alcohol can facilitate sleep onset but it can also disturb sleep by decreasing delta activity and REM sleep (e.g. Dahl 1998). In addition, alcohol is a diuretic substance. In Finland beer drinking is very popular among adolescents (e.g. Ahlström et al. 1994). Drinking a lot of beer results in an increased need to go to the toilet. If this occurs during night it also disrupts sleep. Thus, using alcohol may cause sleep difficulties. In contrast, infrequent use of alcohol in combination with regular sleep rhythm and adequate sleep duration seems to be associated with better sleep quality, less sleepiness and better daily functioning.

The results of the Finnish school children's data in the 1990 and the 1994 surveys (II, III, IV, V) confirmed that age and in some cases gender were the most important background factors with regard to children's sleep habits, sleep difficulties and perceived tiredness. The father's occupation, living environment (urban/rural) or geographical region in Finland were less important factors. Concerning gender differences, boys seemed to have more irregular sleep rhythms, and girls seemed to report daytime tiredness or feeling of tiredness more often than boys (II, III, IV). This study also supported the notion that shifts in bedtime and wake up time between the school week and weekends are quite common among adolescents (IV), and may lead to erratic sleep schedules and to the problem of sleepiness (see Kirmil-Gray et al. 1984, Carskadon 1990b, Dahl 1998).

On a general level, the findings of the present study, especially the models of sleep quality (V) have interesting similarities with equilibrium theories of health and system theoretical approaches (e.g. Puroola 1972, Pörn 1984, Nordenfelt 1986, Hyyppä 1987, Pörn 1988, Hyyppä 1989, Pörn 1990, Rimpelä 1991). According to Rimpelä (1991), nutrition, physical strain and rest, mental strain and relaxation, and relationships with other people are essential elements of health.

The balance between these different elements appears as good health. Similarly, the structural equation models developed in the present study suggest that good sleep quality among adolescents can be described as a result of the balance in the interrelationships between a good home atmosphere (good human relationships), good self-perception and health promotive habits. A characteristic of good sleepers is general mental and physical well-being (cf. Hyyppä et al. 1991).

### 9.1.1 International comparisons

In the 1986 international comparison the most tired children on school mornings were Finnish and Norwegian children (I). The results from the 1994 HBSC-Study revealed that the situation had not changed much: children in Norway and other Scandinavian countries as well as in Austria were still most tired on school mornings (King et al. 1996, see also Tynjälä et al. 1998b).

Morning tiredness among Finnish children may be due to a too short sleep duration during school nights because Finns had the second shortest night's sleep in the international comparison (Israeli youth had the shortest). In Norway, the data were collected in November-December 1985 when daylight is short in Nordic countries. However, interpreting differences between countries is very difficult and would require more than a general background knowledge about each country and its culture. A more detailed study of the differences between the countries would be an interesting topic for future research.

International comparisons indicate that in most participating countries sleeping habits seem to be consistently associated with the use of psychoactive substances and with some leisure time activities. In addition, difficulty in falling asleep was correlated with many other indicators of health in most of the countries that participated in the 1986 HBSC-Study. These results suggest the universal – country independent – nature of these associations. Results of the 1986 HBSC-Study (I) show that sleeping habits, sleep difficulties and subjective morning tiredness varied by age group. As their age increased children went to bed later, slept less during school nights and were more tired on school mornings. However, difficulty in falling asleep was less prevalent among older adolescents than in the youngest age group.

### 9.1.2 Tiredness among youth

Tiredness experienced by Finnish school children is a key problem (see King et al. 1996, Tynjälä et al. 1998b) and needs further attention. At least every third pupil reported morning tiredness on almost every school morning or felt tired more often than once a week (IV). This leads to an assumption that a large proportion of pupils in every classroom has a weakened ability to concentrate on school work or other activities. Besides real physical fatigue, tiredness on school mornings may reflect the subjective feelings of adolescents when completing the questionnaire. Tiredness on school mornings may also be a sign of a stre-

nuous lifestyle (see Rahkonen et al. 1992). The results (IV) supported this notion: morning tiredness together with frequency of feeling tired correlated with sleep habits and use of psychoactive substances (alcohol, tobacco and coffee) among 15-year-old Finns.

The results found in this study are in line with a recently presented summary of developmental changes in sleep regulation in adolescence: 1) there is an increase in daytime sleepiness; even though adolescents get the same amount of sleep as in earlier years they show more objectively measured daytime sleepiness than pre-pubertal children; 2) there appears to be a circadian shift near puberty which manifests itself as a strong tendency to stay up later at night and to sleep later in the morning; 3) there are many social influences further contributing to the tendency to stay up late at night, particularly at weekends. (Dahl 1998.)

The results indicated that regular and early bedtime is important in relation to alertness (IV). The significance of a regular sleep rhythm has received support from the study conducted by Manber and colleagues (1996). They found that among college undergraduate students the combination of adequate sleep duration and regular nocturnal sleep schedules was superior to adequate sleep duration alone in decreasing reported daytime sleepiness. This combination also had favourable effects on sleep in general by decreasing latency to sleep onset and increasing sleep efficiency. This finding is a strong argument for the importance of regular sleep rhythms and adequate sleep duration for maintaining a good level of daily functioning.

An interesting question arose in this study concerning the effect of the length of daylight on children's tiredness and alertness. Time use studies in the Finnish population have shown that the length of sleep does not vary significantly by season or by the length of daylight on workday nights (Niemi et al. 1991, Niemi & Pääkkönen 1992). The HBSC-Study design does not lend itself to investigate seasonal variations in sleep because the data collections were administered within a few (2-3) months. However, seasonal variation in tiredness was investigated in the Jyväskylä follow-up study (Tynjälä et al. 1998a) by measuring perceived tiredness four times (September, December, February, April) during a school year 1996-97. Preliminary results indicated that 13- and 15-year-old pupils were most tired in December – the darkest time of the year – and more alert during spring time. The length of daylight in Jyväskylä is almost three times greater in April (third week: about 15 hours and 20 minutes) than in December (first week: about 5 hours and 45 minutes). This suggests that light may have had some effect on pupils' alertness. There may also be other factors that may have affected pupils' alertness, for instance, variations in school stress at different points in the school year. Adolescents may have had more home work in November and December and have therefore had to stay up later. In addition, maturational factors may be related to alertness, because, after all, the pupils were eight months older in April 1997 than during the first measurement in September 1996. Thus, definite conclusions about the role of light in relation to alertness and tiredness are difficult to make, and the matter merits further investigation.



Future research should also examine how sleep habits, sleep difficulties and tiredness relate to school motivation and school performance. Earlier studies have shown that children with poor school performance have more psychosomatic symptoms, including sleep difficulties (e.g. Aro et al. 1987). Children with poor sleep quality and greater sleep lag (difference in sleep duration between school nights and weekend nights) also do not do well at school (Kahn et al. 1989, Hofman & Steenhof 1997, see also Wolfson & Carskadon 1998). In addition, preliminary results from the HBSC-Study in 1998 (Tynjälä et al. 1998b) support the finding that many school related factors, such as poor teacher-pupil relationships and poor school motivation, correlate with lowered alertness, which may result in poor performance at school.

### 9.1.3 Models of sleep quality

Factors associated with perceived sleep quality among 15-year-olds were investigated (V). Results indicated that about every tenth pupil felt that their sleep quality was at most satisfactory. About 30% of pupils had also had difficulties in falling asleep and almost every fifth adolescent reported nocturnal awakenings every week. These prevalences were relatively high. In addition, at least every third 15-year-old pupil was tired on almost every school morning or reported feelings of tiredness more often than once a week (IV).

Investigation of the factors associated with good perceived sleep quality among 15-year-old Finns (V) revealed interesting and new information concerning gender differences. Among boys home atmosphere seemed to be the most important element, among girls of the same age self-perception, health habits and home atmosphere were all equally important elements in associations with subjective sleep quality. It may be concluded that good relationships at home form an important ground for positive self-perception and health promotive habits, which all correlate with good subjective sleep quality. These results support the idea that good relationships with parents and family support in general have salutary effects on adolescents' psychological well-being (cf. Healey et al. 1981, Reicher 1993, Vilhjalmsson 1994).

Physical activity was a significant factor in the sleep quality models only for girls. Nevertheless, the role of physical activity in relation to good sleep (see Shapiro et al. 1984) should also be taken into consideration for boys. Physical activity, for statistical reasons, was not included in the final statistical model as other elements in the model had higher correlation with sleep quality.

In future research the role of family relationships and social support in the family and the associations of these factors with adolescents' sleep and subjective health in general should be covered in more detail, not only in cross-sectional studies but also in follow-up studies. In the present study only one question measured family relationships, but even that proved to be of great importance concerning adolescents' subjective sleep quality. Good family relationships have a 'protective' effect in relation to adolescents' health and in a broader sense to their well-being (see Aro 1988, Nestmann & Hurrelmann 1994).

## 9.2 Methodological aspects

### 9.2.1 Sampling

In a large-scale survey like this, one critical question is sampling or how the subjects of the study have been selected. The HBSC-Study has adopted strict sampling procedures that were agreed upon by the WHO/HBSC committee, and each country adhered to these requirements. In summary, samples had to be comprised of pupils within three age groups with at least 1000 pupils in each age group in each country. The mean ages in the age groups had to be as close as possible to 11.5, 13.5 and 15.5 years. These samples had to be statistically representative of pupils in each age group in the whole country. Sampling units had to be based on actual classroom units. Stratification by regions, type of municipalities, or other relevant criteria was accepted. In addition, some special recommendations were made if a country had a heterogeneous population due to the size of the country, many ethnic groups, cultures or languages. (Aarø & Wold 1986.)

In Finland the same sampling procedure was used in each survey year to ensure comparability between different survey years. Schools for the study were selected using cluster sampling in such a way that the size of schools was taken into consideration (probability proportional to size of school, PPS); within the school the class was randomly selected. Response rates (Table 6) indicated that losses were very small in each survey year. After the data cleaning process the samples were still large enough to make generalisations regarding all three age groups. In the 1994 survey, old school registers from the school year 1989/1990 were used to select the schools for the sample. This did not influence the bias in the sample but the sampling error was about 1% higher. Comparisons between the original sample and the actual sample by stratum, gender and grade in each survey year indicated that they did not differ statistically significantly from each other. In addition, response rates were very high in each survey year, and losses consisted of pupils absent from school on the data collection day. Thus, the samples in each survey year may be regarded as representative of the whole country, and generalisability of the results of this study should not be a problem.

In the separate Jyväskylä follow-up study, the number of cases was limited ( $n = 475$ , 202 of whom were 15-year-olds), though the response rate after four measurements was 65%. In spite of the limited number of cases, the structure of the sleep quality scale and the perceived alertness scale obtained by confirmatory factor analysis was very similar to that of the corresponding scales in the Finnish HBSC-Study in 1998 when the same scales were applied to 15-year-olds (see Tynjälä et al. 1998b). Accordingly, the results of the follow-up study may be generalised to apply to the whole age group.

### 9.2.2 Comparability of data

Another critical point in a large scale survey with international comparisons is the matter of ensuring the comparability of data between the countries. To that end the questionnaire was developed in collaboration with each participating country. Before its acceptance, the final form of the international questionnaire was pre-tested in several countries using the national language of each country. Necessary modifications were made to the questionnaire after the pre-testing process. After that the final international English version of the questionnaire was translated into national languages in each country. Thereafter the national versions of the questionnaire were retranslated into English by two independent translators. These translations were carefully compared to the international version. Any deviations from the international questionnaire were identified and altered or were reported to the responsible coordinator of the HBSC project. Thus, all questions measuring sleeping habits and disorders were carefully structured in order to make sure that the respondents understood the questions in the same way and to ensure comparability between countries as far as possible. However, despite the careful checking of the questionnaire, one response category ("About once a week") was erroneously omitted from the question concerning difficulties in falling asleep (I) from the Finnish questionnaire. This biased the results of the Finnish children.

Another matter that must be taken into account is the comparability of national data between different survey years. The problem with the Finnish data is the time of data collection. The 1986 data were gathered in January-February and the 1990 and 1994 data were collected in March-May. This difference may have affected students' answers to certain critical questions regarding seasonal circumstances. This is what the results of the Jyväskylä follow-up study on pupils' alertness during a school year seem to suggest. Alertness was the highest in September, lowest in December, and increased again during spring term. More detailed investigation revealed that pupils' alertness did not vary significantly between February and April. (Tynjälä et al. 1998a, see also Niemi et al. 1991, Niemi & Pääkkönen 1992.)

### 9.2.3 Validity

Validity is a complex matter and it may be approached from different viewpoints. Traditionally, validity has been defined as the extent to which an instrument measures what it is supposed to measure (e.g. Berger & Patchner 1988). Recent definitions of validity give the concept broader meaning referring to the interpretations and inferences that can be appropriately and meaningfully made on the basis of the results of the study (Standards for Educational and Psychological Testing 1985, Streiner & Norman 1995, McDowell & Newell 1996, Nummenmaa et al. 1997). Thus, validity is no longer considered as a property of the individual measurement but rather as a quality of the whole study. It can be assessed with content-related, criterion-related and construct-related evidence (Standards for Educational and Psychological Testing 1985).

One aspect of validity is content validity, which refers to the comprehensiveness of the questions in relation to the phenomenon to be studied or to how adequately the sampling of questions reflects the aims of the index that were specified in the conceptual definition of its scope (McDowell & Newell 1996). In this study the comprehensiveness of the questions was attained by compiling the measures and indexes on the basis of earlier studies. The content validity of sleep quality (V) could have been improved if the suggestions of Åkerstedt and colleagues (1994) had been available when designing the sleep related questions for the 1994 HBSC-Study questionnaire. Åkerstedt and colleagues (1994) concluded that sleep quality is mainly a question of sleep continuity and that the index of sleep quality should include the following measures: (general) sleep quality, calmness of sleep, easiness of falling asleep, sleeping throughout the night and freshness after sleep. In the present study (V) the following three questions were used: 1) difficulty in falling asleep, 2) nocturnal awakenings and 3) general sleep quality. Later, in the Jyväskylä follow-up study, the general sleep quality question was replaced with a question about sleep latency which Monroe (1967) found to be a valid indicator of sleep quality.

Content-related evidence of validity can also be acquired from factor analysis (McDowell & Newell 1996). In the present study, confirmatory factor analysis was used to test whether the items intended to measure the quality of sleep and the items intended to measure alertness (Jyväskylä follow-up study) would be grouped under the expected categories. The results of the factor analyses indicated that questions relating to sleep quality as well as questions relating to alertness were well grouped under the sleep quality dimension and the alertness dimension, respectively.

In the HBSC-Study, the questions used in the international version of the questionnaire were also tested in pilot studies which included separate, specific validation studies. For example, in Wales a study was carried out in which students' answers to the questions about their smoking behaviour were compared with the concentration of thiocyanate in their saliva. The conclusion of this study was that adolescents proved to be honest respondents. In addition to these specific criterion-referenced studies, the relevance of the questions and their ability to collect the desired information was investigated in pilot surveys in several participating countries.

The most essential aspect of validity is construct validity. It refers to the way in which the phenomenon to be studied is theoretically constructed and conceptualised and further operationalised (Standards for Educational and Psychological Testing 1985, Streiner & Norman 1995). In the present study, sleep habits, sleep difficulties and quality of sleep are theoretical constructs about the nature of sleep and sleep behaviour. These constructs arise from the conceptual framework developed on the basis of previous research on sleep behaviour in Finland and elsewhere. The conceptual and theoretical framework itself provides a basis for construct validity, for it specifies the meaning of the constructs, distinguishes them from other constructs and indicates how measures of the constructs should relate to other variables (Standards for Educational and Psychological Testing 1985). In addition, construct-related evidence for validity can

be obtained from variety of sources. For example, reassuring construct validity involves careful test development within the conceptual framework of the study. Therefore the above described pilot studies and confirmatory factor analyses related to content validity also provide construct-related evidence for validity; there is no sharp distinction between test content and test construct (Standards for Educational and Psychological Testing 1985).

In the present thesis, the national questions in Finland concerning sleep habits and sleep difficulties (Appendix 1) were the same or slightly modified versions of the questions used in earlier studies in Finland (Partinen 1982, Partinen & Rimpelä 1982, Rimpelä & Rimpelä 1983, Hyyppä & Kronholm 1987, Urponen et al. 1988) or elsewhere (e.g. Monroe 1967, Bixler et al. 1979, Welstein 1983, Kirmil-Gray et al. 1984) among adolescents and adults. Thus the questions had been shown to be theoretically sound and useful for empirical investigations. One critical point is whether it is appropriate to use the same questions for adolescents and adults. This notion is related to the question of how well/correctly 11, 13 and 15-year-old children understand the concepts used in the study (see Valkonen 1981). The validation process therefore requires paying careful attention to aspects of measurement such as test format, administration conditions, or language level, that may affect test meaning and interpretation (Standards for Educational and Psychological Testing 1985). As earlier described, the test format was developed through several international and national pilot studies. In order to make questions as understandable as possible, the questions in this study were formulated in such a way that the terminology used was as concrete as possible, for example, instead of the Finnish word "vi-reisyys" (alertness) the word "väsymys" (tiredness) was used because "väsymys" is used more frequently in everyday speech. The administration conditions were also carefully planned to convince the participants of the confidentiality of their responses and to ensure that the data collection conditions were the same in all participating schools.

In sum, many careful test development on the basis of previous literature and pilot studies and the continuing process of repeating the HBSC-survey in several countries and across time provide a good basis for the validity of the study (cf. Piette et al. 1993).

#### **9.2.4 Reliability of the measurements**

Reliability refers to the extent to which a measurement is free from random errors (e.g. McDowell & Newell 1996). For practical purposes reliability is defined as the extent to which a measuring instrument is stable and consistent. The instrument should measure the phenomenon in question the same way in different circumstances and at different time points (Hyyppä & Kronholm 1994). One important feature of reliability is repeatability, that is, if we administer our instrument over and over again it should yield the same results if the property of being measured has not changed between the measurements (e.g. Berger & Patchner 1988).

The present study included questions both about exact facts, for example, respondents' gender and grade, and estimated facts, such as number of cigarettes smoked a week, frequency of difficulty in falling asleep and bedtime during school week (see Eskola 1971). Questions about children's health habits and perceptions of sleep quality also belong to estimated facts. Reliability of this kind of measurements is greatly affected by respondents' memory and the nature of the phenomenon studied. When studying regular habits, such as smoking frequency or bedtime during school week, it is usually easy for children to answer the questions. (see Rimpelä & Telama 1979.) Valkonen (1981) has also concluded that measurements of the behaviour frequencies – for example health habits in this study – are generally quite reliable. Some questions may produce less reliable answers. A case in point is bedtime because it does not necessarily correspond to time when sleep commences and may thus result in miscalculation of the duration of sleep. However, these kind of errors in estimation and measurement can be assumed to be evenly distributed throughout the samples and therefore they need not be regarded as harmless to the general reliability.

In this study reliability has been improved by asking several questions about each topic of interest. Internal consistency was estimated with Cronbach's Alpha and confirmatory factor analyses. An important advantage of the confirmatory factor analyses is that it makes it possible to analyse the structure of the scales and estimate reliability in each subscale concurrently (Nummenmaa et al. 1997). The Cronbach Alpha was 0.66 in the sleep quality index (V). In the Jyväskylä follow-up study the alpha values were all at least 0.79 in the alertness scale and 0.74 in the sleep quality scale. This suggests that the sleep quality scale in the Jyväskylä follow-up study had better internal consistency than the one used in the HBSC-Study (V), though the number of items (3) included in the scale was the same. The only difference was that instead of asking how well adolescents generally slept (V) a question of sleep latency was used (Appendix 2).

Reliability was also estimated in a separate test-retest study in one comprehensive school in Jyväskylä. One general problem with the study was the small number of cases ( $n=68$ ). It should have been higher, especially in the confirmatory factor analyses, in order to get more accurate estimates (McDowell & Newell 1996). Another possible problem was the ordinally scaled variables and their skewed distributions. This problem was avoided by computing polychoric correlations and using a weighted least squares (WLS) estimation method (see Jöreskog & Sörbom 1993). In addition, a problem might be related to the interval between measurements. On the one hand, if the interval between measurements is too short, subjects may remember how they responded the first time, which leads to over-estimation of reliability. On the other hand, if the interval is too long, the property being measured may change, which leads to underestimation of reliability. (Berger & Patchner 1988.) There was an interval of one week between the measurements in our test-retest study. The interval was the same as in the study conducted by Torsheim and colleagues (1996) in Norway among adolescents of the same age group. This made it possible to compare the results of these two studies.

In the first phase of the test-retest study, simple descriptive stability rates were calculated. The problem is that this measure may be biased by the number of response categories in each item. That is, the more response categories in the question, the poorer stability rates (shifts between categories). The stability rates gained in this study supported this notion (see Figure 3). The stability rates varied between about 40 and 90 per cent. The greatest stability rate was in the question about daytime tiredness compared with other pupils – about 90 per cent answered this question in exactly the same way in the two measurements. The lowest stability rate was calculated for the question measuring feeling of tiredness. A low stability rate does not necessarily mean that the question is not reliable. It may also indicate state dependency, that is, the phenomenon may vary during a short period of time. Circumstances may also change and distort the results.

In the second phase of the test-retest study, the Pearson product moment correlation coefficients, the intraclass correlation coefficients (ICC) and the Kappa coefficients were calculated. Most of the items showed fair test-retest stability: Kappa values were in the range 0.4-0.6 and the ICC and Pearson values in the range 0.6-0.8. We were also able to compare the coefficients calculated in our study to those calculated in another study conducted in Norway (Torsheim et al. 1996). The item in question concerns adolescents' difficulty in falling asleep. In our study, both the ICC coefficient and the Pearson coefficient were 0.79 and the Kappa coefficient was 0.41. In the Norwegian study, the corresponding values were 0.72 and 0.43. The coefficients were very similar in these two studies, which indicates that the question measured difficulty in falling asleep equally reliably.

In the test-retest study, ICC coefficients and Pearson coefficients for the sumscore of sleep quality (3 items) and the sumscore of alertness (5 items) were calculated. Table 10 indicates that on average the sumscores exhibited slightly higher test-retest reliability than the items individually. This result lends support to the notion that by using indexes we get a more reliable picture of the phenomenon. Boys had higher ICC and Pearson coefficients than girls in the sumscores. On the one hand, this may suggest that boys' perception of sleep quality and alertness is more stable over time, even though the interval was only one week. On the other hand, it may indicate that for some reason the property being measured changes more easily among girls.

Studies of reliability and internal consistency should have been made much earlier – in the beginning of the study series. However, different measures of reliability used in this study – internal consistency, stability rate, Kappa coefficients, intraclass correlation coefficients (ICC) and Pearson product moment correlation coefficients – proved to be at least fair and in some variables relatively high. Thus, selection of questions to measure sleep and related matters may be regarded as quite successful with a few exceptions.

### 9.2.5 Considerations in measuring sleep habits, sleep difficulties and tiredness

How reliable and accurate are subjective data (e.g. questionnaires) on sleep in comparison with data obtained by objective methods (e.g. EEG features of sleep)? Previous research has produced inconclusive results. Monroe (1967) found that subjectively poor sleepers also slept worse than subjectively good sleepers when measured by objective characteristics of sleep (e.g. EEG features of sleep, rectal temperature, body movements, basal skin resistance and phasic vasoconstrictions). Other studies have confirmed Monroe's findings (Johns 1975, Saletu 1975, Coates et al. 1982). Nonetheless, Armitage and colleagues (1997) discovered that sleep quality, depth and the degree to which people felt rested upon awakening were not strongly correlated with objective sleep characteristics.

Comparisons of subjective and objective data on estimates of sleep latency, number of nocturnal awakenings and total sleep time have similarly produced somewhat conflicting results. According to Baekeland and Hoy (1971), healthy young men could accurately estimate sleep latency and number of nocturnal awakenings when data from sleep logs and EEG sleep were compared. These findings have been supported in some other studies (Haynes et al. 1985, Rogers et al. 1993, Armitage et al. 1997). However, many studies have detected overestimation of sleep latencies and underestimation of total sleep length both among good sleepers and insomniacs (Lewis 1969, Johns 1975, Carskadon et al. 1976, Bonnet & Moore 1982, Coates et al. 1982). Bonato and Ogilvie (1989) used a behavioural response monitor of sleep and wakefulness. They found that first-year undergraduate subjects could adequately report how long they had slept but consistently underestimated the number of arousals. Moreover, they were unable to reliably specify sleep-onset latency. Overestimation of the number of nocturnal awakenings was also typical among healthy young males in Lewis's study (1969). Johns (1975) got opposite results and concluded that his subjects, healthy males, could not remember short awakenings the next day.

In the Finnish population based study of 35- to 55-year-olds Kronholm (1993) compared data from sleep habit questionnaires and sleep logs. In the sleep habit questionnaire subjects reported earlier bedtime and wake-up times than they did in sleep logs. On the basis of the sleep questionnaire subjects also slept less when compared to the data from the sleep diary. However, sleep latency responses did not differ between the sleep questionnaire and the sleep log. In addition, subjects who reported difficulties in falling asleep on the basis of the sleep habit questionnaire reported this difficulty also in the sleep diary.

Few studies have compared children's estimates of sleep with information from other sources. In Finland, Saarenpää-Heikkilä and colleagues (1995) used a questionnaire to study schoolchildren's (age 7 to 17) own estimates of their sleep habits and sleep disorders and then compared this information with their parents' estimates of their sleep. Children's and parents' estimates were mostly in concordance. There were, however, some minor deviations in sleep disorders



among older children. Children's and parents' assessments of daytime sleepiness also differed slightly.

For the purpose of objectively measuring diurnal somnolence the Multiple Sleep Latency Test (MSLT) was introduced in the late 1970's (Carskadon & Dement 1977, Richardson et al. 1978). MSLT has proven to be a reliable and valid test (e.g. Carskadon & Dement 1987). It has been widely used in different age groups and both in healthy subjects and in clinical settings (e.g. Carskadon & Dement 1979, 1987, Kronholm et al. 1995). However, in the present study it was not possible to use MSLT or other objective measures because they would have required sleep laboratory settings.

While accurate description of sleep characteristics in terms of sleep stages in individual subjects requires electronic monitoring methods like EEG, previous studies give reason to believe that a lot of information on sleep habits and subjective tiredness can be obtained using a detailed sleep questionnaire or test (e.g. Åkerstedt & Gillberg 1990, Johns 1991). These methods can give an overall picture of a person's sleep pattern, wakefulness and sleepiness that could not be derived from electronic monitoring methods used only at night in a sleep laboratory. (Johns et al. 1971.) If EEG measures and subjective ratings of sleep quality do not seem to correlate, the assumption is that subjective experiences may not always have corresponding objective correlates. Low or weak correlations between objective and subjective estimates of sleep do not necessarily diminish the importance of subjective data in the study of sleep quality. Rather, they suggest that there are aspects of sleep quality that may best be studied phenomenologically rather than physiologically. (Zammit 1988.) Moreover, Evans (1977) has contended that the usefulness of subjective sleep estimates does not depend on their correlation with EEG sleep and that reported (experienced) sleep difficulties, such as difficulty in initiating sleep or maintaining sleep, should therefore be taken seriously in spite of EEG findings. Furthermore, Johns (1975) has reminded us that most hypnotic drug prescriptions are written on the basis of a person's subjective reports without any objective investigation.

### **9.3 Practical implications – adolescents' sleep and challenges for health promotion**

In the adolescent years several arenas are important for the development of healthy sleeping habits and health promotive habits in general. The importance of home and family should be stressed. Parents should pay attention to their children's bedtimes in order that children learn and understand the importance of regular bedtime and the restorative function of sleep. Studies on child rearing practices have demonstrated that the way in which parents rear their children is associated with children's health behaviour. For example, Pulkkinen (1984) has studied adolescents' lifestyle and its association with child rearing practices from a longitudinal perspective. Adoption of a healthy lifestyle (e.g. infrequent substance use) was associated with a 'controlling' rearing style. Ty-

pical features of this rearing style were control over children's actions, democratic family atmosphere (it was easy for the children to talk to parents; parents supported and had confidence in their children), encouragement in school work and sympathy for the children. In this rearing style parents trusted their children, were interested in their daily life, treated them fairly and gave advice when the children needed it.

Nestmann and Hurrelmann (1994) also suggested that good family relationships probably have a 'protective' effect in relation to adolescents' health and in a broader sense to their well-being. The present research revealed that adolescents slept more and were less tired in countries where parental control seems to be rather strict, for instance, in Hungary, Switzerland, Belgium and Austria. In the Nordic countries parents do not seem to have such control over their children's bedtimes and waking-up times. As a result the number of tired adolescents is growing in these countries. However, more research is needed to clarify the relationships between different child rearing practices and adolescents' sleep habits in different countries.

### **9.3.1 The role of school health promotion and health education**

From a health promotion point of view, school is another arena responsible for teaching adolescents sleep promoting skills such as good sleep hygiene. Adolescence is an important stage in the adoption of a healthy lifestyle because the ways in which adolescents learn to deal with sleep disturbances may set the pattern for how they deal with them later in life (Kirmil-Gray et al. 1984). Proper sleeping skills are important in relation to quality of life and health, and they even have an important economic dimension in society (Shapiro & Dement 1993, Hyyppä & Kronholm 1997). Sleep habits, sleep disorders and related matters should therefore be seen as an equally important area in school health education as, for example, alcohol, smoking and physical activity.

Investigation into a textbook used in Finnish secondary schools (Korhonen et al. 1989) revealed that the lesson on sleep habits and sleep disorders consisted of the following topics: reasons for fatigue (disabling tiredness), relaxation and stretching, the significance of sleep (why we sleep) and factors promoting deep and refreshing sleep. However, we know very little about the extent to which sleep and related matters are taught and discussed in Finnish comprehensive schools, and this matter needs to be investigated in the future. It is also common that matters related to sleep habits and sleep difficulties are taught to pupils during such diverse lessons as physical education, biology and health education.

It is difficult to formulate concrete guidelines for health education because value judgements about what are healthy and unhealthy sleeping patterns are highly debatable. Sleeping rhythm and need for sleep, for example, can vary from person to person (Arajärvi 1981). However, in adult studies those adults who slept 7-8 hours a night had the best health outcomes in comparison to persons whose average sleep duration was either longer or shorter (Belloc & Breslow 1972, Belloc 1973). In the adolescent years sleeping on average 8-9 hours per

night is a good starting point, even though individual variations may be large. Manber and colleagues (1996) showed that the combination of adequate sleep duration and regular nocturnal sleep schedules was more effective than adequate sleep duration alone in decreasing reported daytime sleepiness (see also Wolfson & Carskadon 1998). This result provides strong evidence for the significance of regular sleep rhythm and adequate sleep duration for a good level of daily functioning.

Young people should be taught to recognise their need for sleep. If they are usually refreshed and energetic in the morning and seldom have daytime sleepiness, they probably sleep enough. In the adolescent years not only adequate sleep duration and good sleep quality but also general sleep hygiene is of importance. A sleep promoting environment such as a quiet, well-ventilated bedroom and a good bed are important for good and refreshing sleep (e.g. Hyyppä 1991). This study also stresses the importance of good relationships at home, good self-perception and infrequent use of psychoactive substances. Health educators should help pupils to become more aware of possible associations between their sleeping habits and well-being, perceived health and daytime alertness.

When teaching about sleeping and health in classrooms, for example, the following topics are worth discussing: relationships between sleep and health, well-being and factors that affect sleep, such as, stress, nutrition, physical activities, maturation, sleeping environment, illness, etc. During health education classes, it is also important to teach pupils skills for promoting good sleep. Discussions about norms and values related to sleeping habits are needed as well. The question about sleeping habits may have been regarded more as a normative behavioural than as a health related matter. This may be one reason for the fact that sleeping habits among teenagers have had such a small role in health promotion practices and research.

### 9.3.2 Challenges of school health care system

Perheentupa's (1997) review of Finnish children's and adolescents' health indicates that the role of the school health care system is important in following pupils' health status. School health care services usually include general health screening among pupils. It is recommended that the assessment of sleeping habits and sleep difficulties be made routinely in these screenings. Inquiring about pupils' sleep habits and sleep problems should be a normal procedure in school health care not just because sleepy pupils have difficulties in concentrating on school work but also from the point of view of adolescents' future health (e.g. Bixler et al. 1979, Kirmil-Gray et al. 1984, Ferber 1990, Morrison et al. 1992).

Children with more serious and long-lasting sleep difficulties need special care: discussions and consultations with families and health care persons are necessary. Although young people have reported a lot of sleep related complaints in studies on sleep and health, they seldom speak about their problems to teachers or health care professionals (Welstein et al. 1983, Kirmil-Gray et al.

1984). Therefore it is important that teachers and health care staff – especially school health nurses – initiate discussions about these matters.

The results of the present study also indicate that when inquiring about pupils' tiredness, not only questions of tiredness but also information about their smoking and drinking habits as well as their sleep habits – especially their bedtimes and wake-up times during the school week and weekend – should be asked. The information obtained from questionnaires should be supplemented, for example, by using a sleep diary. In this way pupils would be able to increase their knowledge about their sleep and rest and the factors affecting them. This information could be used as a basis for health promotion among school children. Kirmil-Gray and colleagues (1984) have demonstrated that many children have erroneous conceptions of sleep and the factors affecting sleep and that they believe, for example, that it is possible to make up or restore sleep (see also Manber et al. 1996).

In the present study, scales for measuring adolescents' alertness and sleep quality were tested in the Jyväskylä follow-up study. The same scales were then applied in the HBSC-Study in 1998 (Tynjälä et al. 1998b). The results of both these studies indicated that the scales fitted well with the data. Thus, it can be concluded that the scales can be recommended to be tested in the field of school health care to measure adolescents' alertness and sleep quality. These tests or measurements would help in the early detection of perpetually tired pupils or pupils with poor sleep quality. However, further investigations e.g. in different age groups are still needed for validating the scales.

The fact that tiredness is a common problem in youth raises a question about the need for preventive measures or intervention studies to alter sleep patterns and wakefulness in adolescence and to teach school children proper sleep hygiene (cf. Carskadon 1990b, see also Hyypä & Kronholm 1998). The findings of Manber and colleagues (1996) suggest that in such interventions it is important to advise students to combine adequate sleep duration with regular nocturnal sleep schedules, because adequate sleep duration alone does not decrease daytime sleepiness as effectively as when it is combined with regular sleep schedule. Carskadon (1990b) has suggested that perhaps the most useful way to carry out an intervention is to combine the education of children, parents, teachers and paediatricians about the fundamental principles of sleep hygiene.

### **9.3.3 Other health promotion implications**

What else can schools do to promote pupils' alertness? One important thing is taking care of the general prerequisites of well-being in the school environment and everyday school life. This concerns both the social atmosphere and physical circumstances. Preliminary results of Tynjälä and colleagues (1998b) show that students who considered their school atmosphere good and encouraging showed better alertness than students who reported problems with teachers, who had poor school motivation and did not feel safe at school. Therefore, it is important to provide students with encouragement and support in school. It is

also important to pay attention to factors related to physical health and fitness. For example, the role of school physical education lessons is important in improving pupils' alertness and sleep quality (V; Shapiro et al. 1984, Tynjälä et al. 1998b). In addition, general working conditions at school, such as indoor air quality and classroom ventilation, play an important part in relation to pupils' alertness (see Harju-Kivinen & Kannas 1995, Savolainen et al. 1998).

School starting time and scheduling of school work and holidays during semesters are also questions worth discussing. There are differences between countries both in the hour when school days begin and in how long school periods are scheduled. For example, in Finland and in Norway classes usually begin between 8 and 9 o'clock, in the United Kingdom at 9 o'clock but in Spain between 9 and 10 o'clock. In addition, there is about a three hour lunch break in Spain between 12 noon and 3 p.m. (The European Education Information Network 1995.) In the future, it might be worth experimenting and investigating whether postponing school starting time for an hour would have a favourable impact on pupils' alertness. It would also be important for further research to examine how different arrangements in school time and holidays, for example 6 week school time and 1 week holiday period, affect students' workload and their alertness.

Finally, the importance of cooperation with pupils' parents should be stressed. A well-functioning network between school (teachers and other staff) and pupils' homes is essential, including such activities as parent-teacher/health care personnel meetings and face-to-face discussions. There has been a lot of discussion in the Finnish media about child rearing being in crisis. Although parents have the main responsibility for guiding their children toward healthy sleeping habits, schools also have opportunities to promote pupils' alertness and prevent tiredness. In addition, schools have opportunities to increase pupils' knowledge of and change their attitudes towards sleep and related matters. The role of the school health care system is crucial in identifying sleep related risk groups such as perpetually tired pupils.

## 10 YHTEENVETO

Hyvä yöuni on keskeinen fyysisen, henkisen ja sosiaalisen terveyden osatekijä. Kouluikäisillä nuorilla unen merkitys korostuu, sillä murrosikään liittyvän fyysisen kypsymisen vuoksi nuorten unentarve on aiempaa suurempi (Carskadon & Dement 1987, Carskadon 1990b). Ruumiilliset muutokset sekä murrosiän erilaiset kehityspiirteet kuten identiteetin rakentaminen, toveripiirin kasvava merkitys, suhteiden luominen vastakkaiseen sukupuoleen ja sukupolvien väliset ristiriidat vaativat myös runsaasti henkistä energiaa kasvavalta nuorelta. Pitääkseen yllä fyysistä ja henkistä tasapainotilaa nuori tarvitsee riittävän pitkän ja virkistävän yön. Tällä on merkitystä myös nuoren koulutyön kannalta, sillä oppiminen onnistuu parhaiten virkeänä ja levänneenä. Vastaavasti hyvät oppimiskokemukset koetaan mieltä piristävinä, millä on taas positiivisia vaikutuksia esimerkiksi yön laatuun. Näin unella ja levolla voi olla eräänlainen kehävaikutus nuoren elämässä.

Vaikka unitutkimus onkin kansainvälisesti vilkasta, ei nuorten nukkumisen ja lepotottumuksiin oltu kiinnitetty paljoakaan huomiota 1970- ja 1980-luvuilla. Tutkimukset ovat olleet luonteeltaan pääasiassa kliinisiä ja psykofysiologisia, kun taas terveystieteen näkökulmasta asiaa on tutkittu vähän. 1990-luvulla kuitenkin näyttää siltä, että unitutkijoiden ja terveystieteen tutkijoiden mielenkiinto nuorten nukkumistottumuksien, univaikeuksien ja vireisyyden tutkimiseen on lisääntymässä niin ulkomailla kuin Suomessa.

Tämän työn tarkoituksena oli tutkia 11-, 13- ja 15-vuotiaiden nuorten nukkumistottumuksia, univaikeuksia, koettua väsymystä ja koettua unen laatua sekä niihin yhteydessä olevia tekijöitä. Tutkimus on osa laajempaa, WHO:n koordinoimaa koululaistutkimusta, jossa selvitetään kouluikäisten lasten ja nuorten elämäntyyliä terveyden näkökulmasta (Health Behaviour of School Aged Children – A WHO Cross-National Survey, the HBSC-Study). Suomessa tätä tutkimusta kutsutaan nimellä WHO-Koululaistutkimus. Tähän tutkimukseen on osallistunut monien Euroopan maiden lisäksi myös Israel ja Kanada. Työn toisena tarkoituksena oli testata nukkumistottumusten, univaikeuksien, koetun unen laadun ja vireisyyden mittareita, joita on kehitetty WHO-Koululaistutkimuksessa syntyneiden kokemusten pohjalta.

Tässä väitöskirjatyössä käytettiin WHO-Koululaistutkimuksen kansainvälistä aineistoa (n=41809) vuodelta 1986 ja suomalaista aineistoa vuosilta 1990 (n=2996) ja 1994 (n=4187). Koettua unen laatua ja vireisyyttä koskevia mittareita testattiin 15-vuotiailla jyvaskyläläisnuorilla seurantatutkimuksessa, johon aineistoa kerättiin neljästi lukuvuoden 1996-97 aikana (n=475, joista 202 15-vuotiaita). Yksittäisten, nukkumistottumuksia, univaikeuksia ja vireisyyttä mittaavien kysymysten reliabiliteettia testattiin erillisessä reliabiliteettitutkimuksessa, johon osallistui 13-15-vuotiaita nuoria yhdestä jyvaskyläläiskoulusta (n=66). Reliabiliteettitutkimuksen aineisto kerättiin huhtikuussa 1997. Kaikki tutkimusaineistot kerättiin luokkakyselyinä.

Aineistojen analysoinnissa käytettiin monipuolisesti tilastollisia menetelmiä kuten ristiintaulukointeja, Pearsonin tulomomenttikorrelaatiokertoimia, varianssianalyysiä sekä logistista regressioanalyysiä ja rakenneyhtälömalleja (LISREL).

Tutkimus koostuu viidestä aikaisemmin julkaistusta osatutkimuksesta sekä aiemmin julkaisemattomasta Jyvaskylän koulujen seurantatutkimuksesta. Reliabiliteettitutkimuksen tulokset ovat myös aiemmin julkaisemattomia. Ensimmäinen osatutkimus oli yhdentoista maan välinen kansainvälinen vertailu vuoden 1986 WHO-Koululaistutkimuksen aineistosta. Tutkimus osoitti, että nuorten nukkumistottumuksissa, nukahtamisvaikeuksissa ja aamuväsymyksessä oli tilastollisesti merkitseviä eroja maiden välillä. Suomalaiset nuoret olivat norjalaisten ohella kouluamuisin kaikkein väsyneimpiä verrattuna muiden tutkimukseen osallistuneiden maiden nuoriin. Vähintään viidesosa tutkimukseen osallistuneista suomalaisnuorista tunsi itsensä väsyneeksi lähes jokaisena kouluamuna. Suomalaisten nukkumaanmeno-aika iltaisin kouluviikon aikana oli muihin maihin verrattuna keskivertoa tasoa (noin klo 22), mutta nuorten keskimääräinen yön pitempisyys kouluviikolla oli suomalaisnuorilla tutkituista maista toiseksi lyhyin israelilaisten jälkeen vaihdellen 11-vuotiaiden 9,3 tunnista 15-vuotiaiden 8,7 tuntiin. Pisin yöni oli sveitsiläisillä nuorilla, joista 11-vuotiaat nukkuivat keskimäärin 10 tuntia yössä ja 15-vuotiaat 9,2 tuntia yössä.

Toisessa ja kolmannessa osatutkimuksessa selvitettiin vuonna 1990 kerättyyn aineistoon pohjautuen suomalaisten nuorten nukkumistottumuksia ja univaikeuksia. Tutkimustulosten perusteella useimpien nuorten nukkumistottumuksia voitiin pitää terveellisinä, mutta lisäksi havaittiin, että iän myötä lisääntyivät myös epäsäännölliset nukkumistottumukset, univaikeudet ja väsymys. 5-10 %:lla 11-15-vuotiaista nuorista oli epäsäännölliset nukkumistottumukset ja keskimääräistä enemmän univaikeuksia. Nukkumistottumuksia ja univaikeuksia selittävästä taustatekijöistä keskeisimpiä olivat ikä ja sukupuoli. Myöhään nukkumaan menevien osuus lisääntyi iän myötä, ja tämä osuus oli pojilla tyttöjä suurempi kaikissa ikäryhmissä. 15-vuotiasta pojista joka kolmas ja tytöistä joka viides ilmoitti menevänsä nukkumaan kello 23 tai myöhemmin kouluviikolla.

Useimmat suomalaisnuoret nukkuivat hyvin, mutta noin joka viidennellä nuorella oli nukahtamisvaikeuksia ja lähes joka kolmas 15-vuotiasta tunsi olevansa väsynyt lähes kaikkina kouluamuna. Päiväväsymys yleistyi iän myötä ja päivittäin tai lähes päivittäin väsyneitä oli 6-12 % nuorista. Tytöillä päiväväsymys oli jonkin verran yleisempää kuin pojilla.

Tutkimuksessa selvitettiin myös eräiden sosiodemograafisten taustatekijöiden kuten vanhempien sosioekonomisen taustan (isän ammatti), asuinympäristön (maaseutu/kaupunki) sekä maantieteellisen asuinalueen (pääkaupunkiscutu, Etelä-Suomi, Keski-Suomi, Pohjois-Suomi) samoin kuin nuorten koulututorientaation (aikomus mennä lukioon vs. ammatilliseen koulutukseen) yhteyttä nuorten nukkumistottumuksiin ja univaikeuksiin. Näillä tekijöillä ei ollut juurikaan yhteyksiä nuorten nukkumistottumuksiin ja univaikeuksiin, vaikkakin maaseudulla asuvat nuoret ja erityisesti maanviljelijöiden lapset näyttävät nukkuvan pitempiä yöunia kuin kaupunkilaislapset.

Neljännän ja viidennen osatutkimuksen aineisto kerättiin vuonna 1994. Näissä tutkimuksissa selvitettiin nuorten nukkumistottumusten, psykoaktiivisten aineiden (alkoholi, tupakka ja kahvi) käytön ja koetun väsymyksen välisiä yhteyksiä sekä hyvän unen edellytyksiä. Tulosten mukaan aamuväsymys oli yleistynyt nuorten keskuudessa vuoteen 1990 verrattuna. Noin joka kolmas 15-vuotias nuori valitti aamuväsymystä vähintään neijänä kouluamuna viikossa. Lähes puolet 15-vuotiaista tytöistä ja 37 % pojista tunsivat olevansa väsynyt useammin kuin kerran viikossa. Julkaisemattomat tulokset vuoden 1998 WHO-Koululaistutkimuksesta osoittavat, että kouluamuisin väsyneiden osuus on edelleen kasvanut (Tynjälä 1998b).

Eri taustatekijöiden välisiä yhteyksiä 15-vuotiaiden väsymykseen tutkittiin rakenneyhtälömalleilla, jotka osoittivat, että nukkumistottumukset, psykoaktiivisten aineiden käyttö (pääasiassa alkoholi ja tupakka) ja koettu väsymys olivat tilastollisesti merkitsevästi yhteydessä toisiinsa. Hyvä koti-ilmapiiiri oli tärkein hyvään koettuun unen laatuun yhteydessä oleva tekijä 15-vuotiailla pojilla. Myös terveyttä edistävä elämäntyyli (hyvä unihygienia, kuten säännöllinen ja varhainen nukkumaanmenoaika, ja vähäinen psykoaktiivisten aineiden käyttö) ja korkea itsearvostus olivat tilastollisesti merkitsevästi yhteydessä hyvään unen laatuun, vaikkakaan eivät yhtä voimakkaasti kuin koti-ilmapiiiri. Tyttöillään sijaan hyvä koti-ilmapiiiri, terveyttä edistävä elämäntyyli ja korkea itsearvostus olivat yhtä tärkeitä hyvään koettuun unen laatuun yhteydessä olevia tekijöitä.

Yksittäisten, nukkumistottumuksia, nukkumisvaikeuksia ja unen kestoja ja vireisyyttä mittaavien kysymysten reliabiliteetti osoittautui vähintäinkin kohtuullisen hyväksi. Jyväskylän seurantatutkimuksessa testatut koetun vireisyyden ja unen laadun mittarit osoittautuivat reliabiliteetiltään hyväksi ja niiden antamat tulokset olivat samansuuntaisia neljänä lukuvuoden ajankohtana. Mittareita suositellaan kokeiltavaksi kouluterveydenhuollossa esimerkiksi jatkuvasti väsyneiden ja huonosti nukkuvien oppilaiden seulomiseksi.



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Appendix 1 Questions of sleep habits, sleep difficulties and tiredness used in the 1986, 1990 and 1994 HBSC-Studies in Finland. In 1986 the same questions were used in Finland and other participating countries. The numbering of the questions is the same as in the Finnish questionnaires. Complete questionnaires are available from the author

#### WHO-Koululaistutkimus 1986

37. Milloin tavallisesti menet nukkumaan, jos sinun on mentävä kouluun seuraavana aamuna
- Noin klo 21.00 tai aikaisemmin  
 Noin klo 21.30  
 Noin klo 22.00  
 Noin klo 22-30  
 Noin klo 23.00 tai myöhemmin
38. Milloin tavallisesti heräät koulupäivinä?
- Noin klo 6.30 tai aikaisemmin  
 Noin klo 7.00  
 Noin klo 7.30  
 Noin klo 8.00 tai myöhemmin
39. Miten usein koulupäivinä tunnet itsesi väsyneeksi noustessasi aamulla?
- Harvoin tai en koskaan  
 Satunnaisesti  
 1 – 3 kerta viikossa  
 4 kertaa viikossa tai useammin
42. Kuinka usein Sinulla on seuraavia oireita\*?
- |  | Lähes päivittäin         | Useammin kuin kerran viikossa | Noin kerran kuukaudessa  | Harvemmin tai ei koskaan |
|--|--------------------------|-------------------------------|--------------------------|--------------------------|
| ****<br>Vaikeuksia päästä uneen<br>****  | <input type="checkbox"/> | <input type="checkbox"/>      | <input type="checkbox"/> | <input type="checkbox"/> |
| *****<br>*) Vastausvaihtoehto "Noin kerran viikossa" puuttui suomenkielisestä kysymyslomakkeesta |                          |                               |                          |                          |

#### HBSC-Study 1986

37. When do you usually go to bed if you have to go to school next morning?
- About at 21.00 or earlier  
 About at 21.30  
 About at 22.00  
 About at 22.30  
 About at 23.00 or later
38. When do you usually wake up on school mornings?
- At 6.30 or earlier  
 At 7.00  
 At 7.30  
 At 8.00 or later
39. How often do you feel tired when you wake up in the morning during school days?
- Seldom or never  
 Sometimes  
 1 – 3 times a week  
 4 or more times a week
42. How often have you had the following symptoms\*?
- |  | About every day          | More than once a week    | About every week         | Rarely or never          |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
| ****<br>Difficulties in getting to sleep<br>****   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| *****<br>*) Response category "About once a week" was missing in the Finnish questionnaire |                          |                          |                          |                          |

## WHO-Koululaistutkimus 1990

26. Kuinka usein Sinulla on ollut seuraavia oireita viimeisen 6 kuukauden aikana?
- |                         | Lähes päivittäin | Useammin kuin kerran viikossa | Noin kerran kuukaudessa | Harvemmin tai ei koskaan |
|-------------------------|------------------|-------------------------------|-------------------------|--------------------------|
| ....                    |                  |                               |                         |                          |
| Vaikeuksia päästä uneen | ( )              | ( )                           | ( )                     | ( )                      |
| Väsyyksien tunnetta     | ( )              | ( )                           | ( )                     | ( )                      |
| .....                   |                  |                               |                         |                          |
48. Milloin tavallisesti menet nukkumaan, jos Sinun on mentävä kouluun seuraavana aamuna?
- ( ) Noin klo 21.00 tai aikaisemmin  
 ( ) Noin klo 21.30  
 ( ) Noin klo 22.00  
 ( ) Noin klo 22.30  
 ( ) Noin klo 23.00 tai myöhemmin
49. Milloin tavallisesti heräät koulupäivinä?
- ( ) Noin klo 6.30 tai aikaisemmin  
 ( ) Noin klo 7.00  
 ( ) Noin klo 7.30  
 ( ) Noin klo 8.00 tai myöhemmin
50. Onko nukkumaanmenoaikasi tavallisesti säännöllinen?
- ( ) Hyvin säännöllinen  
 ( ) Melko säännöllinen  
 ( ) Melko epäsäännöllinen  
 ( ) Hyvin epäsäännöllinen

## HBSC-Study 1990

26. In the last 6 months: how often have you had the following?
- |                                | About every day | More than once a week | About every month | Rarely or never |
|--------------------------------|-----------------|-----------------------|-------------------|-----------------|
| ....                           |                 |                       |                   |                 |
| Difficulties in falling asleep | ( )             | ( )                   | ( )               | ( )             |
| Feeling tired                  | ( )             | ( )                   | ( )               | ( )             |
| .....                          |                 |                       |                   |                 |
48. When do you usually go to bed if you have to go to school next morning?
- ( ) About at 21.00 or earlier  
 ( ) About at 21.30  
 ( ) About at 22.00  
 ( ) About at 22.30  
 ( ) About at 23.00 or later
49. When do you usually wake up on school mornings?
- ( ) At 6.30 or earlier  
 ( ) At 7.00  
 ( ) At 7.30  
 ( ) At 8.00 or later
50. Do you usually go to bed at certain time?
- ( ) Very regularly  
 ( ) Quite regularly  
 ( ) Quite irregularly  
 ( ) Very irregularly

## Appendix 1 continues

51. Kuinka hyvin yleensä nukut?  
 Hyvin  
 Melko hyvin  
 Tyydyttävästi  
 Melko huonosti  
 Huonosti
52. Miten usein koulupäivinä tunnet itsesi väsyneeksi noustessasi aamulla?  
 Harvoin tai en koskaan  
 Satunnaisesti  
 1 – 3 kertaa viikossa  
 4 kertaa viikossa tai useammin
53. Kuinka usein olet nukkunut päiväunia (nokosia) viimeksi kuluneiden kolmen kuukauden aikana?  
 En kertaakaan  
 Harvemmin kuin kerran viikossa  
 1 – 2 päivänä viikossa  
 3 – 5 päivänä viikossa  
 Päivittäin tai lähes päivittäin
54. Oletko tuntenut itsesi väsyneeksi päiväsaikaan viimeisen kolmen kuukauden aikana?  
 Päivittäin tai lähes päivittäin<sup>\*)</sup>  
 En kertaakaan  
 Harvemmin kuin kerran viikossa  
 1 – 2 päivänä viikossa  
 3 – 5 päivänä viikossa
- \*) Tämä vastausvaihtoehto sijoitettiin virheellisesti ensimmäiseksi. Sen tulisi olla viimeinen vastausvaihtoehto.
51. How well do you usually sleep at night?  
 Very well  
 Quite well  
 Satisfactorily  
 Quite badly  
 Very badly
52. How often do you feel tired when you get up on school mornings?  
 Seldom or never  
 Sometimes  
 1 – 3 times a week  
 4 or more times a week
53. How often have you taken naps in the past three months?  
 Not once  
 Less than once a week  
 1 – 2 days a week  
 3 – 5 days a week  
 Daily or almost daily
54. Have you felt tired in the daytime in the past three months?  
 Daily or almost daily<sup>\*)</sup>  
 Not once  
 Less than once a week  
 1 – 2 days a week  
 3 – 5 days a week
- \*) This response category was by mistake placed as the first alternative. It should be the last response category.

Appendix 1 continues

55. Kuinka nopeasti yleensä saat unen päästä kiinni illalla käydessäsi nukkumaan?
- 10 minuutissa tai nopeammin
  - 11 – 20 minuutissa
  - 21 – 30 minuutissa
  - 31 – 40 minuutissa
  - Yleensä nukahtamiseen kuluu yli 40 minuuttia
56. Kuinka usein yleensä heräät öiseen aikaan?
- En koskaan
  - Harvemmin kuin kerran kuukaudessa
  - Harvemmin kuin kerran viikossa
  - 1 – 2 päivänä viikossa
  - 3 – 5 päivänä viikossa
  - Joka yö tai lähes joka yö
57. Oletko viimeisen kolmen kuukauden aikana herännyt liian aikaisin kykenemättä nukahtamaan enää uudelleen?
- En kertaakaan
  - Harvemmin kuin yhtenä aamuna viikossa
  - 1 – 2 aamuna viikossa
  - 3 – 5 aamuna viikossa
  - Joka aamu tai lähes joka aamu
58. JOS heräilet tahtomattasi öiseen aikaan, niin mitkä seuraavista tekijöistä ovat syynä heräämiseen? (Numeroi kolme tärkeintä syytä)
- Painajaisunet
  - Huolet, murheet, levottomuus
  - WC-tarpeet
  - Melu, äänet valaistus
  - Kivut, säryt
  - Jokin muu syy, mikä?
55. How long does it usually take you to fall asleep?
- Ten minutes or less
  - About 11-20 minutes
  - About 21-30 minutes
  - About 31 -40 minutes
  - Usually more than 40 minutes
56. How often do you usually wake up during the night?
- Never
  - Less than once a month
  - 1 – 2 days a week
  - 3 – 5 days a week,
  - Every night or almost every night
57. Have you woken up during the night without being able to fall asleep again?
- Never
  - Less than once a month
  - 1 – 2 days a week
  - 3 – 5 days a wee,
  - Every night or almost every night
58. If you suddenly wake up during the night, which of the following usually cause this? (Please, number three in order of frequency).
- Nightmares
  - Worries, restlessness
  - Need to go to the toilet
  - Noise and lightning
  - Pain and aches
  - Some other reason, please specify

## WHO-Koululaistutkimus 1994

33. Kuinka usein Sinulla on seuraavia oireita?

	Lähes päivittäin	Useammin kuin kerran viikossa	Noin kerran viikossa	Noin kerran kuu-kaudessa	Harvemmin tai ei koskaan
..... Vaiveuksia päästä uneen	( )	( )	( )	( )	( )
..... Väsymyksen tunnetta	( )	( )	( )	( )	( )
..... Heräilemistä öisin	( )	( )	( )	( )	( )

34. Miten usein koulupäivinä tunnet itsesi väsyneeksi noustessasi aamulla?

- ( ) Harvoin tai en koskaan  
 ( ) Satunnaisesti  
 ( ) 1 – 3 kertaa viikossa  
 ( ) 4 kertaa viikossa tai useammin

37. Onko nukkumaanmenoikasi tavallisesti säännöllinen?

- ( ) Hyvin säännöllinen  
 ( ) Melko säännöllinen  
 ( ) Melko epäsäännöllinen  
 ( ) Hyvin epäsäännöllinen

38. Milloin menet tavallisesti nukkumaan?

a) Jos Sinun on mentävä kouluun seuraavana päivänä, noin klo:

Viim.	21.00	21.30	22.00	22.30	23.00	24.00	00.30	01.00	01.30	02.00 tai myöh.
( )	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )

b) Viikonloppuisin tai vapaapäivinä, noin klo:

21.00	21.30	22.00	22.30	23.00	24.00	00.30	01.00	01.30	02.00
( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
02.30	03.00	03.30	04.00	tai myöhemmin					
( )	( )	( )	( )						

## HBSC-Study 1994

33. In the last six months: How often have you had the following symptoms?  
(Please, tick one box for each line.)

	Almost daily	More than once a week	About once a week	About once a month	Rarely or never
..... Difficulties in falling asleep	( )	( )	( )	( )	( )
..... Feeling tired	( )	( )	( )	( )	( )
..... Waking up during the night	( )	( )	( )	( )	( )

34. How often do you feel tired when you wake up in the morning school days?

- ( ) Seldom or never  
 ( ) Sometimes  
 ( ) 1 – 3 times a week  
 ( ) 4 times a week or more

37. Do you usually go to bed at certain time?

- ( ) Very regularly  
 ( ) Quite regularly  
 ( ) Quite unregularly  
 ( ) Very unregularly

38. When do you usually go to bed?

a) if you have to go to school the next morning?

No later than	21.30	22.00	22.30	23.00	23.30	24.00	00.30	01.00	01.30	02.00 or later
21.00	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )

b) if it is weekend or holiday?

No later than	21.30	22.00	22.30	23.00	23.30	24.00	00.30	01.00	01.30	02.00
21.00	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
02.30	03.00	03.30	04.00	or later						
( )	( )	( )	( )							



Appendix 1 continues

39. Milloin tavallisesti heräät?

a) Kouluaamuisin, noin klo:

Viim.

05.00 05.30 06.00 06.30 07.00 07.30 08.00 tai myöh.

( ) ( ) ( ) ( ) ( ) ( ) ( )

b) Viikonloppuisin tai vapaapäivinä, noin klo:

Viim.

07.00 07.30 08.00 08.30 09.00 09.30 10.00 10.30 11.00 11.30

( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )

12.00 12.30 13.00 13.30 14.00 tai myöhemmin

( ) ( ) ( ) ( ) ( )

40. Kuinka hyvin yleensä nuket?

- ( ) Hyvin
- ( ) Melko hyvin
- ( ) Tyydyttävästi
- ( ) Melko huonosti
- ( ) Huonosti

39. When do you usually wake up

a) during school days?

No later

than 5.30 6.00 6.30 7.00 7.30 08.00 08.30

5.00 or later

( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )

b) during weekends and holidays?

No later than

7.00 7.30 8.00 8.30 9.00 9.30 10.00 10.30 11.00 11.30

( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )

12.00 12.30 13.00 13.30 14.00 or later

( ) ( ) ( ) ( ) ( )

40. How well do you usually sleep?

- ( ) Very well
- ( ) Quite well
- ( ) Satisfactorily
- ( ) Quite badly
- ( ) Very badly

Appendix 2. Questions of sleep habits, sleep difficulties and alertness used in the Jyväskylä follow-up study in 1996-97 and in the test-retest (reliability) study. The numbering of the questions is the same as in the Jyväskylä follow-up study questionnaire. Complete questionnaires are available from the author

14. Onko sinulla ollut seuraavia oireita viimeisen kuukauden aikana?

	Lähes päi- vittäin	Useammin kuin kerran viikossa	Noin kerran viikossa	Noin kerran kuukau- dessa	Ei lain- kaan	VAIN TYTÖILLE Merkitse ne oi- reet, jotka toistu- vat kuukautisten aikana
--	--------------------------	--	----------------------------	------------------------------------	---------------------	---

.... Vaikeuksia päästä uneen	( )	( )	( )	( )	( )	( )
Väsymyksen tunnetta	( )	( )	( )	( )	( )	( )
... Heräilemistä öisin	( )	( )	( )	( )	( )	( )

18. Kuinka usein olet nukkunut päiväunia (nokosia) viimeksi kuluneen kuukauden aikana?

( ) En kertaakaan  
( ) Harvemmin kuin kerran viikossa  
( ) 1 - 2 päivänä viikossa  
( ) 3 - 5 päivänä viikossa  
( ) Päivittäin tai lähes päivittäin

19. Onko nukkumaanmenoaikasi koulupäivää edeltävänä iltana tavallisesti

( ) Hyvin säännöllinen  
( ) Melko säännöllinen  
( ) Melko epäsäännöllinen  
( ) Hyvin epäsäännöllinen

14. How often have you had the following symptoms in the past month?

	Almost daily	More than once a week	About once a week	About once a month	Never	ONLY FOR GIRLS Please tick the symptoms you usually have dur- ing your period
--	-----------------	--------------------------------	-------------------------	--------------------------	-------	---

.... Difficulties in falling asleep	( )	( )	( )	( )	( )	( )
Feeling tired	( )	( )	( )	( )	( )	( )
... Waking up during the night	( )	( )	( )	( )	( )	( )

18. How often have you taken naps in the past month?

( ) Not once  
( ) Less than once a week  
( ) 1-2 days a week  
( ) 3-5 days a week  
( ) Daily or almost daily

19. Do you **usually** go to bed at certain time if you have to go to school the next morning?

( ) Very regularly  
( ) Quite regularly  
( ) Quite irregularly  
( ) Very irregularly

Appendix 2 continues

20. Milloin menet **tavallisesti** nukkumaan, jos Sinun on mentävä kouluun seuraavana päivänä? Noin kello:

21.00 21.30 22.00 22.30 23.00 24.00 00.30 01.00 01.30 02.00 tai  
 ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) myöh.  
 ( ) ( )

21. Milloin menet **tavallisesti** nukkumaan **perjantai-iltaisin**? Noin kello:

21.00 21.30 22.00 22.30 23.00 24.00 00.30 01.00 01.30 02.00  
 ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )  
 02.30 03.00 03.30 04.00 tai myöhemmin  
 ( ) ( ) ( ) ( )

22. Milloin menet **tavallisesti** nukkumaan **lauantai-iltaisin**? Noin kello:

21.00 21.30 22.00 22.30 23.00 24.00 00.30 01.00 01.30 02.00  
 ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )  
 02.30 03.00 03.30 04.00 tai myöhemmin  
 ( ) ( ) ( ) ( )

23. Kuinka nopeasti yleensä saat unen päästä kiinni nukkumaan käydessäsi?

	Noin	Noin	Noin	Yleensä nukah-
10 minuutissa	10 – 20	20 – 30	30 – 40	tamiseen kuluu
tai nopeammin	minuutissa	minuutissa	minuutissa	yli 40 minuuttia
( )	( )	( )	( )	( )

20. When do you **usually** go to bed if you have to go to school the next morning?  
 At about:

21.00 21.30 22.00 22.30 23.00 24.00 00.30 01.00 01.30 02.00  
 ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) or later  
 ( ) ( )

21. When do you **usually** go to bed on **Friday** nights?  
 At about:

21.00 21.30 22.00 22.30 23.00 24.00 00.30 01.00 01.30 02.00  
 ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )  
 02.30 03.00 03.30 04.00 or later  
 ( ) ( ) ( ) ( )

22. When do you **usually** go to bed on **Saturday** nights?  
 At about:

21.00 21.30 22.00 22.30 23.00 24.00 00.30 01.00 01.30 02.00  
 ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )  
 02.30 03.00 03.30 04.00 or later  
 ( ) ( ) ( ) ( )

23. How long does it usually take you to fall asleep?

	About	About	About	Usually more
Ten minutes	10-20	20-30	30 – 40	than 40 minutes
or less	minutes	minutes	minutes	
( )	( )	( )	( )	( )

Appendix 2 continues

24. Milloin **tavallisesti** heräät kouluaamuisin? Noin kello:

5.00 5.30 6.00 6.30 7.00 7.30 08.00 tai myöhemmin  
( ) ( ) ( ) ( ) ( ) ( ) ( )

25. Milloin **tavallisesti** heräät viikonloppuisin tai vapaapäivinä? Noin kello:

7.00 7.30 8.00 8.30 9.00 9.30 10.00 10.30 11.00  
( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )

11.30 12.00 12.30 13.00 13.30 14.00 tai myöhemmin

( ) ( ) ( ) ( ) ( ) ( )

26. Miten nuket öisin, sen jälkeen kun olet nukahtanut?

- ( ) Hyvin rauhallisesti
- ( ) Melko rauhallisesti
- ( ) En osaa sanoa
- ( ) Melko levottomasti
- ( ) Hyvin levottomasti

27. Miten usein Sinusta tuntuu, että olet nukkunut riittävästi?

- ( ) Joka tai lähes joka aamu
- ( ) 3 – 5 aamuna viikossa
- ( ) 1 – 2 aamuna viikossa
- ( ) Ei juuri koskaan

28. Onko Sinun yleensä vaikea herätä aamuisin?

- ( ) Harvoin tai ei koskaan
- ( ) Silloin tällöin
- ( ) Melko usein
- ( ) Usein tai joka aamu

29. Tunnetko itsesi aamulla herätessäsi tavallisesti pirteäksi?

- ( ) Joka tai lähes joka aamu
- ( ) 3 – 5 aamuna viikossa
- ( ) 1 – 2 aamuna viikossa
- ( ) Ei juuri koskaan

24. When do you **usually** wake up on school mornings? At about:

5.00 5.30 6.00 6.30 7.00 7.30 08.00 or later  
( ) ( ) ( ) ( ) ( ) ( ) ( )

25. When do you **usually** wake up during weekends and holidays? At about:

7.00 7.30 8.00 8.30 9.00 9.30 10.00 10.30 11.00  
( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )

11.30 12.00 12.30 13.00 13.30 14.00 or later

( ) ( ) ( ) ( ) ( ) ( )

26. How well do you usually sleep at night?

- ( ) Very well
- ( ) Quite well
- ( ) Don't know
- ( ) Quite badly
- ( ) Very badly

27. How often do you feel that you have slept sufficiently?

- ( ) Every or almost every morning
- ( ) 3-5 mornings a week
- ( ) 1-2 mornings a week
- ( ) Hardly ever

28. Is it usually difficult for you to wake up in the mornings?

- ( ) Rarely or never
- ( ) Sometimes
- ( ) Quite often
- ( ) Often or every morning

29. Do you usually wake up refreshed and energetic?

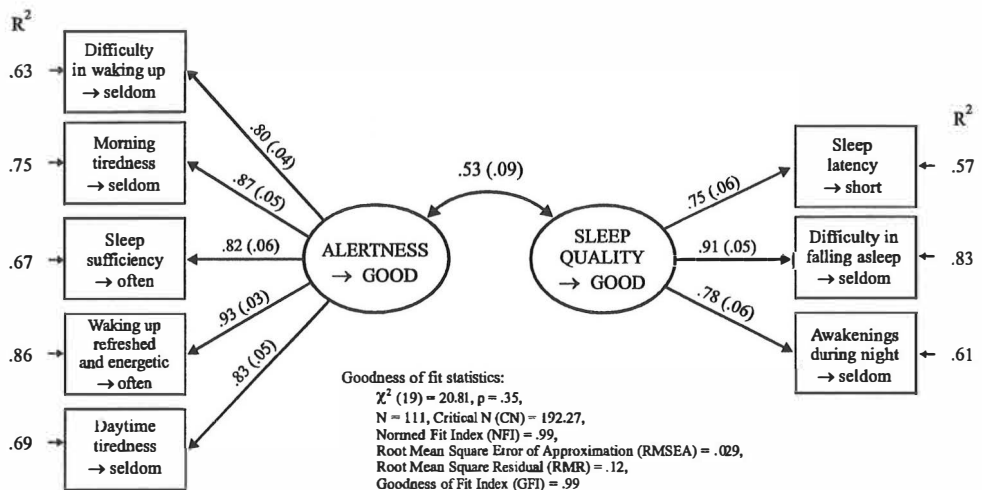
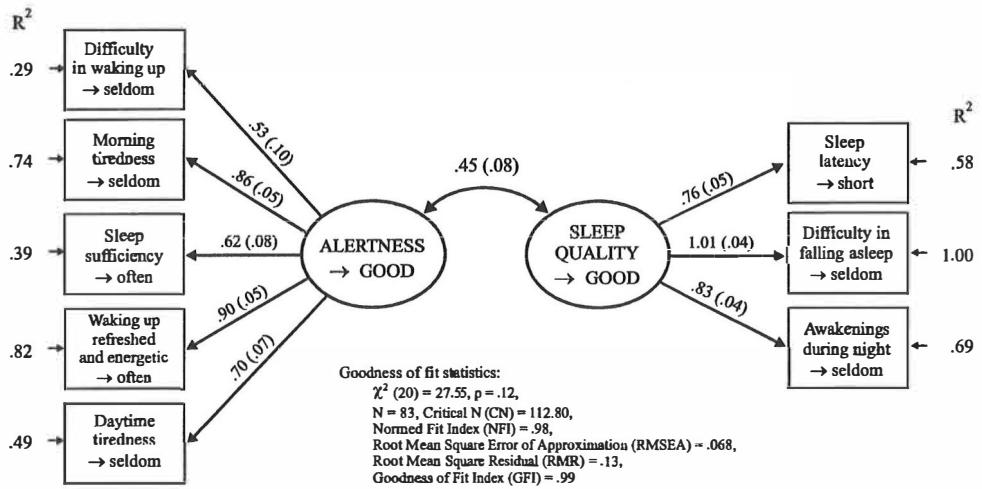
- ( ) Often or every morning
- ( ) Quite often
- ( ) Sometimes
- ( ) Rarely or never

Appendix 2 continues

30. Miten usein koulupäivinä tunnet itsesi väsyneeksi noustessasi aamulla?  
( ) Harvoin tai en koskaan  
( ) Satunnaisesti  
( ) 1 – 3 kertaa viikossa  
( ) 4 kertaa viikossa tai useammin
31. Oletko tuntenut itsesi väsyneeksi päiväsaikaan viimeisen kuukauden aikana?  
( ) En koskaan  
( ) Harvemmin kuin kerran viikossa  
( ) 1 – 2 päivänä viikossa  
( ) 3 – 5 päivänä viikossa  
( ) Päivittäin tai lähes päivittäin
32. Oletko mielestäsi päivisin väsyneempi kuin koulutoverisi ja ystäväsi?  
( ) En  
( ) Hieman väsyneempi  
( ) Huomattavasti väsyneempi
33. Miten usein olet viimeisen kuukauden aikana myöhästynyt koulusta, koska et ole jaksanut herätä aamulla riittävän aikaisin?  
( ) Harvoin tai en koskaan  
( ) Satunnaisesti  
( ) 1 – 2 kertaa viikossa  
( ) 3 – 5 kertaa viikossa
30. How often do you feel tired when you get up on school mornings?  
( ) Rarely or never  
( ) Sometimes  
( ) 1-3 times a week  
( ) 4 or more times a week
31. Have you felt tired in the daytime in the past month?  
( ) Not once  
( ) Less than once a week  
( ) 1-2 days a week  
( ) 3-5 days a week  
( ) Daily or almost daily
32. Do you think that you are more tired in the daytime than your school mates and friends?  
( ) No  
( ) A little more tired  
( ) Far more tired
33. In the past month, how often have you been late for school because you were too tired to wake up early enough in the morning?  
( ) Rarely or never  
( ) Occasionally  
( ) 1-2 times a week  
( ) 3-5 times a week

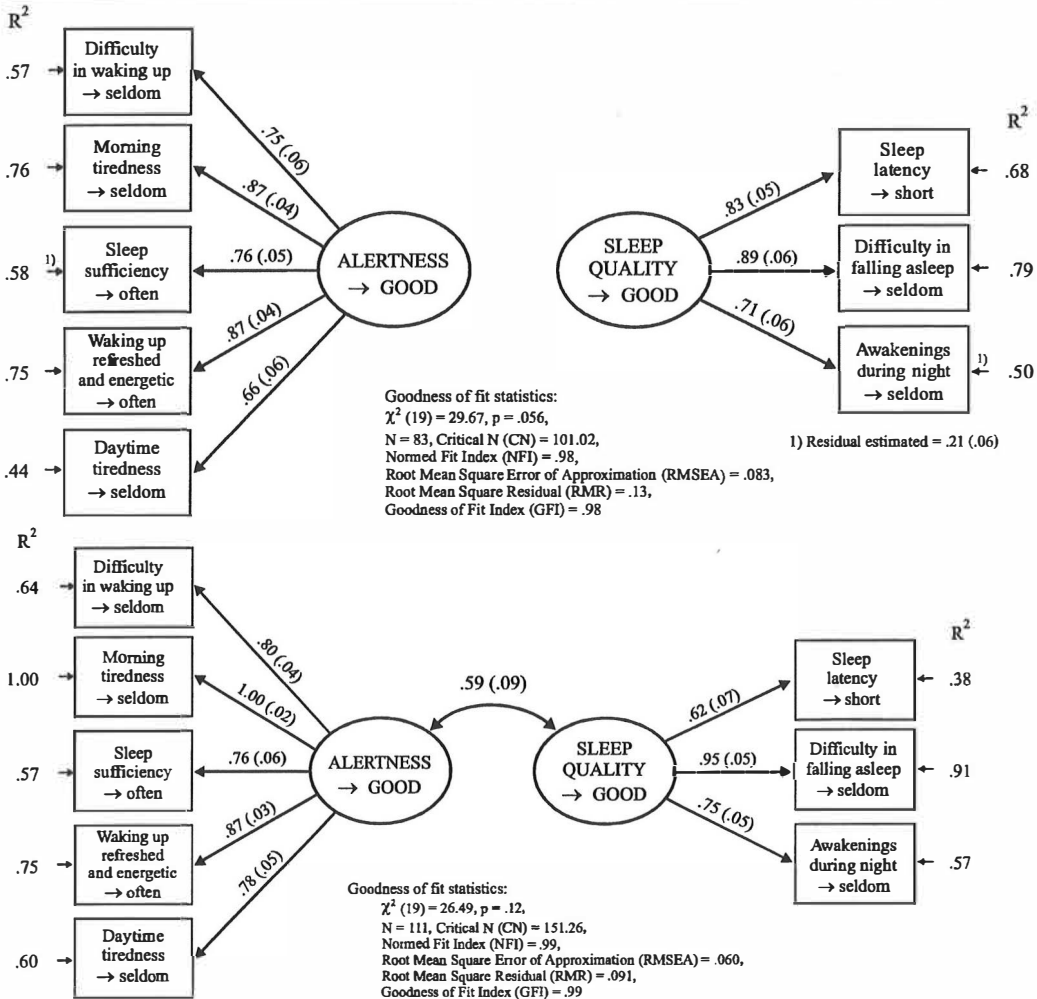
Appendix 3. Polychoric correlation coefficients among 15-year-old boys (n=88, lower triangle and among girls (n=111, upper triangle) in September 1996. Graphical presentation of the confirmatory factor analyses: the upper figure is for boys, the lower figure is for girls. The Jyväskylä follow-up study 1996-97

	1.	2.	3.	4.	5.	6.	7.	8.
1. Sleep latency → short	1.000	.698	.457	.138	.126	.232	.272	.247
2. Difficulty in falling asleep → seldom	.768	1.000	.682	.197	.226	.361	.301	.383
3. Awakenings during night → seldom	.584	.819	1.000	.121	.246	.282	.113	.363
4. Difficulty in waking up → seldom	.092	.189	.048	1.000	.622	.474	.731	.520
5. Morning tiredness → seldom	.145	.383	.191	.454	1.000	.664	.770	.652
6. Sleep sufficiency → often	.001	.047	.017	.316	.600	1.000	.676	.612
7. Waking up refreshed and energetic → often	.099	.094	.061	.337	.757	.680	1.000	.536
8. Daytime tiredness → seldom	.182	.390	.348	.184	.512	.421	.526	1.000



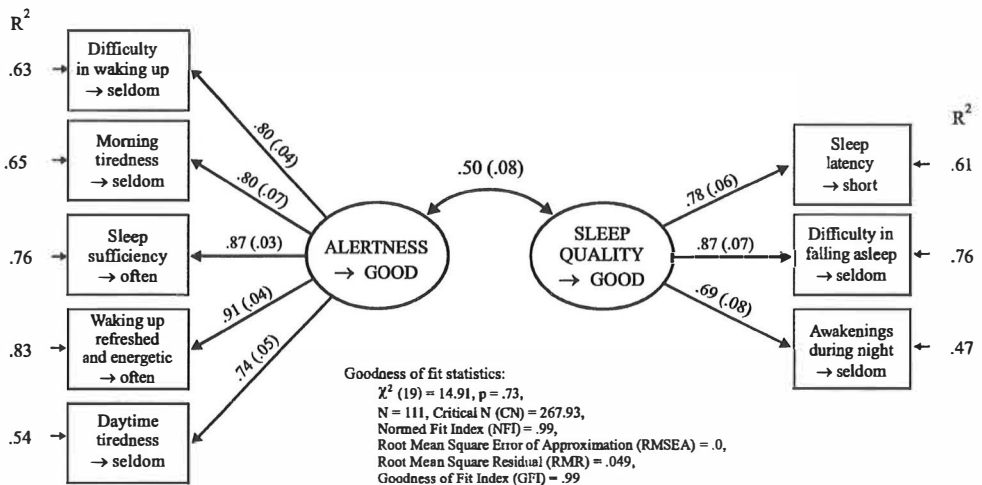
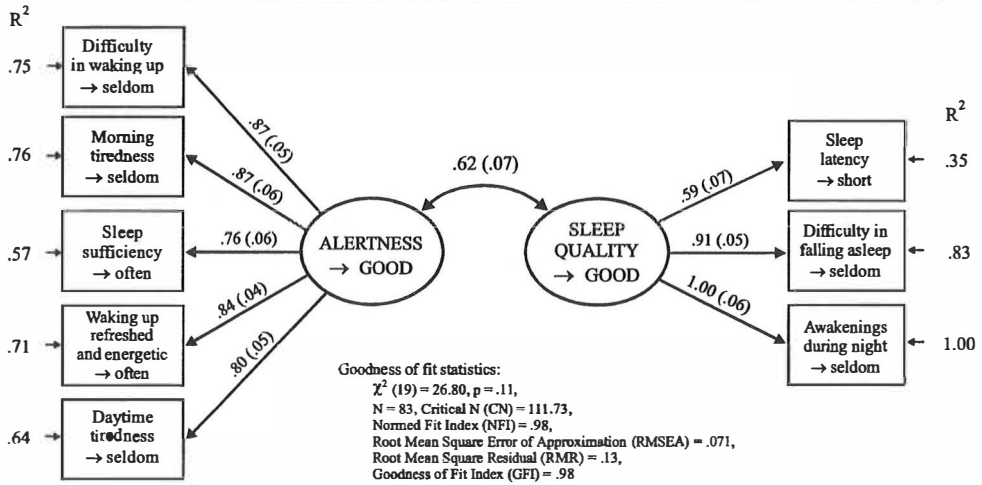
Appendix 4 Polychoric correlation coefficients among 15-year-old boys (n=88, lower triangle) and among girls (n=111, upper triangle) in December 1996. Graphical presentation of the confirmatory factor analyses: the upper figure is for boys, the lower figure is for girls. The Jyväskylä follow-up study 1996-97

	1.	2.	3.	4.	5.	6.	7.	8.
1. Sleep latency → short	1.000	.574	.407	.146	.198	.326	.246	.271
2. Difficulty in falling asleep → seldom	.728	1.000	.709	.305	.328	.468	.300	.339
3. Awakenings during night → seldom	.568	.668	1.000	.226	.190	.297	.256	.323
4. Difficulty in waking up → seldom	.104	.283	.286	1.000	.786	.614	.731	.649
5. Morning tiredness → seldom	.133	.134	.094	.726	1.000	.703	.862	.769
6. Sleep sufficiency → often	.091	.237	.492	.665	.661	1.000	.621	.523
7. Waking up refreshed and energetic → often	.124	.066	.011	.565	.724	.699	1.000	.660
8. Daytime tiredness → seldom	.162	.312	.210	.550	.518	.511	.528	1.000



Appendix 5. Polychoric correlation coefficients among 15-year-old boys (n=88, lower triangle) and among girls (n=111, upper triangle) in February 1997. Graphical presentation of the confirmatory factor analyses: the upper figure is for boys, the lower figure is for girls. The Jyväskylä follow-up study 1996-97

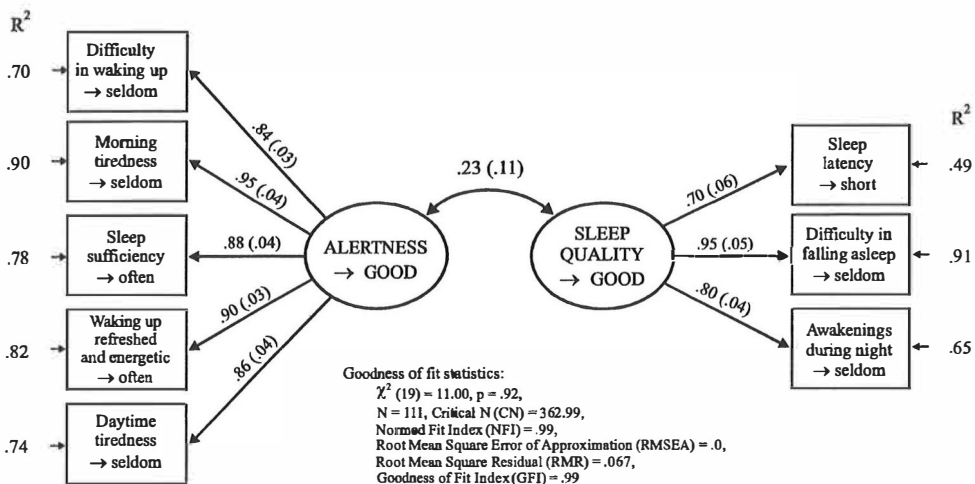
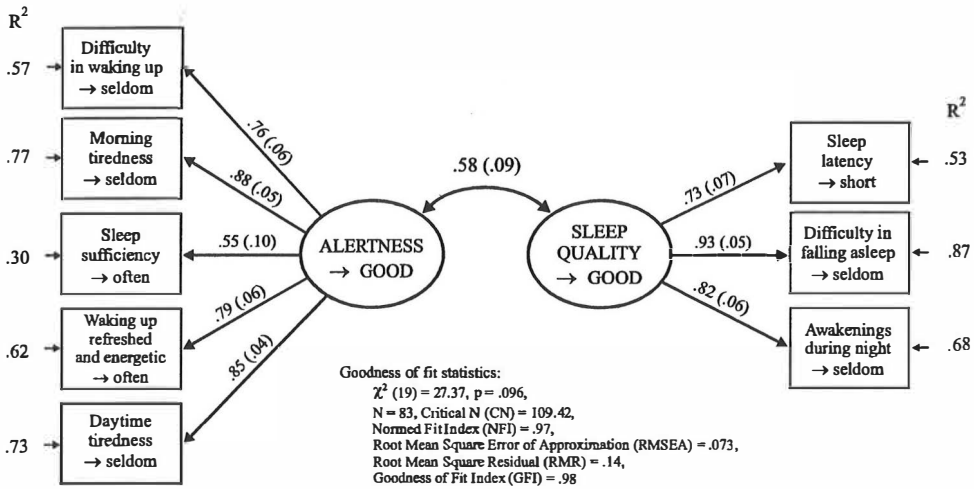
	1.	2.	3.	4.	5.	6.	7.	8.
1. Sleep latency short	1.000	.671	.516	.268	.175	.340	.261	.201
2. Difficulty in falling asleep → seldom	.614	1.000	.576	.341	.257	.409	.359	.349
3. Awakenings during night → seldom	.445	.804	1.000	.214	.183	.240	.317	.269
4. Difficulty in waking up → seldom	.200	.490	.573	1.000	.644	.713	.751	.529
5. Morning tiredness → seldom	.016	.248	.275	.638	1.000	.684	.715	.665
6. Sleep sufficiency → often	.141	.304	.289	.526	.476	1.000	.780	.647
7. Waking up refreshed and energetic → often	.158	.361	.357	.655	.612	.624	1.000	.587
8. Daytime tiredness → seldom	.172	.488	.590	.572	.600	.425	.627	1.000





Appendix 6. Polychoric correlation coefficients among 15-year-old boys (n=88, lower triangle) and among girls (n=111, upper triangle) in April 1997. Graphical presentation of the confirmatory factor analyses: the upper figure is for boys, the lower figure is for girls. The Jyväskylä follow-up study 1996-97

	1.	2.	3.	4.	5.	6.	7.	8.
1. Sleep latency → short	1.000	.618	.562	.085	.060	.163	.223	.052
2. Difficulty in falling asleep → seldom	.675	1.000	.768	.154	.161	.275	.267	.200
3. Awakenings during night → seldom	.285	.707	1.000	.144	.083	.202	.261	.152
4. Difficulty in waking up → seldom	.122	.032	.181	1.000	.811	.727	.724	.685
5. Morning tiredness → seldom	.214	.295	.285	.695	1.000	.702	.704	.736
6. Sleep sufficiency → often	.276	.113	.074	.308	.455	1.000	.770	.702
7. Waking up refreshed and energetic → often	.073	.111	.135	.582	.687	.450	1.000	.689
8. Daytime tiredness → seldom	.298	.439	.471	.593	.724	.543	.613	1.000



Appendix 7. Items used in the perceived alertness scale and in the sleep quality scale in the Jyväskylä follow-up study 1996-97.

Both the perceived alertness scale and sleep quality scale were composed of several items. The following questions were used for the alertness scale (response categories and equivalent coding for the scale in parenthesis):

*Is it usually difficult for you to wake up in the mornings?* (3 = Rarely or never, 2 = Sometimes, 1 = Quite often, 0 = Often or every morning);

*How often do you feel tired when you get up on school mornings?* (3 = Rarely or never, 2 = Sometimes, 1 = 1-3 times a week, 0 = 4 or more times a week);

*How often do you feel that you have slept sufficiently?* (3 = Every or almost every morning, 2 = 3-5 mornings a week, 1 = 1-2 mornings a week, 0 = Hardly ever);

*Do you usually wake up refreshed and energetic?* (3 = Often or every morning, 2 = Quite often, 1 = Sometimes, 0 = Rarely or never);

*Have you felt tired in the daytime in the past month?* (3 = Not once, 2 = Less than once a week, 1 = 1-2 days a week, 0 = 3-5 days a week, 0 = Daily or almost daily).

The following questions were used for the sleep quality scale (response categories and equivalent coding for the scale in parenthesis):

*How long does it usually take you to fall asleep?* (4 = Ten minutes or less, 3 = About 10-20 minutes, 2 = About 20-30 minutes, 1 = 30-40 minutes, 0 = Usually more than 40 minutes);

*How often have you had the following symptoms in the past month?*

Difficulties in falling asleep; (0 = Almost daily, 1 = More than once a week, 2 = About once a week, 3 = About once a month, 4 = Never)

Waking up during the night (0 = Almost daily, 1 = More than once a week, 2 = About once a week, 3 = About once a month, 4 = Never).

I

## **How young Europeans sleep?**

by

**Tynjälä, J., Kannas, L. & Välimaa, R.**

**Health Education Research 1993; 8, 69-80**

**<https://doi.org/10.1093/her/8.1.69>**

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**II**

**Sleeping habits of Finnish school children by  
sociodemographic background**

by

**Tynjälä, J. & Kannas, L.**

**Health Promotion International, 1993; 8, 281-289**

**<https://doi.org/10.1093/heapro/8.4.281>**

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III

**Suomalaisten nuorten lepotottumukset ja  
univaikeudet sekä koulutusorientaatio.**  
Sleeping habits, sleep difficulties and educational  
expectations among Finnish school children

**Teoksessa/In: S. Shemeikka & A. Nissinen (Eds.)  
Terveyskasvatustutkimuksen vuosikirja 1992**  
The Yearbook of the Health Education Research 1992

by

**Tynjälä, J.**

**Sosiaali- ja terveysministeriön selvityksiä 1993: 1, 99-113.**  
Reports of the Ministry of Social Affairs and Health, 1993: 1, 99-113

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November 1998

## **Suomalaisten nuorten lepotottumukset ja univaikeudet sekä koulutusorientaatio**

**Jorma Tynjälä**

*Tutkimuksessa tarkasteltiin 11-, 13- ja 15-vuotiaiden suomalaisten nuorten lepotottumuksia ja univaikeuksia sekä 15-vuotiaiden ikäryhmässä oppilaan ilmoittaman peruskoulun jälkeisen koulutusvalinnan, oppilaan sukupuolen ja isän ammattiseuran yhteyttä lepotottumuksiin ja univaikeuksiin.*

*Tutkimustulokset perustuvat WHO-Koululaistutkimuksen Suomen aineistoon vuodelta 1990. Koko maata edustava aineisto kerättiin luokkakyselymenetelmää käyttäen strukturoiduilla kysymyslomakkeilla keväällä 1990. Oppilaat vastasivat nimettöminä kyselylomakkeeseen. Otokseen kuuluneista 151 koulusta 150 toteutti kyselyn. Tutkimukseen vastasi kaikkiaan 3048 oppilasta, joista aineiston puhdistuksen jälkeen kelpuutettiin lopulliseen tutkimusaineistoon 2996 oppilasta.*

*Lepotottumusten ja univaikeuksien erot sukupuolten välillä olivat vähäisempiä kuin ikäryhmien välillä. Mitä vanhempi oppilas oli kyseessä, sitä kuluttavammaksi olivat hänen lepotottumuksensa ja sitä enemmän hän koki univaikeuksia. Pojilla oli jonkin verran epäsäännöllisemmät lepotottumukset. Suurin osa 11-15 -vuotiaista oppilaista noudatti kuitenkin terveellisiä lepotottumuksia, mutta 5-10 %:lla nuorista oli epäterveelliset lepotottumukset ja keskimääräistä enemmän univaikeuksia. 15-vuotiailla nuorilla oppilaan sukupuoli selitti parhaiten lepotottumuksia ja univaikeuksia, isän ammattiasema selitti ainoastaan yöllisiä heräilyjä ja nuorten ilmoittama peruskoulun jälkeinen koulutusvalinta ei ollut yhteydessä yhteenkään lepotottumuksia ja univaikeuksia kuvaavaan muuttajaan.*

*Terveyskasvatuksen kannalta olennaisen ryhmän muodostaa em. 5-10 % nuorista, joilla on epäsäännölliset lepotottumukset ja usein univaikeuksia. Tähän ryhmään tulisi kiinnittää aktiivisesti huomiota koulussa keskustelemalla oppilaiden ja heidän vanhempiansa kanssa säännöllisten lepotottumusten merkityksestä oppilaan vireystilaan ja hyvinvointiin.*

## JOHDANTO

Tässä artikkelissa kuvataan suomalaisten 11-15-vuotiaiden nuorten lepotottumuksia ja univaikeuksia. Lisäksi tarkastellaan 15-vuotiaiden nuorten ilmoittamien peruskoulun jälkeisten koulutusvalintojen (koulutusorientaation) yhteyttä lepotottumuksiin ja univaikeuksiin. Raportti liittyy laajempaan nuorten lepotottumuksia ja univaikeuksia käsittelevään tutkimukseen, jonka muissa osaraporteissa käsitellään eurooppalaisten nuorten lepotottumuksia (Tynjälä ym. 1989, Tynjälä ym. 1993) ja eräiden keskeisten sosiodemografisten taustatekijöiden yhteyttä suomalaisten nuorten lepotottumuksiin ja univaikeuksiin (Tynjälä ja Kannas 1992).

Nuorilla unen tarve on hyvin yksilöllistä ja vaihtelee suuresti lapsen kehitysvaiheen mukaan. Nuorten nukkumaanmenoajan on todettu siirtyvän myöhäisemmäksi iän lisääntyessä. Nukkumistottumuksissa ilmenee eroja myös sukupuolten välillä. Pojilla nukkumaanmenoajan on havaittu olevan epäsäännöllisempi kuin tytöillä. (Rimpelä ja Rimpelä 1983) Useissa tutkimuksissa on myös todettu, että pojat menevät tyttöjä myöhemmin nukkumaan (Rugg-Gunn ym. 1984, Carskadon 1990) ja että tytöt nukkuvat jonkin verran pitempiä yöunia kuin pojat (Levy ym. 1986).

Tutkimustulokset sosiodemografisten taustatekijöiden kuten iän ja sukupuolen yhteyksistä

univaikeuksiin ovat ristiriitaisia. Univaikeuksien on todettu lisääntyvän iän myötä ja ne ovat tyypillisempiä tytöillä ja naisilla kuin pojilla ja miehillä (Partinen ja Rimpelä 1982, Welstein ym. 1983, Kronholm ym. 1985, Kronholm ym. 1987, Urponen ym. 1988, Martikainen 1991). Fischerin ja Wilsonin (1987) ja Klackenbergin (1982) mukaan sukupuolella ei nuoruusiässä ollut kuitenkaan yhteyttä univaikeuksiin. WHO-Koululaistutkimuksessa 1986 noin 30 %:lla suomalaisista 11-15 -vuotiaista oli nukahtamisvaikeuksia vähintään kahtena iltana viikossa ja suomalaisten ohella norjalaiset koululaiset kokivat eniten aamuväsymystä kouluamuina - 15-vuotiaat enemmän kuin 11- ja 13-vuotiaat (Tynjälä ym. 1989).

## KOULUTUSORIENTAATIO, SOSIAALI-LUOKKA JA LEPOTOTTUMUKSET

Nuorten koulutusorientaation tiedetään aiempien tutkimusten perusteella liittyvän vahvasti vanhempien omaan koulutustaustaan ja ammattiasemaan siten, että korkean asteen koulutuksen saaneiden vanhempien lapset ohjautuvat pääsääntöisesti lukioon ja korkeakouluun ja vain perusasteen koulutuksen saaneiden vanhempien lapset pääsääntöisesti ammatilliseen koulutukseen (esim. Lähteenmaa ja Siurala 1991). Kuusinen (1992) totesi tutkimuksessaan nuorten koulutusvalinnoista peruskoulun jälkeen, että ylimpään sosiaaliryhmään kuuluvien vanhempien lapsista siirtyi



lukioon 88 %, keskiryhmään kuuluvien vanhempien lapsista 53 % ja alimpaan sosiaaliryhmään kuuluvien lapsista 35 %. Erot eivät ole vuosien kuluessa myöskään tasoittuneet, vaan isän koulutusasteella mitattuna koulutuserot ovat pikemminkin kasvaneet (Isoaho ym. 1990). Sosiaalinen liikkuvuus yhteiskunnassa ei Kuusisen (1992) mukaan näytä koulutusta koskevien muutosten tuloksena myöskään lisääntyneen.

Eri sosiaaliluokkiin kuuluvat vanhemmat asettavat erilaisia odotuksia lapsensa koulutukseen. Ylemmissä sosiaaliluokissa vanhemmat toivovat, että heidän lapsensa valitsisivat pitemmän (ja usein myös akateemisen) koulutuksen kuin alempiin sosiaaliluokkiin kuuluvat vanhemmat. Ylemmissä sosiaaliluokissa ero vanhempien odotusten ja lasten toiveiden välillä on pienin ja lisääntyy keskimmaisessä ja alimmassa sosiaaliluokassa. (Jalkanen 1990) Tällaiset odotukset yhdessä niihin liittyvine sosiaalisine paineineen voivat heijastua psykosomaattisena oireiluna, johon kuuluvat myös univaikeudet. Toisaalta psykosomaattista oireilua voi aiheuttaa myös se, että nuori tekee koulutusvalintansa vanhempiensa toiveiden mukaisesti, vaikka hänen oma motivaationsa suuntautuisi toisenlaiseen koulutusratkaisuun.

Aiemmat tutkimukset sosiaaliluokan ja psyykkisen oireilun suhteen ovat osoittaneet, että erot sosiaaliluokkien välillä nuorilla ovat vähäiset ja epä johdonmukaiset ja että erot sosiaaliluokkien välillä ilmaantuisivat vasta aikuisuudessa (Eriksson ym. 1992). Sosiaaliluokkien väliset erot oireilun suhteen yleensäkin ovat osoittautuneet nuoruusiässä vähäisiksi (West 1988, West ym. 1990, Rahkonen ja Lahelma 1992).

## TUTKIMUSONGELMAT

Tässä tutkimuksessa kuvataan:

1. Millaiset ovat 11-, 13- ja 15-vuotiaiden suomalaisten nuorten lepotottumukset ja missä määrin heillä ilmenee univaikeuksia?
2. Missä määrin oppilaan sukupuolella, koulutusorientaatiolla (ilmoitettu peruskoulun jälkeinen koulutusvalinta) ja isän ammattiasemalla voidaan selittää 15-vuotiaiden nuorten univaikeuksia ja lepotottumuksia?

## AINEISTO JA MENETELMÄT

Tutkimus on osa laajempaa kansainvälistä nuorten elämäntyyliä terveyden näkökulmasta kartoittavaa tutkimusta, josta käytetään nimitystä HBSC-STUDY (Health Behavior in School Aged Children. A WHO Cross-National Survey). Suomessa tätä tutkimusta kutsutaan WHO-Koululaistutkimukseksi. Tutkimusaineistot on kerätty tähän mennessä kolme kertaa - vuosina 1984, 1986 ja 1990. Tutkimuksen periaatteita ja tavoitteita on kuvattu tarkemmin muussa yhteydessä (esim. Aarø ym. 1986; Aarø ja Wold 1989). Tämän tutkimuksen aineistona on käytetty WHO-Koululaistutkimuksen Suomen aineistoa vuodelta 1990. Tutkimusjoukon muodostivat suomen kieltä äidinkielenään puhuvat 5., 7. ja 9. luokkien oppilaat, joiden keski-ikä oli pojilla 11.7, 13.7 ja 15.6 vuotta ja tytöillä 11.6, 13.7 ja 15.7 vuotta. Tutkimukseen osallistuneista 151 koulusta 150 (99 %) toteutti kyselyn. Oppilaita näissä kouluissa oli 3226, joista kyselyyn osallistui 3048 oppilasta (94.5 %). Puhdistetun aineiston kooksi muodostui 2996 (92.9 %). Tutkimusaineisto on koko maata edustava ja kerättiin luokkakyselyä käyttäen vuoden 1990 huhti-toukokuussa.



Lepotottumuksia ja univaikeuksia mittaavien muuttujien suorat jakaumat esitetään sukupuolen ja iän mukaan. Tilastolliset merkitsevyydet kaksikulotteisissa ristiintaulukoissa on laskettu  $\chi^2$ -testillä. Logit-regressioanalyysia varten oppilaan ilmoittama peruskoulun jälkeinen koulutusvalinta (koulutusorientaatio) ja perheen sosiaaliluokkaa kuvaava isän ammattiasema dikotomisoitiin, jotta analyysien pohjana olevissa useampisuuntaisissa ristiintaulukoissa olisi ollut riittävästi tapauksia kaikkiin taulukon ruutuihin. Logit-regressioanalyysiin valittiin vain vanhin ikäryhmä, koska peruskoulun jälkeinen koulutusvalinta oli heillä ajankohtaisin.

Logit-regression avulla haluttiin tutkia, selittääkö oppilaan sukupuoli, hänen ilmoittamansa peruskoulun jälkeinen koulutusvalinta ja isän ammattiasema oppilaan lepotottumuksia ja univaikeuksia. Koska haluttiin tutkia samanaikaisesti näiden kolmen selittävän muuttujan vaikutusta yhteen selitettävään dikotomiseen muuttujaan kerrallaan, päädyttiin logit-regressioon. Mallien tuloksin yksinkertaistamiseksi myös kaikki selittävät muuttujat muutettiin kaksiluokkaisiksi. Logit-regressioanalyysit suoritettiin GLIM -ohjelmiston PC-versiolla 3.77 (Aitkin ym. 1990). Logit-regressiomalleissa muuttujat dikotomisoitiin seuraavasti: (L=lepotottumus, U=univaikeus, T=taustamuuttuja):

#### Selittävät muuttujat:

##### NUKKUMAANMENOAIKA (L)

- 1 = klo 22.30 tai aikaisemmin
- 2 = klo 23.00 tai myöhemmin

##### NUKAHTAMISVAIKEUS (U)

- 1 = Harvemmin
- 2 = Useammin kuin 1 krt/vk - lähes päivittäin

##### NUKKUMAANMENON SÄÄNNÖLLISYYS (L)

- 1 = Melko tai hyvin säännöllinen
- 2 = Melko tai hyvin epäsäännöllinen

##### UNEN LAATU (U)

- 1 = Melko hyvä tai hyvä
- 2 = Tyydyttävä tai huonompi

##### AAMUVÄSYMYS KOULUAAMUINA (U)

- 1 = 3 krt/vk tai harvemmin
- 2 = 4 krt/vk tai useammin

##### PÄIVÄUNET (U)

- 1 = Vähintään 3 pv/vk
- 2 = Korkeintaan 2 pv/vk

##### PÄIVÄAIKAINEN VÄSYMYS (U)

- 1 = Korkeintaan 2 pv/vk
- 2 = Vähintään 3 pv/vk

##### NUKAHTAMISVIIVE (U)

- 1 = Korkeintaan 10 minuuttia
- 2 = Enemmän kuin 10 minuuttia

##### ÖISET HERÄILYT (U)

- 1 = Ei viikoittain
- 2 = Vähintään 1 krt/vk

##### VARHAISET HERÄILYT (U)

- 1 = Ei viikoittain
- 2 = Vähintään 1 krt/vk

##### HERÄILYN SYYT<sup>\*)</sup> (U)

- 1 = Ei-ulkoiset syyt
- 2 = Ulkoiset syyt

\*) Ei-ulkoiset syyt: painajaiset, huolet, WC-tarpeet ja kivut

Ulkoiset syyt: äänet ja valaistusolosuhteet

Kohta "muut syyt" jätettiin pois analyysistä

#### Selittävät muuttujat:

##### SUKUPOOLI (T)

- 1 = Poika
- 2 = Tyttö

##### KOULUTUSORIENTAATIO (T)

- 1 = Lukio
- 2 = Ammatillinen koulutus

##### ISÄN AMMATTIASEMA (T)

- 1 = Toimihenkilö (ylemmät ja alemmat th:t)
- 2 = Työväestö (ammattitaitoiset ja ammattitaidottomat)

#### TULOKSET

#### Lepotottumukset ja univaikeudet

Lepotottumusten ja univaikeuksien erot sukupuolten välillä olivat vähäisempiä kuin ikäryhmien välillä. Yleispiirteenä oli, että mitä van-

hemmasta oppilaasta oli kyse, sitä kuluttavammat olivat hänen lepotottumuksensa ja sitä enemmän hän koki univaikeuksia. Suurin osa 11-15 -vuotiaista nuorista noudatti terveellisiä lepotottumuksia, mutta 5-10 %:lla nuorista oli epäterveelliset lepotottumukset ja myös keskimääräistä enemmän univaikeuksia. (Liitteet 1 ja 2)

Myöhään nukkumaan menevien osuus lisääntyi iän myötä - tämä osuus oli pojilla tyttöjä suurempi kaikissa ikäryhmissä. 15-vuotiaista pojista joka kolmas ja tytöistä joka viides ilmoitti menevänsä nukkumaan kello 23 tai myöhemmin. Usein nukahtamisvaikeuksia koki 5-10 % nuorista sukupuolten välisten erojen ollessa vähäisiä. 11-vuotiailla oli jonkin verran enemmän nukahtamisvaikeuksia kuin muilla ikäryhmillä. Epäsäännöllisesti nukkumaan menevien osuus lisääntyi iän myötä - pojilla nopeammin kuin tytöillä. 13-vuotiaiden ikäryhmää lukuunottamatta erot sukupuolten välillä olivat tilastollisesti merkitseviä tyttöjen mennessä jonkin verran säännöllisemmin nukkumaan. Nukahtamisviive vaihteli tilastollisesti merkitsevästi ikäryhmien välillä pojilla ja sukupuolten välillä ainoastaan nuorimmassa ikäryhmässä. Sekä pojista että tytöistä noin 10 % ilmoitti nukahtamiseen kuluvan vähintään puoli tuntia. Noin kolmasosa ilmoitti, että he nukahtivat alle 10 minuutissa. (Liitteet 1 ja 2)

Vähintään kerran viikossa yöaikaan heräilevien osuus oli noin 15 % ja noin joka neljäs nuori ilmoitti, ettei heräillyt lainkaan öiseen aikaan. Tyttöillä öiset heräilyt vaihtelivat tilastollisesti merkitsevästi ikäryhmien välillä. Liian varhain aamulla heräilevien osuus oli suurimmillaan nuorimmassa ikäryhmässä, jossa vähintään kerran viikossa heräilevien osuus pojilla oli 14 %

ja tytöillä 15 %. Heräilyn syistä yleisimmäksi muodostui ympäristön melu, äänet ja valaistus, jonka osuus vaihteli 30 - 40 %:iin vastaajista. Ikäryhmien väliset erot olivat pojilla jonkin verran suurempia kuin tytöillä. Sukupuolten väliset erot heräämisen syissä eri ikäryhmissä olivat vähäisiä. Heräämisaika vaihteli tilastollisesti merkitsevästi ikäryhmien välillä sekä pojilla että tytöillä. 13- ja 15-vuotiaiden keskuudessa myöhään heräävien poikien osuus oli tyttöjä suurempi. Kello 7.30 tai myöhemmin heräävien osuus oli 15-vuotiailla pojilla 45 %, kun tytöistä tähän ryhmään kuului vain 26 %. Yöunen pituuden keskiarvo ei eronnut tilastollisesti merkitsevästi sukupuolten välillä missään ikäryhmässä, mutta 13-15 -vuotiaiden yöuni oli lyhyempi kuin 11-vuotiaiden. (Liitteet 1 ja 2)

Hyväksi tai melko hyväksi koki unensa noin 80 % vastaajista. Koettu unen laatu ei vaihdellut tilastollisesti merkitsevästi ikäryhmien tai sukupuolten välillä. Usein itsensä koulu-aamuina väsyneeksi kokevien osuus lisääntyi iän mukana. Nuorimmassa ikäryhmässä vähintään neljänä koulu-aamuna viikossa itsensä väsyneeksi koki joka kymmenes, kun vanhimmassa ikäryhmässä pojista lähes joka kolmas ja tytöistä joka neljäs ilmoitti kuuluvansa tähän ryhmään. Vähintään kerran viikossa päiväaikaan itsensä väsyneeksi kokevien osuus kasvoi iän myötä. 11-vuotiaista pojista ja tytöistä joka neljäs oli väsynyt päivisin ainakin kerran viikossa. 15-vuotiaista pojista 43 % ja tytöistä 51 % kuului tähän ryhmään. Päiväunia vähintään kerran viikossa nukkuvien osuus lisääntyi oppilaiden vanhetessa. 11-vuotiaista pojista noin 10 % ja tytöistä noin 6 % otti nokoset ainakin kerran viikossa; 15-vuotiailla vastaavat osuudet olivat noin 20 % ja noin 29 %.

Sukupuolten välinen ero oli tilastollisesti merkitsevä vain 15-vuotiaiden ryhmässä. (Liitteet 1 ja 2)

### Koulutusorientaatio, sosiaaliluokka ja lepotottumukset

Lukio oli enemmän tyttöjen kuin poikien suosiossa kaikissa ikäryhmissä. Esimerkiksi vanhimman ikäryhmän tytöistä yli 60 % ilmoitti valitsevansa lukion jatkokoulutusväyläkseen, pojilla tämä osuus oli alle 50 %. (Taulukko 1) Tulevaisuuden suunnitelmansa epävarmoiksi tuntevien osuus vähäni sikästä iän lisääntyessä. Oppisopimuskoulutukseen menevien tai niiden osuudet, jotka arvelivat joutuvansa työttömäksi, olivat hyvin pienet. Isän ammatiaseman jakauman tarkastelu 15-vuotiaiden ryhmässä osoitti, että johtajien ja ylempien toimihenkilöiden osuus oli 27 %, alempien

toimihenkilöiden 23 %, ammattitaitoisten työntekijöiden 32 %, ammattitaidottomien työntekijöiden 3 %, maanviljelijöiden 9 % sekä muiden ryhmien yhteensä 7 %.

Logit-regressionanalyseissä lähtökohtana oli, että kutakin selitettävää muuttujaa pyrittiin selittämään samanaikaisesti kaikilla kolmella selittäväällä muuttujalla (oppilaan sukupuoli, koulutusorientaatio ja isän ammattiasema). Seitsemässä tapauksessa yksikään edellä mainituista selittävästä muuttujasta ei ollut tilastollisesti merkitsevästi yhteydessä selitettävään muuttujaan. Neljässä tapauksessa saatiin kuitenkin hyväksyttävä malli. Kaikissa neljässä mallissa merkitsevien selittävien muuttujien määrä supistui yhteen kolmesta mahdollisesta, jolloin malli palautui kaksiulotteiseen ristiintaulukkoon. Sukupuoli oli ainoa tilastollisesti

Taulukko 1. Oppilaiden ilmoittama aiottu koulutusorientaatio peruskoulun jälkeen sukupuolen ja iän mukaan.

Koulutusorientaatio	POJAT			TYTÖT		
	11-v. %	13-v. %	15-v. %	11-v. %	13-v. %	15-v. %
Lukio	37.8	46.7	46.4	58.0	57.3	61.4
Ammatillinen koulutus	26.9	36.1	46.9	15.6	28.6	31.6
Työelämä	3.7	1.7	2.8	2.2	1.7	2.0
Oppisopimuskoulutus	0.2		1.1			1.7
Työttömäksi	0.2		0.7			
Ei osaa sanoa	31.3	15.4	2.2	24.3	12.4	3.3
Yhteensä	100.0	100.0	100.0	100.0	100.0	100.0
(N)	(588)	(460)	(461)	(551)	(461)	(459)

merkitsevä selittävä muuttuja nukkumaanmenoajan, nukkumaanmenon säännöllisyyden ja heräilyjen syiden (heräilyjä joko yöaikaan tai varhain aamulla kokeneiden) suhteen. Isän ammattiasema selitti yksinään ainoastaan yöaikaan tapahtuvaa heräilyä. Ristiintaulukot selitettävän ja selittävien muuttujien välillä on esitetty taulukoissa 2-5. Tulokset osoittivat, että myöhään nukkumaan menevien poikien osuus oli tyttöjä suurempi, pojilla oli epäsäännöllisemmät nukkumaanmenotottumukset, työväestöön kuuluvien lapset heräilivät öiseen aikaan toimihenkilöiden lapsia useammin ja ei-ulkoisia (painajaiset, huolet, WC-tarpeet ja kivut) heräilyn syitä oli tytöillä poikia enemmän.

Taulukko 2. Nukkumaanmeno-aika sukupuolen mukaan 15-vuotiailla.

	Pojat %	Tytöt %
Klo 22.30 tai aikaisemmin	66.7	78.4
Klo 23 tai myöhemmin	33.3	21.6
Yhteensä (N)	100.0 (459)	100.0 (464)

$\chi^2 = 16.10$ , vapausasteet 1,  $p < 0.001$

Taulukko 3. Nukkumaanmenon säännöllisyys 15-vuotiailla sukupuolen mukaan.

	Pojat %	Tytöt %
Säännöllisesti	67.0	76.9
Epäsäännöllisesti	33.0	23.1
Yhteensä (N)	100.0 (461)	100.0 (463)

$\chi^2 = 11.14$ , vapausasteet 1,  $p < 0.001$

Taulukko 4. Heräilyn syyt niitä kokeneilla 15-vuotiailla sukupuolen mukaan.

	Pojat %	Tytöt %
Ei ulkoiset syyt <sup>*)</sup>	49.2	59.8
Ulkoiset syyt	50.8	40.2
Yhteensä (N)	100.0 (244)	100.0 (286)

$\chi^2 = 5.99$ , vapausasteet 1,  $p < 0.014$

\*) Ei-ulkoiset syyt: painajaiset, huolet, WC-tarpeet ja kivut

Ulkoiset syyt: äänet ja valaistusolosuhteet

Taulukko 5. Öinen heräily isän ammattiaseman mukaan 15-vuotiailla.

	Toimihenkilöt %	Työväestö %
Vähintään 1 krt/vk	10.9	18.5
Harvoin-ei koskaan	89.1	81.5
Yhteensä (N)	100.0 (440)	100.0 (302)

$\chi^2 = 8.66$ , vapausasteet 1,  $p < 0.003$

Yhteenvedon voi todeta, että vanhimmassa ikäryhmässä nuorten koulutusorientaatio ja isän ammattiasema eivät olleet lainkaan tai olivat hyvin heikosti yhteydessä nuorten lepotottumuksiin ja univaikeuksiin. Sukupuolella oli merkitystä ainoastaan nukkumaanmeno-aikaan, nukkumaanmenon säännöllisyyteen ja heräilyn syihin.

## YHTIENVETO JA POHDINTA

Tulokset osoittivat, että oppilaan ikäryhmä oli sukupuolta tärkeämpi lepotottumuksia ja univaikeuksia säätelevä tekijä. Iän myötä lepotot-

tumukset muuttuivat terveyden kannalta huonompaan suuntaan. Tulokset tukivat lepotottumusten osalta aiempia tutkimuksia (esimerkiksi Rimpelä ja Rimpelä 1983, Rugg-Gunn ym. 1984, Carskadon 1990). Sukupuolten väliset erot olivat yleensä ottaen vähäisiä. Ainoastaan nukkumaanmenoajan ja koetun päiväaikaisen väsymyksen suhteen erot olivat kaikissa ikäryhmissä tilastollisesti merkitseviä siten, että pojat menivät tyttöjä myöhemmin nukkumaan ja tytöt olivat poikia jonkin verran väsyneempiä päivääikaan. Päiväväsymyksen osalta tulokset olivat samansuuntaisia kuin aikuisväestöllä tehdyt tutkimukset, joissa naisilla on todettu enemmän väsymystä päivääikaan (esim. Partinen ja Rimpelä 1982, Kronholm ym. 1987, Martikainen ym. 1991).

Monissa tutkimuksissa tytöt ovat poikia yleisemmin ilmoittaneet nukahtamisvaikeuksista iltaisin (Karazan ym. 1983, Rimpelä ja Rimpelä 1983, Welstein ym. 1983, Yang ym. 1987), mutta tulokset inihäiriöiden ja univaikeuksien sukupuolieroista ovat olleet myös ristiriitaisia (esim. Dollinger 1982, Klackenberg 1982, Abe ja Suzuki 1985, Fischer ja Wilson 1987). Aikuisväestössä naiset sen sijaan ovat melko johdonmukaisesti ilmoittaneet miehiä enemmän nukahtamisvaikeuksia (esim. Kronholm ym. 1985, Kronholm ym. 1987). Tässä tutkimuksessa sukupuolten välinen ero koetussa nukahtamisvaikeudessa ilmeni ainoastaan 11-vuotiaiden ikäryhmässä, mutta erot eivät ilmenneet viikoittain, vaan hyvin harvoin ongelmia kokeneiden ryhmässä. Heräämisaike osoittautui mielenkiintoiseksi lepotottumusten mittaksi 13- ja 15-vuotiaiden ikäryhmässä, sillä pojat ilmoittivat tyttöjä selkeästi useammin heräävänsä suhteellisen myöhään aamulla. Esimerkiksi 15-vuotiaista pojista 45 % ja tytöistä vain 26 %

ilmoitti heräävänsä aikaisintaan kello 7.30. Pojat näyttävät siten kompensoivan myöhäistä nukkumaanmenoaikaa myöhäisellä aamuheräämisellä.

Suurimmalla osalla nuorista on terveyden kannalta hyvät ja usein myös riittävän säännölliset lepotottumukset ja tähän ryhmään kuuluvilla on suhteellisen vähän uneen liittyviä vaikeuksia. Vain noin 5-10 %:lla nuorista voidaan sanoa olevan terveyden kannalta huolestuttavan epäsäännölliset lepotottumukset ja melko vaikeitakin koettuja univaikeuksia. Epäsäännöllisiin lepotottumuksiin liittyy tällöin hyvin usein tavallista enemmän univaikeuksia, kuten aikaisemmat tutkimukset (Rimpelä ja Rimpelä 1983, Tynjälä ym. 1989) ovat osoittaneet. Tämä ryhmä pitäisi pystyä tunnistamaan esim. koulussa ja ryhmään tulisi kiinnittää aktiivisesti huomiota keskustelemalla oppilaiden kanssa oppitunneilla ja heidän vanhempiensa kanssa sopivissa yhteyksissä säännöllisten lepotottumusten merkityksestä nuorten vireystilaan ja hyvinvointiin, sillä väsymys heijastuu koko koulutyöhön esimerkiksi keskittymiskykyä heikentämällä (Tynjälä ym. 1989, ks. myös Rintahaka 1991). Lepotottumusten ja univaikeuksien keskinäistä yhteyttä ja niiden kumuloitumista WHO-Koululaistutkimusaineistossa tullaan tarkastelemaan myöhemmin ilmestyvässä raportissa. Tavoitteena on myös määrittellä huonosti ja hyvin nukkuvien nuorten ryhmät ja tarkastella, mitkä tekijät ovat yhteydessä hyvään tai huonoon uneen.

Isän ammattiasemalla ja nuorten peruskoulun jälkeisillä koulutusvalinnoilla oli heikko yhteys nuorten univaikeuksiin lukuunottamatta yöllisiä heräilyjä, joita kokivat jonkin verran useammin työväestön kuin toimihenkilöiden lapset (vrt.

Aro ym. 1987, Kahn ym. 1989). Kaiken kaikkiaan logit-regressioanalyysiin valitut, unta ja lepoa selittävät muuttujat osoittautuivat melko huonoiksi valinnoiksi. Sukupuolta lukuunottamatta niillä oli vähän tai ei lainkaan merkitystä lepotottumuksiin ja univaikeuksiin. Tämä osoittaa, että lukuisilla muilla tekijöillä kuten perheen sosioekonomisella asemalla, perheen vuorovaikutussuhteilla, nuorten sosiaalisella tuella (esim. ystävien määrä ja ystävyys-suhteiden laatu) ja monilla koulutyöhön liittyvien asioilla (Tynjälä ym. 1992) on todennäköisesti paljon suurempi nuorten lepotottumuksia ja univaikeuksia säätelevä vaikutus. Erityisesti on huomattava, että koulutusorientaatio ei korreloinut yhteenkään univaikeus- tai lepotottumusmuuttujaan käytetyn analyysin - logit-regression - perusteella. Vanhempien odotukset ja toiveet (niihin liittyvine sosiaalisine paineinen) lastensa koulutuksen suhteen eivät siten juurikaan heijastuneet nuorten univaikeuksina tai epäsäännöllisinä lepotottumuksina, vaan monet muut esim. perheen ulkopuoliset tekijät

näyttävät olevan paljon määrävämmässä asemassa. Logit-regressioanalyysiin olisi ollut hyödyllistä ottaa mukaan kolmas isän ammattiasema kuvaava luokka, maanviljelijät, mutta aineiston pienuuden vuoksi se ei ollut mahdollista. Maanviljelijäväestön mukaanottoa analyysiin olisi puoltanut se, että aiempien tutkimusten (Rimpelä ja Rimpelä 1983, Tynjälä ja Kannas 1992) mukaan maanviljelijöiden lapsilla on muiden ammattiryhmien lapsiin verrattuna jonkin verran terveellisemmät lepotottumukset.

Jatkossa tulisi selvittää mm., miten koulumenestys ja kouluviihtyvyyt ovat yhteydessä nuorten lepotottumuksiin ja univaikeuksiin. Aiemmat tutkimukset (esim. Aro ym. 1987) ovat osoittaneet, että huonosti koulussa menestyvät oppilaat kokevat hyvin menestyviä enemmän psykosomaattisia oireita univaikeudet mukaanlukien. Huonosti nukkuvilla nuorilla on myös koulumenestyksen todettu olevan keskimääräistä huonompi (Kahn ym. 1989).

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## SUMMARY

*Tynjälä J. Sleeping habits, sleep difficulties and educational expectations among Finnish school children. The Yearbook of the Health Education Research 1992, Finland, pp. 99-113.*

In this study sleeping habits and sleep difficulties among 11-, 13- and 15-year-old Finns were of primary interest. In the oldest age group the second area of interest was how sleeping habits and sleep difficulties varied according to pupils' sex, educational expectations and father's occupation.

The results are based on the Finnish part of the HBSC-STUDY (Health Behaviour in School Aged Children - A WHO Cross-National Survey). The research data were nationally representative. The data were collected in spring 1990. Pupils answered the questionnaire anonymously. 150 out of 151 possible schools took part in the survey. The total number of pupils completing the questionnaire was 3048, of which 2996 pupils were in the final study population.

Differences in sleeping habits and sleep difficulties were smaller between sexes than between age groups. Sleeping habits were less healthy among older pupils and these also had more sleep difficulties. Boys' sleeping habits were more irregular. Most of the 11-15-year-old pupils had healthy sleeping habits, but 5-10 per cent of adolescents had unhealthy sleeping habits and more sleep difficulties than average. Pupils' sex was the best explanatory factor for sleeping habits and sleep difficulties; father's occupational status correlated only with nocturnal awakenings, and pupils' educational expectations did not correlate with any variable measuring sleeping habits and sleep difficulties.

Young people with irregular sleeping habits and many sleep difficulties are an important target group for health education. Special attention should be given to this group, by discussing the influence of regular sleeping habits on adolescents' alertness and general well-being with the pupils and their parents.

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Liite 1. Lepotottumukset ja univaikeudet sukupuolen ja iän mukaan.

	POJAT			TYTÖT		
	11-v. %	13-v. %	15-v. %	11-v. %	13-v. %	15-v. %
<b>Nukkumaanmeno- noaika:</b>						
21 tai aikaisemmin	15.2	3.3	1.1	22.6	5.9	1.7
21.30	32.5	18.0	7.6	34.4	22.3	11.4
22	33.6	37.2	25.3	31.3	34.1	31.0
22.30	12.8	26.7	32.7	9.3	27.8	31.0
23 tai myöhemmin	6.0	14.8	33.3	2.4	10.0	21.6
p (ikäryhmien välillä)		.000			.000	
<b>Koettu nukahta- misvaikeus:</b>						
Harvoin-ei koskaan	55.6	51.7	50.1	47.6	54.0	51.8
N. 1 krt/kk	22.2	31.8	31.3	30.2	26.0	27.3
> 1 krt/vk	13.3	12.1	13.2	16.1	14.1	15.7
Lähes päivittäin	8.9	4.3	5.4	6.1	5.9	5.2
p (ikäryhmien välillä)		.001			NS	
<b>Nukkumaanmenon säännöllisyys:</b>						
Hyvin säännöllisesti	11.6	7.4	3.5	9.5	6.3	3.7
Melko säännöllisesti	68.1	69.5	63.6	77.6	74.9	73.2
Melko epäsäännöll.	16.0	17.9	26.0	11.1	16.1	19.4
Hyvin epäsäännöll.	4.3	5.2	6.9	1.8	2.6	3.7
p (ikäryhmien välillä)		.000			.000	
<b>Nukahtamisviive minuuttia:</b>						
Korkeintaan 10	37.9	33.6	27.5	30.8	36.3	29.2
11-20	35.4	40.4	40.1	44.4	41.6	44.3
21-30	17.9	17.0	20.8	14.8	14.2	16.0
31-40	4.8	6.8	6.1	6.4	5.5	6.5
> 40	3.9	2.2	5.4	3.6	2.4	4.1
p (ikäryhmien välillä)		.008			NS	
<b>Yölliset heräilyt:</b>						
Ei koskaan	29.9	28.1	26.5	22.2	27.9	19.9
< 1 krt/kk	38.7	34.4	38.2	45.3	37.0	42.3
< 1 krt/vk	16.2	21.8	21.3	16.9	20.3	22.0
1-2 yönä/vk	8.9	9.4	9.1	8.4	10.2	9.1
3-5 yönä/vk	2.0	3.1	1.5	1.5	2.2	3.0
Joka yö tai lähes joka yö	4.3	3.3	3.5	5.8	2.4	3.7
p (ikäryhmien välillä)		NS			.004	
(N)	(588)	(462)	(463)	(553)	(461)	(465)

## Liite 1 jatkuu ...

	POJAT			TYTÖT		
	11-v. %	13-v. %	15-v. %	11-v. %	13-v. %	15-v. %
<b>Varhainen heräily:</b>						
Joka tai lähes joka aamu	2.4	0.2	0.4	1.3		
3-5 aamuna/vk	2.6	0.9	0.9	1.1	0.7	1.3
1-2 aamuna/vk	8.6	5.4	4.1	12.7	5.7	5.4
< 1 aamuna/vk	33.7	34.4	28.3	35.5	38.5	35.6
Ei lertaakaan	52.7	59.0	66.3	49.5	55.1	57.7
p (ikäryhmien välillä)		.000			*)	
<b>Heräilyn syyt**):</b>						
Painajaisunet	5.0	1.3	2.9	3.5	1.0	1.3
Huolet, murheet, levottomuus	2.1	1.9	2.4	1.4	2.3	1.8
WC-tarpeet	23.0	25.8	14.4	23.6	18.9	20.9
Melu, äänet, valaistus	31.7	34.6	40.8	32.4	29.6	33.1
Kivut, säröt	21.3	20.5	20.7	18.6	26.5	24.4
Muu syy	16.8	16.0	18.8	20.5	21.7	18.6
p (ikäryhmien välillä)		.001			.033	
<b>Heräämisaike:</b>						
N. 6.30 tai aikaisemmin	24.3	23.4	12.0	26.0	36.0	28.2
N. 7.00	48.3	55.3	42.9	51.8	48.2	45.4
N. 7.30	21.9	17.1	29.6	19.3	14.1	20.2
N. 8.00 tai myöhemmin	5.4	4.1	15.3	2.9	1.7	6.2
p (ikäryhmien välillä)		.000			.000	
<b>Yöunen pituus:</b>						
Keskiarvo (h, min)	9.15	8.52	8.50	9.20	8.51	8.43
Hajonta (h, min)	0.36	0.34	0.35	0.34	0.35	0.34
p (ikäryhmien välillä)		.000			.000	
(N)	(588)	(462)	(463)	(553)	(461)	(465)

\*) tilastollista merkittävyyttä ei voitu laskea, koska ruutuja, joissa odotettu frekvenssi oli < 5, oli yli 25 %

\*\*\*) heräilyn syyt on laskettu vain heräilyjä joko yöaikaan tai varhain aamulla kokeneiden joukosta, jolloin N:t olivat pojilla 517 (11-v), 376 (13-v), 382 (15-v) ja tytöillä 488, 392, 393.

	POJAT			TYTÖT		
	11-v. %	13-v. %	15-v. %	11-v. %	13-v. %	15-v. %
<b>Koettu unen laatu:</b>						
Hyvä	55.6	51.0	49.2	53.8	54.9	53.3
Melko hyvä	32.9	33.1	35.4	35.3	33.6	35.2
Tyydyttävä	8.5	13.9	12.1	9.1	9.2	9.1
Melko huono	1.7	1.5	2.6	1.8	2.2	2.2
Huono	1.2	0.4	0.7		0.2	0.2
p (ikäryhmien välillä)		.095			.987	
<b>Koettu aamu- väsymys:</b>						
Harvoin tai ei koskaan	26.2	15.4	6.7	30.7	13.5	6.9
Satunnaisesti	37.1	35.5	30.2	32.8	34.4	34.2
1-3 krt/vk	25.1	26.5	32.3	25.5	29.8	32.0
4 krt/vk tai useammin	11.6	22.6	30.8	10.9	22.2	26.8
p (ikäryhmien välillä)		.000			.000	
<b>Koettu päiväaikainen väsymys:</b>						
Ei kertaakaan	31.8	21.1	13.2	25.0	11.5	6.5
< 1 krt/vk	44.7	44.4	43.8	48.5	46.4	42.3
1-2 pv/vk	15.6	22.2	23.6	14.6	25.3	31.3
3-5 pv/vk	2.4	4.8	8.9	2.6	5.9	8.2
Päivittäin tai lähes päivittäin	5.5	7.4	10.4	9.5	10.9	11.7
p (ikäryhmien välillä)		.000			.000	
<b>Päiväunet:</b>						
Ei kertaakaan	60.8	51.3	39.8	59.5	45.1	29.4
< 1 krt/vk	29.7	36.0	39.8	34.4	40.5	42.1
1-2 pv/vk	7.7	10.5	15.4	5.3	10.5	20.5
3-5 pv/vk	1.2	1.7	3.3	0.5	2.8	4.8
Päivittäin tai lähes päivittäin	0.7	0.4	1.7	0.4	1.1	3.2
p (ikäryhmien välillä)		.000			.000	
(N)	(588)	(462)	(463)	(553)	(461)	(465)

**Liite 2. Lepotottumusten ja univaikeuksien tilastollinen merkitsevyys sukupuolten välillä eri ikäryhmissä (merkitsevyydet perustuvat liitteessä 1 esitettyihin arvoihin).**

<b>Lepotottumus/ univaikeus</b>	<b>11-v.</b>	<b>13-v.</b>	<b>15-v.</b>
Nukkumaanmenoaika	.003	.033	.001
Koettu nukahtamisvaikeus	.002	NS	NS
Nukkumaanmenon säännöllisyys	.002	NS	.007
Nukahtamisviive	.010	NS	NS
Yölliset heräilyt	.044	NS	NS
Varhainen heräily	.029	NS	.042
Heräilyn syyt	NS	.032	.015
Heräämisaika	NS	.000	.000
Yöunen pituus	NS	NS	NS
Koettu unen laatu	NS	NS	NS
Koettu aamuväsymys	NS	NS	NS
Koettu päiväaikainen väsymys	.019	.002	.003
Päiväunet	NS	NS	.007

IV

**Perceived tiredness among adolescents and its  
association with sleep habits and use of  
psychoactive substances**

by

**Tynjälä, J., Kannas, L. & Levälähti, E.**

**Journal of Sleep Research, 1997; 6, 189-198**

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v

**Perceived sleep quality and its  
precursors in adolescents**

by

**Tynjälä, J., Kannas, L., Levälahti, E. & Välimaa, R.**

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