

Department of Public Health
University of Helsinki

**SOCIOECONOMIC DIFFERENCES
IN SMOKING IN ESTONIA:
National and international
comparisons**

Kersti Pärna

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Supervisors: Docent Helena Mussalo-Rauhamaa, MD, PhD
Department of Public Health
University of Helsinki

Professor Mati Rahu, PhD
Department of Epidemiology and Biostatistics
National Institute for Health Development, Tallinn

Reviewers: Professor Pekka Jousilahti, MD, PhD
Department of Epidemiology and Health Promotion
National Public Health Institute (KTL), Helsinki

Docent Sakari Karvonen, PhD
Welfare Research Group
National Research and Development Centre for Welfare and
Health (STAKES), Helsinki

Opponent: Professor Lasse Kannas, PhD
Department of Health Sciences
Research Centre for Health Promotion
University of Jyväskylä

The author of the photograph in the front cover: Mati Rahu

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*In memory of Heino
To my children Katri and Kaur*

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ABSTRACT

The present thesis compares socioeconomic differences in smoking in Estonia and its neighbouring countries. The objectives were (1) to study socioeconomic features of smoking among adolescents in Estonia compared to adolescents in Finland and Russia, (2) to examine socioeconomic differences in smoking among adults in Estonia, (3) to study smoking among physicians as representatives of a higher socioeconomic bracket compared to the general population in Estonia and compared to physicians in Finland, and (4) to investigate socioeconomic differences in the misclassification of one's smoking status among pregnant women in Estonia.

Four separate studies were used to accomplish these objectives. The first one was designed as a cross-sectional study among the 13–18-year-old adolescents in Tallinn, Helsinki, and Moscow. The second study was based on a subsample of the 30–59-year-old adult population of the Estonian Health Interview Survey. The third study was designed as a cross-sectional postal survey among physicians in Estonia and Finland. The fourth one was based on a subsample of the cross-sectional Human Papillomavirus Type-16 Seroprevalence Study in Tallinn. Serum cotinine assays of the pregnant women, who were determined to deliver, were performed. The serum cotinine-validated smoking level was compared with the subjects' self-reported smoking levels obtained from the records of the Estonian Medical Birth Registry.

The socioeconomic status of adolescents was measured by the level of education of the head of the family, whereas, among adults, the level of education, employment status, and income were used. The socioeconomic status of the individuals was categorized according to basic sociodemographic and socio-environmental indicators. Logistic regression analysis was applied to assess association between smoking and socioeconomic status.

The present study confirms that the socioeconomic differences in smoking represent a complex and multifaceted phenomenon. The comparison of adolescents in Tallinn, Helsinki, and Moscow revealed that the prevalence of smoking was higher among boys compared to girls in Tallinn and Moscow, but was higher among girls compared to boys in Helsinki. The prevalence of smoking among girls in Estonian schools in Tallinn was much lower than among girls in the other study samples, but no such difference existed when comparing boys. A multivariate analysis revealed no relationship between the level of education of the head of the household and smoking among adolescents in Tallinn, Helsinki, and Moscow. However, what school was attended had an effect on the variation in smoking prevalence in every study sample. Adolescent smokers in all three capitals were more likely than their non-smoking peers to have a parent, sibling, or friend that smoked. Smoking among siblings and friends showed interaction between the study site and smoking among girls. The association with friends' smoking was strongest among the girls in Helsinki, but siblings' smoking among the girls in Moscow. Passive smoking, analysed only in Tallinn, was associated with a higher prevalence of smoking among adolescents. Other characteristics, such as family

structure and importance of religion, were not associated with smoking among adolescents in Tallinn, Helsinki, and Moscow.

The prevalence of smoking was higher among men than women irrespective of the age group in Estonia. Adult smokers were more likely to be less educated in the case of men, and younger, divorced, separated, or widowed in the case of both men and women. No relationship was established between smoking and employment status, income, ethnicity, and type of residence in Estonia.

Significantly fewer physicians smoked compared to the general adult population, and also compared to the highest educational bracket of the total population in Estonia. However, more male and female physicians smoked in Estonia compared to the physicians in Finland. In both countries smoking was more prevalent in male than in female physicians. Compared to Estonia, physicians in Finland more often agreed that smoking is harmful to their health, that trying to persuade people to stop smoking is their responsibility, and that prevention of smoking should be part of the training programmes of health professionals. In both countries the non-smoking physicians held more unfavourable attitudes towards smoking than those who were smokers themselves.

One fifth of the pregnant women in Estonia who did not admit to current smoking showed serum cotinine values that matched up with those of smokers. Among self-reported non-smokers, non-disclosure of apparent current smoking was more frequent among less educated, economically inactive, non-Estonian, cohabiting and multiparous women.

It can be concluded on the basis of the results of this thesis that in order to reduce smoking among the country's population, the health policies of Estonia should be directed towards addressing specific risk groups, school health education, and fundamental issues of socioeconomic inequality.

YHTEENVETO (Summary in Finnish)

Tupakoinnin sosioekonomiset erot Virossa: kansallisia ja kansainvälisiä vertailuja

Väitöskirjassa tutkitaan tupakoinnissa ilmeneviä sosioekonomisia eroja Virossa ja verrataan niitä naapurimaiden Suomen ja Venäjän tupakointieroihin. Tutkimuksen tavoitteena oli (1) selvittää virolaisten, suomalaisten ja venäläisten nuorten tupakointitottumuksia ja niiden yhteyttä nuorten sosioekonomiseen asemaan, (2) kartoittaa virolaisten aikuisten tupakoinnin sosioekonomisia eroja, (3) vertailla korkeaa sosioekonomista asemaa edustavien virolaislääkärien tupakointia yhtäältä virolaisen aikuisväestön tupakointiin ja toisaalta suomalaisten lääkäreiden tupakointiin ja (4) tutkia raskaana olevien naisten heidän omaa tupakointiaan koskevien virheellisten arviointien sosioekonomista vaihtelua Virossa.

Tutkimukset toteutettiin neljällä eri tutkimusasetelmalla. Ensimmäisessä, poikkileikkaustutkimuksessa tutkittiin 13–18-vuotiaita koululaisia Tallinnassa, Helsingissä ja Moskovassa. Toisen tutkimuksen aineisto koostui Viron terveyshaastattelun (Estonian Health Interview Survey) 30–59-vuotiaita koskevasta osaotoksesta. Kolmas aineisto kerättiin virolaisille ja suomalaisille lääkäreille lähetetyllä postikyselyllä. Neljännen tutkimuksen aineisto oli osa 'Human Papillomavirus Type 16 Seroprevalence' tutkimuksen poikkileikkausaineistoa. Tutkimuksen yhteydessä synnytystä varten sairaalaan tulleista naisista määriteltiin heidän seeruminsa kotiinipitoisuus ja seerumin avulla validoitua tupakointia verrattiin Viron lääketieteelliseen syntymärekisteriin (Estonian Medical Birth Registry) kirjattuun naisten itsensä raportoimaan tupakointiin.

Sosioekonomisen aseman mittareina käytettiin nuorisoinneistossa huoltajan koulutusta ja aikuisväestössä omaa koulutusta, työllisyysasemaa ja palkkatulon määrää. Sosioekonominen asema jaoteltiin sosiodemografisten ja sosiaalisen ympäristön indikaattoreiden mukaan. Tupakoinnin ja sosioekonomisen aseman välistä yhteyttä tutkittiin logistisen regressioanalyysin avulla.

Tämä tutkimus vahvistaa, että tupakoinnin sosioekonomiset erot ovat monimutkainen ja monitasoinen ilmiö. Virolaisten, venäläisten ja suomalaisten koulu- nuorten vertailussa poikien tupakointi oli tyttöjen tupakointia yleisempää Tallinnassa ja Moskovassa, kun taas Helsingissä tytöt ohittivat pojat tupakoinnin yleisyydessä. Tallinnalaisten tyttöjen tupakointi oli huomattavasti harvinaisempaa kuin vertailumaiden tyttöjen mutta vastaavaa ei ollut todettavissa eri maiden poikia vertailtaessa. Monimuuttuja-analyysi osoitti, että perheen pään koulutus ei ollut yhteydessä missään vertailumaassa nuorten tupakointiin. Sen sijaan koulun vaikutus oli todettavissa kaikissa kolmessa pääkaupungissa. Kaikkien pääkaupunkien tupakoivilla nuorilla oli myös usein vanhempien, sisarusten tai ystävien keskuudessa tupakkaa polttavia. Tupakoivilla tytöillä sisarusten ja ystävien tupakointi vaihteli tutkimuspaikan mukaan. Helsingiläistyttöjen tupakointi liittyi vahvimmin ystävien tupakointiin, kun taas sisarusien tupakointi oli yhteydessä moskovaalaistyttöjen tupakointiin. Altistuminen passiiviselle tupakoinnille, jota tutkittiin vain Tallinnassa, liittyi nuorten tupakoinnin yleisyyteen.

Muut tekijät, kuten perherakenne ja uskonnon tärkeys eivät liittyneet nuorten tupakointiin tutkimuskohdemaissa.

Virossa tupakointi oli miehillä naisia yleisempää kaikissa ikäryhmissä. Aikuisten miesten tupakointi oli yleisempää vähemmän koulutusta saaneilla. Sekä miehillä että naisilla tupakoinnin todennäköisyyttä lisäsi nuorempi ikä, eronneisuus, erillään asuminen ja leskeys. Yhteyttä tupakoinnin ja palkkatulon, työllisyysaseman, etnisen ryhmän tai asumisalueen välillä ei Virossa todettu.

Virolaisten lääkäreiden tupakointi oli merkitsevästi vähemmän yleistä kuin muun virolaisväestön ja myös vähemmän yleistä verrattuna korkeasti koulutetun väestönosan tupakointiin. Suomalaisiin lääkäreihin verrattuna virolaiset sekä miehiä että naislääkärit olivat useammin tupakoijia. Molemmissa maissa mieslääkärien tupakointi oli yleisempää kuin naislääkärien. Suomalaiset lääkärit tunnistivat virolaisia useammin tupakoinnin terveydelleen haitalliseksi ja kokivat velvollisuudekseen yrittää vaikuttaa väestön tupakoinnin lopettamiseen. Heidän mielestään tupakoinnin vastustamisen pitäisi olla osa terveydenhuollon koulutusta. Molemmissa maissa tupakoimattomat lääkärit suhtautuivat kielteisemmin tupakointiin kuin heidän tupakoivat kollegansa.

Viidesosalla virolaisista raskaana olevista naisista, jotka eivät raportoineet olevansa nykyhetkellä tupakoivia, oli seerumin kotiniinipitoisuus vastaavaa tasoa kuin virolaisilla tupakoijilla. Tähän ryhmään kuuluvat olivat merkitsevästi muita useammin vähemmän koulutettuja, sosiaalisesti inaktiiveja, syntyperältään ei-virolaisia, ilman avioliittoa yhdessäasuvia ja monilapsisia.

Tämän väitöskirjatyön tulosten perusteella terveystieteiden toimia ja huomiota tulisi Virossa kohdentaa erityisiin riskiryhmiin, koulujen terveystasotukseen sekä sosioekonomiseen epätasa-arvoon liittyviin ongelmiin, jotta virolaisväestön tupakointi saataisiin vähenemään.

KOKKUVÕTE (Summary in Estonian)

Suitsetamise sotsiaalmajanduslikud erinevused Eestis: riigisene ja rahvusvaheline võrdlus

Käesolevas doktoritöös uuritakse suitsetamise sotsiaalmajanduslike erinevusi Eestis ja rahvusvahelises võrdluses. Töö eesmärkideks oli (1) analüüsida suitsetamise seoseid sotsiaalmajanduslike teguritega Tallinna kooliõpilaste hulgas võrreldes Helsingi ja Moskva kooliõpilastega, (2) kirjeldada suitsetamise seoseid sotsiaalmajanduslike teguritega Eesti täiskasvanud rahvastikus, (3) kirjeldada suitsetamist ning hinnata suhtumist suitsetamisesse Eesti arstide hulgas võrreldes Eesti täiskasvanud rahvastiku ja Soome arstidega ning (4) hinnata Eesti rasedate naiste suitsetamise varjamise seost sotsiaalmajanduslike teguritega vere kotiniinisalduse põhjal.

Töö põhineb neljal levimusuuringul. Esimeses uuringus viidi läbi ankeetküsitlus Tallinna eesti ja vene õppekeelega koolide, Helsingi ja Moskva 13–18-aastaste kooliõpilaste hulgas. Teises uuringus intervjueriti Eesti kogurahvastikku esindavat valimit, mille 30–59-aastaste vastajate hulgas hinnati suitsetamise seost sotsiaalmajanduslike teguritega. Kolmandas uuringus koguti postiküsitluse teel andmeid suitsetamise kohta Eesti ja Soome arstkonnas. Analüüsiti Eesti arstide suitsetamist võrreldes Eesti kogurahvastiku ja Soome arstkonnaga. Neljandas uuringus koguti andmed HPV-16 serolevimusuuringu käigus Tallinnas. Vereseerumi kotiniinisaldus määrati vaid nendel rasedatel naistel, kes kavatsesid sünnitada. Naiste isikuandmed lingiti Eesti Meditsiinilise Sünniregistriga, et saada teada nende sotsiaalmajanduslikud andmed ja suitsetamine enesehinnangu järgi.

Sotsiaalmajanduslikest teguritest analüüsiti kooliõpilastel perekonnapea haridust ning täiskasvanutel haridust, sissetulekut ja majanduslikku aktiivsust. Seost suitsetamise ja sotsiaalmajanduslike, sotsiaaldemograafiliste ning sotsiaalset keskkonda iseloomustavate tegurite vahel hinnati logistilise regressiooniga.

Uuringutulemused näitavad, et Tallinna kooliõpilastest suitsetasid rohkem poisid ja mitte-eestlased ning need, kes omasid suitsetavaid vanemaid, õvesid või sõpru ja olid sagedamini eksponeeritud passiivsele suitsetamisele. Rahvusvahelises võrdluses oli vaid Helsingis rohkem suitsetajaid tütar-, mitte poeglaste hulgas. Tütarlaste võrdluses oli suitsetamise levimusmäär oluliselt madalam Tallinna eesti õppekeelega koolides. Poeglaste suitsetamise levimusmääras olulist erinevust riigiti ei esinenud. Mitmetasandilise analüüsi põhjal ei leitud suitsetamise seost perekonnapea haridusega. Nii Tallinnas, Helsingis kui Moskvas olid suitsetamisega seotud teguriteks vanemate, õvede ja sõprade suitsetamine. Suitsetamise seos sõprade suitsetamisega oli tugevaim Helsingi tütarlaste hulgas ning seos õvede suitsetamisega Moskva tütarlaste hulgas. Suitsetamise levimus erines kooliti nii Tallinnas, Helsingis kui ka Moskvas. Ei leitud suitsetamise seost perekonna liigi ega religiooniga.

Suitsetamise levimusmäär oli kõrgem Eesti täiskasvanud meeste kui naiste hulgas. Suitsetajaid esines rohkem madalama haridustasemega meeste ning nooremas vanuserühmas, lahutatud, lahus elavate või lehestunud meeste ja naiste

hulgas. Ei leitud suitsetamise seost majandusliku aktiivsuse, sissetuleku, rahvuse ega elukohaga.

Eesti arstid suitsetasid oluliselt vähem kui täiskasvanud rahvastik. Võrreldes Soome arstidega esines Eestis arstkonnas oluliselt rohkem suitsetajaid. Eesti arstide suhtumine suitsetamisesse oli oluliselt heatahtlikum kui Soome arstidel. Kummaski riigis oli suitsetavate arstide suhtumine suitsetamisesse oluliselt heatahtlikum kui mittesuitsetavate arstidel.

Ühel viiendikul enesehinnangu järgi mittesuitsetaval rasedal naisel Eestis oli kotiniinisaldus vereplasmas võrdne suitsetaja tasemega. Suitsetamise varjajaid ilmnes oluliselt rohkem madalama haridustaseme, sotsiaalselt väheaktiivsete, mitte-eestlaste ja vabaabielus olevate rasedate naiste hulgas.

Kokkuvõtteks tuleb käesolevale tööle toetudes enam eesmärgistada suitsetamise vähendamise meetmete riiklikult koordineeritud suunamist konkreetsetele riskirühmadele.

LIST OF ORIGINAL PUBLICATIONS

The thesis is based on the following original publications referred to in the text by Roman numerals I – VI.

- I Pärna K. Passive smoking among adolescents in Estonia. *Human and Experimental Toxicology* 1999;18:229–232.
- II Pärna K, Rahu K, Rahu M. Patterns of smoking in Estonia. *Addiction* 2002;97:871–876.
- III Pärna K, Rahu K, Fischer K, Mussalo-Rauhamaa H, Zhuravleva I, Umbleja T, Rahu M. Smoking and associated factors among adolescents in Tallinn, Helsinki and Moscow: a multilevel analysis. *Scandinavian Journal of Public Health* 2003;31:350–358.
- IV Pärna K, Rahu K, Rahu M. Smoking habits and attitudes towards smoking among Estonian physicians. *Public Health* 2005;119:30–39.
- V Pärna K, Rahu K, Barengo NC, Rahu M, Sandström PH, Jormanainen VJ, Myllykangas MT. Comparison of attitudes and opinions of Estonian and Finnish physicians towards smoking. *Social and Preventive Medicine* (in press).
- VI Pärna K, Rahu M, Youngman LD, Rahu K, Nygård-Kibur M, Koupil I. Self-reported and serum cotinine-validated smoking in pregnant women in Estonia. *Maternal and Child Health Journal* (in press).

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ABBREVIATIONS

CI	confidence interval
EMBR	Estonian Medical Birth Registry
ETS	environmental tobacco smoke
EU	European Union
GDP	gross domestic product
h	hour
HBSC	Health Behaviour Survey in School-Aged Children
HFA	Health for All
HPV16	Human Papillomavirus type-16
l/s	litre per second
ng/ml	nanogram per millilitre
OR	odds ratio
POR	prevalence odds ratio
SAS	Statistical Analysis System
SES	socioeconomic status
SPSS	Statistical Package for the Social Sciences
SQL	Structured Query Language
WHO	World Health Organization

1. INTRODUCTION

Smoking is a major single cause of preventable serious ill health and premature death (Marcus *et al.*, 1993; Bobak & Marmot, 1996; WHO, 1999a; WHO, 1999b; Molarius *et al.*, 2001; Holm *et al.*, 2003). Although the vast majority of smoking-related deaths occur in middle-aged and elderly people, smoking behaviour is undeniably established in adolescence (Godeau *et al.*, 2004). Moreover, individuals who begin smoking at a younger age have an increased risk of becoming regular smokers, of becoming heavy smokers, and of falling ill or dying from cigarette-attributable causes (Forster *et al.*, 1992; Marcus *et al.*, 1993; Nelson *et al.*, 1995; Zhu *et al.*, 1996; Colby *et al.*, 2000; Ausems *et al.*, 2003; Jefferis *et al.*, 2003).

Today, about one in three adults or 1.1 billion people smoke worldwide. With the current smoking patterns, by the year 2030, the proportion of deaths will be one in six, or accounting for about 10 million deaths per year (Jha & Chaloupka, 1999). In the WHO European Region, over 30% of adults are regular smokers, and cigarettes are responsible for 1.2 million deaths, with an average loss of 20 years of life expectancy (WHO, 1999b). Peto *et al.* (1994) estimated that smoking accounts for 26% of all male deaths and 3% of female deaths in Estonia. This equals an average 17 years of life lost per death from smoking. These figures indicate the role of tobacco as a cause of premature death in Estonia and the need for an effective policy to reduce tobacco consumption. To develop and implement effective measures of smoking control, one must understand the patterns of tobacco use and factors associated with smoking (Murray & McReynolds, 1987; van Roosmalen & McDaniel, 1989; McGraw *et al.*, 1991; Townsend *et al.*, 1994; Zhu, *et al.*, 1996).

Studies on socioeconomic factors contributing to smoking reveal important information about determinants of smoking and can help in determining the need for smoking prevention programmes and in determining the effectiveness of the existing prevention efforts, predicting the future burden of tobacco-related disease, and measuring the impact of cigarette manufacturers' marketing efforts on people within countries (Ecob & Smith, 1999; Pomerleau *et al.*, 2004). Socioeconomic variations in smoking might be a pathway to explain the socioeconomic gradients in health, morbidity, and mortality, making the determinants of smoking differences key objects of inquiry for public health research and policy (Lynch *et al.*, 1997; Tuinstra *et al.*, 1998; Osler *et al.*, 2001; Duetz *et al.*, 2003). Further, the issue of socioeconomic gradient in a former socialist society like Estonia is important for the reason to know whether the intensively followed programmes of income equalization in Soviet Union removed socioeconomic differences in health behaviour like smoking. Moreover, the considerable East-West health divide leads on to new questions about socioeconomic gradients of smoking, and it is thought that smoking may explain a significant part of excess mortality between the East and the West (Watson, 1995; Bobak & Marmot, 1996; Gilmore *et al.*, 2001). Thus, to narrow the socioeconomic differences in health and to promote favourable patterns of behaviour throughout the whole population, more information is needed about the distribution of smoking by socioeconomic divisions.

The present study was undertaken to explore socioeconomic differences in smoking within Estonia and to draw comparisons with other countries. Four research activities were carried out to accomplish this objective. The first one was designed as a cross-sectional study among adolescents in Tallinn, Helsinki, and Moscow. Of particular interest was international comparison of smoking and socioeconomic factors among adolescents. The second research activity was based on the pre-existing data of cross-sectional Estonian Health Interview Survey to describe socioeconomic factors contributing to smoking among the adult population in Estonia. The third research activity was designed as a cross-sectional study among physicians in Estonia and Finland. Of particular interest was smoking of physicians as representatives of a higher socioeconomic bracket in relation to the adult population in Estonia and international comparison of smoking and attitudes towards smoking between Estonian and Finnish physicians. The fourth research activity was based on the pre-existing data of cross-sectional Human Papillomavirus Type-16 Seroprevalence Study. A special effort in this research activity was undertaken to examine the validity of the reporting of real smoking status by socioeconomic factors among pregnant women in Estonia.

2. LITERATURE REVIEW

2.1. Definition of smoking in epidemiological studies

Smoking is part of the individual behaviour and personality environment and also part of his or her means of coping with society (Isohanni *et al.*, 1991).

According to the WHO guidelines (Shafey *et al.*, 2003) respondents who report smoking at the time of the survey are ‘current smokers’. ‘Current smokers’ can be further categorized as ‘daily’ or ‘occasional smokers’. ‘Daily smokers’ are defined as individuals who smoke at least once a day. ‘Occasional smokers’ are individuals who do not smoke every day. ‘Ex-smokers’ are those who formerly smoked but no longer do so. The same terminology was used in the present study.

2.2. The smoking epidemic

Several authors have noted that the spread of the smoking epidemic in the developed countries has followed roughly four stages (Lopez *et al.*, 1994; Graham, 1996; Cavelaars *et al.*, 2000; Regidor *et al.*, 2001; Platt *et al.*, 2002). In the first stage, smoking is infrequent in the population and mainly a habit of higher socioeconomic groups. In the second stage, the prevalence of smoking among men increases to over 50% and is similar in the different socioeconomic groups. The spread of smoking among women lags 10–20 years behind that of men, and the habit is adopted first by women in the higher socioeconomic group. In the third stage, the prevalence of smoking among men decreases to about 40% as men begin to quit smoking, especially those in the higher socioeconomic groups while the prevalence among women reaches a ceiling of about 35–45%. At the end of this stage a reduction in smoking begins to be observed among women. Finally, in the fourth stage, the prevalence of smoking slowly decreases both among men and women, and smoking becomes a habit concentrated mainly in the lower socioeconomic groups (Lopez *et al.*, 1994; Cavelaars *et al.*, 2000; Regidor *et al.*, 2001; Platt *et al.*, 2002).

However, not all countries have followed this evolution during the same historical period. For example, China, Japan, and the countries of Latin America, are at stage two, the countries of southern Europe such as France, Italy, and Spain are at the beginning of the third stage while the countries of northern Europe were at the end of the third or in the fourth stage (Cavelaars *et al.*, 2000; Platt *et al.*, 2002). The exact stage of the smoking epidemic varies between the countries of the former Soviet Union, but generally men have remained between the second and third stages while women in some countries are undergoing the first stage and in other countries the second stage (Gilmore *et al.*, 2004).

2.2.1. The smoking epidemic among physicians as representatives of the higher socioeconomic bracket

The prevalence of smoking among physicians as representatives of the higher socioeconomic bracket may reflect the ‘maturity’ of the smoking epidemic in a particular country. Before the hazards of smoking become well known in a society, physicians take up smoking earlier and to a greater extent than the general population. During this stage smoking prevalence among physicians is higher than that among general population and the smoking epidemic might be considered ‘immature’. As the dangers of smoking become better known, physicians will give up smoking earlier than the general population. When the prevalence of smoking among doctors falls below that of the general population, the country’s smoking epidemic can be considered ‘mature’. During this phase smoking prevalence in the general population will continue to increase for a time but will eventually level off and then a steady decline begins as the hazards of smoking become better known, as tobacco policies are adopted, and as smoking becomes socially less acceptable (Davis, 1993).

For example, in the United Kingdom (Doll *et al.*, 1994), Finland (Barengo *et al.*, 2004), and Norway (van Reek & Adriaanse, 1991) smoking among physicians is lower, but in the Mediterranean Region and Eastern Europe (Dekker *et al.*, 1993; Rogovska, 1996) it is higher than in the general population.

2.3. Smoking situation in Estonia compared to other countries

The Republic of Estonia lies on the eastern coast of the Baltic Sea and shares borders with Latvia in the south, and Russia in the east. Estonia has a territory of 45 216 square kilometres and had a population of 1.4 million inhabitants in 2000 (Statistical Office of Estonia, 2001a). Of the total population ethnic Estonians comprised 68% (Statistical Office of Estonia 2001b). The Republic of Estonia was proclaimed in 1918 and was built up on the ideas of Western liberal democracy. In 1940 Estonia was annexed and incorporated into the Soviet Union and lost its political and economic autonomy for half the century.

Everyone in the Soviet Union lived under the umbrella of the central government, which took responsibility for the health of the population. Healthy lifestyle was neither encouraged nor rewarded. The priority of state goals and interests over personal needs and desires taught people that their individual values were of little importance. Moreover, they believed the state would take care of them in case of a serious health problem and the resulting careless lifestyle became especially dangerous (Cockerham, 2000). Also, those living in the socialist societies were considered less health-conscious because there were too many basic problems and no credible health promotion and because health had a low priority (Uitenbroek *et al.*, 1996). During the Soviet period smoking in Estonia was seen as one of the few simple pleasures in life, and the related health hazards were not emphasized.

In 1991, after the collapse of the Soviet Union, Estonia regained its independence on the basis of the historical continuity of its statehood. The

restoration of independence was accompanied by major changes in political, economic, and social realities. Estonia as a newly independent former Soviet republic shared many characteristics typical of Eastern Europe. However, compared to other transition economies in Eastern Europe and the former Soviet Union, Estonia opted for much more far-reaching and intense free market reforms (Leinsalu, 2002; Leinsalu *et al.*, 2003). Since the upheaval of the Soviet Union, the production and GDP of Estonia dropped dramatically, and the real income of people decreased. As a consequence, many social welfare services were weakened. The years 1994–1995 showed signs of stabilization and modest economic growth. On the other hand, there were signs of poverty, deteriorating public health, a higher crime rate, and decreased loss of social security and hopes for a better life often leading to disillusionment (Kutsar, 1997). People felt that insecurity ‘causes so much stress’ that it is not easy to stop smoking in this situation (Puska, 1997). Moreover, since transition the tobacco industry has been flooding post-Soviet countries with heavy marketing strategies making the effective tobacco control even more difficult (Puska, 1997; Gilmore *et al.*, 2001b).

2.3.1. Smoking among adolescents

Smoking among 11-, 13- and 15-year-old adolescents in Estonia has been studied every fifth year since 1993 by the WHO collaborative cross-national survey Health Behaviour in School-aged Children (HBSC). In 2001–2002, daily smoking prevalence proportion among boys was 2%, 8%, and 23%, respectively. The prevalence among girls was 0.3%, 4%, and 12%, respectively (Godeau *et al.*, 2004). Weekly smoking increased among adolescents in all age groups during the study period (Figure 1). A particularly high increase in weekly smoking was found among 13- and 15-year-old girls (King *et al.*, 1996; Gabhainn & François, 2000; Godeau *et al.*, 2004).

According to the Global Youth Tobacco Survey, carried out among 13–15-year-old adolescents in Estonia, 34% of boys and 30% of girls were current cigarette smokers in 2003 (Global Tobacco Surveillance System Collaborating Group, 2005).

Cross-national comparison of at least weekly smoking 15-year-old adolescents revealed clear gender differences (Figure 2). Prevalence proportion was substantially higher for boys than for girls in Estonia as well as in other post-Soviet countries. In contrast, in north European countries prevalence proportion was higher for girls than for boys.

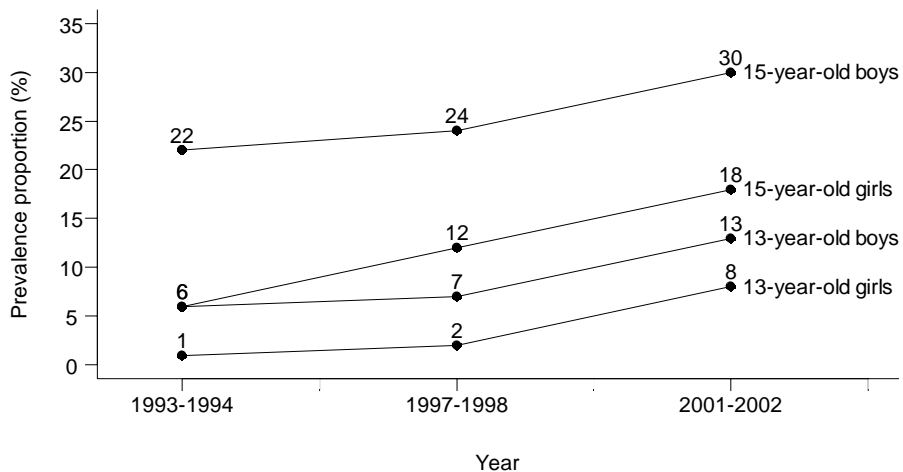


Figure 1. Smoking at least once a week among 13- and 15-year-old boys and girls in Estonia in 1993–1994, 1997–1998, and 2001–2002, according to the HBSC survey.

Source: King *et al.*, 1996; Gabhainn & François, 2000; Godeau *et al.*, 2004

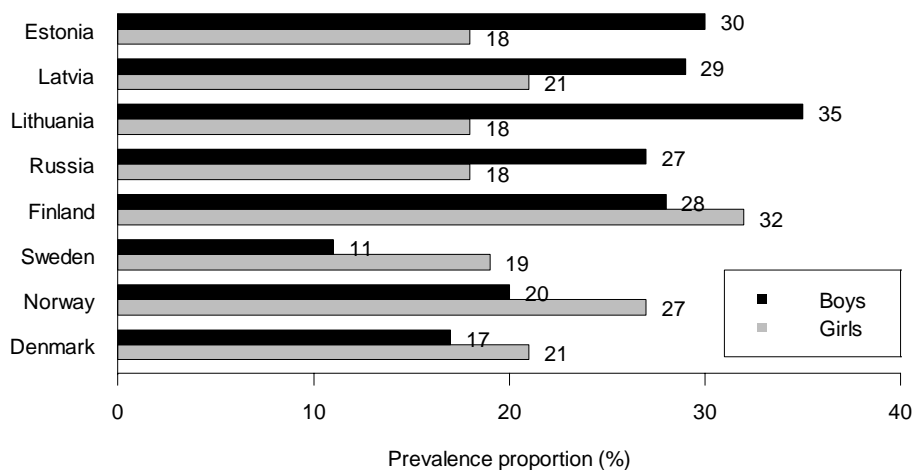


Figure 2. Cross-national comparison of 15-year-old adolescents who smoke at least once a week, 2001–2002, according to the HBSC survey.

Source: Godeau *et al.*, 2004

2.3.2. Smoking among adults

Smoking prevalence among the 16–64-year-old population has been studied by the biannual survey Health Behaviour among Estonian Adult Population, following the common Finbalt Health Monitor protocol and procedures in Estonia since 1990 (Puska *et al.*, 2003).

The survey in 2002 showed a 46% prevalence of daily smoking for males and 19% for females (Kasmel *et al.*, 2003) (Figure 3). The proportion of daily smokers among males remained on the same level as in 1990, but it has increased among females. However, female daily smoking has decreased since 1994. The highest prevalence of smoking during this period was in the year 1994 with 52% of daily smoking prevalence for males and 23% for females.

The 1996 Estonian Health Interview Survey showed that the daily smoking prevalence was 48% for males and 17% for females in the age group 15–79 (Leinsalu *et al.*, 1999).

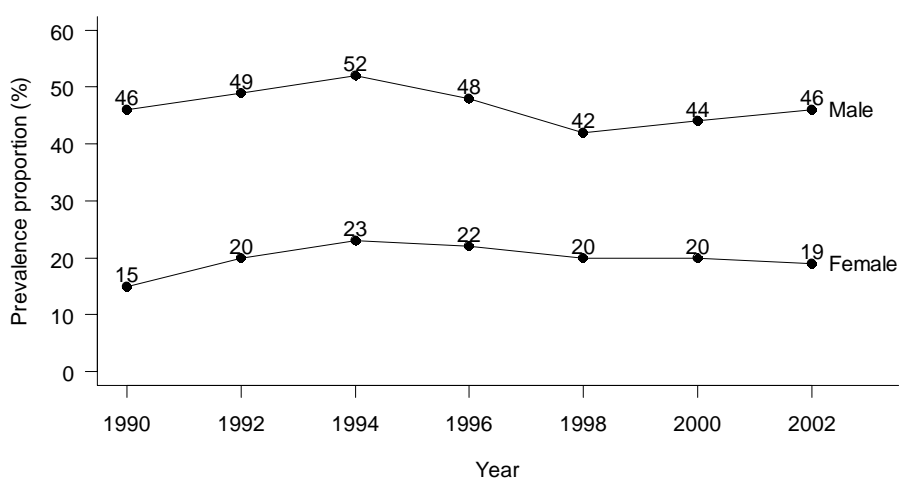
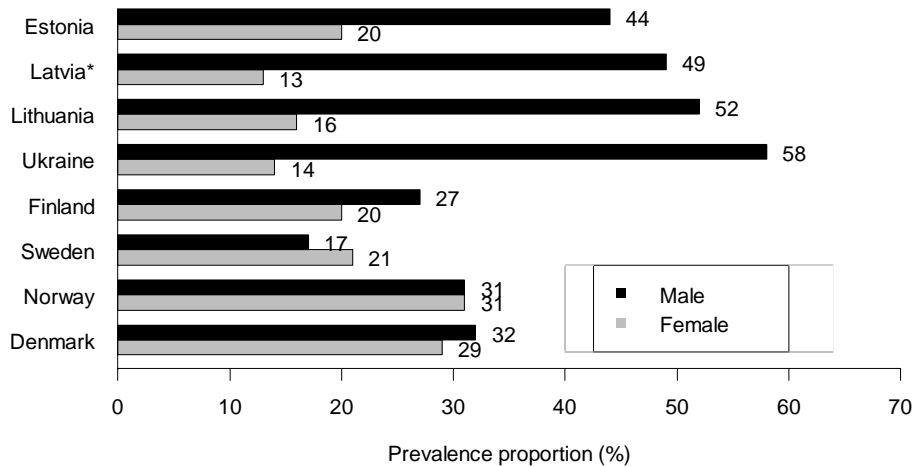


Figure 3. Daily smoking prevalence proportions among the adult population in Estonia, 1990–2002, according to the survey Health Behaviour among Estonian Adult Population.

Source: Kasmel *et al.*, 2003

Cross-national comparison of over 14-year-old adult daily smoking prevalence proportions revealed clear gender differences (Figure 4). The prevalence proportions were considerably higher for male than for female in Estonia as well as in other post-Soviet countries. North European societies did not reveal any big differences in prevalence proportion for male and female.



* Data from the year 1999

Figure 4. Cross-national comparison of adult daily smoking prevalence proportions in 2000, according to the database Health for All.

Source: WHO, 2004

2.3.3. Smoking among physicians

There are no data on trends in smoking prevalence in Estonian physicians over the decades because the previous surveys were carried out only in 1977 and 1982 with the prevalence proportion of male physicians 42% and 42% respectively, and of female physicians 20% and 15%, respectively (Väärt *et al.*, 1979; Rahu & Raudsepp, 1986).

In the neighbouring countries, 19% of Finnish male and 9% of female physicians were current smokers in 1995 (Barengo *et al.*, 2004). During the time period 1969–1995 the percentage of daily smoking physicians in Finland continually decreased from 24% to 7% in males and from 17% to 3% in females (Barengo *et al.*, 2004). The proportion of smokers among physicians in the United Kingdom decreased from 62% to 18% between the years 1951 and 1991 (Doll *et al.*, 1994). The prevalence of 74% in 1952–1953 has decreased to 19% in 1984 among Norwegian male physicians (van Reek & Adriaanse, 1991; WHO, 2004). Among Swedish physicians, the proportion of daily smoking was 6% in 1996 (Bolinder *et al.*, 2002). Among Latvian physicians, 35% were smokers in 1994, with a higher prevalence among male physicians (Rogovska, 1996).

2.3.4. Tobacco legislation

In Estonia, there was no tobacco law during the Soviet era and the first years after the collapse of the Soviet Union, and tobacco control policies were based on separate regulations of the Ministry of Health.

Since 2000, Estonia has witnessed considerable change in tobacco control. The Estonian Tobacco Act, which was enforced in 2001, required warning labels on tobacco products and established a minimum purchase age of 18 years (Tubakaseadus, 2000). It was illegal to sell cigarettes in vending machines or in quantities less than 20 cigarettes. Sharp restrictions were imposed on smoking in public places like health care, educational, and children's social welfare institutions and their designated territories, in cultural and sports establishments and facilities. All public transport (except boats) was required to be smoke-free. Advertising was banned in national media and at the point of sale. Product placement and tobacco brand advertising was banned, and tobacco sponsorship was restricted. Visible and clear information concerning where smoking was permitted was required to be displayed in catering establishments with one room where service was provided to the public. Some rooms were required to be separated and marked for smokers, and smoking in other rooms was prohibited in catering establishments with two or more rooms where service was provided to the public. Separate rooms for smokers were required to be equipped with air conditioners refreshing air at least 8.4 l/s per square metre.

The revised Tobacco Act, which came into force in June 2005, brings Estonia in line with the EU directive on tobacco and the WHO anti-tobacco convention (Tubakaseadus, 2005). This law totally bans smoking in catering establishments. It is allowed to smoke in a catering establishment only in special smoking rooms where food is not served to the public. Catering establishments have up to two years to build the smoking rooms where the above-described requirements are followed.

2.4. Measurement of socioeconomic status

The socioeconomic status (SES) is a complex variable that is conceptualized in different ways and is usually measured by a combination of variables as linked to both adolescence and adulthood (Krieger *et al.*, 1997; Osler *et al.*, 2001). Using only one indicator of SES may yield misleading result or provide less accurate information than using multiple measures (Winkleby *et al.*, 1992). The choice of the socioeconomic indicators often reflects the data that are available rather than any explicit theorization of the possible effects of different dimensions of socioeconomic disadvantage (Davey Smith *et al.*, 1998).

SES of the individuals can be categorized according to basic sociodemographic indicators like *age, gender, religion, ethnicity, neighbourhoods, urban/rural residence, marital status* and *family structure* (Krieger *et al.*, 1997; Tyas & Pederson, 1998). Religion can influence people's orientation and behaviour regarding the use of tobacco, which restricts the consumption of health-damaging substances (Chollat-Traquet, 1992). Ethnicity is a complex construct of defined

biology but also culture, language, religion, and distinct health beliefs and health behaviour. Therefore, ethnicity has been considered as an important moderating factor for population differences in social influences and may point to different cultural assets on adolescent as well as adult smoking (Chaturvedi, 2001). Neighbourhoods and urban/rural residence characterize aspects of people's living conditions, which may be especially important in studies involving people from diverse ethnic groups. In addition, urban residence in previous Soviet countries is likely to reflect exposure to Western influences and advertising. Neighbourhood measures permit to carry out contextual analyses, thereby gaining insight into how social class, at multiple levels, shapes population patterns of health, disease, and well-being (Krieger *et al.*, 1997). Marital status is related to the social relationships and the availability of social support of the individual. Indicators related to family structure include intact families and non-intact families, which reflect social relationships in the immediate environment of the adolescents (Tyas & Pederson, 1998). These relationships as essential aspects of social identity provide important social resources, including emotional support, information, access to new social contacts and roles, and assistance in fulfilling social and personal obligations and responsibilities (McLeroy *et al.*, 1988).

In addition, SES of the adolescents can be categorized according to indicators of social environment like *parental (father' and/or mother')*, *siblings'* and *friends' smoking* (Tyas & Pederson, 1998). Parental and siblings' smoking are directly linked with the smoking at the household of adolescents and with *the passive smoking of adolescents*. The indicator friends' smoking explains adolescence as a time of transition and a period of upheaval when parental influence is decreasing while at the same time the quest for personal autonomy is increasing (Lau *et al.*, 1990; Piko & Fitzpatrick, 2001). Moreover, friends' smoking is associated with the sub-cultural effect when individual behaviour is shaped by a subculture of the social context like *school* or *school class*.

2.4.1. Indicators of socioeconomic status for adolescents

Classically, the SES assigned to the adolescents is based on *the education of the head of household* and *the occupation of parent* that describe the basic structural position in socioeconomic hierarchy (Macintyre & West, 1991; Griesbach *et al.*, 2003). Occupational categories also provide some indirect assessment of the income status of adolescents and families (Piko & Fitzpatrick, 2001). Vereecken & Vandegheuchte (2003) have suggested that children aged 11–12 years are able to describe their parents' occupational activity in sufficient detail in a survey setting, which could be useful for research on socioeconomic differences. Nevertheless, there may arise the issue of the validity of responses given by school-age children as they may not know their parents' occupations, or they may not be able to describe them accurately or in sufficient detail for classificatory purposes. Also, when coding parental occupational class, there is no satisfactory way of differentiating between social status of parents who may be students, housepersons, actively seeking work, or retired (Currie *et al.*, 1997). Therefore, recent studies have alternatively used non-occupationally based or family material affluence

indicators like *housing tenure*, *telephone* and *motor vehicle ownership*, *crowded housing conditions* (having one's own unshared bedroom), and *weekly spending money* (comprising pocket money and money earned) (Currie *et al.*, 1997; Bobak *et al.*, 1999).

Education of the head of the household was used to measure SES among adolescents in this study.

2.4.2. Indicators of socioeconomic status for adults

Education, *occupational status* and *income* are three most commonly used SES indicators in epidemiological studies among adults (Currie *et al.*, 1997; Bobak *et al.*, 1999). These variables are interrelated as higher education is likely to ensure better position at the labour market, which in turn offers a higher income (Krieger *et al.*, 1997; Laaksonen *et al.*, 1998; Laaksonen *et al.*, 2003; Turrell *et al.*, 2003; Kristenson *et al.*, 2004). Nevertheless, these indicators are treated as interchangeable measures of socioeconomic position because education, occupational status, and income represent different dimensions of SES, and their influence on health behaviour may therefore follow different pathways (Laaksonen *et al.*, 2003). Thus, each of these three indicators is likely to reflect both the common impacts of a general ranking in society as well as particular impacts related to the specific nature of each socioeconomic indicator (Gregorio *et al.*, 1997).

In health behaviour research *educational level* is an especially important indicator as it reflects better than the other indicators the knowledge and skills that are important for making health behaviour choices, for example, those concerning smoking (Backlund *et al.*, 1999). Education is also an indicator for the ability to use knowledge more or less effectively to cope successfully with demanding or potentially stressful situations (Osler *et al.*, 2001). Furthermore, education may determine individual membership in certain subcultures of societies with their own norms of smoking, not governed by individual knowledge (Uitenbroek *et al.*, 1996; Osler *et al.*, 2001). In comparison with occupation and income, educational level has the advantage of being available for both men and women, including those who are currently outside employment. It generally does not change during one's adult life and has a high reliability and validity (Winkleby *et al.*, 1992; Stronks *et al.*, 1997; Laaksonen *et al.*, 1998; Droomers *et al.*, 2004). Finally, education relates more to social status in early life as compared to the present occupational status (Osler *et al.*, 2001; Kristenson *et al.*, 2004).

Occupational status is closely related to one's educational level and constitutes a link between acquired education and income. However, it also indicates health-related concomitants of the job, such as variations in control over the workplace or differing reward structures. Occupational life involves human relations and networks that may influence health behaviour (Laaksonen *et al.*, 2003). Also, *employment status*, at least in the West, is closely related to one's social background, the level of income, living circumstances, social deprivation, marital status, and other domestic problems (Uitenbroek *et al.*, 1996). Socioeconomic indicators based on occupational classifications have a limitation in that they

cannot readily be used for social groups outside of the recognized paid labour force (Krieger *et al.*, 1997).

Income more clearly than the other above-described two indicators of SES relates to material well-being and financial resources that may contribute to health behaviour through consumption and describes the availability of material resources but also a level of prestige (Laaksonen *et al.*, 2003; Kristenson *et al.*, 2004). The lack of material resources may affect health behaviour through financial restrictions that prevent health choices although it is clear that all health choices do not require money (Laaksonen *et al.*, 2003).

Household income may be useful when people living together share class position in ways not reflected by individual circumstances (Berkman & Macintyre, 1997). Household income indicates people's spending power while individual income also reflects one's status or prestige, autonomy, and power of decision (Laaksonen *et al.*, 2003). Two different approaches to measuring the household income have been used: to equate household class with the most dominant and powerful individual class position in the household, regardless of gender, or to classify households by the actual, and at times discordant, class and gender composition of the relevant heads of household (Krieger *et al.*, 1997).

The non-occupational classification of SES serves as an alternative to the occupational classification, which focuses on such consumption-based measures as *housing tenure* and *motor vehicle ownership*. While income has been usually measured at one point of time, housing tenure has rather been an indicator of cumulative prosperity and wealth (Krieger *et al.*, 1997). Housing tenure and motor vehicle access have often been used as indicators of material resources where a direct measure of income was unavailable (Macintyre *et al.*, 1998). However, non-occupational measures should be regarded as adding to rather than supplanting the more traditional occupationally based measures (Macintyre & West, 1991; Glendinning *et al.*, 1992).

Education, employment status and income measures of SES were used among adults in this study.

2.4.3. Specific features of socioeconomic stratification in Estonia

Socioeconomic stratification processes have been somewhat different in socialist societies compared to Western market economies (Palosuo *et al.*, 1998), which may also influence their associations with smoking and adoption of the smoking epidemic model in Estonia.

Education, occupational status, and income

In the Soviet Union higher education was no guarantee of a higher income; on the contrary, there was discrimination of some professional groups, and traditional working-class groups had better incomes (Cockerham, 2000). The communist regimes declared social equality as a priority (Uitenbroek *et al.*, 1996), so income distribution in socialist countries was substantially more equal than in the West. Two broad groups were privileged: higher members of the party and preferred occupations. Most party members were not better educated than the rest of the

population, and the preferred occupations often included manual workers in preferred sectors of industry, such as construction and energy. Professions with university education were not among the best paid (Bobak *et al.*, 1999; Bobak *et al.*, 2000a). Therefore, perhaps higher education has not always been a resource helping an individual to master his material living conditions, and income was often less important in obtaining benefits in the same way as in welfare states (Palosuo *et al.*, 1998; Bobak *et al.*, 2000b). However, education was important for the self-perception of own social status and commanded high prestige (Bobak *et al.*, 2000a).

Concerning occupational status, it has been particularly difficult to find equivalent classifications, given that the processes of stratification and emerging occupational hierarchies have been as different as they were in affluent Western societies (Palosuo, 2003).

Ethnicity

Classification of the population of Estonia by ethnicity reflects a Soviet tradition, which is somewhat different to that used in the West.

During the first independent statehood, between 1918 and 1940, ethnic Estonians constituted almost 90% of the population. In 1940 Estonia lost its political and economic autonomy, and the situation changed dramatically. Estonians found themselves in the position of being a repressed nation in their own country (Lauristin & Heidmets, 2002). More than a quarter of its population was lost as a result of emigration, political terror, war, and mass deportations followed by massive immigration from Russia (Leinsalu *et al.*, 2004). As the working lives of non-Estonians (mainly Russians) were closely linked with large all-Union industrial enterprises, they typically had a technical or vocational education, related to this industry.

With the fall of the Soviet Union in 1991, these enterprises lost their traditional markets followed by an increase in the unemployment among non-Estonians who had inadequate skills in the Estonian language (Pavelson & Luuk, 2002). Thus, the restoration of Estonian statehood deeply touched the identity and values of Russians, who, as former representatives of the major nation in the Soviet Union, lost their social standing. Their adaptation to Estonia's liberal free market reforms was difficult and reluctant. Moreover, Estonia adopted a citizenship policy that granted citizenship to the citizens of the pre-occupation republic and their descendants, and Soviet-era immigrants had to fulfil naturalization requirements (Pettai & Hallik, 2002; Leinsalu *et al.*, 2004). Today, the Russian-speaking community in Estonia has established its own social networks and leaders, schools and cultural life (Lauristin & Heidmets, 2002).

By the end of the Soviet period, in 1989, the foreign-born population in Estonia comprised 26%, which was one of the highest in Europe (Katus & Sakkeus, 1993). The percentage of Estonians had decreased to 61% and the second biggest ethnic group were Russians (30%). From 1989 to 2000, the Russian population in Estonia decreased by 26%. In 2000, ethnic Estonians formed 68% of the total population (Statistical Office of Estonia, 2001b).

2.5. Validity of self-reported smoking

Validity, the extent to which a measure indicates what it is believed to measure, is of particular importance when studies rely on self-reports of sensitive behaviour like smoking (Bauman & Koch, 1983; Slattery *et al.*, 1989; Last, 2001). Self-reported smoking status has been widely used to assess detrimental health effects of smoking and to orient counselling and other preventive interventions and is considered to be rather reliable in population studies (Patrick *et al.*, 1994; Laatikainen *et al.*, 1999; Caraballo *et al.*, 2001). However, self-reporting can be unreliable if subjects are under pressure because of social or medical disapproval (e.g. pregnant women). Therefore, increased emphasis has been placed on measuring exposure through the use of biological markers and biochemical assessment to provide more accurate estimates of smoking status (Patrick *et al.*, 1994; Rebagliato, 2002).

Still, there has been no research on validity measures of self-reported smoking status in Estonia. Pregnant women as a better accessible target group were used to obtain this information in the present study.

2.5.1. Measuring cotinine to validate self-reported smoking status

In a number of studies (English *et al.*, 1994; Eskenazi & Trupin, 1995; Ford *et al.*, 1997; Suadicani *et al.*, 1997; Caraballo *et al.*, 1998; Heller *et al.*, 1998; Wells *et al.*, 1998; Mathews *et al.*, 1999; Klebanoff *et al.*, 2001; Kaufman *et al.*, 2002; Schluter *et al.*, 2002;), cotinine, a major metabolite of nicotine, is considered to be the most reliable and valid biochemical marker of active nicotine consumption and exposure to environmental tobacco smoke (ETS) because of its high sensitivity and specificity (Boyd *et al.*, 1998; Lain *et al.*, 1999; Klebanoff *et al.*, 2001; Centers for Disease Control and Prevention, 2003). Measuring cotinine is preferred over measuring nicotine because cotinine persists longer in the body. The average half-life of cotinine in different body fluids in adults is approximately 20 hours, compared with the half-life of two hours for nicotine, making it a good indicator of the integrated exposure over the previous two to three days (Benowitz, 1999; Rebagliato, 2002). Other markers (e.g. carbon monoxide, cyanide, nicotine-derived nitrosoamines) are non-specific, insensitive, technically demanding or have high baseline values even in non-smokers (Benowitz, 1999). Cotinine can be measured in blood serum, urine, saliva, or hair (Benowitz, 1999; Rebagliato, 2002). Saliva and blood cotinine levels are highly correlated, with a saliva-to-blood ratio of 1.1 to 1.4. Urine concentrations are also highly correlated with blood concentrations, with urine levels about six times higher than those for blood (Benowitz, 1999). Non-smokers exposed to typical levels of ETS have serum or saliva cotinine levels of less than 1 ng/ml, with a heavy exposure to ETS producing levels in the 1–15 ng/ml range (Rebagliato, 2002; Centers for Disease Control and Prevention, 2003).

Previous studies that measured cotinine levels in the blood have used different cut-off points, usually 10–20 ng/ml, to detect active smoking (Slattery *et al.*, 1989; Wagenknecht *et al.*, 1992; Heller *et al.*, 1998; Peacock *et al.*, 1998; Caraballo *et al.*, 2001; Schluter *et al.*, 2002; Vartiainen *et al.*, 2002). A cut-off point 15 ng/ml

was used in this study. On the basis of cotinine measurements, self-reported non-smokers who seem to be smokers were considered ‘deceivers’ of their true smoking status (Rebagliato, 2002).

2.6. Previous studies of socioeconomic differences in smoking

2.6.1. Socioeconomic differences in smoking within countries

2.6.1.1. Smoking among adolescents

Generally, several studies have shown that smoking is more frequent among adolescents with a low family SES (Conrad *et al.*, 1992; Flay *et al.*, 1994; Glendinning *et al.*, 1994; de Vries, 1995). Other studies have rejected this hypothesis and have shown that SES has little or no relationship to the smoking (Tuinstra *et al.*, 1998; Paavola *et al.*, 2004).

Adolescents who had less educated parents were more likely to have tried a cigarette and more likely to have adopted cigarette smoking (Waldron & Lye, 1990; Griesler & Kandel, 1998; Langille *et al.*, 2003; Monden *et al.*, 2003). Traditionally, however, paternal education has been a stronger determinant of household SES than maternal education, whereas maternal education level has been associated with the smoking in a household (Tyas & Pederson, 1998).

Previous research has established that sociodemographic factor as ethnic group reveal differences in smoking (Laugesen & Scragg, 1990; Headen *et al.*, 1991; Wills & Cleary, 1997; Griesler & Kandel, 1998; Scarinci *et al.*, 2002). However, most of these studies come from the United States where ethnical composition is different from European countries. Also, religious participation has become an epidemiologically justified protective factor in smoking among adolescents (Piko & Fitzpatrick, 2004; van den Bree *et al.*, 2004).

Living in non-intact families has been shown to increase smoking rates (Rantakallio, 1983; Isohanni *et al.*, 1991; Langille *et al.*, 2003). At the same time, it is not clear to what extent such outcomes may be a direct result of family structure rather than the poorer socioeconomic circumstances of lone-parents and stepfamilies compared to intact two-parent families. Moreover, parental and siblings’ smoking, which are known to influence smoking rates in young people, may be higher in non-intact families (Griesbach *et al.*, 2003).

There are many studies of the impact of socioenvironmental indicators as smoking of parents, siblings and friends to the smoking among adolescents. Many more studies found that adolescent smoking was associated with parental smoking (Murray & McReynolds, 1987; Green *et al.*, 1991; Glendinning *et al.*, 1994; Laugesen & Scragg, 1999; Hesketh *et al.*, 2001; Rosendahl *et al.*, 2003) than the studies that have reported a non-significant association (Reimers *et al.*, 1990). Some of the inconsistencies may reflect gender-specific differences as parental smoking may be more important for girls than for boys because several studies have reported a significant effect only for girls (McGraw *et al.*, 1991; Flay *et al.*, 1994) whereas none have found the reverse (Tyas & Pederson, 1998). Additionally, adolescents whose parents smoke can evidently start smoking due to having been

brought up in a smoking environment (Chollat-Traquet, 1992). Studies examining the effect of paternal and maternal smoking separately have reported both to be significant (Tuakli *et al.*, 1990), non-significant (Botvin *et al.*, 1993), or each one significant (Murray & McReynolds, 1987; Rosendahl *et al.*, 2003) while the other was not. It is unclear whether parental smoking has a stronger influence when it occurs in the same-gender parent as reports have both supported (Murray *et al.*, 1985; Murray & McReynolds, 1987; McGraw *et al.*, 1991; Shamsuddin & Haris, 2000) and opposed this hypothesis (Green *et al.*, 1991).

Similarly, siblings' smoking has been reported to have an impact on adolescent smoking (Murray & McReynolds, 1987; McGraw *et al.*, 1991; Moran *et al.*, 2000). In some studies, the influence of smoking by siblings has been stronger than that of smoking by parents (Hu *et al.*, 1990; Santi *et al.*, 1990). In general, family influence has been typically the second most important determinant of the smoking among adolescents (Ennett & Bauman, 1993; Flay *et al.*, 1994; Duncan *et al.*, 1995; Wang *et al.*, 1995; Zhu *et al.*, 1996; Urberg *et al.*, 1997; Distefan *et al.*, 1998; Moran *et al.*, 2000).

Smoking of one's best friends has been noted as the most powerful determinant of smoking among adolescents (Murray & McReynolds, 1987; McGraw *et al.*, 1991; Zhu *et al.*, 1996; Urberg *et al.*, 1997; Smet *et al.*, 1999; Moran *et al.*, 2000). This may support the selection assumption, which states that smokers use smoking behaviour as a selection criterion for choosing their best friend (Ausems *et al.*, 2003).

Smoking by friends has been reported to be an independent and strong risk factor for smoking among adolescents (Skinner *et al.*, 1985; Elders *et al.*, 1994; Wiecha, 1996). This finding has been more consistent than those for parental and siblings' smoking (Flay *et al.*, 1994; Wiecha, 1996; Sasco *et al.*, 2003). Smoking adolescents have appeared to see the peer group, not as encouraging them to smoke, but as not providing any discouragement for smoking (Urberg *et al.*, 1990; Ennett & Bauman, 1993). Thus, the behavioural choices adolescents make, are partially determined by how acceptable the behaviour is believed to be among their peers (Distefan *et al.*, 1998; Stahl *et al.*, 2001). However, the considerable importance of peer pressure during the adolescent period is also revealed in the decisive influence exercised by peer smokers on the initiation and experimentation of smoking among individuals (Spear & Akers, 1988; Covey & Tam, 1990; Reimers *et al.*, 1990; McGraw *et al.*, 1991; Wiecha, 1996; Urberg *et al.*, 1997; Williams & Covington, 1997; Distefan *et al.*, 1998; Tomori *et al.*, 2001).

Until recently, most studies of tobacco use among adolescents focused on the contributing factors of smoking of individuals, and the wider social context was largely ignored (Duncan *et al.*, 1993; Karvonen & Rimpelä, 1996). Nevertheless, school culture is a channel through which social context can influence smoking of adolescents (Aveyard *et al.*, 2004). As the common identity often develops within the group of schoolmates (Rasmussen *et al.*, 2002), the smoking of adolescents is highly dependent upon membership of a social group in the schools (Von Korff *et al.*, 1992; Karvonen & Rimpelä, 1996; Rice & Leyland, 1996; Rasmussen *et al.*, 2002).

2.6.1.2. Smoking among adults

Studies in a variety of developed countries have shown that generally lower SES is associated with higher rates of smoking. The situation is different in the most former socialist countries where no clear association between smoking and SES has been found. Thus, the exact stage of the smoking epidemic varies in different countries.

Education in affluent societies has shown a clear inverse association with smoking among adults (Pierce *et al.*, 1989; Rahkonen *et al.*, 1995; Uitenbroek *et al.*, 1996; Hart *et al.*, 1997; Hill *et al.*, 1998; Duncan *et al.*, 1999; Laaksonen *et al.*, 1999; Cavelaars *et al.*, 2000; Palosuo, 2000; Perez-Stable *et al.*, 2001; Tseng *et al.*, 2001; Chaix *et al.*, 2004; Paavola *et al.*, 2004; van Lenthe *et al.*, 2004). No relationship between education and smoking was found among adults in Russia and Ukraine (McKee *et al.*, 1998), and in Bulgarian men (Balabanova *et al.*, 1998; Gilmore *et al.*, 2001). However, smoking rates have been higher in less educated adults in Estonia (Kunst *et al.*, 2002; Volozh *et al.*, 2002). In southern European countries such as Italy, Spain, Greece, Switzerland and in the former socialist country such as Bulgaria, women, but not men, with a higher education, are more often smokers (Hill, 1992; Graham, 1996; Balabanova *et al.*, 1998; Faggiano *et al.*, 2001; Federico *et al.*, 2004). Nevertheless, there is some evidence to indicate that the class distribution of women's smoking in southern European countries is changing as smoking cessation is also positively related to social and material advantages (Graham, 1996).

The proportion of smokers is the smallest in the highest occupational class among both men and women in the developed countries such as United Kingdom, Denmark, Sweden and Australia (Hill *et al.*, 1998; Lindström & Östergren, 2001; Osler *et al.*, 2001). Also, smoking is associated with material deprivation, particularly with unemployment in Ukraine (Gilmore *et al.*, 2001), but no significant association between smoking and employment was found in Albania (Shapo *et al.*, 2003).

Smoking is more common among men and women with a lower income in the developed countries (Winkleby, 1992; Laaksonen *et al.*, 2003; Laaksonen *et al.*, 2005; Rahkonen *et al.*, 2005). In all the Baltic countries, the likelihood of smoking was lower among men but not women with higher incomes (Pudule *et al.*, 1999). In contrast, no clear association was found between smoking and household income in Bulgaria and Albania (Balabanova *et al.*, 1998; Shapo *et al.*, 2003).

Several studies of adults have revealed interaction between ethnicity and smoking (Lindström & Sundquist, 2002; Barnett *et al.*, 2004; Baron-Epel *et al.*, 2004). A Swedish cross-sectional study of smoking and ethnicity has demonstrated that men born in countries other than Sweden have a generally higher prevalence of smoking than men born in Sweden. In contrast, the female prevalence was higher in some ethnic minority groups and lower in others (e.g. women born in Arabic-speaking countries) (Lindström & Sundquist, 2002). Some research has supported that a higher smoking prevalence in some ethnic groups might be explained by psychosocial and economic factors that impede smoking cessation (Lindström & Sundquist, 2002; Baron-Epel *et al.*, 2004).

Residency of adults has been measured mainly in the previous socialist countries to examine whether urban residence reflects exposure to western influences and advertising or not. In the countries of the former Soviet Union, such as Russia, Belarus, and Ukraine, smoking is more common among those living in urban than in rural areas (McKee *et al.*, 1998; Hibell *et al.*, 2000; Gilmore *et al.*, 2001a, 2001b). In these countries especially women living in cities are far more likely to smoke than those living in the countryside (Gilmore *et al.*, 2001b). In the Baltic countries, smoking rates among women have been found to be lower in rural than in urban areas in Latvia and Lithuania but not in Estonia (Pudule *et al.*, 1999).

In addition, smoking is influenced by one's marital status (Shohaimi *et al.*, 2004). Divorced and separated appeared to be at higher risk and married individuals at lower risk of tobacco smoke (Hay & Foster, 1981; Waldron & Lye, 1989; Umberson, 1992; Chaix *et al.*, 2004; Rahkonen *et al.*, 2005). Particularly, in the groups of single or divorced men with lower education the prevalence of smoking was higher (Prättälä *et al.*, 1994; Tseng *et al.*, 2001). In contrast, subjects who were married and better educated had lower prevalence of cigarette smoking (Marques-Vidal *et al.*, 2003).

2.6.2. Socioeconomic differences in smoking between countries: Eastern and Western Europe

Eastern and Western Europe represented different political and socioeconomic regimes for half of the century resulting in a sharp East-West health divide (Bobak *et al.*, 2000b; Cavelaars *et al.*, 2000; Puska *et al.*, 2003). In Eastern European countries mortality crisis deteriorated further after the collapse of the communist regimes in 1991 and during the following transition to democracy and market economy (Cornia & Paniccia, 2000; Leinsalu *et al.*, 2003). At the same time it has been suggested that the major reasons for the high mortality in post-Soviet countries may be found not so much in the elevated stress levels, ecological situation, or shortcomings of the health care system as in the lifestyle factors, including smoking (Palosuo *et al.*, 1998).

Over the decades, evidence on the socioeconomic patterning of smoking accumulated mainly from affluent countries. There are only a few studies of the former 'classless' Eastern Europe and countries of the Soviet Union (Cockerham, 2000; Palosuo, 2003). Moreover, although the basic determinants of smoking have been described from the perspective of a single country, there is less consensus over the extent to which the findings of within-country studies can be generalized across cultures because of different study methods in different studies (Rahkonen *et al.*, 1992; Karvonen *et al.*, 2000). Thus, part of the variations observed between the studies may be related to the choice of diverse markers of SES as major limitations of between-study comparisons (Pomerleau *et al.*, 2004).

There are few comparative studies that used standardized methods of data collection on East-West socioeconomic differences in smoking. Therefore, the present study aims to provide more information about this issue.

2.6.2.1. Smoking among adolescents

The HBSC survey related to the WHO provided measures of smoking among 12–16-year-old children in 36 countries (2001–2002), places the data sets within an internationally comparative context, and provided a good basis for comparative research between countries among adolescents (Uitenbroek *et al.*, 1996).

Griesbach *et al.* (2003) compared smoking and family structure factors among adolescents in affluent countries such as Austria, Denmark, Finland, Germany, Norway, Scotland and Wales in accordance with the HBSC survey in 1997/1998. In all the studied countries girls smoked more than boys. Adolescent smokers lived in a stepfamily, had a parent that smoked, and lived with other smokers. Young people in intact families were less likely to be daily smokers than those in lone-parent families, who in turn were less likely to smoke than young people in stepfamilies.

Until now there is no published comparative research on East-West socioeconomic differences in smoking among adolescents based on the data of HBSC survey. This study aims to provide comparable data for smoking among adolescents in Estonia, Finland and Russia.

2.6.2.2. Smoking among adults

The common Finbalt Health Monitor protocol and procedures in the Health Behaviour Survey among the 16–64-year-old population in Finland, Estonia, Latvia and Lithuania provided a good basis for the cross-national comparison of data. The comparison of patterns of health behaviour in Estonia, Finland, and Lithuania in 1994–1998 showed that smoking was more prevalent in the younger age groups and among less educated people. The differences between urban and rural areas were small and inconsistent in all the countries. Finnish women tended to smoke in urban areas (Puska *et al.*, 2003).

A cross-sectional comparative survey conducted in all Baltic countries (1997) showed that in each country men belonging to the Russian minority were more likely to smoke than men in the majority group. In all of the countries, there were no significant differences in smoking between men living in urban and rural areas. In Latvia and Lithuania smoking rates among women were much lower in rural than in urban areas, but this was not so in Estonia. Among men, the likelihood of smoking was lower among those with higher incomes and higher education in all countries (Pudule *et al.*, 1999).

According to a comparative study of Finland and Russia (1991), men in Moscow were more often daily smokers than men in Helsinki while rather the reverse was true for women. In Helsinki smoking was connected with a lower educational level, notably among men (Palosuo, 2000). Male workers in Moscow were typically smokers, whereas white-collar employees and health care workers were more seldom smokers. Women in Moscow revealed a little variation in smoking by occupation, teachers being slightly less prone to smoke than other groups. In Helsinki there was no statistically significant association between

smoking and occupation. Family income had no effect on smoking in either city (Palosuo, 2000).

The comparative study of Varna, Glasgow, and Edinburgh (1994) reported a higher smoking prevalence among the less educated and unemployed respondents in all the cities (Uitenbroek *et al.*, 1996). However, cigarette smoking, a relatively expensive behaviour, seemed to falsify the economic explanation as smoking was more common in Varna and among those who were least able to afford this behaviour (Uitenbroek *et al.*, 1996).

The latest cross-sectional comparative survey (2001) in eight countries of the former Soviet Union (Armenia, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, and Ukraine) showed that age was a strong determinant of smoking in both genders, with elderly individuals being less likely to smoke. Men from Belarus, Ukraine, Georgia, and Moldova were less likely to smoke than those living in Russia. Women revealed significantly lower prevalence of smoking, compared with Russians in all the countries, except Belarus and Ukraine. Socially disadvantaged men (less educated, poorer economic situation and/or less social support) were more likely to smoke. In women, living in urban areas was the strongest predictor of smoking. Divorced, separated, or widowed women were more likely to smoke than married women. Muslim respondents smoked less frequently compared with other respondents (Pomerleau *et al.*, 2004).

2.6.3. Smoking among physicians

Although the activities of physicians are only one of the many factors determining the smoking of the population, there is no doubt that physicians play an important role in smoking and health.

Knowledge of the prevalence of smoking among physicians is useful for at least two reasons. First, such information may indicate the likelihood of the success of anti-tobacco campaigns in a particular country as medical professionals are often able to influence the behaviour of their own patients as well as society as a whole in the prevention of illness and promotion of well-being (Davis, 1993; Samuels, 1997; Grossman *et al.*, 1999; Josseran *et al.*, 2005). The influence of physicians by their exemplary behaviour and cessation advice has been regarded as a factor in the social dynamics of changes in smoking in the general population (van Reek & Adriaanse, 1991; Scott *et al.*, 1992; Chapman, 1995; Korhonen, 1997; Law *et al.*, 1997). It has been reported that when a physician gives advice to quit smoking, the probability of success in the smoking cessation increases (Bener *et al.*, 1993; Mark *et al.*, 1997; Grossman *et al.*, 1999; Lancaster *et al.*, 2000; McEwen & West, 2001; Kaetsu *et al.*, 2002; Mellvain *et al.*, 2002). Moreover, smoking status of physicians has affected their enthusiasm and the resulting effectiveness in convincing their smoking patients to give up smoking (Waalkens *et al.*, 1992; Tessier *et al.*, 1993b; Bouros *et al.*, 1995; Kawakami *et al.*, 1997; Hughes & Rissel, 1998; Kaetsu *et al.*, 2002; Vakefliu *et al.*, 2002; Willaing *et al.*, 2003).

Second, the prevalence of smoking among physicians may reflect the ‘maturity’ of the smoking epidemic in a particular country. An increased awareness of the dangers of cigarette smoking has brought about a steady decline in smoking among

the medical profession in most Westernized countries where the prevalence of smoking among doctors is well below the levels reported for the general population (van Reek & Adriaanse, 1991; Hensrud & Sprafka, 1993; Samuels, 1997; Hay, 1998; Eckert & Junker, 2001; Ohida *et al.*, 2001). For example, the proportion of smokers among physicians in the United Kingdom decreased from 62% to 18% between the years 1951 and 1991 compared with 30% among the total population in 1990 (Doll *et al.*, 1994; WHO, 2004). The prevalence of 74% in 1952–1953 has decreased strongly to 19% in 1984 among Norwegian male physicians compared with 33% among total population in 1984 (van Reek & Adriaanse, 1991; WHO, 2004). In Finland in 1990 daily smoking among male physicians amounted to 10% and female physicians to 6% compared with 32% and 20% for the total population, respectively (Barengo *et al.*, 2004; WHO, 2004). At the same time, smoking among physicians in Eastern Europe, in the countries of the Eastern Mediterranean Region and other developing world has been higher than that among the total population (Dekker *et al.*, 1993; Rogovska, 1996). In China, smoking among physicians increased from 51% to 61% among male and from 5% to 12% among female physicians in 1987–1996 (Li *et al.*, 1999). The overall smoking prevalence among Italian physicians has been similar to that of the general population (25% in 1993) (La Vecchia *et al.*, 2000). The prevalence of smoking among male physicians has been similar to that in the total Dutch population while it was lower among female physicians (Dekker *et al.*, 1993).

Still, there is no comparative research on the smoking among physicians in Eastern and Western Europe. The present study provides comparable data for smoking among Estonian and Finnish physicians.

2.6.4. Socioeconomic differences in the validity of self-reported smoking status among pregnant women

For the general population, self-reported measures have been found to provide reliable estimates of smoking status without systematic differentials in under-reporting by socioeconomic group (Vartiainen *et al.*, 2002). However, some authors have reported that the socioeconomic factors such as gender (Wells *et al.*, 1998), ethnicity (Caraballo *et al.*, 2001), lower education, and the number of household members who smoke in the home (Wagenknecht *et al.*, 1992), were associated with discrepant findings.

The self-report has been found to be a less reliable measure for the pregnant population, where smokers can feel under greater pressure to describe themselves as non-smokers (Graham & Owen, 2003). As maternal smoking during pregnancy has been associated with a variety of adverse pregnancy outcomes (Walsh *et al.*, 1997; Boyd *et al.*, 1998; Mathews *et al.*, 1999; Klebanoff *et al.*, 2001; Schluter *et al.*, 2002) and infants born to smokers are more prone to increased health risks in later life than infants born to non-smokers (Floyd *et al.*, 1993; Pichini *et al.*, 2000; Lawrence *et al.*, 2003), the pregnant women wish to give the appearance of a healthy lifestyle by under-reporting their current smoking habit (Ford *et al.*, 1997; Boyd *et al.*, 1998; Owen & McNeill, 2001).

A related, but a largely neglected question is whether the rates of under-reporting vary between the socioeconomic groups among pregnant women. According to English *et al.* (1994), denial of one's real smoking status is associated with one's educational level. Some authors have demonstrated ethnic differences in the misclassification of the smoking status (English *et al.*, 1994; Caraballo *et al.*, 1998). However, recent research has indicated that validated prevalence rates of smoking are higher than self-reported rates in all the socioeconomic groups among pregnant women, with no difference in rates of underreporting by education, occupational class, and housing tenure (Graham & Owen, 2003).

The present study aims to provide new data on socioeconomic differences in misclassification of smoking among pregnant women in Estonia.

3. OBJECTIVES OF THE STUDY

The thesis is based on six papers on the socioeconomic differences in smoking. The general objective of the thesis is to study socioeconomic differences in smoking within Estonia and draw comparisons with other countries. In order to do this, a number of more specific objectives were set:

- to study differences in the socioeconomic factors contributing to smoking among adolescents in Estonia compared to Finland and Russia (Papers I and III);
- to examine differences in the socioeconomic factors related to smoking among adult population in Estonia (Paper II);
- to describe smoking and to evaluate attitudes towards smoking among Estonian physicians in relation to the general population in Estonia and compared to the Finnish physicians (Papers IV and V);
- to investigate differences in the socioeconomic factors associated with the discrepancy between self-reported and cotinine-validated smoking status among pregnant women in Estonia (Paper VI);

4. MATERIAL AND METHODS

4.1. Overall description of the studies

Four separate studies were used to accomplish the objectives of this research project. A multidisciplinary approach aiming at a comprehensive picture of smoking and the socioeconomic factors is used throughout the study.

Previous studies from different countries have reported that smoking is associated with different socioeconomic factors. Therefore, the present study examined socioeconomic variations in smoking in the Estonian context (Papers I, II, IV, VI) and investigated to what extent the situation in Estonia differs from other countries (Papers III, V).

4.2. Data sources and subjects

Table 1 presents a summary description of the data sources, subjects, and data collection methods of this study. Different sample constructions were used according to the objectives of each original study. A more detailed description of the data sources and the selection of methods are provided in the respective papers.

Table 1. Subjects and methods

Study	Paper	Data source	Number of subjects used in the study	Data collection methods	Year
<i>I</i>	I III	Comparative study among adolescents in Estonia, Finland, and Russia	1268 adolescents in Estonian schools and 901 in Russian schools in Tallinn, 1396 in Helsinki, 618 in Moscow (aged 13–18)	Questionnaire completed in the classroom	1995 1994 1995
<i>II</i>	II	Subsample of the Estonian Health Interview Survey	2086 adults in Estonia (aged 30–59)	Structured face-to-face interview	1996
<i>III</i>	IV V	Study of the smoking of physicians in Estonia and Finland	4140 physicians in Estonia, 3000 in Finland	Mailed questionnaire	2002 2001
<i>IV</i>	VI	Subsample of Human Papillomavirus Type-16 Seroprevalence Study	1360 pregnant women in Tallinn	Venous blood collection, data at the Estonian Medical Birth Registry	1996– 1997

Study I was based on the data from the comparative survey “Environmental attitudes and knowledge of environmental health hazards among young people in Finland, Russia, and Estonia. A cross-national comparison of urban youth”. The study was carried out in the capitals of three countries. The data were collected in schools in Tallinn, Moscow, and Helsinki by almost an identical (two questions were different) self-administered questionnaire. As about 50% of the population in Tallinn is predominantly Russian-speaking, both Estonian- and Russian-speaking schools were included. All the specialized schools were excluded. The schools were selected randomly from the telephone directory. In Tallinn the data were collected in grades 8, 10, and 12 (aged 13–14, 15–16, and 17–18 years, respectively) in ten Estonian (n=1268) and seven Russian (n=901) secondary schools in the autumn of 1995. In Helsinki 1396 pupils of grade 8 (aged 14) of six lower-secondary schools and from grades 1 and 3 (school year 10 and 12; aged 16 and 18 years, respectively) of the respective upper-secondary schools (gymnasiums) participated in the survey in the autumn of 1994. The sample areas were selected on the basis of the socioeconomic information of the city districts. Schools in extreme districts with regard to the income level were excluded. In Moscow the data collected in the spring of 1995 covered 618 adolescents of grades 9, 10, and 11 (aged 15, 16, and 17 years, respectively) from nine schools that were randomly selected from different administrative areas of Moscow.

Study II used data from the Estonian Health Interview Survey conducted in 1996 (Leinsalu *et al.*, 1998; Leinsalu *et al.*, 1999). The target population consisted of cohorts born in 1916–1980 (aged between 15–79 years). The survey was designed to represent the Estonian population. All persons within this age group who were permanent residents of Estonia at the time of the 1989 population census were eligible for sampling. A simple random selection was used for drawing the sample from 16 sampling units (15 counties and Tallinn, the capital city, as a separate unit). Each sampling unit was stratified by gender and age. In all, 6019 eligible respondents were selected. The present study involved the population aged 30–59 with a total of 2086 respondents (1008 men and 1078 women).

Data for *study III* was collected among physicians in Estonia in 2002 and Finland in 2001. The Estonian participants included all the physicians (n=4140) having a contract with the Management Board in the database of the Estonian Health Insurance Fund. In Finland, a systematic random sample (n=3000) was taken from the Registry of the Finnish Medical Association by using the personal identity number. The sample was restricted to physicians who lived in Finland and were younger than 65 years. In a comparative study with Finnish physicians, the Estonian sample was restricted to physicians younger than 65 years (n=2550).

Study IV was based on a subsample of the HPV16 Seroprevalence Study (Kibur *et al.*, 2000). The participants included 2943 consecutive pregnant women who made the first antenatal visit to the women’s consultation clinic in Tallinn between February 1996 and November 1997. For the cotinine analysis 1372 blood serum samples were collected from the women who were determined to deliver.

4.3. Data collection

In *study I* adolescents completed the questionnaire with 79 questions on health-related topics in the classroom under the supervision and guidance of a member of the study team. In order to exclude pre-formed answers, the teachers in the schools were requested not to inform their pupils about the forthcoming survey, and the survey was conducted in the course of one day in one school. The pupils were assured of anonymity and of the confidentiality of their responses and of the inviolability of their status at school by their honest answers. The time limit for responding was 45 minutes. Only the pupils present on the day of the survey were eligible to participate. Participation was voluntary. Non-responses consisted mainly of those pupils who were absent on the day of the survey. In Tallinn and Moscow the participants included all the pupils present on the day of the survey (response rate 100%). In Helsinki four pupils refused to fill in the questionnaire and six questionnaires were rejected, because they were completed in a non-serious manner (response rate 99.3%).

In *study II* face-to-face interviews were conducted in two languages (Estonian and Russian), and trained interviewers with previous experience were used. The respondents answered questions on a large variety of health-related topics (375 questions). In all, 6019 eligible respondents were forwarded to the interviewers. Of those 4711 interviews (2131 men and 2580 women) were completed. Therefore, the crude response ratio was 78.3%. As all dropouts were regarded as ineligible (dead, emigrated, double recorded or without address), the corrected response ratio was 84.3%.

In *study III*, a self-administered questionnaire originally developed by the WHO and modified according to the Estonian and Finnish health care systems and special needs was used in both countries. The questionnaire contained 38 questions about past and present smoking habits, attitudes, and knowledge of tobacco use and smoking cessation, attitudes towards patients' smoking, and responsibilities of physicians concerning this matter. The questionnaire was mailed to the physicians. A reminder with a copy of the questionnaire was sent by mail to non-respondent study subjects 4–6 weeks after the initial questionnaire. The overall response rate was 67.8% in Estonia, and 69.8% in Finland.

In *study IV*, between February 1996 and November 1997, venous blood was collected from 2943 pregnant women during the first antenatal visit to the women's consultation clinic in Tallinn. The serum samples were stored at a cold storage facility at -20°C at the Institute of Experimental and Clinical Medicine. For the cotinine analysis, 1372 serum samples were collected from the women who were determined to deliver. Cotinine was analysed at the Clinical Trial Service Unit (CTSU), Radcliffe Infirmary, University of Oxford, using the STC (SolarCare Technologies, Bethlehem, Pennsylvania, USA) ELISA (enzyme-linked immunosorbent assay). The self-reported smoking status was blinded during sampling and laboratory assay. The unique personal identification numbers made it possible to obtain additional information about the reproductive history of the women by linkage to the Estonian Medical Birth Registry (EMBR). The linkage of the serum sample data to the EMBR was performed in November 1999. Among 1372 serum samples 12 lacked data in the EMBR and were excluded from the

analysis. Smoking status was recorded in the EMBR on the basis of the first antenatal visit to the women's consultation clinic and of standardized birth registration forms completed in maternity and/or postnatal wards (Tellmann, 2002).

4.4. Study variables

4.4.1. Smoking status

The smoking status in all the studies was based on self-reported information. Additionally, quantitative analysis was used in *study IV* to measure cotinine-validated smoking status.

In *study I* the smoking status was determined from responses of adolescents to an item asking about current and past smoking (I, III). Four categories of the self-reported smoking status (never / have tried, but do not smoke now / smoke every now and then / smoke regularly) were used. For the analysis of current smoking, adolescents who answered "I smoke every now and then" or "I smoke regularly" were considered as smokers; those who answered "I have never tried" or "I have tried, but do not smoke now" were classified as current non-smokers.

In *study II* the smoking status was determined from responses to two questions: "Have you ever smoked more than just to taste?" (yes / no) and "Thinking back to the previous four weeks, have you smoked during this period?" (yes / no) (II). The responses to these questions served as a basis for categorizing respondents as non-smokers, ex-smokers, and current smokers.

In *study III* the smoking status was determined by the questions: "Do you smoke now?" (no / yes, daily / yes, occasionally), "Have you ever smoked regularly for one year or more?" (yes / no). The respondents were classified as current, past, and never smokers (IV) or daily, occasional, past, and never smokers (V).

In *study IV* the self-reported smoking status was determined from the response to the question "Smoking during pregnancy" (I did not smoke during pregnancy / I quit smoking during the first trimester of pregnancy / yes, I smoked during pregnancy) (VI). A non-smoker was defined as a person who claimed not to have smoked during pregnancy. An ex-smoker was a woman who claimed having stopped smoking during the first trimester of pregnancy, and a smoker was a woman who continued smoking during pregnancy. A cotinine level 15 ng/ml as a suggested cut-off for active smoking (Caraballo *et al.*, 1998; Heller *et al.*, 1998; Peacock *et al.*, 1998; Klebanoff *et al.*, 2001; Schluter *et al.*, 2002) was used to divide pregnant women into cotinine-validated non-smokers and smokers. Women with serum cotinine levels 15–99 ng/ml were regarded as lighter smokers and those with levels ≥ 100 ng/ml as heavier smokers.

4.4.2. Socioeconomic status

SES variables were self-reported (I–III, VI). Generally, SES was not the issue in the study among physicians (IV, V) as representatives of the higher socioeconomic bracket of the general population.

Classical indicators of SES included education of the head of the family among adolescents (III), education (II, VI), employment status (II, VI), and income (II) among adults. Education was classified as basic (less than 10 years of schooling) / secondary (10–14 years or 10–12 years) / higher (15–16 years or a university degree). Employment status (during the previous 12 months) was coded as employed / unemployed or homemakers / retired or disabled (II), and economically active (employed or student) / economically inactive (unemployed, at home, or disabled) (VI). The income level was dichotomized as below the subsistence level (1050 Estonian kroons monthly per person) / equal to or above the subsistence level. The level was based on the estimated subsistence level (covers only the bare necessities of life).

SES of the individuals was categorized according to such basic socio-demographic indicators as age (I–VI), religion (III), ethnicity (I–IV, VI), country (III, V), type of residence (II), marital status (II, VI), and family structure (III). Age by grades (8 or 9 / 10 / 11 or 12) (I, III), five (VI) or ten years (II, IV, V) age groups were used. Age was measured in full years. Religion was dichotomized as important (very important or important) / not important (not so important or not at all important) (III). Ethnicity was dichotomized as Estonian / non-Estonian (I–III, VI). In international comparisons subjects were classified by country Estonia (Tallinn) / Finland (Helsinki) / Russia (Moscow) (I) and Estonia / Finland (V). The type of residence was classified as urban (2000 inhabitants or more) / rural (less than 2000). Marital status was classified as married or cohabiting / single / divorced or separated or widowed (II) and married / cohabiting / unmarried (VI). The family structure variable was dichotomized as intact families (both parents alive and live together) and non-intact families, comprising mostly a single parent and neo-families (families with a stepfather or a stepmother) (III).

SES of the adolescents was categorized according to such indicators of social environment as parental smoking (mother, father, both) (I, III), siblings' smoking (yes / no) (III), passive smoking (I), friends' smoking (III) and variable school (III). Passive smoking was measured as exposure to tobacco smoke per day (hardly ever / less than 1 h / 1-5 h / more than 5 h).

4.4.3. Other variables

Parity (VI) was dichotomized as primiparae (the first child) / multiparae (at least the second child).

The attitudes towards smoking among Estonian physicians (IV) were examined by the following variables:

- As many people smoked during their whole lives until old age and did not become ill, smoking is not so dangerous as experts declare (agree / disagree / can not say)

- To smoke or not to smoke – that is my personal issue (agree / disagree / can not say)
- To stop smoking is very hard for many people. So it is better for their health to simply continue smoking (agree / disagree / can not say)
- Smoking does not damage my health as long as I follow a healthy lifestyle in other fields (agree / disagree / can not say)
- Smoking is dangerous to my health only if I smoke more than 10 cigarettes a day (agree / disagree / can not say).

Using the 10-point scale (10 – very harmful) Estonian and Finnish physicians assessed the harmfulness of smoking to the health (V). Those who had chosen points 8–10 were considered as having agreed with the above statement (disagreed, 0–7).

Attribution of the causative role of smoking to smoking-related diseases, such as coronary heart disease, lung cancer, chronic bronchitis and emphysema, was examined for each disease separately among Estonian physicians (IV) (a major cause / one of the causes / is not a cause / can not say).

The attitudes towards the smoking of patients among Estonian and Finnish physicians (IV, V) were examined by the following variables:

- Asking the patients about their smoking habits during the previous week (never / sometimes / every second patient / often) (IV). The answers were dichotomized as never / sometimes or more often (V).
- Reasons for not asking about patients' smoking habits (lack of time, lack of habit, wish not to disturb the privacy of a patient, a physician can not influence a patient, some other reason) for each reason separately (yes / no)
- Importance of the exemplary role in being a non-smoker (important / not important).

Importance of the reasons of being non-smoker by themselves (protection of one's own health, avoidance of unpleasant symptoms, setting a good example, inconvenience for those around me, opinion of friends or family members, pressure from colleagues, saving money) among Estonian and Finnish physicians was examined separately for each reason (important / not important) (V).

Agreement with statements about smoking counselling among Estonian and Finnish physicians (V) was examined by the different statements (totally agree / agree / do not know / do not agree / totally do not agree). The answers were dichotomised as agree / disagree.

- It is the doctor's responsibility to try to convince people to stop smoking
- My present knowledge is sufficient to enable me to advise a patient who wishes to stop smoking
- Smoking prevention should form part of the formal training of health professionals
- Health professionals should receive special training on how to help patients who wish to stop smoking.

4.5. Statistical methods

As gender was strongly associated with smoking, the results were analysed separately for boys and girls (I, III), males and females (II, IV, V).

In *study I* the primary data analysis involved the determination of the prevalence proportion (I, III) and 95% confidence interval (CI) (III) for tobacco use and associated factors. The secondary analysis involved age-adjusted logistic regression to measure association between smoking among adolescents and exposure to the ETS (I). For the logistic regression analysis the smoking status was dichotomized to the current smokers (regular and occasional smokers) and non-smokers (past smokers and never smokers) (I, III). Odds ratio (OR) and the corresponding 95% CI were computed for each independent variable. For the analysis, the statistical package SPSS 9.0 was used (I).

In the international comparison (III), the secondary analysis involved a two-level logistic regression model offering simultaneous consideration of individual as the first unit level, and school as the second unit level. There was a considerable variability in smoking prevalence at school level seen among participating schools in each country. Two-level approach accounted for this source of variation to obtain more precise estimates of the effects of individual characteristics for adolescents in each school. First, a model including only the covariates that themselves can not be influenced by respondents' smoking level, was fitted. In this model all significant effects had a causal interpretation. The second model included additionally the effect of friends' and siblings' smoking, that can be influenced by the smoking level of the respondents. The adjusted OR of smoking and the corresponding 95% CI were computed. For the analysis, the statistical packages Stata and SAS 8.0 macro GLIMMIX were used (III).

Among a total of 4183 respondents (III), 103 (2.5%) revealed inconsistencies in responses to items on smoking and were excluded from the analysis. This percentage was the lowest among pupils in Russian schools in Tallinn (0.2%) and the highest among Finnish adolescents (4.6%). For the gender-stratified analyses, it was necessary to exclude additionally 12 questionnaires (0.3%) with missing values about the gender of the respondent. The final data set consisted of 4068 questionnaires. Before the multivariate regression analysis, additionally 19 (0.5%) questionnaires that lacked information on questions related to associated factors were excluded from further analysis. In all, 4049 questionnaires were used in the model.

In *study II* the primary data analysis involved the determination of the prevalence proportion of tobacco use and associated factors (II). Secondary analysis involved a multivariate regression model to explore the association of socioeconomic characteristics with current smoking. The data were analysed using the statistical package Stata 6.0. Crude and adjusted prevalence odds ratio (POR) of smoking and the corresponding 95% CI were computed.

Among 2089 questionnaires (II) three (0.1%) with missing values about smoking and were excluded from the analysis. Before the regression analysis, ex-smokers (340 questionnaires) and additional 29 questionnaires that lacked information about questions about the associated factors were excluded from further analysis. The logistic regression analysis used dichotomized smoking status

(current smokers and never smokers). Altogether 1717 questionnaires were used in the model. The data were analysed using the statistical package Stata 8.0.

In *study III* the primary data analysis involved the determination of the mean age and standard deviation of respondents, the prevalence proportion, and the corresponding 95% CI (IV, V). Logistic regression analysis was used to measure the association between the physicians' opinions, attitudes, and smoking status by country (V). The age adjusted POR and the corresponding 95% CI were computed. For the logistic regression analysis smoking status was dichotomised to the current smokers (daily and occasional smokers) and non-smokers (past and never smokers). The multiple category outcomes (smoker in Estonia, non-smoker in Estonia, smoker in Finland, non-smoker in Finland) was used. The data were analysed using the statistical package Stata 8.0.

In *study IV* the primary data analysis involved the determination of the prevalence proportion of self-reported and cotinine-validated tobacco use among pregnant women (VI). Secondary analysis involved the logistic regression to estimate the distribution of women's socioeconomic characteristics between cotinine-validated smokers and cotinine-validated non-smokers, both among the group of self-reported non-smokers. Among the 1239 self-reported non-smokers, 17 (1.4%) lacked data in the EMBR on ethnicity, education, employment status, or marital status and were excluded from the regression analysis. Thus, the logistic regression analysis was restricted to the 1222 self-reported non-smoking pregnant women with complete data. The model used dichotomized smoking status (cotinine-validated smokers / cotinine-validated non-smokers) as a dependent variable. Crude and adjusted OR with 95% CI were calculated in the model. Database management and record linkage was conducted using the Visual FoxPro 6.0 (SQL). The data were analysed using the statistical package Stata 6.0.

5. RESULTS

The results are presented in the following order:

- the description of socioeconomic differences in smoking among adolescents in Estonia and in international comparison (I, III)
- the description of socioeconomic differences in smoking among adults in Estonia (II)
- the description of smoking among Estonian physicians compared to smoking among Estonian adult population and Finnish physicians (IV, V)
- the description of socioeconomic differences in the misclassification of the smoking status among pregnant women in Estonia (VI).

5.1. Smoking among adolescents (I, III)

One in four adolescents (25%) in Tallinn had smoked occasionally (16%) or regularly (10%). The proportion of smokers was higher in boys (31%) than girls (22%).

Smoking prevalence among girls was 34.6% in Russian schools in Tallinn, 39.5% in Helsinki, 32.1% in Moscow, and 17.6% among girls in Estonian schools in Tallinn. Smoking was slightly less prevalent among boys in Helsinki (27.5%) than among boys in Estonian (33.6%) and Russian (35.6%) schools in Tallinn and among boys in Moscow (32.8%).

Multilevel logistic regression analysis indicated that education of the head of the family, family structure and religion did not correlate with smoking among the adolescents. School effect accounted for an important source of variation in smoking prevalence (Table 2). The first model showed that adjusted ORs for smoking differed by country among girls but not among boys. OR for tobacco use was the lowest among girls in Estonian schools in Tallinn compared to girls in the other study sites. Smoking increased by age in both genders. Parental smoking was linked to the tobacco use among adolescents with slightly more prevalent effect among girls than among boys. In the second model, both, the effects of smoking among one's friends and siblings appeared to be significant, confirming the fact that smoking indeed occurs in clusters of friends and siblings with the effect of friends' smoking being the strongest. Among girls who had smoking friends, the OR for tobacco use was twice as high as among boys. Smoking among one's friends and siblings showed interaction with the study sites among girls, but not among boys. The effect of friends' smoking was the strongest among girls in Helsinki and the weakest among girls in Russian schools in Tallinn. The association between siblings' smoking and the tobacco use was strongest among girls in Moscow. Passive smoking, analysed in this study only in Tallinn, led to the higher prevalence of smoking among adolescents. (Paper I, Table 2).

Table 2. Multilevel modelling results (OR and 95% CI) for association between smoking and different factors on individual and school level among adolescents in Tallinn (1995), Helsinki (1994) and Moscow (1995)

Factor	I Model (Excluding smoking among friends and siblings)		II Model (Including smoking among friends and siblings)	
	Girls	Boys	Girls	Boys
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
<u>School level</u>				
Study site				
Est* schools in Tallinn	1	1	1	1
Russ** schools in Tallinn	2.4 (1.7–3.5)	1.0 (0.6–1.7)	6.8 (3.4–13.9)	1.2 (0.7–1.8)
Helsinki				
Helsinki	3.5 (2.4–5.0)	0.7 (0.4–1.2)	2.0 (0.9–4.6)	0.7 (0.5–1.1)
Moscow	2.4 (1.6–3.6)	1.0 (0.6–1.7)	3.8 (1.7–8.5)	1.2 (0.7–1.9)
<u>Individual level</u>				
Grades				
8 or 9	1	1	1	1
10	1.6 (1.2–2.0)	1.3 (1.0–1.7)	1.3 (1.0–1.7)	1.1 (0.9–1.5)
11 or 12	1.9 (1.5–2.4)	2.0 (1.6–2.7)	1.5 (1.2–2.0)	1.6 (1.2–2.0)
Parental smoking				
No	1	1	1	1
Yes	1.8 (1.5–2.2)	1.3 (1.1–1.6)	1.7 (1.4–2.1)	1.3 (1.0–1.6)
Smoking among siblings				
No			1	1
Yes			1.5 (0.9–2.3)	1.7 (1.3–2.3)
Smoking among friends				
No			1	1
Yes			8.4 (4.6–15.5)	4.0 (3.1–5.1)
<u>Interaction</u>				
Smoking among siblings * study site				
Est schools in Tallinn			1	–
Russ schools in Tallinn			0.9 (0.5–1.7)	
Helsinki			1.4 (0.7–2.7)	
Moscow			2.0 (1.0–4.2)	
Smoking among friends * study site				
Est schools in Tallinn			1	–
Russ schools in Tallinn			0.3 (0.1–0.6)	
Helsinki			1.5 (0.7–3.5)	
Moscow			0.5 (0.3–1.1)	
<u>Covariance parameters</u>				
Between schools	0.073 (p=0.07)	0.198 (p=0.01)	0.074 (p=0.07)	0.116 (p=0.03)
Residual	0.983	0.986	0.963	0.984

* Est – Estonian; ** Russ – Russian;

Table 3. PORs and 95% CIs for smoking among adults in Estonia, 1996

Characteristic	Male			Female		
	No of smokers	Crude POR (95% CI)	Adjusted POR* (95%CI)	No of smokers	Crude POR (95% CI)	Adjusted POR* (95%CI)
Age group (years)						
30–39	240	1	1	117	1	1
40–49	194	0.77 (0.53–1.14)	0.74 (0.49–1.11)	116	0.83 (0.60–1.15)	0.82 (0.58–1.14)
50–59	141	0.54 (0.36–0.80)	0.49 (0.31–0.76)	42	0.26 (0.18–0.40)	0.27 (0.17–0.44)
Ethnicity						
Estonian	355	1	1	172	1	1
Non-Estonian	220	1.07 (0.77–1.48)	1.01 (0.68–1.50)	103	0.95 (0.71–1.27)	0.76 (0.55–1.05)
Type of residence						
Urban	394	1	1	209	1	1
Rural	181	1.18 (0.83–1.68)	0.97 (0.63–1.51)	66	0.83 (0.60–1.15)	0.77 (0.53–1.12)
Education						
Higher	61	1	1	51	1	1
Secondary	363	3.91 (2.59–5.89)	3.38 (2.19–5.21)	194	1.23 (0.85–1.77)	1.23 (0.84–1.81)
Basic	151	4.36 (2.66–7.17)	4.50 (2.60–7.80)	30	0.68 (0.41–1.14)	1.15 (0.65–2.03)
Employment						
Employed	457	1	1	219	1	1
Unemployed/homemaker	83	2.34 (1.29–4.22)	1.84 (0.97–3.52)	44	1.11 (0.74–1.64)	1.04 (0.68–1.60)
Retired/disabled	35	1.06 (0.55–2.05)	1.28 (0.60–2.72)	12	0.28 (0.15–0.52)	0.57 (0.28–1.15)
Income						
≥ subsistence level	321	1	1	145	1	1
< subsistence level	254	1.55 (1.11–2.16)	1.00 (0.67–1.49)	130	1.07 (0.81–1.42)	0.97 (0.70–1.36)
Marital status						
Married/cohabiting	446	1	1	176	1	1
Single	40	0.83 (0.47–1.47)	0.58 (0.31–1.09)	15	1.16 (0.62–2.18)	1.23 (0.63–2.39)
Divorced/widowed	89	2.69 (1.46–4.93)	2.14 (1.14–4.02)	84	1.34 (0.98–1.84)	1.60 (1.14–2.24)

*Each POR was adjusted for all the other characteristics in the table.

5.2. Smoking among adults (II)

The current smoking prevalence proportion was 57.9% (95% CI 54.8–61.0) among men and 25.7% (95% CI 23.1–28.4) among women in the age group 30–59 in Estonia. Age-standardized prevalence (world standard population by Waterhouse *et al.* (1976)) was 58.3% and 26.5%, accordingly.

For men and women, the current smoking rate was consistently lower in the age group 50–59 compared to the age group 30–39 (Table 3). Men, but not women, revealed a distinctly negative relationship between smoking and the educational level. Crude ORs showed that smoking was more common among unemployed men with lower income, but there was no clear pattern for women. After adjustment, employment and income appeared not to be associated with smoking among men. No relationship to employment and income was found among women. The crude and adjusted ORs showed that for both genders, the probability of smoking was much higher if the respondent was divorced, separated or widowed. No consistent relationship to ethnicity and type of residence was found in both genders.

5.3. Smoking among physicians (IV, V)

The current smoking prevalence was 24.9% for Estonian male and 10.8% for female physicians (Paper IV, Table 1). Nearly twice as many males (20.5%) as females (12.3%) were categorized as past smokers. Therefore, there were more females who had never smoked (62.0% and 21.5%, respectively).

The ratio of age-standardized prevalence rate (world standard population by Waterhouse *et al.* (1976)) of current smoking physicians and total Estonian adult population was 0.43 for males and 0.40 for females. A comparison of the proportion of smokers among the respondents and the Estonian population in the highest educational bracket, adjusted for age differences, showed the ratios of 0.71 among males and 0.63 among females.

The current smoking prevalence among under 65-years-old Estonian physicians was higher than among Finnish physicians (26.3 % and 21.6 % among males, 11.2 % and 8.9 % among females, respectively). Male daily smoking prevalence was higher in Estonia than in Finland (18.6 % and 6.7 %) (Table 4). The highest daily smoking prevalence proportion among male physicians was in the age group 45–54 in Estonia (21.3 %) and in the oldest age group (55–64) in Finland (12.6 %).

Female daily smoking prevalence was higher among Estonian than Finnish physicians (6.6 % and 3.6 %). The daily smoking prevalence proportion of female physicians in Estonia was the highest in the age group 35–44 (7.4 %), but in Finland it was the highest in the oldest age group (4.9 %). Compared to Estonia, Finnish physicians more often agreed that smoking is harmful to their health. In both countries the smoking of the physicians themselves downplayed the health hazard of smoking (Paper V, Table 2).

Table 4. Smoking habits among Estonian (2002) and Finnish (2001) physicians by age and gender (n, %, 95 % CI)

	Age group (years)				Total
	-34	35-44	45-54	55-64	
Estonian males					
No of physicians	61	150	122	81	414
Daily smoker	18.0 (9.4-30.0)	17.3 (11.6-24.4)	21.3 (14.4-29.6)	17.3 (9.8-27.3)	18.6 (15.0-22.7)
Occasional smoker	13.1 (5.8-24.2)	6.7 (3.2-11.9)	7.4 (3.4-13.5)	6.2 (2.0-13.8)	7.7 (5.3-10.7)
Past smoker	19.7 (10.6-31.8)	33.3 (25.9-41.5)	34.4 (26.1-43.6)	34.6 (24.3-46.0)	31.9 (27.4-36.6)
Never smoker	49.2 (36.1-62.3)	42.7 (34.6-51.0)	36.9 (28.3-46.1)	42.0 (31.1-53.5)	41.8 (37.0-46.7)
Finnish males					
No of physicians	147	253	346	199	945
Daily smoker	4.8 (1.9- 9.6)	4.3 (2.2- 7.6)	5.8 (3.6- 8.8)	12.6 (8.3-18.0)	6.7 (5.2- 8.4)
Occasional smoker	23.8 (17.2-31.5)	20.2 (15.4-25.6)	11.3 (8.1-15.1)	8.0 (4.7-12.7)	14.9 (12.7-17.4)
Past smoker	26.5 (19.6-34.4)	33.6 (27.8-39.8)	46.5 (41.2-51.9)	50.3 (43.1-57.4)	40.7 (37.6-44.0)
Never smoker	44.9 (36.7-53.3)	41.9 (35.7-48.2)	36.4 (31.3-41.7)	29.1 (22.9-36.0)	37.7 (34.6-40.8)
Estonian females					
No of physicians	306	638	622	494	2060
Daily smoker	5.2 (3.0- 8.4)	7.4 (5.5- 9.7)	6.8 (4.9- 9.0)	6.1 (4.1- 8.6)	6.6 (5.5- 7.7)
Occasional smoker	4.6 (2.5- 7.6)	5.2 (3.6- 7.2)	4.3 (2.9- 6.3)	3.2 (1.9- 5.2)	4.4 (3.5- 5.3)
Past smoker	12.4 (8.9-16.6)	16.5 (13.7-19.6)	19.0 (16.0-22.3)	19.0 (15.7-22.8)	17.2 (15.6-18.9)
Never smoker	77.8 (72.7-82.3)	71.0 (67.3-74.5)	69.9 (66.2-73.5)	71.7 (67.5-75.6)	71.8 (69.8-73.8)
Finnish females					
No of physicians	308	431	309	82	1130
Daily smoker	4.5 (2.5- 7.5)	2.6 (1.3- 4.5)	3.9 (2.0- 6.7)	4.9 (1.3-12.0)	3.6 (2.6- 4.9)
Occasional smoker	5.8 (3.5- 9.1)	5.3 (3.4- 7.9)	5.8 (3.5- 9.1)	1.2 (0.0- 6.6)	5.3 (4.1- 6.8)
Past smoker	31.2 (26.0-36.7)	31.8 (27.4-36.4)	36.6 (31.2-42.2)	41.5 (30.7-52.9)	33.6 (30.9-36.5)
Never smoker	58.4 (52.7-64.0)	60.3 (55.5-65.0)	53.7 (48.0-59.4)	52.4 (41.1-63.6)	57.4 (54.5-60.3)

In Estonia, significantly more smoking than non-smoking physicians agreed that smoking is not as dangerous as experts declare because smokers have smoked for their whole lives without falling ill, and to smoke or not to smoke is their personal choice (Paper IV, Table 3).

Compared to Estonia, Finnish physicians more often agreed that smoking is harmful to their health. In both countries the smoking of the physicians themselves downplayed the health hazard of smoking (Paper V, Table 2).

The majority of Estonian physicians stated that smoking is a major cause or one of the causes of the coronary heart disease, lung cancer, chronic bronchitis, or emphysema. A higher proportion of past smokers, compared to current and never smokers, agreed that smoking is a major cause of heart diseases. A significantly lower proportion of smokers, compared to non-smokers, agreed that smoking is a major cause of lung cancer (Paper IV, Table 4).

Significantly fewer Estonian current smokers than past or never smokers had during the previous week often asked their patients whether they smoked (Paper IV, Table 5). Nearly twice as many male and female never smokers as current smokers had no time to pay attention to whether their patients smoked or not. Compared to past and never smokers, the wish not to disturb the privacy of a patient as a reason for not asking about their smoking habits was significantly more prominent among smoking physicians. No difference by smoking status was found among supporters of other reasons as no habit of discussing smoking and inability to influence the patient in their opinion.

Estonian and Finnish male physicians did not reveal any differences in asking their patients during the previous week whether they had smoked. Among female physicians, significantly more Estonian non-smokers and Finnish physicians tried to assess the smoking status of their patients compared to Estonian smokers (Paper V, Table 4).

Compared to Estonian smoking physicians, lack of time as a reason for not asking about the smoking habits of one's patients was more prominent among non-smokers in Estonia and physicians in Finland (Paper V, Table 5). The comparison of non-smokers in two countries revealed that this opinion had more supporters in Finland. Compared to Finnish physicians, lack of habit as a reason for not asking about the smoking habits of their patients was more prominent among Estonian physicians. In both countries smoking among physicians was associated with the wish not to disturb the privacy of a patient as the reason for not asking about the smoking habits of their patients. More Estonian male physicians than Finnish colleagues were sure that it was not important to ask this question because a physician has no influence over their patients' smoking. Among female physicians only non-smokers in Finland less likely agreed with this statement.

Almost all the Finnish physicians (less so in Estonia) agreed that it was the doctor's responsibility to try to convince people to stop smoking (Table 5). Among non-smoking physicians the above-mentioned statement was even more widespread. In both countries the majority of physicians felt their knowledge was sufficient to counsel patients to quit. No statistically significant relationship was found between one's smoking status and the opinion about the sufficiency of knowledge to advise the patient to stop smoking in both countries. Agreement with the statement that smoking prevention should be part of the normal training of

health professionals was strongly correlated with the smoking status among physicians in Estonia and male colleagues in Finland. Compared to Estonia, agreement with this statement was more prevalent among Finnish physicians. Finnish non-smokers agreed much more with this statement than Estonian non-smokers. Compared to Estonian males, Finnish males agreed much more with the necessity to receive special training on how to help patients who wish to stop smoking. Among females, agreement among Estonian non-smokers and Finnish smokers was stronger than in Estonian smokers.

Table 5. Agreement with statements related to smoking counselling (compared to disagreement) among Estonian (2002) and Finnish (2001) physicians by smoking status, country, and gender (n, %, POR, 95% CI)

Statement	Male			Female		
	Agree n	%	Age adjusted POR (95 % CI)	Agree n	%	Age adjusted POR (95 % CI)
It is the doctor's responsibility to try to convince people to stop smoking						
Est* smokers	45	55.6	1	88	61.1	1
Est non-smokers	159	69.4	1.84 (1.09– 3.13)	892	70.7	1.52 (1.06– 2.18)
Fin** smokers	146	83.4	4.40 (2.41– 8.03)	74	85.1	4.19 (2.11– 8.29)
Fin non-smokers	608	92.0	9.12 (5.39–15.43)	877	93.9	11.20 (7.24–17.31)
My present knowledge is sufficient advise a patient who wishes to stop smoking						
Est smokers	56	81.2	1	95	73.1	1
Est non-smokers	176	81.9	1.03 (0.51–2.08)	856	74.2	1.01 (0.67–1.53)
Fin smokers	141	84.4	1.31 (0.62–2.73)	73	81.1	1.82 (0.94–3.52)
Fin non-smokers	463	81.7	1.02 (0.54–1.94)	583	74.4	1.22 (0.80–1.86)
Smoking prevention should form part of the formal training of health professionals						
Est smokers	54	67.5	1	133	82.6	1
Est non-smokers	216	84.7	2.71 (1.52– 4.85)	1396	90.5	2.01 (1.29– 3.13)
Fin smokers	161	88.5	3.71 (1.93– 7.14)	93	97.9	10.11 (2.34–43.60)
Fin non-smokers	668	96.3	12.24 (6.64–22.57)	962	98.2	11.52 (6.18–21.48)
Health professionals should receive special training on how to help patients to stop smoking						
Est smokers	62	78.5	1	137	87.3	1
Est non-smokers	208	85.6	1.69 (0.88–3.24)	1478	94.1	2.34 (1.39–3.91)
Fin smokers	158	93.5	4.07 (1.80–9.21)	87	100.0	4.71 (2.56–8.66)
Fin non-smokers	618	92.9	3.63 (1.96–6.71)	912	97.1	0.78 (0.46–1.33)

* Est – Estonian; **Fin – Finnish;

5.4. Smoking among pregnant women in Estonia (VI)

Among the pregnant women 91.1% reported that they were non-smokers, and 5.1% claimed that they were current smokers. Among the women who did not admit smoking, 20.9% had cotinine concentrations of ≥ 15 ng/ml. The cotinine measurements indicated also that 9.8% of the self-reported non-smokers were actually heavy smokers. Half of the self-reported current smokers had cotinine levels between 100 and 485 ng/ml (Paper VI, Table 1).

The adjusted ORs show that non-Estonians, less educated, economically inactive, cohabiting, and multiparous women were more likely to misclassify current smoking (Table 6). After adjustment the effect of low-level education, economic inactivity, and unmarried status decreased slightly while the effect of ethnicity, cohabiting status, and multiparae increased. Age appeared not to be associated with under-reporting of the smoking status as the probability of misclassification decreased among the youngest age group, but it increased only slightly among the older age groups compared to the age group 20–24 years.

Table 6. Sociodemographic and socioeconomic characteristics of serum cotinine-validated smokers and non-smokers among self-reported non-smokers, ORs, and 95% CIs for smoking denial among pregnant women in Estonia, 1996–1997

Characteristic	Self-reported non-smokers			
	No of cotinine-validated smokers	No of cotinine-validated non-smokers	Crude OR	Adjusted OR* (95% CI)
Age (years)				
≤19	58	127	1.61 (1.12–2.32)	0.75 (0.48–1.17)
20–24	138	488	1	1
25–29	54	299	0.64 (0.45–0.90)	0.82 (0.56–1.21)
≥30	6	52	0.41 (0.17–0.97)	0.51 (0.20–1.28)
Ethnicity				
Estonian	152	667	1	1
Non-Estonian	104	299	1.53 (1.15–2.03)	1.83 (1.32–2.54)
Education				
Higher	14	157	1	1
Secondary	157	715	2.46 (1.39– 4.37)	1.94 (1.06– 3.55)
Basic or less	85	94	10.14 (5.45–18.86)	7.31 (3.61–14.78)
Employment status				
Working/Student	168	777	1	1
Unemployed/Housewife / Disabled/Unknown	88	189	2.15 (1.59–2.92)	1.50 (1.07–2.10)
Marital status				
Married	86	466	1	1
Cohabiting	143	432	1.79 (1.33–2.42)	1.85 (1.31–2.61)
Unmarried	27	68	2.15 (1.30–3.55)	1.74 (0.98–3.09)
Parity				
Primiparae	187	722	1	1
Multiparae	69	244	1.09 (0.80–1.49)	1.63 (1.12–2.37)

*Adjusted for all the other variables shown in the table.

6. DISCUSSION

The main findings of this set of studies confirm that the socioeconomic differences in smoking represent a complex and multifaceted phenomenon.

Education of the head of the household as indicator of SES was not associated with smoking among adolescents in Tallinn, Helsinki and Moscow. Relationship was found between smoking among adolescents and indicators of social environment. Adolescent smokers in every study site were more likely to have a parent, sibling, or friend that smoked. Smoking among siblings and friends showed interaction between the study site and smoking among girls. The association with friends' smoking was strongest among the girls in Helsinki and with siblings' smoking among girls in Moscow. School was an important source of variation in smoking prevalence. Passive smoking, analysed only in Tallinn, led to the higher prevalence of smoking among adolescents. Sociodemographic indicators such as family structure and religion were not associated with smoking among adolescents in Tallinn, Helsinki, and Moscow.

Among indicators of SES, lower education was associated with smoking among men, but there was no clear pattern among women in Estonia. Employment status and income were not associated with smoking among adults. Adult smokers in Estonia were more likely to be younger, divorced, separated, or widowed. No relationship was established between smoking and ethnicity, and type of residence.

Significantly fewer physicians smoked compared with the general adult population, and the highest educational bracket of the total population in Estonia. Compared to the Finnish physicians, more male and female physicians smoked in Estonia. Compared to Estonia, physicians in Finland had more often strict attitudes towards smoking. In both countries non-smoking physicians held more unfavourable attitudes towards smoking than those who were smoking.

One fifth of pregnant women who did not report current smoking had serum cotinine values compatible with the smoking ones in Estonia. Among self-reported non-smokers, non-disclosure of current smoking was significantly more frequent in less educated, economically inactive, non-Estonian, cohabiting and multiparous women.

6.1. Methodological considerations

6.1.1. Data sets and study design

A multidimensional picture of smoking and socioeconomic factors was obtained by using diverse data sets and complementary methodological approaches concerning the socioeconomic factors. The present thesis utilized data from four cross-sectional studies. The different types of data sets and study designs used had various strengths and limitations.

One common limitation of all the data sets was the study design because the nature of prevalence studies does not allow making causal inferences with any

confidence. Thus, the results present a snapshot of smoking and certain aspects of socioeconomic variables at one point in time.

The international study among adolescents was based on randomly selected schools in Tallinn, Helsinki, and Moscow. A clear strength of this study was the similar questionnaire used in all the capitals that provided a good basis for international comparison. The limitation of this study was related to the capital-based study sample. In the capitals the concentration of education, administration and culture is higher than in other regions, even other cities, and smoking prevalence might be higher than in other parts of the country. Thus, the prevalence of smoking in capitals might be overestimated in comparison with the representative sample of particular countries. Also, the data of this study was collected in different years and time periods of the year (in Tallinn in the autumn of 1995, in Helsinki in the autumn of 1994, and in Moscow in the spring of 1995), which may influence the comparability of the results. Furthermore, age of the adolescents in Moscow compared to those in Tallinn and Helsinki was somewhat different, which requires carefulness in making conclusions.

The Estonian Health Interview Survey (1996) was based on population-based sample of adults. A representative sample of Estonia was the main strength of this study. The limitation of the study was related to the dataset of the 1989 census used as the sample frame, which may have contributed to some over- and undercoverage because of the time that had elapsed since the census (Leinsalu *et al.*, 1998). However, as the migrating population since the census formed a small part of the total population (2.2% of the 1989 census population (Statistical Office of Estonia, 2000)), undercoverage can hardly be significant to the reliability of the survey.

The study on smoking patterns of Estonian and Finnish physicians was based on two sets of data, collected one year apart (2002 and 2001, respectively). A similar questionnaire used in Estonia and Finland provided a good basis for the comparative research on smoking among physicians. Although the proportion of males and females was different in the Estonian and Finnish samples, it was proportional to the gender distribution of physicians in both countries. However, the average age of female physicians slightly differed in two samples, being higher among Estonians.

The study on misclassification of self-reported smoking status by SES among pregnant women in Tallinn was carried out in 1996–1997. As with adolescents, this study sample was from the capital, where smoking might be more common and the proportion of non-Estonians could be higher than in Estonia on average. Also, the use of the EMBR as the sample frame could be regarded as a factor contributing to the misclassification rate. The EMBR was the only possibility to obtain recorded data about self-reported smoking for comparison with serum-validated smoking of pregnant women. The quality of the EMBR has been generally good as the proportion of births with missing data on birth outcome indices or maternal characteristics has been small and stable (2.8–3.6%) during the years 1992–1996 in the Registry (Koupilova *et al.*, 2000). On the other hand, since the EMBR does not focus on smoking, it is possible that the box in the birth registration form asking information on smoking status, may have been filled in carelessly, without paying the attention to the smoking habits of women and without direct questioning of them (Karro *et al.*, 1998).

6.1.2. Definitions of smoking and use of socioeconomic factors

The definitions of smoking and use of socioeconomic factors were not constant in the different data sets. Occasional and regular smoking was not defined in the international study on adolescents. In the survey among adults in Estonia, the limitation stemmed from the unusual questions used to establish the smoking status. The use of such well-established questions as those of the WHO MONICA Project (Molarius *et al.*, 2001) could increase the external validity of the results. The definition of smoking according to the WHO guidelines used among physicians in Estonia and Finland was a clear advantage of this study. The EMBR, which was linked to the data about cotinine-validated and self-reported smoking status among pregnant women in Estonia, included only one general question concerning maternal smoking. Therefore, the smoking misclassification rate among pregnant women could have been affected also by the lack of data about the amount of cigarettes smoked a day, nicotine levels of cigarettes, and information about the smoking style (intensity and duration of each smoking exposure).

The measures of SES status used in these studies did not cover all the relevant aspects of a person's location in the socioeconomic system. It was difficult to measure SES among adolescents. In the present study the large number of adolescents (e.g. 33.7% among girls and 32.4% among boys in Helsinki) did not know the education of their supporter, which could influence the results. Also, parental occupational status was not used in the international comparison. Occupational status may have different meanings in Eastern and Western Europe because it requires comparability of the occupational coding systems of the respective countries, labour market conditions, and social welfare programs. Despite the fact that Estonia, Finland, and Russia have close historical ties, they are, however, quite different regarding their cultural, economic, social, and political conditions. Moreover, in a number of papers the conceptualization of SES in health research among adolescents has been discussed and critically examined (Berkman & Macintyre, 1997; Krieger *et al.*, 1997; Macintyre *et al.*, 2003; Turrell *et al.*, 2003). It appeared that additionally such non-occupational measures as housing tenure and motor vehicle access should be used in the future cross-national comparative research because these might reflect the class environment of adolescents much better and consequently exhibit a stronger relationship with smoking (Macintyre & West, 1991; Heslop *et al.*, 2001; Godeau *et al.*, 2004).

The studies among the adult population and pregnant women in Estonia used classical SES indicators such as educational level, employment status, and income.

6.1.3. Methods

All the findings, except the measurement of cotinine in blood serum, were based on self-reported information. Different methods such as completion the questionnaires in classrooms, face- to-face interviews and postal questionnaire survey method were utilized to collect self-reported information. Still, one cannot rule out the bias of self-presentation. The validity of self-reported smoking is often questioned

because of the widespread belief that smokers are inclined to underestimate the amount smoked or they deny smoking at all (Patrick *et al.*, 1994). As more attention is paid to smoking in the media and in public places, workplaces, and clinical practice, individuals become sensitized to socially desirable forms of behaviour and may have tended to underreport smoking (Patrick *et al.*, 1994; Molarius *et al.*, 2001; Pampel, 2003). Particularly physicians, who know more about the devastating effects of smoking, may be prone to self-deception or understatement, and their underreporting may differ from the general population (Hay, 1998). There is a possibility that initial respondents and initial non-respondents were different from persistent non-respondents by their smoking habits (Hay, 1998; Li, *et al.*, 1999). If true, smokers might be over-represented among persistent non-respondents since they might be less likely to fill in a questionnaire about smoking. Thus, any non-response bias would likely make the estimate of smoking prevalence an underestimate.

As non-disclosure of smoking status among pregnant women could be higher because of increased deception rates due to the heightened awareness related to the hazards of smoking during pregnancy (Boyd *et al.*, 1998; Schluter *et al.*, 2002; Lawrence *et al.*, 2003), the cotinine-validation was performed. The validity of using cotinine as a biomarker for smoking could be questioned only because there is no standard method for determining nicotine or its metabolites in biological fluids (Benowitz, 1999). Thus, the serum cotinine threshold of 15 ng/ml for active smoking may be not perfectly sensitive and may affect the estimates of the percentages of false reports of the non-smoking status (Perez-Stable *et al.*, 1992). However, as in the present study nearly half of the biochemically-validated smokers had a cotinine value 100 ng/ml or over, then even by setting different cut-offs, and, thus, different degrees on undetected exposure, one has to consider the misclassification of smoking status among pregnant women in Estonia.

6.2. Description of the key results

6.2.1. Socioeconomic differences in adolescent smoking

The smoking proportions for boys substantially exceeded those for girls in different age groups in Estonian schools in Tallinn but only slightly exceeded those for girls in Moscow and in Russian schools in Tallinn. Notable exceptions included Finnish girls, whose smoking exceeded that of boys. According to the WHO HBSC study, in many Western countries (e.g. Denmark, Norway, Sweden, Wales, Germany) the smoking prevalence for girls was higher than that for boys (Duncan *et al.*, 1993; WHO, 1999a). The reasons for the recent increase in smoking rates for girls in the West have been diverse and probably include such factors as focused advertising and concerns about weight control (Griesler & Kandel, 1998). In Tallinn, as well as in Moscow, the gender differences were similar to those found in the developed European countries in the 1960s: fewer girls than boys were smoking. At the same time, following the break-up of the eastern-block countries, the Western tobacco industry has tried in a more determined fashion to conquer the market, targeting especially young women and girls. Indeed, the smoking rates for girls in Eastern-

European countries are rising and are approaching those among boys (McKee *et al.*, 1998; WHO, 1999a). Compared to the WHO HBSC study in Estonia (1994/1995), the smoking prevalence for girls and boys was higher in the present study (1994–1995) (Kepler *et al.*, 1999; WHO, 2000). This might be related to the fact that the present study sample was only from the capital where smoking may be more widespread than in other parts of the country.

As for ethnic groups in Estonia, dissimilarities in the smoking status between girls in Estonian and Russian schools in Tallinn may reflect the socially and culturally prescribed gender role norms and expectations, as well as different socialization among girls and boys. It also shows that the youth of these two cultures do not attend the same schools (Nurk *et al.*, 1999). At the same time smoking prevalence of girls in Russian schools in Tallinn was similar to the girls in Moscow. Both culturally determined factors in the country of origin, as well as the current social and economic living conditions in the new country, may affect smoking (Lindström & Sundquist, 2002). Some authors have suggested that the degree to which individuals from various ethnic backgrounds identify with or have been assimilated into mainstream society would be related to the adoption of certain behaviours, including smoking (Tyas & Pederson, 1998).

In the present study, education of the head of the household as classical indicator of SES was not associated with smoking among adolescents. One possible explanation to this fact could be that education played lower role in former Soviet societies like Tallinn and Moscow at this time. On the other hand, the great number of respondents in Helsinki (over 30%) did not know the education of their supporter in this study. Also, there seems to be some bias by education in Moscow data although it is noteworthy that having a higher education (30% of the population of 15 years and older and 37% of the employed population) is rather common in Moscow (Hokka *et al.*, 1999). Several studies have suggested that adolescents with less educated parents are more likely to try cigarettes, more likely to adopt cigarette smoking, and less likely to quit smoking (Waldron & Lye, 1990). In addition, the adolescents with less educated parents appear to be more rebellious against adult authority and are more predisposed towards adopting adult behaviour, such as smoking.

The results of the present study showed association between smoking among adolescents and such factors of social environment as smoking of the parents, siblings and peers. According to worldwide literature, there is plenty of evidence that the proximity of other smokers is associated with the tobacco use of adolescents (Sallis & Nader, 1988; Johnson & Gilbert, 1991; McGraw *et al.*, 1991; Flay *et al.*, 1994; de Vries, 1995; Duncan *et al.*, 1995; Wang, *et al.*, 1995; Zhu *et al.*, 1996; Williams & Covington, 1997; Sugathan *et al.*, 1998; Moran *et al.*, 2000).

Adolescents with one or both parents who used tobacco and with siblings that smoked were more likely to smoke, which confirmed the findings of other studies (Rantakallio, 1983; Glendinning *et al.*, 1994; Laugesen & Scragg, 1999; Hesketh *et al.*, 2001; Rosendahl *et al.*, 2003). This fact underlined once again the important role of the family in the development of health behaviour of the child and the family as an important agent of socialization (Lau *et al.*, 1990). Additionally, the findings suggested that girls were more susceptible than boys to such social influences as parental smoking in the family, which is consistent with previous

research (McGraw *et al.*, 1991; Flay *et al.*, 1994). Girls in Moscow seemed to be most sensitive toward the siblings' smoking, which could be explained by cultural differences (e.g. with whom and where it is preferable to smoke). Further, as adolescents spend a lot of time at home, parental smoking is related to their exposure to the ETS and to the future smoking status of adolescents (Chollat-Traquet, 1992). Passive smoking, analysed in this study only in Tallinn, led to the higher prevalence of smoking among adolescents.

Having a friend who smokes was one of the main and strongest factors associated with smoking in every study site. The observation that peer variables appeared important across ages and countries probably indicated something about the way adolescents learn to function in society (Tyas & Pederson, 1998). Also, as adolescents mature, the effect of friends' smoking shows a tendency to increase while the effect of parental smoking remains fairly stable (Distefan *et al.*, 1998). In the present study the influence of smoking friends on the tobacco use was stronger among girls compared to boys. It could be explained by the hypothesis that girls are more peer-oriented than boys, which results in higher levels of exposure to social influences for girls. Furthermore, previous research has found that girls tend to spend more time with friends of the opposite sex and are more involved in social activities such as dancing and youth clubs (Flay *et al.*, 1994). The finding that the effect of friends' smoking among girls differed by countries in this study but was comparable in Russian schools in Tallinn and in Moscow might be related to ethnicity. Nevertheless, despite the consistency of results across studies, some researches have argued that peer influence has been overestimated because much of the research fails to address projection and selection effects. For example, many studies, including this one, rely on the adolescents' perception of peer behaviour rather than the peers' own reports of their behaviour to assess similarity in smoking between friends. If adolescents tend to project their own smoking behaviour onto their friends, the similarity in smoking between adolescents and peers will be inflated if perceived reports are used. Indeed, prior research has shown that adolescents tend to overestimate their friends' actual smoking (Alexander *et al.*, 1999).

The multilevel analysis indicated that the school was an important source of variation in smoking prevalence in Tallinn, Helsinki and Moscow. Therefore, one should pay more attention to the social norms within a school regarding cigarette use and how they interact with peer influence to contribute to adolescent smoking. It seems that the school environment comprises a combination of the social characteristics of adolescents and peer groups, and the structure of relationships between individuals and within groups (Alexander *et al.*, 1999; Smet *et al.*, 1999). On the other hand, the detailed nature of this relationship remains unclear. A fruitful way might be to use a more fixed unit like a school class as a contextual level of measurement in the future analysis.

Other sociodemographic factors as family structure and religion were not associated with smoking among adolescents in this study. The results presented here are inconsistent with previous studies as the evidence leads to the conclusion that intact, two-parent families are protective against smoking (Tyas & Pederson, 1998; Griesbach *et al.*, 2003; Langille *et al.*, 2003). Children in single-parent families may have different home environments, in particular in relation to the

quality of family relationships measured in terms of parental support and control, and family attachment (Murray *et al.*, 1985; Isohanni *et al.*, 1991; Griesbach *et al.*, 2003). The results of this study could be partly explained by the fact that in many countries of Europe, as well as in Estonia, the number of children living in single-parent families or stepfamilies has increased. This reflects an increase in the rates of divorce and remarriage as well as the fact that more children are born into lone-parent families (Karro *et al.*, 1998; Tellmann, 2002; Griesbach *et al.*, 2003). The strong protective effect of adolescent religious involvement and its contribution to lower rates of tobacco use has been more often found in the countries with long and stronger religious traditions (Chollat-Traquet, 1992) compared to the countries in this study.

6.2.2. Socioeconomic differences in adult smoking

The smoking prevalence among adults was higher among men than women in Estonia. These results confirmed the findings of other studies in Eastern Europe, where smoking among the male population has been quite common and usually higher than in Western countries and relatively uncommon among the female population, though on the increase (Puska *et al.*, 1997; Balabanova *et al.*, 1998; McKee *et al.*, 1998; Pudule *et al.*, 1999; Gilmore *et al.*, 2001a, 2001b). In many developed European countries, smoking of young women was not different from that of young men. In some instances (e.g. Sweden, Norway) the prevalence proportion was even higher among women than men (WHO, 2004). Because the pressure of the Western tobacco industry is targeted especially at young women, a similar trend is predicted for East-European countries, including Estonia.

Age was a strong determinant of smoking in both genders in Estonia, and the observed lower likelihood of smoking at older ages was consistent with other studies conducted in the countries of the former Soviet Union (McKee *et al.*, 1998; Pudule *et al.*, 1999; Cockerham, 2000; Gilmore *et al.*, 2001a, 2001b; Pomerlau *et al.*, 2004) and in some affluent countries (Bergen & Caporaso, 1999). It is conceivable that those born in recent years are more likely to begin smoking because of the promotional efforts by transnational tobacco companies in Eastern Europe. On the other hand, it reflects the consequences of high death rates among smokers in the older age group.

Education as indicator of SES was the strongest predictor of smoking among men, but there was no clear pattern among women in Estonia. The same tendency was reported in the previous study in the Baltic countries (Pudule *et al.*, 1999), and it was consistent with the results in Belarus (Gilmore *et al.*, 2001a) but not in Russia and Ukraine (McKee *et al.*, 1998; Laatikainen *et al.*, 1999; Cockerham, 2000; Gilmore *et al.*, 2001b). At the same time, some studies have demonstrated, that smoking has become increasingly common among the less educated men and women in Estonia (Kunst *et al.*, 2002; Leinsalu, 2004). Furthermore, several studies have shown that smoking was clearly more common among the less educated men as well as women in such affluent countries as the United Kingdom, Finland, Sweden, Norway, France, West Germany, the Netherlands (Rahkonen *et al.*, 1995; Laaksonen *et al.*, 1999; Cavelaars *et al.*, 2000), and the United States

(Pierce *et al.*, 1989). In Estonia, the low smoking rate among women compared to men may have something more to do with historically prescribed cultural norms than with education. On the other hand, the different effect of education according to gender may reflect phase of the smoking epidemic. It seems that Estonia is in the beginning of the third stage where smoking prevalence is lower among the higher educational group of men, but not women (Regidor *et al.*, 2001). Also, Estonia underwent earlier industrialization and is therefore farther along the epidemic curve than other former Soviet countries (e.g. Russia, Ukraine, Belarus) (Gilmore *et al.*, 2001b).

Other indicators of SES as income and employment were not associated with smoking among adults in Estonia. It seems, that in a command economy with bureaucratic and party power and personal connections influencing resource allocations in the former Soviet Union, income was less important in obtaining benefits than in western countries (Bobak *et al.*, 2000b; Gilmore *et al.*, 2001b). The primary link between material resources related to the income, occupational status, and health behaviour is that lack of money may limit the possibilities to engage in healthy behaviour (Laaksonen *et al.*, 2003). Smoking among adults in Estonia is one example of the behaviour for which this link does not seem to apply because non-smoking is the cheapest as well as the healthiest choice. Moreover, smoking was more common among men and women suffering material deprivation in Russia and Ukraine (McKee *et al.*, 1998; Gilmore *et al.*, 2001b) as well as many Western countries (Hill *et al.*, 1998; Lindström & Östergren, 2001; Osler *et al.*, 2001). One potential explanation to the smoking among the deprived might be that people smoke to compensate for unfavourable socioeconomic conditions, such as low income (Laaksonen *et al.*, 2003; Barnett *et al.*, 2004). Smoking among poor women in the West has been found to be a positive way of coping with a situation of multiple deprivation and stress, as cigarette smoking provides these women with opportunities for enjoyment and having time for oneself (Macintyre *et al.*, 2003).

In both genders being divorced, widowed, or separated was significantly associated with a higher smoking prevalence in Estonia, which is in agreement with other studies (Thornton *et al.*, 1994; Uitenbroek *et al.*, 1996; Pomerleau *et al.*, 2004). A possible explanation might be the better social support for married subjects, which could prevent them from smoking (Marques-Vidal *et al.*, 2003). Also, marriage provides greater social control and stronger health norms, especially for men (Prättälä *et al.*, 1994).

Other sociodemographic characteristics such as ethnicity and residency were not associated with smoking among adults in Estonia. One reason why smoking was not associated with ethnicity in this study might be the limited age group (30–59-year-olds). For example, according to Leinsalu (Leinsalu *et al.*, 2003, 2004), Russian men in the age group 60–79 had almost twice higher odds for ever having smoked than Estonian men, whereas this difference was smaller and statistically not significant in younger age groups in 1996/1997. In general, the health profile of an ethnic group is probably determined by its cultural traditions, its social and economic standing and power versus other ethnic groups in the same society and by the life history of its individual members, some of whom have migrated between countries and societies (Davey Smith *et al.*, 1998; Leinsalu *et al.*, 2004).

The absence of a link with living in urban areas in Estonia was inconsistent with the current pattern in some East-European and post-Soviet countries, such as Bulgaria, Russia, Latvia and Lithuania (Balabanova *et al.*, 1998; McKee *et al.*, 1998; Pudule *et al.*, 1999). The missing urban-rural gradient in Estonia seems likely to be because the rural areas in Estonia are much less rural than in the bigger countries, where the association has been found. In Estonia, a much lower percentage of the population is employed in agriculture and many of those living in rural areas work in towns and cities. Thus, a higher proportion of the population in Estonia is likely to be exposed to predominantly urban indirect tobacco advertising.

6.2.3. Smoking among physicians as representatives of the higher socioeconomic bracket

Significantly fewer physicians smoked compared to the general adult population and the highest educational bracket of the total population in Estonia. Thus, smoking among Estonian physicians is comparable with the 'mature' smoking epidemic in Western countries, where the prevalence of smoking among physicians is generally lower than in the total population (van Reek & Adriaanse, 1991; Hensrud & Sprafka, 1993; Rogovska, 1996; Kawakami *et al.*, 1997; Samuels, 1997; Didilescu & Munteanu, 2000). Compared to the previous study with the prevalence of smoking 41.5% for male and 15.2% for female Estonian physicians in 1982 (Rahu & Raudsepp, 1986), the findings of the present study seem to indicate that smoking among Estonian physicians is on the decline and may already be shifting towards the pattern of the 'developed world', where the educated upper socioeconomic classes have given up smoking (Davis, 1993). However, the data of the present and previous studies are incomparable because of the time (20 years) that has elapsed, the political changes that have occurred in Estonia, as well as a much lower response rate (80.7% in 1982) and the use of non-identical questionnaire in the present study.

On the other hand, the prevalence of smoking in Estonian physicians is much higher than in Western countries (Hensrud & Sprafka, 1993; Barengo *et al.*, 2004). Compared to the Finnish physicians, there were more daily smokers in Estonia. This could be explained by the fact that Finland has for many years been subject to intensive anti-smoking campaigns by governmental and non-governmental organizations. In Estonia, anti-smoking campaigns are a relatively recent phenomenon and have so far had little governmental support. Thus, there is a long and difficult way to go to decrease the smoking prevalence among Estonian physicians to the Finnish level, where physicians smoke even less than their colleagues in other European countries (Tessier *et al.*, 1993b; Nardini *et al.*, 1998; Willaing *et al.*, 2003). Effective policies to reduce smoking among physicians should be implemented in Estonia to influence the willingness of society to recognize the health consequences of smoking and perhaps to lead to a decline in the smoking epidemic among the total population.

The beliefs of Estonian physicians about the smoking-related aetiology of coronary heart disease, lung cancer, chronic bronchitis, and emphysema, not studied among Finnish physicians, were consistent with medical evidence and

indicated little doubt affected by their own smoking habits. The current smokers were less likely to admit the causative role of the heart diseases and lung cancer than those who did not smoke, which confirms the findings of previous studies (Rankin *et al.*, 1975; Willaing *et al.*, 2003). According to the theory of cognitive dissonance, it is intolerable to have a specific knowledge, for example, of the health consequences of smoking, and not act accordingly. In order to keep the balance one has to change either knowledge or behaviour. This study indicates that professional knowledge is easier to change than one's lifestyle because one's professional knowledge is suppressed as a result of personal lifestyle (Willaing *et al.*, 2003).

Though most physicians in Finland assessed on the 10-point scale that smoking is very harmful to their health, it is regrettable that many Estonian physicians, especially the smoking ones, did not support this opinion. Actually, smokers know they face increased risks, but they judge the size of the risks to be lower and less established than non-smokers, and they also minimize the personal relevance of these risks (Jha & Chaloupka, 1999). Among smoking physicians, the Finns ones significantly more often supported the opinion that smoking is very harmful to their health. This striking difference in opinions between two countries might be partly attributed to the less advanced climate of medical and public opinion about tobacco in Estonia.

The finding that the smoking of female physicians affects beliefs about their responsibility to serve as a positive role model were in line with other studies (Waalkens *et al.*, 1992; Tessier *et al.*, 1993a, 1993b). Smoking physicians obviously find themselves in a difficult position because they should advise patients against smoking but set a bad example at the same time (Dekker *et al.*, 1993). The conflict situation could also be explained by the fact that in the present study more than one third of the smoking physicians in Estonia skipped the question concerning the exemplary role in being a non-smoker. As identifiers of the smoking status of their patients, Estonian physicians demonstrated less active practices than physicians in Finland and in other developed countries (Dekker, *et al.*, 1993; Ohida *et al.*, 2001). Among female physicians, significantly more Estonian non-smokers and Finnish physicians tried to assess the smoking status of their patients compared to Estonian smokers. A comparison of smoking female physicians in both countries revealed that Finnish physicians asked significantly more often their patients about their smoking habits. Nevertheless, physicians should have an ethical obligation to educate their patients about smoking and should not hesitate to routinely advise to quit (Liu & Tang, 1998). Lack of habit as the main reason for not asking about patients' smoking habits in Estonia could be again explained by relatively recent anti-smoking campaigns in this country, which takes time to affect practices and beliefs. At the same time, lack of time was the main reason for not asking about patients' smoking habits in Finland.

Motivating smokers who do not desire to quit and cessation counselling appear to be more complicated and call for special counselling techniques (Kawakami *et al.*, 1997; Eckert & Junker, 2001). The results of the present study confirmed that about four fifths of the physicians in both countries regarded their knowledge as sufficient to advise a patient to stop smoking. In both countries, smoking physicians revealed less responsibility to counsel smoking patients and the need to

receive training in this field. Furthermore, attitudes towards smoking cessation counselling and the necessity to receive training on how to help patients who wish to stop smoking were much more favourable in Finland. It seems that those living in transition societies like Estonia are considered less health-conscious because of the long-time atmosphere of the low priority for health. Moreover, a high proportion of Estonian physicians, who did not believe that they could influence a patient and did not yet appreciate their responsibility to counsel smoking patients to quit may be partly due to the fact that doctors in Estonia concern themselves primarily with treating their patients rather than protecting them from future diseases.

6.2.4. Socioeconomic differences in misclassification of smoking status among pregnant women

About one fifth of pregnant women who did not report current smoking had serum cotinine values compatible with the smoking ones. This finding confirmed the results of other reports indicating that pregnant women have cotinine concentrations inconsistent with their self-report of the smoking status (Walsh *et al.*, 1997; Boyd *et al.*, 1998; Mathews *et al.*, 1999; Markovic *et al.*, 2000; Owen & McNeill, 2001; Lawrence *et al.*, 2003). Misclassification of the smoking status among pregnant women could have resulted from increased deception rates due to the heightened awareness related to the hazards of smoking during pregnancy and due to the wish not to provide a socially undesirable response (Boyd *et al.*, 1998; Schluter *et al.*, 2002; Lawrence *et al.*, 2003). Because smoking presents a danger to the fetus and not only to the women themselves, they might be more reluctant to reveal their true smoking status (Floyd *et al.*, 1993; Ford *et al.*, 1997; Pichini *et al.*, 2000). One could argue that some women who reported non-smoking and had high cotinine values may have been misclassified due to their heavy exposure to the ETS from friends, husband, and other household members (Patrick *et al.*, 1994; Boyd *et al.*, 1998). However, since no information about the exposure to passive smoking was obtained in present study, this inference is incomplete and inconclusive. Further, it can be argued that the category of non-smokers with high cotinine levels may in fact include former smokers who have recently stopped smoking (Christensen *et al.*, 2004). Because of the half-life of serum cotinine, the self-reported non-smoker with a high cotinine level should regard herself as a former smoker if she stopped smoking maximum two or three days earlier (Suadicani *et al.*, 1997).

The women who reported smoking during pregnancy but had cotinine levels below 15 ng/ml in the present study were probably mostly occasional smokers. Klebanoff *et al.* (2001) noted that cotinine becomes a reliable marker for smoking at an intake of three cigarettes a day. In fact, a low cotinine level in smokers may arise for a number of reasons, for example, due to light smoking without inhaling the smoke or metabolic differences (Wagenknecht *et al.*, 1992; Suadicani *et al.*, 1997; Owen & McNeill, 2001). Finally, some pregnant women may falsely claim that they smoke, which seems unlikely.

The results of the present study indicate that socioeconomic and sociodemographic factors of pregnant women contribute to the discrepancy between self-reported and cotinine-validated smoking status. A significantly higher rate of subjects who misclassified themselves as non-smokers was found among less educated, economically inactive, non-Estonian, cohabiting, and multiparous women.

According to English *et al.* (1994), any under-reporting is expected to vary by the educational level. Social desirability of the non-smoking status leads to misclassification especially among pregnant women in the lower social class as less educated women still smoke more and are heavier smokers before becoming pregnant (Floyd *et al.*, 1993; Wakschlag *et al.*, 2003). One contributing factor to smoking among women in lower socioeconomic class is the high prevalence of smoking among other members of their households. In Estonia, the proportion of daily smokers to other individuals smoking in their home is about twice as high among women with a basic education compared to those with a higher education (Kasmel *et al.*, 1997). Also, less educated pregnant women might be less aware of the risks associated with smoking during pregnancy.

The economically inactive group, consisting of unemployed pregnant women and pregnant women at home in this study, could represent mainly the lower socioeconomic class. It is possible that a higher risk of unemployment increases the level of stress and contributes to the increase in the smoking prevalence. Also, unemployment has been higher among non-Estonians (Statistical Office of Estonia, 1997).

Other authors, too, found that ethnic groups vary with regard to the misclassification reflected in self-report (English *et al.*, 1994; Caraballo *et al.*, 1998). The transformation processes in Estonia have been particularly hard on non-Estonians, who found themselves in the position of outsiders for several reasons (Wakschlag *et al.*, 2003). One could speculate that misclassification of the smoking status among non-Estonians is related to the wish not to be 'outsiders' in maternal smoking. Moreover, the social upheaval has increased health-related inequalities between Estonians and non-Estonians, which relates to the behaviour, problem solving abilities, values, and better coping strategies. In addition, differences in the cotinine levels between Estonians and non-Estonians may also be due to ethnic variations in smoking characteristics (different smoking and inhalation intensity, smoking of non-tipped cigarettes) and exposure to the tobacco smoke, not explored in this study. However, non-Estonian women are daily longer exposed to the tobacco smoke at home and outside home compared to the Estonian ones (Kasmel *et al.*, 1997). Finally, non-Estonian women who continue to smoke while pregnant may be the ones who are more addicted to nicotine and who require more intensive intervention efforts to quit smoking.

One could speculate that non-disclosure of current smoking among cohabiting pregnant women in this study is related to the higher prevalence proportion of smoking among cohabiting women compared to the married ones. Further, non-smoking cohabiting women are more often exposed to the ETS compared to the married ones in Estonia (Leinsalu *et al.*, 1999). Moreover, the recent increase in the frequency of unregistered unions is pronounced in Estonia followed by the increase in the proportion of births to unmarried and cohabiting women (Katus *et al.*, 1995; Tellmann, 2002).

The higher misclassification of the smoking status among the multiparae compared to the primiparae could be explained by the fact that the former include more smokers (Karro *et al.*, 1998). It is also conceivable that the multiparae are less worried about the hazards of smoking but still have no willingness to report their smoking status.

7. SUMMARY AND CONCLUSIONS

The present thesis compared the socioeconomic differences in smoking habits in Estonia with those in some neighbouring countries. The objectives were to study smoking and socioeconomic factors among adolescents in Estonia compared to Finland and Russia, to examine socioeconomic differences in smoking among adults in Estonia, to study smoking among physicians as representatives of the higher socioeconomic bracket compared to the general population in Estonia and the physicians in Finland, and to investigate socioeconomic differences in the misclassification of one's smoking status among pregnant women in Estonia.

Four separate studies were used to accomplish these objectives. The first one was designed as a cross-sectional study among the 13–18-year-old adolescents in Tallinn, Helsinki, and Moscow. The second study was based on a subsample of the 30–59-year-old adult population of the Estonian Health Interview Survey. The third study was designed as a cross-sectional postal survey among physicians in Estonia and Finland. The fourth one was based on a subsample of the cross-sectional Human Papillomavirus Type-16 Seroprevalence Study in Tallinn. Serum cotinine assays of the pregnant women, who were determined to deliver, were performed. The serum cotinine-validated smoking level was compared with the subjects' self-reported smoking levels obtained from the records of the Estonian Medical Birth Registry.

The socioeconomic status of adolescents was measured by the level of education of the head of the family, whereas, among adults, the level of education, employment status, and income were used. The socioeconomic status of the individuals was categorized according to basic sociodemographic and socio-environmental indicators. Logistic regression analysis was applied to assess association between smoking and socioeconomic status.

The present study confirms that the socioeconomic differences in smoking represent a complex and multifaceted phenomenon. The comparison of adolescents in Tallinn, Helsinki, and Moscow revealed that the prevalence of smoking was higher among boys compared to girls in Tallinn and Moscow, but was higher among girls compared to boys in Helsinki. The prevalence of smoking among girls in Estonian schools in Tallinn was much lower than among girls in the other study samples, but no such difference existed when comparing boys. A multivariate analysis revealed no relationship between the level of education of the head of the household and smoking among adolescents in Tallinn, Helsinki, and Moscow. However, what school was attended had an effect on the variation in smoking prevalence in every study sample. Adolescent smokers in all three capitals were more likely than their non-smoking peers to have a parent, sibling, or friend that smoked. Smoking among siblings and friends showed interaction between the study site and smoking among girls. The association with friends' smoking was strongest among the girls in Helsinki, but siblings' smoking among the girls in Moscow. Passive smoking, analysed only in Tallinn, was associated with a higher prevalence of smoking among adolescents. Other characteristics, such as family structure and importance of religion, were not associated with smoking among adolescents in Tallinn, Helsinki, and Moscow.

The prevalence of smoking was higher among men than women irrespective of the age group in Estonia. Adult smokers were more likely to be less educated in the case of men, and younger, divorced, separated, or widowed in the case of both men and women. No relationship was established between smoking and employment status, income, ethnicity, and type of residence in Estonia.

Significantly fewer physicians smoked compared to the general adult population, and also compared to the highest educational bracket of the total population in Estonia. However, more male and female physicians smoked in Estonia compared to the physicians in Finland. In both countries smoking was more prevalent in male than in female physicians. Compared to Estonia, physicians in Finland more often agreed that smoking is harmful to their health, that trying to persuade people to stop smoking is their responsibility, and that prevention of smoking should be part of the training programmes of health professionals. In both countries the non-smoking physicians held more unfavourable attitudes towards smoking than those who were smokers themselves.

One fifth of the pregnant women in Estonia who did not admit to current smoking showed serum cotinine values that matched up with those of smokers. Among self-reported non-smokers, non-disclosure of apparent current smoking was more frequent among less educated, economically inactive, non-Estonian, cohabiting and multiparous women.

Based on the results of this thesis, health policies should address specific risk groups and fundamental issues of socioeconomic inequality to reduce smoking rates among the Estonian population.

For future activities, the present study has the following implications:

First,

Estonia should implement comprehensive intervention programmes for young people that are sensitive to culture and gender. The programmes should be directed at family and schools where parents, siblings, and peers act as role models. Health policies should be addressed at school health education.

Second,

Effective interventions and policies that reduce smoking among men and prevent increase among women should be implemented in Estonia. Policies to reduce the socioeconomic gradient in smoking should be socioeconomic group specific focusing on less educated and younger adults.

Third,

Estonia should improve its medical education in terms of motivating of physicians to ask about the smoking habits of their patients and training medical students and resident physicians to counsel their smoking patients to stop smoking. International collaboration is of great importance for this development.

Fourth,

Maternal and child health clinic practitioners should seek to improve the identification of smokers especially among deprived and non-Estonian pregnant women to better identify the target group for the cessation of prenatal smoking. In the future, antenatal clinics could also consider routine biochemical testing to increase smoking-detection rates.

8. REFERENCES

- Alexander C, Piazza M, Mekos D, Valente T. Peers, schools, and adolescent cigarette smoking. *J Adolesc Health* 1999;29:22–30.
- Ausems M, Mesters I, van Breukelen, G, de Vries H. Do Dutch 11–12 years olds who never smoke, smoke experimentally or smoke regularly have different demographic backgrounds and perceptions of smoking? *Eur J Public Health* 2003;13:160–167.
- Aveyard C, Cheng KK, Daniels H, Bobak M. The influence of school culture on smoking among pupils. *Soc Sci Med* 2004;58:1767–1780.
- Backlund E, Sorlie PD, Johnson NJ. A comparison of the relationships of education and income with mortality: the National Longitudinal Mortality Study. *Soc Sci Med* 1999;49:1373–1384.
- Balabanova D, Bobak M, McKee M. Patterns of smoking in Bulgaria. *Tob Control* 1998;7:383–385.
- Barengo NC, Sandström PH, Jormanainen VJ, Myllykangas MT. Changes in smoking prevalence among Finnish physicians 1990–2001. *Eur J Public Health* 2004;14:201–203.
- Barnett R, Moon G, Kearns R. Social inequality and ethnic differences in smoking in New Zealand. *Soc Sci Med* 2004;59:129–143.
- Baron-Epel O, Haviv-Messika A, Tamir D, Nitzan-Kaluski D, Green M. Multiethnic differences in smoking in Israel: pooled analysis from three national surveys. *Eur J Public Health* 2004;14:384–389.
- Bauman KE, Koch GG. Validity of self-reports and descriptive and analytical conclusions: the case of cigarette smoking by adolescents and their mothers. *Am J Epidemiol* 1983;118:90–98.
- Bener A, Gomes J, Anderson JA. Smoking habits among physicians in two Gulf countries. *J R Soc Health* 1993;113:298–301.
- Benowitz NL. Biomarkers of environmental tobacco smoke exposure. *Environ Health Perspect* 1999;107 Suppl:349–355.
- Bergen AW, Caporaso N. Cigarette smoking. *J Nat Cancer Inst* 1999;91:1365–1375.
- Berkman LF, Macintyre S. The measurement of social class in health studies: old measures and new formulations. *Social inequalities and cancer*. Lyon: WHO International Agency for Research and Cancer; 1997. p. 51–64.
- Bobak M, Hertzman C, Škodova Z, Marmot M. Socioeconomic status and cardio-vascular risk factors in the Czech Republic. *Int J Epidemiol* 1999;28:46–52.
- Bobak M, Hertzman C, Škodova Z, Marmot M. Own education, current conditions, parental material circumstances, and risk of myocardial infarction in a former communist country. *J Epidemiol Community Health* 2000a;54:91–96.
- Bobak M, Marmot M. East–West mortality divide and its potential explanations: proposed research agenda. *BMJ* 1996;312:421–425.
- Bobak M, Pikhart H, Rose R, Hertzman C, Marmot M. Socioeconomic factors, material inequalities, and perceived control in self-rated health: cross-sectional data from seven post-communist countries. *Soc Sci Med* 2000b;51:1343–1350.
- Bolinder G, Himmelmann L, Johansson K. Swedish physicians smoke least in all the world. A new study of smoking habits and attitudes to tobacco. [Article in Swedish]. *Läkartidningen* 2002;99:3111–3117.
- Botvin GJ, Baker E, Botvin EM, Dusenbury L, Cardwell J, Diaz T. Factors promoting cigarette smoking among black youth: a causal modelling approach. *Addict Behav* 1993;18:397–405.

- Bouros F, Maltezikis M, Siafakas VM. Pattern of smoking habits of the employees in a university hospital in Greece. *Indoor Environ* 1995;4:121–125.
- Boyd NR, Windsor RA, Perkins LL, Lowe JB. Quality of measurement of smoking status by self-report and saliva cotinine among pregnant women. *Matern Child Health J* 1998;2:77–83.
- Caraballo RS, Giovino GA, Pechacek TF, Mowery PD. Factors associated with discrepancies between self-reports on cigarette smoking and measured serum cotinine levels among persons aged 17 years or older: Third National Health and Nutrition Examination Survey, 1988–1994. *Am J Epidemiol* 2001;153:807–814.
- Caraballo RS, Giovino GA, Pechacek TF, Mowery PD, Richter PA, Strauss WJ, *et al.* Racial and ethnic differences in serum cotinine levels of cigarette smokers: Third National Health and Nutrition Examination Survey, 1988–1991. *JAMA* 1998; 80:135–139.
- Cavalaars AE, Kunst AE, Geurts JJ, Crialesi R, Grotvedt L, Helmert U, *et al.* Educational differences in smoking: international comparison. *BMJ* 2000;320:1102–1107.
- Centers for Disease Control and Prevention. Second national report on human exposure to environmental chemicals. Atlanta: National Center for Environmental Health NCEH Pub No 02-0716; 2003.
- Chaix B, Guilbert P, Chauvin P. A multilevel analysis of tobacco use and tobacco consumption levels in France. *Eur J Public Health* 2004;14:186–190.
- Chapman S. Doctors who smoke. *BMJ* 1995;311:142–143.
- Chaturvedi N. Ethnicity as an epidemiological determinant—crudely racist or crucially important? *Int J Epidemiol* 2001;30:925–927.
- Chollat-Traquet C. Women and tobacco. Geneva: World Health Organization; 1992. p. 3–128.
- Christensen AE, Tobiassen M, Jensen TK, Wielandt H, Bakketeig L, Host A. Repeated validation of parental self-reported smoking during pregnancy and infancy: a prospective cohort study of infants at high risk for allergy development. *Paediatr Perinatal Epidemiol* 2004;18:73–79.
- Cockerham WC. Health lifestyles in Russia. *Soc Sci Med* 2000;51:1313–1324.
- Colby SM, Tiffany ST, Shiffman S, Niaura RS. Are adolescent smokers dependent on nicotine? A review of the evidence. *Drug Alcohol Depend* 2000;59 Suppl:83–95.
- Conrad KM, Flay BR, Hill D. Why children start smoking cigarettes: predictors of onset. *Br J Addict* 1992;87:1711–1724.
- Cornia, GA, Paniccia R. The transition mortality crisis: evidence, interpretation and policy responses. In: Cornia, GA, Paniccia R, eds. *The mortality crisis in transitional economies*. Oxford: Oxford University Press; 2000. p. 3–37.
- Covey LS, Tam D. Depressive mood, the single-parent home, and adolescent cigarette smoking. *Am J Public Health* 1990;80:1330–1333.
- Currie CE, Elton RA, Todd J, Platt S. Indicators of socioeconomic status for adolescents: the WHO health behaviour in school-aged children survey. *Health Educ Res* 1997;12:385–397.
- de Vries H. Socioeconomic differences in smoking: Dutch adolescents' beliefs and behaviour. *Soc Sci Med* 1995;41:419–424.
- Davey Smith G, Hart C, Hole D, MacKinnon P, Gillis C, Watt G, *et al.* Education and occupational social class: which is the more important indicator of mortality risk? *J Epidemiol Community Health* 1998;52:153–160.
- Davis RM. When doctors smoke. *Tob Control* 1993;2:187–188.
- Dekker HM, Looman CW, Adriaanse HP, van der Maas PJ. Prevalence of smoking in physicians and medical students, and the generation effect in The Netherlands. *Soc Sci Med* 1993;36:817–822.

- Didilescu C, Munteanu I. The prevalence of smoking in physicians in Romania. *Pneumologia* 2000;49:91–94.
- Distefan JM, Gilpin EA, Choi WS, Pierce JP. Parental influences predict adolescent smoking in the United States, 1989–1993. *J Adolesc Health* 1998;22:466–474.
- Doll R, Peto R, Wheatley K, Gray R, Sutherland I. Mortality in relation to smoking: 40 years' observations on male British doctors. *BMJ* 1994;309:901–911.
- Droomers M, Schrijvers CT, Mackenbach JP. Educational differences in the intention to stop smoking: explanations based on the theory of planned behaviour. *Eur J Public Health* 2004;14:194–198.
- Duetz MS, Abel T, Niemann S. Health measures. *Eur J Public Health* 2003;13:313–319.
- Duncan C, Jones K, Moon G. Do places matter? A multi-level analysis of regional variations in health-related behaviour in Britain. *Soc Sci Med* 1993;37:725–733.
- Duncan C, Jones K, Moon G. Smoking and deprivation: are there neighbourhood effects? *Soc Sci Med* 1999;48:497–505.
- Duncan TE, Tildesley E, Duncan SC, Hops H. The consistency of family and peer influences on the development of substance use in adolescence. *Addiction* 1995;90:1647–1660.
- Eckert T, Junker C. Motivation for smoking cessation: what role do doctors play? *Swiss Med Wkly* 2001;131:521–526.
- Ecob R, Smith GD. Income and health: what is the nature of the relationship? *Soc Sci Med* 1999;48:693–705.
- Elders MJ, Perry CL, Eriksen MP, Giovino GA. The report of the Surgeon General: preventing tobacco use among young people. *Am J Public Health* 1994;84:543–547.
- English PB, Eskenazi B, Christianson RE. Black-white differences in serum cotinine levels among pregnant women and subsequent effects on infant birthweight. *Am J Public Health* 1994;84:1439–1443.
- Ennett ST, Bauman KE. Peer group structure and adolescent cigarette smoking: a social network analysis. *J Health Soc Behav* 1993;34:226–236.
- Eskenazi B, Trupin LS. Passive and active maternal smoking during pregnancy, as measured by serum cotinine, and postnatal smoke exposure. II. Effects on neurodevelopment at age 5 years. *Am J Epidemiol* 1995;142 Suppl:19–29.
- Faggiano F, Versino E, Lemma P. Decennial trends of social differentials in smoking habits in Italy. *Cancer Causes Control* 2001;12:665–671.
- Federico B, Kunst AE, Vannoni F, Damiani G, Costa G. Trends in educational inequalities in smoking in northern, mid and southern Italy, 1980–2000. *Prev Med* 2004;39:919–926.
- Flay BR, Hu FB, Siddiqui O, Day LE, Hedeker D, Petraitis, J, *et al.* Differential influence of parental smoking and friends' smoking on adolescent initiation and escalation of smoking. *J Health Soc Behav* 1994;35:248–265.
- Floyd RL, Rimer BK, Giovino GA, Mullen PD, Sullivan SE. A review of smoking in pregnancy: effects on pregnancy outcomes and cessation efforts. *Annu Rev Public Health* 1993;14:379–411.
- Ford RP, Tappin DM, Schluter PJ, Wild CJ. Smoking during pregnancy: how reliable are maternal self reports in New Zealand? *J Epidemiol Community Health* 1997;51:246–251.
- Forster JL, Hourigan M, McGovern P. Availability of cigarettes to underage youth in three communities. *Prev Med* 1992;21:320–328.
- Gabhainn SN, François Y. Smoking. In: Currie C, Hurrelmann K, Settertobulte W, Smith R, Todd J. eds. *Health and health behaviour among young people*. WHO Policy Series: Health policy for children and adolescents Issue 1. Copenhagen: WHO Regional Office for Europe; 2000. p. 99–104.

- Gilmore AB, McKee M, Rose R. Prevalence and determinants of smoking in Belarus: a national household survey, 2000. *Eur J Epidemiol* 2001a;17:245–253.
- Gilmore AB, McKee M, Telishevska M, Rose R. Epidemiology of smoking in Ukraine, 2000. *Prev Med* 2001b;33:453–461.
- Gilmore A, Pomerleau J, McKee M, Rose R, Haerpfer CW, Rotman D, *et al.* Prevalence of smoking in 8 countries of the former Soviet Union: results from the living conditions, lifestyles and health study. *Am J Public Health* 2004;94:2177–2187.
- Glendinning A, Love JG, Hendry LB, Shucksmith J. Adolescence and health inequalities: extensions to Macintyre and West. *Soc Sci Med* 1992;35:679–687.
- Glendinning A, Shucksmith J, Hendry L. Social class and adolescent smoking behaviour. *Soc Sci Med* 1994;38:1449–1460.
- Global Tobacco Surveillance System Collaborating Group. Global tobacco surveillance system (GTSS): purpose, production, and potential. *J Sch Health* 2005;75:15–24.
- Godeau E, Rahav G, Hublet A. Tobacco smoking. In: Currie C, Roberts C, Morgan A, Smith R, Settertobulte W, Samdal O, *et al.*, eds. Young people's health in context: international report from the HBSC 2001/02 survey. WHO Policy Series: Health policy for children and adolescents Issue 4. Copenhagen: WHO Regional Office for Europe; 2004. p. 63–72.
- Graham H. Smoking prevalence among women in the European Community 1950–1990. *Soc Sci Med* 1996;43:243–254.
- Graham H, Owen L. Are there socioeconomic differentials in under-reporting of smoking in pregnancy? *Tob Control* 2003;12:434.
- Green G, Macintyre S, West P, Ecob R. Like parent like child? Associations between drinking and smoking behaviour of parents and their children. *Br J Addict* 1991; 86:745–758.
- Gregorio DI, Waksh SJ, Paturzo D. The effects of occupational-based social position on mortality in a large American cohort. *Am J Public Health* 1997;87:1472–1475.
- Griesbach D, Amos A, Currie C. Adolescent smoking and family structure in Europe. *Soc Sci Med* 2003;56:41–52.
- Griesler PC, Kandel DB. Ethnic differences in correlates of adolescent cigarette smoking. *J Adolesc Health* 1998;23:167–180.
- Gritz ER, Prokhorov AV, Hudmon KS, Chamberlain RM, Taylor WC, DiClemente CC, *et al.* Cigarette smoking in a multiethnic population of youth: methods and baseline findings. *Prev Med* 1998;27:365–384.
- Grossman DW, Knox JJ, Nash C, Jimenez JG. Smoking: attitudes of Costa Rican physicians and opportunities for intervention. *Bull World Health Organ* 1999; 77:315–322.
- Hart C, Ecob R, Smith GD. People, places and coronary heart disease risk factors: a multilevel analysis of the Scottish Heart Health Study archive. *Soc Sci Med* 1997;45:893–902.
- Hay DR, Foster FH. The influence of race, religion, occupation and other social factors on cigarette smoking in New Zealand. *Int J Epidemiol* 1981;10:41–43.
- Hay KT. Cigarette smoking by New Zealand doctors and nurses: results from the 1996 population census. *N Z Med J* 1998;27:102–104.
- Headen SW, Bauman KE, Deane GD, Koch GG. Are the correlates of cigarette smoking initiation different for black and white adolescents? *Am J Public Health* 1991;81:854–858.
- Heller WD, Scherer G, Sennewald E, Adlkofer F. Misclassification of smoking in a follow-up population study in southern Germany. *J Clin Epidemiol* 1998;51:211–218.
- Hensrud DD, Sprafka JM. The smoking habits of Minnesota physicians. *Am J Public Health* 1993;83:415–417.

- Hesketh T, Ding QJ, Tomkins A. Smoking among youths in China. *Am J Public Health* 2001;91:1653–1655.
- Heslop P, Smith GD, Macleod J, Hart C. The socioeconomic position of employed women, risk factors and mortality. *Soc Sci Med* 2001;53:477–485.
- Hibell B, Andersson B, Ahlström S, Balakireva O, Bjarnason T, Kokkevi A, *et al.* The 1999 ESPAD Report. The European school survey project on alcohol and other drug use among students in 30 European countries. Stockholm: Swedish National Institute of Public Health; 2000.
- Hill C. Trends in tobacco use in Europe. *J Nat Cancer Inst Monographs* 1992;12:21–24.
- Hill DJ, White VM, Scollo MM. Smoking behaviours of Australian adults in 1995: trends and concerns. *Med J Aust* 1998;168:209–213.
- Hokka P, Palosuo H, Zhuravleva I, Pärna K, Mussalo-Rauhamaa H, Lakomova N. Anxiety about environmental hazards among teenagers in Helsinki, Moscow and Tallinn. *Sci Total Environ* 1999;234:95–107.
- Holm K, Kremers SPJ, de Vries H. Why do Danish adolescents take up smoking? *Eur J Public Health* 2003;13:67–74.
- Hu JF, Liu RZ, Zhang HL, Xu XF, Li K, Yang RZ, *et al.* A survey of cigarette smoking among middle school students in 1988. *Public Health* 1990;104:345–351.
- Hughes A-M, Rissel C. Smoking: rates and attitudes among health services staff in Central Sydney, Australia. *Tob Control* 1998;7:441.
- Isohanni M, Moilanen I, Rantakallio P. Determinants of teenage smoking, with special reference to non-standard family background. *Br J Addict* 1991;86:391–398.
- Jefferis B, Graham H, Manor O, Power C. Cigarette consumption and socioeconomic circumstances in adolescence as predictors of adult smoking. *Addiction* 2003;98: 1765–1772.
- Jha P, Chaloupka FJ. *Curbing the epidemic: governments and the economics of tobacco control.* Washington: World Bank Publication; 1999.
- Johnson EH, Gilbert D. Familial and psychological correlates of smoking in black and white adolescents. *Ethn Dis* 1991;1:320–334.
- Josseran L, King G, Guilbert P, Davis J, Brucker G. Smoking by French general practitioners: behaviour, attitudes and practice. *Eur J Public Health* 2005;15:33–38.
- Kaetsu A, Fukushima T, Moriyama M, Shigematsu T. Smoking behaviour and related lifestyle variables among physicians in Fukuoka, Japan: a cross sectional study. *J Epidemiol* 2002;12:199–207.
- Karro H, Rahu M, Gornoi K, Baburin A. Estonian Medical Birth Registry 1992–1994: Association of risk factors with perinatal mortality. *Eur J Obstet Gynecol* 1998;80: 151–156.
- Karvonen S, Abel T, Calmonte R, Rimpelä A. Patterns of health-related behaviour and their cross-cultural validity – comparative study on two populations of young people. *Soz Präventivmed* 2000;45:35–45.
- Karvonen S, Rimpelä A. Socio-regional context as a determinant of adolescents' health behaviour in Finland. *Soc Sci Med* 1996;43:1467–1474.
- Kasmel A, Lipand A, Kasmel K, Traat U, Markina A, Uutela A, *et al.* Eesti täiskasvanud elanikkonna tervisekäitumise uuring, kevad 1996. Health behaviour among Estonian adult population, spring 1996. Finland: Helsinki, National Public Health Institute; 1997.
- Kasmel A, Lipand A, Markina A. Eesti täiskasvanud elanikkonna tervisekäitumise uuring, kevad 2002. Health behaviour among Estonian adult population, spring 2002. Tallinn: Eesti Tervisekasvatuse Keskus; 2003.
- Katus K, Sakkeus L Foreign-born population in Estonia. RU, Series B, No.19. Tallinn: Estonian Interuniversity Population Research Center; 1993.

- Katus K, Puur A, Sakkeus L. Eesti pere- ja sündimusuuring: standardtabelid. Estonian family and fertility survey: standard tabulations. Tallinn: Estonian Interuniversity Population Research Center; 1995.
- Kaufman FL, Kharrazi M, DeLorenze GN, Eskenazi B, Bernert JT. Estimation of environmental tobacco smoke exposure during pregnancy using a single question on household smokers versus serum cotinine. *J Expo Anal Environ Epidemiol* 2002;12:286–295.
- Kawakami M, Nakamura S, Fumimoto H, Takizawa J, Baba M. Relation between smoking status of physicians and their enthusiasm to offer smoking cessation advice. *Int Med* 1997;36:162–165.
- Kepler K, Maser M, Kasmel A, Tasa E. Eesti kooliõpilaste tervis, tervisekäitumine ja sotsiaalne keskkond muutuvast ühiskonnas aastatel 1991–1998. Estonian school-aged children's health, health behaviour and social environment in a changing society 1991–1998. HBSC study. Tallinn: Eesti Tervisekasvatuse Keskus; 1999.
- Kibur M, Koskela P, Dillner J, Leinikki P, Saikku P, Lehtinen M, *et al.* Seropositivity to multiple sexually transmitted infections is not common. *Sex Transm Dis* 2000;27: 425–430.
- King A, Wold B, Tudor-Smith C, Harel Y. The health of youth: a cross-national survey. WHO Regional Publications, European Series No. 69. Copenhagen: WHO Regional Office for Europe; 1996. p. 15–18.
- Klebanoff MA, Levine RJ, Morris CD, Hauth JC, Sibai BM, Ben Curet L, *et al.* Accuracy of self-reported cigarette smoking among pregnant women in the 1990s. *Paediatr Perinatal Epidemiol* 2001;15:140–143.
- Korhonen HJ. The multiple faces of dependency. In: Waller M, Lipponen S, eds. *Smokefree Europe. A forum for networks.* Jyväskylä: Finnish Centre for Health Promotion; 2001. p. 67–71.
- Koupilova I., Rahu K, Rahu M, Karro H, Leon DA. Social determinants of birthweight and length of gestation in Estonia during the transition to democracy. *Int J Epidemiol* 2000;29:118–124.
- Krieger N, Williams DR, Moss NE. Measuring social class in US public health research: concepts, methodologies, and guidelines. *Annu Rev Public Health* 1997;18:341–378.
- Kristenson M, Eriksen HR, Sluiter JK, Starke D, Ursin H. Psychobiological mechanisms of socioeconomic differences in health. *Soc Sci Med* 2004;58:1511–1522.
- Kunst A., Leinsalu M., Kasmel A., Habicht J. Social inequalities in health in Estonia. Tallinn: Ministry of Social Affairs of Estonia; 2002.
- Kutsar D. Multiple welfare losses and risk of social exclusion in the Baltic States during societal transition In: Aasland A, Knudsen K, Kutsar K, Trapenciere I, eds. *Baltic countries revisited: living conditions and comparative challenges. The NORBALT living conditions project.* Fafo Report 230. Forskningsstiftelsen: Fafo; 1997. pp. 79–102.
- La Vecchia C, Scarpino V, Malvezzi I, Baldi G. A survey of smoking among Italian doctors. *J Epidemiol Community Health*, 2000;54:320.
- Laaksonen M, Prättälä R, Helasoja V, Uutela A, Lahelma E. Income and health behaviour. Evidence from monitoring surveys among Finnish adults. *J Epidemiol Community Health* 2003;57:711–717.
- Laaksonen M, Rahkonen O, Karvonen S, Lahelma E. Socioeconomic status and smoking. *European Journal of Public Health* 2005;15:262–269.
- Laaksonen M, Rahkonen O, Prättälä R. Smoking status and relative weight by educational level in Finland, 1978–1995. *Prev Med* 1998;27:431–437.

- Laaksonen M, Uutela A, Vartiainen E, Jousilahti P, Helakorpi S, Puska P. Development of smoking by birth cohort in the adult population in eastern Finland 1972–97. *Tob Control* 1999;8:161–168.
- Laatikainen T, Vartiainen E, Puska P. Comparing smoking and smoking cessation process in the Republic of Karelia, Russia and North Karelia, Finland. *J Epidemiol Community Health* 1999;53:528–534.
- Lain KY, Powers RW, Krohn MA, Ness RB, Crombleholme WR, Roberts JM. Urinary cotinine concentration confirms the reduced risk of preeclampsia with tobacco exposure. *Am J Obstet Gynecol* 1999;181:1192–1196.
- Lancaster T, Stead L, Silagy C, Sowden A. Effectiveness of interventions to help people stop smoking: findings from the Cochrane Library. *BMJ* 2000;321:355–358.
- Langille DB, Curtis L, Murphy GT. Association of socioeconomic factors with health risk behaviours among high school students in rural Nova Scotia. *Can J Public Health* 2003;94:442–447.
- Last JM, ed. *A dictionary of epidemiology*. Fourth edition. Oxford: Oxford University Press; 2001 p. 184–185.
- Lau RR, Quadrel MJ, Hartman KA. Development and change of young adults' preventive health beliefs and behaviour: influence from parents and peers. *J Health Soc Behav* 1990;31:240–259.
- Laugesen M, Scragg R. Trends in cigarette smoking in fourth-form students in New Zealand, 1992–1997. *N Z Med J* 1999;112:308–311.
- Lauristin M, Heidmets M. Introduction: the Russian minority in Estonia as a theoretical and political issue. In: Lauristin M, Heidmets M, eds. *The challenge of the Russian minority: emerging multicultural democracy in Estonia*. Tartu: Tartu University Press; 2002. p. 19–29.
- Law MR, Cheng R, Hackshaw AK, Allaway S, Hale AK. Cigarette smoking, sex hormones and bone density in women. *Eur J Epidemiol* 1997;13:553–558.
- Lawrence T, Aveyard P, Croghan E. What happens to women's self-reported cigarette consumption and urinary cotinine levels in pregnancy? *Addiction* 2003;98:1315–1320.
- Leinsalu M. Social variation in self-rated health in Estonia: a cross-sectional study. *Soc Sci Med* 2002;55:847–861.
- Leinsalu M. *Troubled transitions. Social variation and long-term trends in health and mortality in Estonia [doctoral dissertation]*. Sweden: Stockholm University / Karolinska Institutet; 2004.
- Leinsalu M, Grintshak M, Noorkõiv R. *Eesti terviseuuring. Tabelid. Estonian Health Interview Survey. Tables*. Tallinn: Eksperimentaalse ja Kliinilise Meditsiini Instituut; 1999.
- Leinsalu M, Grintshak M, Noorkõiv R, Silver B. *Eesti terviseuuring. Metodoloogia-ülevaade. Estonian Health Interview Survey. Methodological report*. Tallinn: Eksperimentaalse ja Kliinilise Meditsiini Instituut; 1998.
- Leinsalu M, Vägerö D, Kunst AE. Estonia 1989–2000: enormous increase in mortality differences by education. *Int J Epidemiol* 2003;32:1081–1087.
- Leinsalu M, Vägerö D, Kunst AE. Increasing ethnic differences in mortality in Estonia after the collapse of the Soviet Union. *J Epidemiol Community Health* 2004;58:583–589.
- Leinsalu M, Aluoja A, Noorkõiv R, Vasar V. *Sotsiaalmajanduslik kuuluvus ja selle toimemehhanismid vaimse ja füüsilise tervise seisundi määramisel. Socioeconomic inequalities in physical and mental health and some possible explanatory mechanisms. Project report*. Tallinn: National Research and Development Program in Public Health; 2003.
- Leinsalu M, Vägerö D, Kunst AE. Estonia 1989–2000: enormous increase in mortality differences by education. *Int J Epidemiol* 2003;32:1081–1087.

- Li HZ, Fish D, Zhou X. Increase in cigarette smoking and decline of anti-smoking counselling among Chinese physicians: 1987–1996. *Health Promot Int* 1999;14: 123–131.
- Lindström M, Sundquist J. Ethnic differences in daily smoking in Malmö, Sweden. Varying influence of psychosocial and economic factors. *Eur J Public Health* 2002;12:287–294.
- Lindström M, Östergren PO. Intermittent and daily smokers: two different socioeconomic patterns, and diverging influence of social participation. *Tob Control* 2001;10:258–266.
- Liu, JLY, Tang J-L. Doctors are ethically obliged to advise patients to quit smoking. *BMJ* 1998;317:1588.
- Lopez AD, Collishaw NE, Piha T. A descriptive model of the cigarette epidemic in developed countries. *Tob Control* 1994;3:242–247.
- Lynch JW, Kaplan GA, Salonen JT. Why do poor people behave poorly? Variation in adult health behaviours and psychosocial characteristics by stages of the socioeconomic life-course. *Soc Sci Med* 1997;44:809–819.
- Macintyre S, Ellaway A, Der G, Ford G, Hunt K. Do housing tenure and car access predict health because they are simply markers of income or self esteem? A Scottish study. *J Epidemiol Community Health* 1998;52:657–664.
- Macintyre S, Ellaway A, Hiscock R, Kearns A, Der G, McKay L. What features of the home and the area might help to explain observed relationships between housing tenure and health? Evidence from the west of Scotland. *Health Place* 2003;9:207–218.
- Macintyre S, West P. Lack of class variation in health in adolescence: an artefact of an occupational measure of social class? *Soc Sci Med* 1991;32:395–402.
- Macintyre S, McKay L, Der G, Hiscock R. Socioeconomic position and health: what you observe depends on how you measure it. *J Public Health Med* 2003;25:288–294.
- Marcus SE, Giovino GA, Pierce JP, Harel Y. Measuring tobacco use among adolescents. *Public Health Rep* 1993;108 Suppl:20–23.
- Mark L, Nagy E, Kondacs A, Deli L. The change of attitude of Hungarian physicians towards the importance of risk factors of coronary heart disease over the period 1985–1996. *Public Health* 1997;112:197–201.
- Markovic N, Ness RB, Cefilli D, Grisso JA, Stahmer S, Shaw LM. Substance use measures among women in early pregnancy. *Am J Obstet Gynecol* 2000;183:627–632.
- Marques-Vidal P, Ruidavets J-B, Cambou J-P, Ferrieres J. Changes and determinants in cigarette smoking prevalence in southwestern France, 1985–1997. *Eur J Public Health* 2003;13:168–170.
- Mathews F, Smith R, Yukdin P, Neil A. Are cotinine assays of value in predicting adverse pregnancy outcome? *Ann Clin Biochem* 1999;36:468–476.
- McEwen A, West R. Smoking cessation activities by general practitioners and practice nurses. *Tob Control* 2001;10:27–32.
- McGraw SA, Smith KW, Schensul JJ, Carrillo JE. Sociocultural factors associated with smoking behaviour by Puerto Rican adolescents in Boston. *Soc Sci Med* 1991;33: 1355–1364.
- McKee M, Bobak M, Rose R, Shkolnikov V, Chenet L, Leon D. Patterns of smoking in Russia. *Tob Control* 1998;7:22–26.
- McIlvain HE, Backer EL, Crabtree BF, Lacy N. Physician attitudes and the use of office-based activities for tobacco control. *Fam Med* 2002;34:114–119.
- McLeroy KR, Bibeau D, Steckler A, Glanz K. An ecological perspective on health promotion programs. *Health Educ Q* 1988;15:351–377.
- Molarius A, Parsons RW, Dobson AJ, Evans A, Fortmann SP, Jamrozik K, *et al.* Trends in cigarette smoking in 36 populations from the early 1980s to the mid-1990s: findings from the WHO MONICA Project. *Am J Public Health* 2001;91:206–212.

- Monden CW, van Lenthe F, de Graaf ND, Kraaykamp G. Partner's and own education: does who you live with matter for self-assessed health, smoking and excessive alcohol consumption? *Soc Sci Med* 2003;57:1901–1912.
- Moran A, Maguire N, Howell F. Smoking and quitting among Irish teenage males. *Ir Med J* 2000;93.
- Murray M, Kiryluk S, Swan AV. Relation between parents' and children's smoking behaviour and attitudes. *J Epidemiol Community Health* 1985;39:169–174.
- Murray M, McReynolds F. Cigarette smoking among 11–12 year olds in the western area of Northern Ireland: family and school factors. *Public Health* 1987;101:465–471.
- Nardini S, Bertoletti R, Rastelli V, Donner CF. The influence of personal tobacco smoking on the clinical practice of Italian chest physicians. *Eur Respir J* 1998;12:1450–1453.
- Nelson DE, Giovino GA, Shopland DR, Mowery PD, Mills SL, Eriksen MP. Trends in cigarette smoking among US adolescents, 1974 through 1991. *Am J Public Health* 1995;85:34–40.
- Nurk E, Mittelmark MB, Suurorg L, Tur I, Luiga E. Trends in tobacco use among Estonian and Russian youth in Tallinn. *Scand J Public Health* 1999;27:301–305.
- Ohida T, Sakurai H, Mochizuki Y, Kamal AMM, Takemura S, Minowa M, Kawahara K. Smoking prevalence and attitudes toward smoking among Japanese physicians. *JAMA* 2001;23:2643–2648.
- Osler M, Holstein B, Avlund K, Damsgaard MT, Rasmussen NK. Socioeconomic position and smoking behaviour in Danish adults. *Scand J Public Health* 2001;29: 32–39.
- Owen L, McNeill A. Saliva cotinine as indicator of cigarette smoking in pregnant women. *Addiction* 2001;96:1001–1006.
- Paavola M, Vartiainen E, Haukkala A. Smoking from adolescence to adulthood: The effects of parental and own socioeconomic status. *Eur J Public Health* 2004;14: 417–421.
- Palosuo H. Health-related lifestyles and alienation in Moscow and Helsinki. *Soc Sci Med* 2000;51:1325–1341.
- Palosuo, H. Health and well-being in Moscow and Helsinki [doctoral dissertation]. Finland: University of Helsinki; 2003.
- Palosuo H, Uutela A, Zhuravleva I, Lakomova N. Social patterning of ill health in Helsinki and Moscow: results from a comparative survey in 1991. *Soc Sci Med* 1998;46:1121–1136.
- Pampel FC. Age and education patterns of smoking among women in high-income nations. *Soc Sci Med* 2003;57:1505–1514.
- Patrick DL, Cheadle A, Thompson DC, Diehr P, Koepsell T, Kinne S. The validity of self-reported smoking: a review and meta-analysis. *Am J Public Health* 1994;84: 1086–1093.
- Pavelson M, Luuk M. Non-Estonians on the labour market: a change in the economic model and differences in social capital. In: Lauristin M, Heidmets M, eds. *The challenge of the Russian minority: emerging multicultural democracy in Estonia*. Tartu: Tartu University Press; 2002. p. 89–116.
- Peacock JL, Cook DG, Carey IM, Jarvis MJ, Bryant AE, Anderson HR, *et al.* Maternal cotinine level during pregnancy and birthweight for gestational age. *Int J Epidemiol* 1998;27:647–656.
- Perez-Stable EJ, Marin G, Marin BV, Benowitz NL. Misclassification of smoking status by self-reported cigarette consumption. *Am Rev Resp Dis* 1992;145:53–57.
- Perez-Stable EJ, Ramirez A, Villareal R, Talavera GA, Trapido E, Sua L, *et al.* Cigarette smoking behaviour among US Latino men and women from different countries of origin. *Am J Public Health* 2001;91:1424–1430.
- Peto R, Lopez AD, Boreham J, Thun M, Heath C, Jr. *Mortality from smoking in developed countries 1950–2000*. New York: Oxford University Press; 1994.

- Pettai V, Hallik K. Understanding processes of ethnic control: segmentation, dependency and co-optation in post-communist Estonia. *Nations Nationalism* 2002; 8:505–529.
- Pichini S, Basagana XB, Pacifici R, Garcia O, Puig C, Vall O, *et al.* Cord serum cotinine as a biomarker of fetal exposure to cigarette smoke at the end of pregnancy. *Environ Health Perspect* 2000;108:1079–1083.
- Pierce JP, Fiore MC, Novotny TE, Hatziaandreu EJ, Davis RM. Trends in cigarette smoking in the United States. Projections to the year 2000. *JAMA* 1989;261:61–65.
- Piko B, Fitzpatrick KM. Does class matter? SES and psychosocial health among Hungarian adolescents. *Soc Sci Med* 2001;53:817–830.
- Piko BF, Fitzpatrick KM. Substance use, religiosity, and other protective factors among Hungarian adolescents. *Addict Behav* 2004;29:1095–1107.
- Platt S, Amos A, Gnich W, Parry O. Smoking policies. In: Mackenbach JP, Bakker MJ, eds. *Reducing inequalities in health: a European perspective*. London: Routledge; 2002.
- Pomerleau J, Gilmore A, McKee M, Rose R, Haerperfer CW. Determinants of smoking in eight countries of the former Soviet Union: results from the Living Conditions, Lifestyles and Health Study. *Addiction* 2004;99:1577–1585.
- Prättälä R, Karisto A, Berg MA. Consistency and variation in unhealthy behaviour among Finnish men, 1982–1990. *Soc Sci Med* 1994;39:115–122.
- Pudule I, Grinberga D, Kadziauskiene K, Abaravicius A, Vaask S, Robertson A, *et al.* Patterns of smoking in the Baltic Republics. *J Epidemiol Community Health* 1999;53:277–282.
- Puska P. Smoking in central & eastern Europe. In: Waller M, Lipponen S, eds. *Smokefree Europe. A forum for networks*. Jyväskylä: Finnish Centre for Health Promotion; 1997. p. 138–145.
- Puska P, Prättälä R, Kasmel A, Klumbiene J. Health behaviour in Estonia, Finland and Lithuania 1994–1998. Standardized comparison. *Eur J Public Health* 2003;13:11–17.
- Rahkonen O, Berg M-A, Puska P. The development of smoking in Finland from 1978 to 1990. *Br J Addict* 1992;87:103–110.
- Rahkonen O, Berg M-A, Puska P. Relationship between educational status, gender and smoking in Finland, 1978–1992. *Health Promot Int* 1995;10:115–120.
- Rahkonen O, Laaksonen M, Karvonen S. The contribution of lone parenthood and economic difficulties to smoking. *Soc Sci Med* 2005;61:211–216.
- Rahu M, Raudsepp J. Teine Eesti NSV arstkonna suitsetamislevimuse ankeetküsitlus 1982. aastal. *Nõukogude Eesti Tervishoid* 1986;65:258–261.
- Rankin DW, Gray NJ, Hill DJ, Evans DR. Attitudes and smoking habits of Australian doctors. *Med J Aust* 1975;2:822–824.
- Rantakallio P. Family background to and personal characteristics underlying teenage smoking. Background to teenage smoking. *Scand J Soc Med* 1983;11:17–22.
- Rasmussen M, Damsgaard MT, Due P, Holstein BE. Boys and girls smoking within the Danish elementary school classes: a group-level analysis. *Scand J Public Health* 2002;30:62–69.
- Rebagliato M. Validation of self reported smoking. *J Epidemiol Community Health* 2002;56:163–164.
- Regidor E, Gutierrez-Fisac JL, Calle ME, Navarro P, Dominguez V. Trends in cigarette smoking in Spain by social class. *Prev Med* 2001;33:241–248.
- Reimers TM, Pomrehn PR, Becker SL, Lauer RM. Risk factors for adolescent cigarette smoking. The Muscatine study. *Am J Dis Child* 1990;144:1265–1272.
- Rice N, Leyland A. Multilevel models: applications to health data. *J Health Serv Res Policy* 1996;1:154–164.

- Rogovska I. Smoking behaviour of medical personnel and students and health consequences of smoking in Latvia [doctoral dissertation]. Finland: University of Tampere; 1996.
- Rosendahl KI, Galanti MR, Gilljam H, Ahlbom A. Smoking mothers and snuffing fathers: behavioural influences on youth tobacco use in Swedish cohort. *Tob Control* 2003;12:74–78.
- Sallis JF, Nader PR. Family determinants of health behaviours. In: Gochman DS, ed. *Health behaviour: Emerging research perspectives*. New York: Plenum; 1988. p. 107–124.
- Samuels N. Smoking among hospital doctors in Israel and their attitudes regarding anti-smoking legislation. *Public Health* 1997;111:285–288.
- Santi S, Best JA, Brown KS, Cargo M. Social environment and smoking initiation. *Int J Addiction* 1990;25:881–903.
- Sasco AJ, Merrill RM, Benhaim-Luzon V, Gerard JP, Freyer G. Trends in tobacco smoking among adolescents in Lyon, France. *Eur J Cancer* 2003;39:496–504.
- Scarinci IC, Robinson LA, Alfano CM, Zbikowski SM, Klesges RC. The relationship between socioeconomic status, ethnicity, and cigarette smoking in urban adolescents. *Prev Med* 2002;34:171–178.
- Schluter PJ, Ford RP, Ford CJ. A biochemical prevalence study of smoking in pregnancy for a cross-section of women in Christchurch, New Zealand. *Aust N Z J Public Health* 2002;26:231–235.
- Scott HD, Tierney JT, Buechner JS, Waters WJ, Jr. Smoking rates among Rhode Island physicians: achieving a smoke-free society. *Am J Prev Med* 1992;8:86–90.
- Shafey O, Dolwick S, Guindon GE, eds. *Tobacco Control Country Profiles*. Second edition 2003. Atlanta: American Cancer Society; 2003.
- Shamsuddin K, Haris MA. Family influence on current smoking habits among secondary school children in Kota Bharu, Kelantan. *Singapore Med J* 2000;41:167–171.
- Shapo L, Gilmore ABC, Coker R, McKee M, Shapo E. Prevalence and determinants of smoking in Tirana city, Albania: a population-based survey. *Public Health* 2003; 117:228–236.
- Shohaimi S, Welch A, Bingham S, Luben R, Day N, Wareham N, *et al.* Residential area deprivation predicts fruit and vegetable consumption independently of individual educational level and occupational social class: a cross sectional population study in the Norfolk cohort of the European Prospective Investigation into Cancer (EPIC-Norfolk). *J Epidemiol Community Health* 2004;58:686–691.
- Skinner WF, Massey JL, Krohn MD, Lauer RM. Social influences and constraints on the initiation and cessation of adolescent tobacco use. *J Behav Med* 1985;8:353–376.
- Slattery ML, Hunt SC, French TK, Ford MH, Williams RR. Validity of cigarette smoking habits in three epidemiologic studies in Utah. *Prev Med* 1989;18:11–19.
- Smet B, Maes L, De Clercq L, Haryanti K, Winarno RD. Determinants of smoking behaviour among adolescents in Semarang, Indonesia. *Tob Control* 1999;8:186–191.
- Spear SF, Akers RL. Social learning variables and the risk of habitual smoking among adolescents: the Muscatine study. *Am J Prev Med* 1988;4:336–342.
- Stahl T, Rutten A, Nutbeam D, Bauman A, Kannas L, Abel T, *et al.* 2001. The importance of the social environment for physically active lifestyle – results from an international study. *Soc Sci Med* 2001;52:1–10.
- Statistical Office of Estonia. *Statistical yearbook of Estonia 1997*. Tallinn: Statistical Office of Estonia; 1997.
- Statistical Office of Estonia. *Statistical yearbook of Estonia 2001*. Tallinn: Statistical Office of Estonia; 2001a.

- Statistical Office of Estonia. Population and housing census 2000. II. Citizenship, nationality, mother tongue and command of foreign languages. Tallinn: Statistical Office of Estonia; 2001b.
- Stronks K, van de Mheen HD, Looman CWN, Mackenbach JP. Cultural, material, and psychosocial correlates of the socioeconomic gradient in smoking behaviour among adults. *Prev Med* 1997;26:754–766.
- Suadicani P, Hein HO, Gyntelberg F. Mortality and morbidity of potentially misclassified smokers. *Int J Epidemiol* 1997;26:321–327.
- Sugathan TN, Moody PM, Bustan MA, Elgerges NS. Age patterns of smoking initiation among Kuwait university male students. *Soc Sci Med* 1998;47:1855–1858.
- Tellmann A. Abordistatistika Eestis 1996–1999. *Eesti Arst* 2002;81:4–8.
- Tessier J-F, Freour P, Nejari C, Belougne D, Crofton JW. Smoking behaviour and attitudes towards smoking of medical students in Australia, Japan, USA, Russia, and Estonia. *Tob Control* 1993a;2:24–29.
- Tessier J-F, Rene L, Nejari C, Belougne D, Moulin J, Freour P. Attitudes and opinions of French general practitioners towards tobacco. *Tob Control* 1993b;2:226–230.
- Thornton A, Lee P, Fry J. Differences between smokers, ex-smokers, passive smokers and non-smokers. *J Clin Epidemiol* 1994;47:1143–1162.
- Tomori M, Zalar B, Plesnicar BK, Zihel S, Stergar E. Smoking in relation to psychosocial risk factors in adolescents. *Eur Child Adolesc Psychiatry* 2001;10:143–150.
- Townsend J, Roderick P, Cooper J. Cigarette smoking by socioeconomic group, sex, and age: effects of price, income, and health publicity. *BMJ* 1994;309:923–927.
- Tseng M, Yeatts K, Millikan R, Newman B. Area-level characteristics and smoking in women. *Am J Public Health* 2001;91:1847–1850.
- Tuakli N, Smith MA, Heaton C. Smoking in adolescence: methods for health education and smoking cessation. A MIRNET study. *J Fam Pract* 1990;31:369–374.
- Tubakaseadus. Riigi Teataja 2000; nr. 59: art. 379 (July 17, 2000). In English available: <http://www.globalink.org/tobacco/docs/eu-docs/legislation/200101estonia.shtml> (last accessed April 25, 2005).
- Tubakaseadus. Riigi Teataja 2005; nr. 29: art. 210 (May 26, 2005). In Estonian available: <https://www.riigiteataja.ee/ert/act.jsp?id=903024> (last accessed October 12, 2005).
- Tuinstra J, Groothoff JW, van den Heuvel WJ, Post D. Socioeconomic differences in health risk behaviour in adolescence: do they exist? *Soc Sci Med* 1998;47:67–74.
- Turrell G, Hewitt B, Patterson C, Oldenburg B. Measuring socioeconomic position in dietary research: is choice of socioeconomic indicator important? *Public Health Nutr* 2003;6:191–200.
- Tyas SL, Pederson LL. Psychosocial factors related to adolescent smoking: a critical review of the literature. *Tob Control* 1998;7:409–420.
- Uitenbroek DG, Kerekovska A, Festchieva N. Health lifestyle behaviour and socio-demographic characteristics. A study of Varna, Glasgow and Edinburgh. *Soc Sci Med* 1996;43:367–377.
- Umberson D. Gender, marital status and the social control of health behaviour. *Soc Sci Med* 1992;34:907–917.
- Urberg KA, Degirmencioglu SM, Pilgrim C. Close friend and group influence on adolescent cigarette smoking and alcohol use. *Dev Psychol* 1997;33:834–844.
- Urberg KA, Shyu SJ, Liang J. Peer influence in adolescent cigarette smoking. *Addict Behav* 1990;15:247–255.
- Vakefliu Y, Argjiri D, Peposhi I, Agron S, Melani AS. Tobacco smoking habits, beliefs, and attitudes among medical students in Tirana, Albania. *Prev Med* 2002;34:370–373.

- van den Bree MB, Whitmer MD, Pickworth WB. Predictors of smoking development in a population-based sample of adolescents: a prospective study. *J Adolesc Health* 2004;35:172–181.
- van Lenthe FJ, Schrijvers CTM, Droomers M, Joung IMA, Louwman MJ, Mackenbach, JP. Investigating explanations of socioeconomic inequalities in health. The Dutch GLOBE study. *Eur J Public Health* 2004;14:63–70.
- van Roosmalen EH, McDaniel SA. Peer group influence as a factor in smoking behaviour of adolescents. *Adolescence* 1989;24:801–816.
- van Reek J, Adriaanse H. Smoking by physicians in Scandinavia: 1952–1989. *Scand J Soc Med* 1991;19:256–259.
- Vartiainen E, Seppälä T, Lillsunde P, Puska P. Validation of self reported smoking by serum cotinine measurement in a community-based study. *J Epidemiol Community Health* 2002;56:167–170.
- Vereecken C, Vandegehuchte A. Measurement of parental occupation: Agreement between parents and their children. *Arch Public Health* 2003;61:141–149.
- Volozh O, Solodkaya E, Abina J, Kaup R, Goldsteine G, Olfieriev A, Deev A. Some biological cardiovascular risk factors and diet in samples of the male population of Tallinn Estonia in 1984/1985 and 1992/1993. *Eur J Public Health* 2002;12:16–21.
- Von Korff M, Koepsell T, Curry S, Diehr P. Multi-level analysis in epidemiologic research on health behaviours and outcomes. *Am J Epidemiol* 1992;135:1077–1082.
- Väärt E, Vahtra M, Rahu M, Raudsepp J. Eesti arstkonna suitsetamishölmavuse ankeetküsitlus. *Nõukogude Eesti Tervishoid* 1979;58:279–281.
- Waalkens HJ, Cohen SJ, Adriaanse H, Knol K. Smoking habits in medical students and physicians in Groningen, The Netherlands. *Eur Respir J* 1992;5: 49–52.
- Wagenknecht LE, Burke GL, Perkins LL, Haley NJ, Friedman GD. Misclassification of smoking status in the CARDIA study: a comparison of self-report with serum cotinine levels. *Am J Public Health* 1992;82:33–36.
- Wakschlag LS, Pickett KE, Middlecamp MK, Walton LL, Tenzer P, Leventhal BL. Pregnant smokers who quit, pregnant smokers who don't: does history of problem behaviour make a difference? *Soc Sci Med* 2003;56:2449–2460.
- Waldron I, Lye D. Family roles and smoking. *Am J Prev Med* 1989;5:136–141.
- Waldron I, Lye D. Relationships of teenage smoking to educational aspirations and parents' education. *J Subst Abuse* 1990;2:201–215.
- Walsh RA, Redman S, Brinsmead MW, Byrne JM, Melmeth, A. A smoking cessation program at a public antenatal clinic. *Am J Public Health* 1997;87:1201–1204.
- Wang MQ, Fitzhugh EC, Westerfield RC, Eddy JM. Family and peer influences on smoking behaviour among American adolescents: an age trend. *J Adolesc Health* 1995;16:200–203.
- Waterhouse J, Muir C, Correa P, Powell J, eds. *Cancer Incidence in Five Continents*. IARC Scientific Publications no. 15, vol. 3. Lyon: IARC; 1976.
- Watson P. Explaining rising mortality among men in eastern Europe. *Soc Sci Med* 1995;41:923–934.
- Wells AJ, English PB, Posner SF, Wagenknecht LE, Perez-Stable EJ. Misclassification rates for current smokers misclassified as nonsmokers. *Am J Public Health* 1998;88:1503–1509.
- WHO. Gender and health in adolescence. WHO Policy Series: Health policy for children and adolescents, Issue 2. Copenhagen: World Health Organization; 1999a.
- WHO. Health 21. The health for all policy framework for the WHO European Region. European Health for All Series No. 6. Copenhagen: World Health Organization; 1999b.
- WHO Health for All database. Copenhagen: World Health Organization; 2004. Electronic Citation (last accessed October 20, 2005).

- Wiecha JM. Differences in patterns of tobacco use in Vietnamese, African-American, Hispanic, and Caucasian adolescents in Worcester, Massachusetts. *Am J Prev Med* 1996;12:29–37.
- Willaing I, Jorgensen T, Iversen L. How does individual smoking behaviour among hospital staff influence their knowledge of the health consequences of smoking? *Scand J Public Health* 2003;31:149–155.
- Williams JG, Covington CJ. Predictors of cigarette smoking among adolescents. *Psychol Rep* 1997;80:481–482.
- Wills TA, Cleary SD. The validity of self-reports of smoking: Analyses by race/ethnicity in a school sample of urban adolescents. *Am J Public Health* 1997;87: 56–61.
- Winkleby MA, Jatulis DE, Frank E, Fortmann SP. Socioeconomic status and health: how education, income, and occupation contribute to risk factors for cardiovascular disease. *Am J Public Health* 1992;82:816–820.
- Zhu BP, Liu M, Shelton D, Liu S, Giovino GA. Cigarette smoking and its risk factors among elementary school students in Beijing. *Am J Public Health* 1996;86:368–375.

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