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Socioeconomic Differences in
Tobacco Use among
Ghanaian and Finnish Adolescents

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To Mum and Dad Mr and Mrs Daniel and Felicia Doku and
all parents in sub-Saharan African countries who have defied
all odds to provide higher education for their children

Contents

List of Original Publications.....	11
List of Abbreviations.....	12
Abstract	13
1 Introduction	16
2 Background	19
2.1 History of tobacco use	19
2.2 Forms of tobacco use	20
2.2.1 Smoking tobacco.....	20
2.2.2 Smokeless tobacco.....	21
2.3 Why people use tobacco.....	22
2.4 Measurement of tobacco use	24
2.5 Global public health burden of tobacco use	24
2.6 Global tobacco control efforts	26
2.7 Tobacco use in developing countries, with emphasis on sub-Saharan Africa	27
2.8 Tobacco cultivation, manufacturing, use and control in Ghana	28
2.8.1 History of tobacco cultivation and manufacturing in Ghana.....	28
2.8.2 Tobacco prevalence in Ghana	29
2.8.3 Tobacco control policies and measures in Ghana.....	30
3 Literature Review.....	31
3.1 The smoking epidemic	31
3.2 Adolescent tobacco use.....	32
3.2.1 Theoretical models explaining adolescent tobacco use.....	32
3.2.1.1 Social cognitive theory	32
3.2.1.2 The problem behaviour theory	33
3.2.2 Tobacco use among adolescents in sub-Saharan Africa	34

3.2.3	Tobacco use among Finnish adolescents	35
3.2.4	Tobacco use among Ghanaian adolescents	35
3.2.5	Environmental factors and adolescent tobacco use	36
3.2.6	Individual factors and adolescent tobacco use	39
3.2.7	Adolescent specific tobacco control efforts.....	42
3.3	Measurement of socioeconomic status	42
3.3.1	The concept of socioeconomic status – historical background	42
3.3.2	The measurement of socioeconomic status in health inequality research.....	44
3.3.3	The measurement of adolescents’ socioeconomic status in health inequality research.....	46
3.4	Socioeconomic differences in tobacco use among adolescents	47
3.4.1	Familial SES factors in relation to tobacco use.....	47
3.4.1	Individual social measures in relation to tobacco use	49
3.5	Summary of the factors associated with adolescent tobacco use	50
4	Aims of the Study	52
5	Study Subjects and Methods	53
5.1	The study setting.....	53
5.1.1	Ghana	53
5.1.2	Finland	54
5.2	Study population and data collection.....	55
5.2.1	Ghana Adolescent Health and Lifestyle Survey (Studies I–III)	55
5.2.2	Adolescent Health and Lifestyle Survey AHLS (Study IV).....	57
5.3	Measurements (Ghana data, studies I–III).....	59
5.3.1	Measurement of adolescent tobacco use	59
5.3.2	Measurement of socioeconomic factors	59
5.3.2.1	Familial SES	59
5.3.2.2	The adolescent’s individual social position	60
5.3.2.3	Predicted inter-generational social mobility.....	60
5.3.3	Measures of tobacco promoting and restraining factors	61
5.3.4	Other measurements	62
5.4	Measurements (Finnish data, Study IV)	63
5.4.1	Measurement of adolescent tobacco use	63
5.4.2	Measurement of socioeconomic factors	63
5.4.2.1	Familial SES	63
5.4.2.2	The adolescent’s individual social position	63

5.5	Statistical methods.....	64
5.5.1	Principal component analysis (Study I).....	64
5.5.2	Logistic regression analysis (Studies I–IV)	65
5.5.3	Validity, reliability and representativeness of the data sets	65
6	Summary of the Results	67
6.1	Prevalence of tobacco use among Ghanaian and Finnish adolescents.....	67
6.2	Exposure to tobacco promoting and restraining factors in Ghana (Study I)	68
6.2.1	Exposure to tobacco promoting and restraining factors	68
6.2.2	Tobacco promoting and restraining factors explaining tobacco use	69
6.3	The development of material affluence scale (MAS) (Study II)	70
6.4	Socioeconomic differences in tobacco use among Ghanaian and Finnish adolescents (Studies III and IV).....	71
6.4.1	Ghanaian and Finnish adolescents' tobacco use by familial socioeconomic status	72
6.4.2	Tobacco use among Ghanaian and Finnish adolescents by individual social position.....	72
6.4.3	Tobacco use by Ghanaian adolescents' predicted inter-generational social mobility	73
6.4.4	Socioeconomic changes over time in tobacco use among Finnish adolescents.....	73
7	Discussion.....	76
7.1	Discussion of the main findings	76
7.1.1	Tobacco use behaviours among Ghanaian and Finnish adolescents	76
7.1.2	Tobacco promoting and restraining factors and tobacco use	77
7.1.3	MAS as a measure of adolescents' SES in health inequality research	79
7.1.3.1	Response rate for material affluence indicators compared to traditional indicators.....	79
7.1.3.2	Reliability and external validity of the material affluence scale	79
7.1.4	Socioeconomic differences in tobacco use among Ghanaian and Finnish adolescents.....	80
7.1.4.1	Tobacco use by familial SES.....	80
7.1.4.2	Tobacco use by adolescents' individual social position.....	81
7.1.5	The concept of smoking epidemic and SES differences in adolescent tobacco use	83

7.2	Methodological considerations	84
7.2.1	Reliability and validity of the adolescents' responses to health inequality surveys	84
7.2.2	Study strengths and limitations	85
8	Conclusions	88
8.1	The main conclusions	88
8.2	Policy implications and future research	89
9	Acknowledgements	91
10	References	94
11	Appendix I Questions used from the Ghanaian survey (studies I–III)	115
12	Appendix II Question used from the Adolescent Health and Lifestyle Survey, AHLS (study IV)	119
	Tiivistelmä	121
	Original Publications	123

List of Figures

FIGURE 1. Prevalence of male and female smoking by geographic region 2002.....	20
FIGURE 2. Factors that influence adolescents' decision to initiate, quit or continue tobacco use.	23
FIGURE 3 Cigarette smoking prevalence in some sub-Saharan African countries by gender.....	28
FIGURE 4. The globe showing the location of Ghana within West Africa.....	53
FIGURE 5. A map showing the location of Finland within Northern Europe	54
FIGURE 6. A flow chart of data sampling procedure for the school data collection in Ghana	56
FIGURE 7. The prevalence of daily smoking among 12–18-year-old Finnish adolescents from 1977 to 2009 by age and gender reported in the Adolescent Health and Lifestyle Survey	68
FIGURE 8. Categorisation of adolescents by material affluence groups.	71
FIGURE 9. Prevalence of smoking from 1977–83 to 2001–07 for personal social position factors that showed interaction with study period	75

List of Tables

TABLE 1. Projected global tobacco-induced deaths, by cause, 2015 baseline scenario	25
TABLE 2. Summary of the associations of social, environmental and individual factors associated with adolescent tobacco use	51
TABLE 3. Key indicators of Finland and Ghana.....	55
TABLE 4. Frequency and percentage distribution of the Ghanaian respondents by school and region.....	56
TABLE 5. Number of respondents and response rates in the Adolescent Health and Lifestyle Surveys in 1977–2007, by gender and age	58
TABLE 6. Prevalence (%) of smoking and tawa use among Ghanaian adolescents by demographic characteristics	67

TABLE 7. Odds ratios (OR) and 95% confidence intervals (CI) for tawa use and smoking by environmental and familial, and individual tobacco promoting/restraining factors among Ghanaian adolescents. Multivariate analysis.	69
TABLE 8. Statistical significance of the effects of material affluence scale (MAS) and parental socioeconomic status on health/health behaviour measures in logistic regression models.....	71
TABLE 9. Prevalence of smoking among Finnish adolescents from 1977–83 to 2001–07 for parental socioeconomic status indicators that showed interaction with study period.....	74

List of Original Publications

The list of the original studies summarised in this dissertation are presented below. They are referred to in this summary as Study I, II, III and IV, respectively as presented here.

- I Doku D, Koivusilta L, Rainio S, Rimpelä A. Tobacco use and exposure to tobacco promoting and restraining factors among adolescents in a developing country (submitted).
- II Doku D, Koivusilta L, Rimpelä A. Indicators for measuring material affluence of adolescents in health inequality research in developing countries. *Child Ind Res* 2010; 3: 243–260. DOI: 10.1007/s12187-009-9045-7.
- III Doku D, Koivusilta L, Rainio S, Rimpelä A. Do socioeconomic differences in tobacco use exist also in developing countries? A study of Ghanaian adolescents. *BMC Public Health* 2010; 758.
- IV Doku D, Koivusilta L, Rainio S, Rimpelä A. Socioeconomic differences in smoking among Finnish adolescents from 1977–2007. *J Adolesc Health* 2010; 47: 479–487.

List of Abbreviations

AHLS	Adolescent Health and Lifestyle Survey
AIDS	Acquired Immune Deficiency Syndrome
ASH	Action on Smoking and Health
BAT	British American Tobacco
CDC	Centers for Disease Control and Prevention
CI	Confidence Intervals
FCTC	Framework Convention on Tobacco Control
GCTC	Gold Coast Tobacco Company
GSHS	Global School Health Survey
GYTS	Global Youth Tobacco Survey
HIV	Human Immunodeficiency Virus
ITG	International Tobacco Ghana
MAS	Material Affluence Scale
MTC	Meridian Tobacco Company Ltd
OR	Odds Ratio
PBT	Problem Behaviour Theory
PCA	Principal Component Analysis
PTC	Pioneer Tobacco Company Ltd
SCT	Social Cognitive Theory
SES	Socioeconomic Status
SLT	Smokeless Tobacco
WHO	World Health Organization

Abstract

Socioeconomic Differences in Tobacco Use among Ghanaian and Finnish Adolescents

Tobacco use has fallen in most Western countries over the past decades. As a result the tobacco industry is shifting its attention to the developing world. Of particular target are adolescents in these regions. With the already huge public health burden caused by HIV/AIDS, malaria, malnutrition, tuberculosis and the so-called re-emerging tropical diseases in developing countries, particularly in sub-Saharan Africa, the public health burden would be severe and the health inequality would widen up if tobacco attributable morbidity and mortality add up to the existing burden.

Ghana has a long history of tobacco cultivation and previous tobacco manufacturing. Adolescents in Ghana therefore stand at high risk of the emerging tobacco epidemic. However, like in most countries in the sub-Saharan Africa, information on tobacco use in general and the socioeconomic patterning of the menace is scanty.

In Western countries on the other hand, despite the reduction in smoking on population levels, socioeconomic differences still exist in smoking among the adult population in many countries. Among adolescents, however, less is known about these disparities as well as the changes over the years. Finland is a model country in terms of tobacco control. It has a comprehensive tobacco control policy including mass media campaigns, measures providing support for smoking cessation among young people and health education in school curriculum. Consequently, much success has been achieved in reducing smoking particularly among male adults, but not in the socioeconomic differences. Regarding adolescents, the extent to which these control measures have reduced inequalities in smoking over the years has not been explored.

The aim of this dissertation was to investigate socioeconomic differences in smoking and tawa (traditional smokeless tobacco) use among Ghanaian adolescents and to make a comparison with their Finnish counterparts. In pursuit of this aim, four sub-studies were conducted using data from the Adolescent Health and Lifestyle Survey, a nation wide representative sample of 12–18-year-old Finns conducted from

1977 to 2007 (N = 96,747, response rate 59%–88%) and a survey of a representative sample of Ghanaian adolescents (N=1566, response rate 90%) conducted in three regions in 2008. Multivariate logistic regression analysis and principal component analysis were the main statistical techniques used.

In Study I, smoking and tawa use and tobacco promoting and restraining factors among Ghanaian adolescents were investigated. Environmental and familial, as well as individual tobacco promoting and restraining factors and their association with smoking and tawa use among Ghanaian adolescents were explored. First, Study I revealed that tobacco use was lower among Ghanaian adolescents compared to Finnish adolescents. Contrary to the popular acclamation that tawa use is reserved to the elderly, this study provides pacesetter evidence that tawa use is also prevalent among the youth. Secondly, exposure to tobacco advertising was high among Ghanaian adolescents. Also, similar to earlier studies in Western countries, the following increase the probability of tobacco use: misconception that smoking is not difficult to quit, not having been taught the harmful effects of smoking, perception that tobacco products should be sold to minors, attending a school where smoking is allowed on campus, parental smoking and male gender. Despite the high exposure to tobacco advertisement and the lack of knowledge of any national tobacco policy, there seems to be some societal norms or cultural values in Ghana that restrict smoking in schools as well as the accessibility of tobacco products to minors.

In Study II, indicators for measuring material affluence status of adolescents in health inequality research in developing countries was explored. Material affluence scale (MAS) was constructed from a summation of underlying structure of numerous material affluence indicators extracted from a principal component analysis. MAS yielded higher response rates compared with the traditional indicators of familial SES (parental occupation and education). It also showed sufficient correlation with the traditional indicators and predicted key health and health behaviour indicators in a similar pattern. In all, Study II revealed that MAS is a reliable alternative for measuring adolescents' socioeconomic status (SES) not only in developing countries where information on the traditional indicators (parental education, occupation and income) may be unavailable or difficult to obtain but can also be useful in Western countries, with some modifications.

The aim of Study III was to investigate whether socioeconomic differences can also be found among adolescents in a developing country as in Western countries, while Study IV was aimed at investigating the changes in SES differences in smoking among Finnish adolescents over a 30 year period (1977–2007). Multiple indicators were used to assess adolescents' SES in both studies. In Study III the SES measures were: familial SES (parental occupation and education, material affluence scale and family structure), an adolescent's individual social position (school performance, plans after graduation) and predicted inter-generational social

mobility (measured by the differences of familial and individual positions) while in Study IV the adolescents' SES was measured by familial SES (parental education and father's occupation) and individual social position (school performance and school career). Studies III and IV revealed that SES differences exist in tobacco use among both Ghanaian and Finnish adolescents whether SES was measured by a familial indicator or an adolescent's individual social position, albeit, the latter was a stronger predictor of tobacco use compared to familial SES. Furthermore, in Ghanaian adolescents, cumulative socioeconomic disadvantage over generations (remaining in lower SES group of origin) increased the probability of adolescent tobacco use. However, tobacco use in Ghana, and probably in sub-Saharan Africa or non-Western countries in general, do not seem to follow the pattern of the smoking epidemic observed in Western countries. In Finland, socioeconomic differences in smoking have persisted over the three decades and even slightly widened despite the well known Finnish comprehensive tobacco control policy measures. On the whole, Studies III and IV conclude that multiple indicators which assess both adolescents' familial SES and individual social position, particularly the latter, should be used in health inequality research among adolescents.

In all, based on the evidence discussed, this dissertation concludes that, surveillance of tobacco use and exposure to tobacco promotion among adolescents are essential for monitoring smoking trends and evaluating tobacco control efforts, particularly in Ghana. In Ghana, tawa use should be part of any tobacco use surveillance among the youth. The benefit of continuous monitoring of the SES trends in smoking among Finnish adolescents is also emphasised. Among both Ghanaian and Finnish adolescents, health promoting strategies aimed at reducing inequalities in tobacco use or health should be (re)designed to meet the needs of adolescents in lower SES groups, especially those who are likely to discontinue their education after the compulsory phase.

1 Introduction

Smoking is the most preventable cause of death and major morbidities worldwide (Ezzati et al. 2005). Over 800 million of the world's 1.2 billion tobacco users live in developing countries. It is estimated that 70% of the over 10 million tobacco-related mortality in 2030 will occur in developing countries (Ezzati and Lopez 2003; Guindon and Bosclair 2003). Tobacco use has fallen in most high income countries over the past decades. On the contrary, tobacco use has risen and continues to rise in middle and low income countries with consequent public health impact (Pampel 2005; WHO 2008).

Despite the rising tobacco use in low and middle income countries, opportunities still exist for the control of the epidemic in these regions, especially in sub-Saharan Africa, the only region where the epidemic still seems to be at its initial stages in some countries. Comprehensive tobacco surveillance among the youth is one important starting point.

Tobacco use predominantly begins in teenage. There is evidence that if smoking behaviour is not initiated during adolescent age, then it is likely it will never begin (US Department for Health and Human Services 1994). Besides, the age at initiation increases the chances of becoming a heavy smoker (Escobedo et al. 1993) and the probability of cessation among adolescents is inversely related to the age at initiation (Combs et al. 1992; Breslau and Peterson 1996). Out of those who begin tobacco use in their teens, 50% would continue into adulthood and die of tobacco-related diseases (Mackay and Erickson 2002). Globally, it is projected that 250 million children alive today will die from tobacco-related illnesses (Peto and Lopez 2001). Data from the US indicates that about 80% of tobacco users began in their adolescence and an estimated 6.4 million of current child smokers will eventually die of tobacco-related diseases (Centers for Disease Control and Prevention 2005). Unhealthy lifestyles, such as tobacco use, established in adolescence may have both short and long term effects on health and increase the public health burden (Vuille and Schenkel 2001; McLellan et al. 2003). Tobacco prevention among adolescents is therefore an important step in controlling the epidemic globally.

Ghana has a long history of tobacco growing and previous manufacturing (Owusu-Dabo et al. 2009a). The British Tobacco Company (BAT) enjoyed monopoly in the manufacturing of tobacco products as well as the sponsoring of its cultivation

in Ghana before relocating its manufacturing plant to Nigeria, in 2006. Ghanaian adolescents therefore stand at a high risk of tobacco use. However, evidence from the scanty studies available so far seems to suggest that tobacco use is relatively low in Ghana compared to other tobacco growing nations and most countries in the region (Townsend et al. 2006; Owusu-Dabo et al. 2009a). Ghana is therefore one of the countries where the prevention of the epidemic remains possible.

Socioeconomic inequality and its impact on health is a growing global public health concern (Final Report of the Commission on Social Determinants of Health World Health Organization 2008). Smoking is not only an adolescent problem but also the single biggest cause of inequality in morbidity and mortality between rich and poor people in many countries (Jarvis and Wardle 2006). Studies, mainly from Western countries, have consistently shown differences in smoking by socioeconomic status (SES) among adults to the detriment of those in the lower socioeconomic groups (Cavelaars et al. 2000; Bang and Kim 2001; Barbeau et al. 2004a; 2004b). Adolescent studies in Western countries have also shown the same pattern, but in some instances the association was found only for some ages, genders or SES indicators (Koivusilta et al. 2003; Paavola et al. 2004; Hanson and Chen 2007a; Richter and Leppin 2007). In developing countries among adolescents, the relationship between socioeconomic factors and smoking is largely unexplored.

In Finland, like in most Nordic welfare countries, equitable distribution of health and social services is an important policy priority (Lehto et al. 1999; Ploug 1999). Furthermore, regarding tobacco control, Finland is not only one of the countries with the strictest legislations in the world but also has several decades of experience of comprehensive tobacco control measures (Pannenen et al. 2006). Many successes have been achieved in reducing the prevalence of smoking at the Finnish population level particularly among male adults. However, smoking remains relatively common among women, and the poorest and less educated adult population (Helakorpi et al. 2007; Palosuo et al. 2008). It is possible that tobacco control efforts have reduced smoking more among adolescents in higher socioeconomic groups than among those in lower socioeconomic groups, resulting in widening of the gap over time.

Education, income and occupation have been extensively used in epidemiological research as a measure of SES (Galobardes et al. 2006a; 2006b). It is argued that these three indicators encompass extensive range of life circumstances which are likely to affect people's health directly or indirectly through for example lifestyle and behaviours (Marmot 2005; Galobardes et al. 2006a; 2006b). However, in countries where official statistics may not be available obtaining information on these indicators may pose a great challenge or be even impossible (Durkin et al. 1994). Furthermore, in adolescent health inequality research where they are themselves the respondents, providing information on parental indicators as a proxy measure of their SES is challenging (Currie et al. 1997; Molcho et al. 2007; Currie et al. 2008).

Adolescence is a period of transition from familial SES (original/assigned) to individual SES (achieved). Assessments of an adolescent's SES should therefore take into account this transitional nature of adolescence and should be conceptualized in two dimensions: familial SES, reflecting the social class of origin, and the adolescent's individual social position in relation to his/her peers (Koivusilta et al. 2003; Paavola et al. 2004; Molcho et al. 2007; Richter and Leppin 2007; Currie et al. 2008). The individual social position measured by school career or school performance predicts education in adulthood (Koivusilta et al. 1998). Besides SES, inter-generational social mobility, i.e. the transition between familial (original) SES in childhood and individual (achieved) social position in adulthood, has been shown to relate to health behaviours including smoking (Karvonen et al. 1999; Hart et al. 2008). There is evidence that among young people, smoking is more related to downwardly mobile than among those upwardly mobile (Karvonen et al. 1999), and risk factors are less common among upward mobility than those stable or downwardly mobile (Hart et al. 2008). Young people who transferred from one SES group to another tend to behave according to the achieved SES groups (Karvonen et al. 1999). In this dissertation inter-generation social mobility is used as a proxy measure of the transition of an adolescent from his or her familial socioeconomic status (origin) to his or her individual social position (achieved). With respect to the concept of inter-generational social mobility individuals who remain in lower socioeconomic group of origin over generation can be described as having cumulative social disadvantage.

2 Background

2.1 History of tobacco use

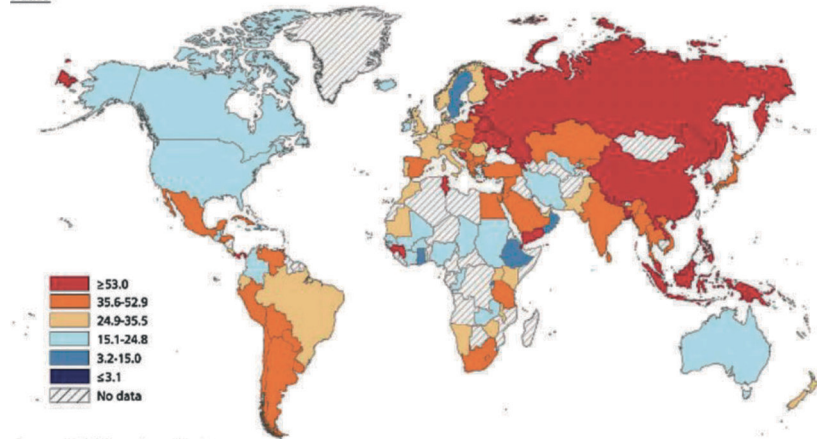
Tobacco use started about 500 years ago among indigenous American for ceremonial and medicinal purposes. In the year 1492 following European exploration to the Americas, Christopher Columbus introduced the product to Europe. Thereafter, the product spread to the rest of the world (Brandt 2007). Tobacco contains nicotine, a substance which leads to strong psychological chemical dependence (addiction). Tobacco use is one of the major risk factors for many health problems including cancer, emphysema and many other cardiovascular diseases (US Department of Health and Human Services 2004).

With the invention and construction of the first cigarette manufacturing machine in 1870, cigarette smoking grew. Nonetheless in the 1900s, tobacco use was mainly limited to chewing, snuffing and pipe smoking among men (Goodman 1995). Tobacco consumption began to rise in Western countries from 1910 due to industrialisation of the tobacco as well as marketing and advertising of its products. Smoking prevalence among men in the United States reached 50% by the year 1960 (Mackay et al. 2006). Similarly, by 1948, 82% of British men were smoking cigarettes (Royal College of Physicians, London 2002). In Finland, smoking prevalence among the adult population in the 1950s was 70% (Martelin 1984).

From the 1960s onwards, smoking prevalence has been declining in most Western countries over the decades. Similar to the start of the epidemic of smoking (the smoking epidemic is described in section 3.1), the decline started first among adult men. By 2008 the prevalence of smoking in the US declined to about 20% (Centers for Disease Control and Prevention 2008) and in the same year in Britain smoking prevalence fell to about 22% (ASH 2008). Likewise, in many Northern, Southern and Western European countries the prevalence of smoking, particularly among men has decreased and continues to decrease during the last decades (Peto and Lopez 2004). As tobacco use declines in many developed countries, the epidemic of smoking is shifting to developing countries. There is currently a rise in the prevalence of tobacco use in many developing countries owing to the aggressive marketing and promotion of the product in these parts of the world since the 1970s

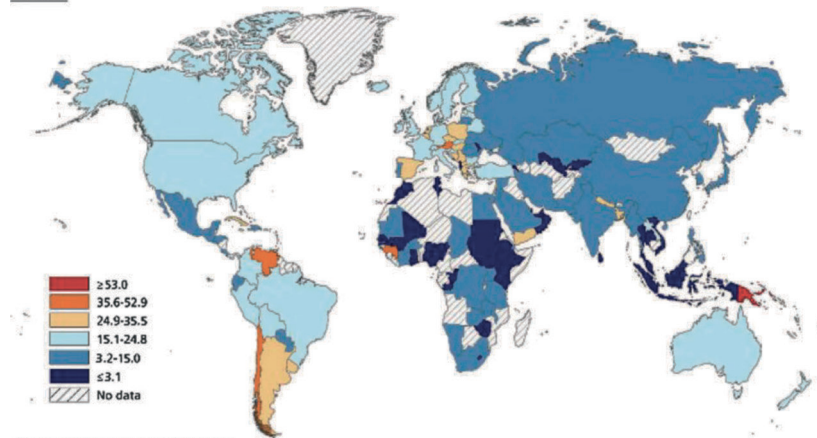
(Figure 1), without much restriction till beginning of the millennium. (Wipfi and Samet 2009).

Male



Source: WHO Tobacco Control Databases.

Female



Source: WHO Tobacco Control Databases.

FIGURE 1. Prevalence of male and female smoking by geographic region 2002

2.2 Forms of tobacco use

2.2.1 Smoking tobacco

Tobacco smoking is the burning of tobacco and inhaling the smoke. Tobacco smoking is the most common form of tobacco use globally. In most Western societies, manufactured and hand-rolled cigarettes constitutes the largest proportion

of smoking form of tobacco use, followed by pipes and cigars. In other parts of the world however, there are other kinds of smoking tobacco. In Sudan for example shisha smoking is popular among the youth (El Ami et al. 2010). Some common forms of smoking tobacco are described below.

Cigarette is a roll of pieces of tobacco wrapped inside a paper tube of about 8mm in diameter and 70–120mm long which is fitted with a filter at one end.

Cigar is a roll of pieces of tobacco in a leaf of tobacco. Cigar can be little cigar, small, regular or premium. Regular cigars are about 17mm in diameter and 150mm long, premium cigars are about 12 to 23mm in diameter and about 125mm long, while little and small cigars are smaller and shorter, measuring about the same length and size as cigarette (Stratton et al. 2001).

Apart from cigarettes and cigars, other commonly used smoking tobaccos are: *Bidis*, *Chutta* and *Kretek* mostly used in India, Southeast Asia and the US (Yadav and Thaku 2000; Fisher 2000; Van der Ed et al. 1993; Stratton et al. 2001). Other kinds of smoking tobacco include *chillum*, *dhumti*, *hooka* and *hooklis* which are commonly used in northern India.

2.2.2 Smokeless tobacco

Smokeless tobacco (SLT) refers to tobacco that is consumed orally or nasally without burning. Many types of smokeless tobacco are consumed globally. A review of the health effects of SLT shows that they all contain varying levels of nicotine and carcinogenic tobacco-specific nitrosamines. All forms of SLT were found to cause localised oral lesions and increase the risk for development of oral cancer. Furthermore, it has been shown that SLT increased the risk of fatal myocardial infarction among users, but the evidence for oral cancer in users of Swedish moist snuff was less unambiguous (SCENIHR 2008).

In India, some smokeless tobacco come in the form of leaf mixed with ingredient such as areca nut and lime (Critchley and Capewell 2003). In Europe, the most common SLT is the Swedish snuff, *snus*. It is a fine ground moist tobacco which is chewed. In the United States, both the native chewing tobacco in the form of chopped tobacco leaves and the Swedish snus are widely used. Other forms of smokeless tobacco use include the Sudanese *toombak* which is a fermented powdered tobacco mixed with aqueous solution of sodium bicarbonate (El Ami et al. 2010), and the Ghanaian *tawa* which is either in the form of fine-grain tobacco powder that often comes in teabag-like pouches that users “pinch” or “dip” between their lower lip and gum, allow it to sit there and spit out the juice and or sniff into their nostrils. The other is *chewing-tobacco* in the form of shredded or twisted tobacco leaves that users put between their cheek and gum, chew it and spit out the juice. Tens of other forms of SLT exist on all the continents (see SCENIHR 2008), several still are unknown to

the scientific community and more are being discovered every now and then (Gupta 1999). The use of SLT is high and has increased in recent years, particularly among adolescents (Vander Weg et al. 2008; Rudatsikira et al. 2010).

2.3 Why people use tobacco

Several factors influence people's decision to lit up, sniff or chew the first cigarette or tobacco product as well as the decision to quit or continue use. Most people initiate tobacco use in their teenage. Neither the addictive nature nor the health consequences of the product is considered during its initiation (US Department of Health Services 1994; Warner 2002). Soon after initiation, nicotine in the tobacco affects the brain and makes withdrawal unpleasant. The addictiveness of nicotine helps experimenters to sustain their tobacco use behaviour and before long become daily smokers (Jarvis 2004).

Cigarette absorbed from the lung produces a high concentration of arterial bolus of nicotine that reaches the brain speedily. Consequently, a stick of cigarette results in a high nicotine concentration in the blood but after an hour or two, the blood nicotine concentration falls sharply thus compelling the smoker to smoke another stick in order to maintain the blood nicotine concentration level – a process that leads to addiction (Warner 2002; Jarvis 2004). Because nicotine is a stimulant it tends to improve performance in new users but with time this effect disappears, and instead nicotine withdrawal symptoms set in few hours without smoking, leading to unpleasant modes (particularly among daily smokers). The mode is then alleviated only by smoking further. This process of unpleasant mode and restoration after smoking a stick of cigarette could explain the misconception that smoking calms stress.

Societal norms also motivate not only the initiation of tobacco use but also enforcement of the behaviour (Goodman 1993; Jarvis 2004). In societies where people are more tolerant to tobacco use or where some form of positive values are attached to the behaviour, e.g. perceiving smoking as an expression of adulthood or as the reserved of the elite and the affluence in society, people are more likely to initiate or sustain their tobacco use behaviour compared to a society where there is less tolerance to tobacco use or where such conceptions do not exist (Warner 2002; Jarvis 2004; Ng et al. 2007).

Furthermore, peer influence and role modelling by smoking parents and celebrities lures people into smoking or other forms of tobacco use (Warner 2002; Kobus 2003; Gilma et al. 2009). A comprehensive review of the role of parental smoking on their children's smoking is presented in a later section.

Tobacco advertisement and other marketing strategies of the tobacco industry such as, attractive branding of the products, leads to both tobacco initiation and

sustained use among adolescents (Sargent et al. 2000; Lovato et al. 2003; Slater et al. 2007; Borland 2008). Previous study has shown that there is correlation between children's interest in tobacco advertisement and their subsequent smoking behaviour (Warner 2002). Furthermore, cigarette advertisement tends to increase consumption substantially (Sargent et al. 2000; Lovato et al. 2003; Borland 2008). Tobacco advertisement presents the behaviour as admirable or a social norm. In poor countries where advertisement is mostly unrestricted, the media gives the impression that smoking belongs to smart folks and celebrities (White 1997; Doku 2010).

In brief, initiation of tobacco use is a personal decision that is strongly influenced by societal factors while continuous use or decision to quit is enforced by both social influences and the addictiveness of nicotine in tobacco. Figure 2 shows the complexity

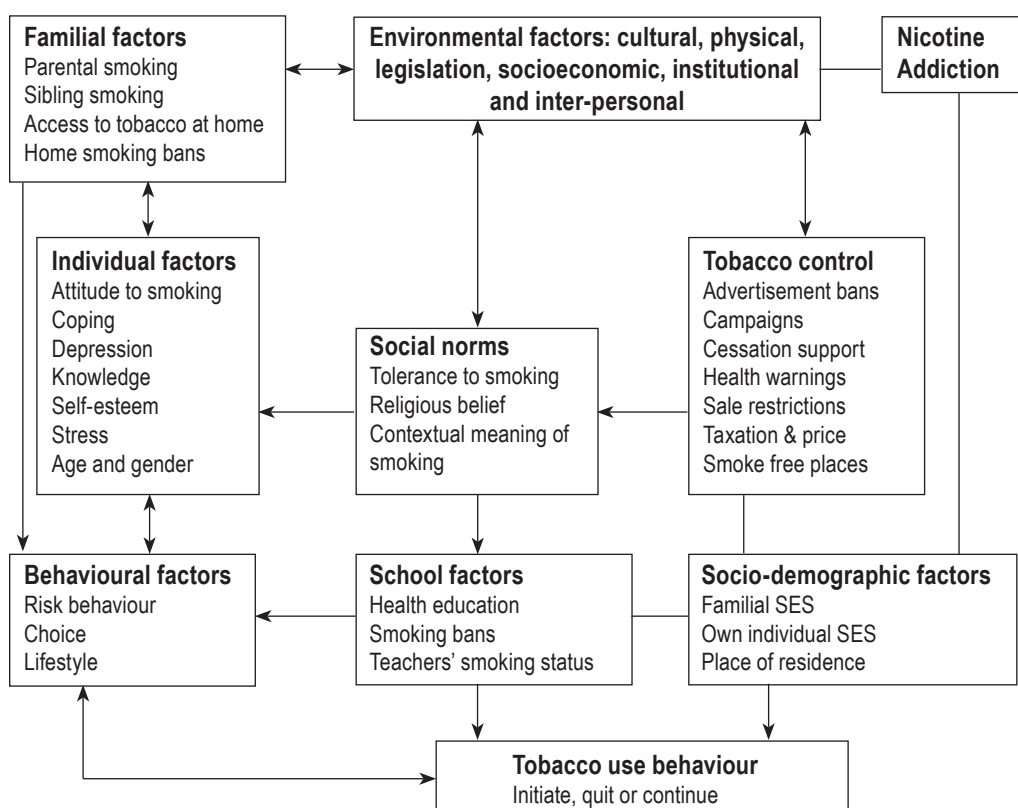


FIGURE 2. Factors that influence adolescents' decision to initiate, quit or continue tobacco use. Modified from Borland 2008.

of the interrelationships between the various factors that affect adolescent tobacco use behaviours.

2.4 Measurement of tobacco use

Self-reported data are the most widely used method for assessing tobacco use, although biochemical measures are also increasingly being used (Adelman et al. 2001; Russel et al. 2004; Al-Delaimy and Willett 2008). However, none of these methods have clearly emerged as a gold standard for the assessment of tobacco use. Self-reported tobacco use data is data derived from respondents either orally or in a written form regarding their tobacco use. Collecting self-reported data is a relatively faster way of assessing health behaviours. It is also inexpensive compared to other methods e.g. biomarkers. Self-reported data is not only the most widely used method of researching health behaviours including tobacco use in large samples but also the only way by which large studies can be done. Consequently, self-reported data has been extensively used in large surveys assessing adolescent tobacco use (e.g. Global Youth Tobacco Collaborating Group 2003; Hublet et al. 2006; Rimpelä et al. 2007).

Despite the overriding advantage of self-reported method, it has some demerits. Self-reports can lead to recall bias and intentional distortion of information by respondents concerning, for instance, their tobacco use behaviours (Solberg 1997). Nonetheless, studies of adolescents' self-reported smoking (Parker et al. 2002; Dolcini et al. 2003; Kentala et al. 2004; Post et al. 2005) and smokeless tobacco use (Post et al. 2005) behaviours have been found to be accurate and in agreement with biochemical measures. Patrick et al. (1994) conducted a review and meta-analysis of the validity of self-reported smoking and concluded that they are accurate in most studies.

Similarly, a study that compared toenail nicotine biomarkers with self-reports of tobacco smoke exposure found a good correlation ($r=0.63$), concluding that different methods may be measuring different aspects of the same exposure (Al-Delaimy and Willett 2008).

2.5 Global public health burden of tobacco use

For many decades tobacco use has 'reigned' as the most preventable cause of death and major morbidities worldwide (Ezzati et al. 2005). Globally, it is estimated that about 650 million people living today will be killed by smoking related mortality. Lung cancer, cardiovascular and respiratory diseases are the largest contributors to smoking-related mortality (Table 1). Tobacco kills one out of very two persistent users and mostly in their middle age. Over 800 million of the world's 1.2 billion

tobacco users live in developing countries (Peto et al. 1992). Still worldwide, over 30 million people start smoking each day. It is estimated that 70% of the over 10 million tobacco related mortality cases in 2030 will occur in developing countries (Guindon and Bosclair 2003). Projections indicate that if the current trend continues, total tobacco-related deaths will rise from 5.4 million in 2005 to 6.4 million in 2015 and 8.3 million in 2030. By the year 2020, tobacco related diseases would claim more lives than any single disease, including HIV/AIDS, violence, road accidents, malnutrition, and war (Murray and Lopez 1996; Mathers and Loncar 2006). The distribution of this burden, however, differs across regions. Tobacco kills over 1 million persons annually in East Asia and the Pacific; 897,000 in Europe and Central Asia; 250,000 in Latin America; 121,000 in the Middle East and North Africa; 879,000 in South Asia; and 135,000 in Sub-Saharan Africa (Mathers and Loncar 2006). Thus, whereas tobacco-related diseases are projected to decline by 9% between 2002 and 2030 in high income countries, the projection shows that it would be doubled from 3.4 million to 6.8 million in low and middle income countries during the same period (Mathers and Loncar 2006). Because of the time-lag of about two to three decades or more from the onset of tobacco use to its related mortality, even these alarming projections are most likely to be underestimations of the actual burden. Tobacco use seems to cause the highest number of deaths in the history of mankind than any addictive substance ever known (Table 1, Mathers and Loncar 2006).

TABLE 1. Projected global tobacco-induced deaths, by cause, 2015 baseline scenario

Cause	Tobacco-caused Deaths	
	Number (millions)	Percent of Total
All causes	6,43	100
Tuberculosis	0,09	1
Lower respiratory infections	0,15	2
Malignant neoplasms	2,12	33
Trachea, bronchus, lung cancers	1,18	18
Mouth and oropharynx cancers	0,18	3
Oesophagus cancer	0,17	3
Stomach cancer	0,12	2
Liver cancer	0,10	2
Other malignant neoplasms	0,34	5
Diabetes mellitus	0,13	2
Cardiovascular diseases	1,86	29
Ischaemic heart disease	0,93	14
Cerebrovascular disease	0,52	8
Other cardiovascular diseases	0,24	4
Respiratory diseases	1,87	29
COPD	1,76	27
Digestive diseases	0,20	3

Source: Mathers and Loncar 2006

2.6 Global tobacco control efforts

Tobacco control refers to any comprehensive strategy such as surveillance, tobacco industry monitoring, legislation or advocacy that is aimed at reducing tobacco cultivation, use and/or protection of people from tobacco smoke. Tobacco control efforts can be global, regional, national, and local or can be targeted at specific 'at risk' groups such as adolescents. This section reviews global tobacco control strategies.

Globalisation has not only increased the mobility of people, goods and services but also the commercialisation of tobacco trade as well as globalisation of the tobacco industry's influences (Yach and Bettcher 2000). However, since tobacco has been firmly established as harmful to human health (Surgeon General Reports 1964), tobacco control efforts have mostly been national issues and mostly carried out in Western countries. In recent years, there have been some global efforts at controlling the threat posed by tobacco but these efforts have not been at par with the magnitude of the threat proposed by globalisation to global public health.

The most marked comprehensive global tobacco control effort only came into force at the beginning of the 21st century when the World Health Organisation (WHO) member states endorsed the Framework Convention on Tobacco Control (FCTC), (WHO 2005). The FCTC is the world's first public health treaty (international law). It was designed to reduce the global rise and spread of the tobacco epidemic. Although the FCTC was conceived in the mid 1990s it actually came into being on the 27th February 2005 after it was ratified by 40 countries including Finland, France, Japan, Ghana and India. By July 2009, about 166 countries, representing 86.38% of the world's population have ratified the FCTC including 39 out of the 46 countries in the WHO Afro region.

Among other things the FCTC mandates the ratifying countries to: implement tax policies, e.g. prohibit of sales and/or importation of tax- and duty-free tobacco products (article 6); provide for protection from exposure to tobacco smoke in indoor workplaces, public transport, indoor public places, and as appropriate, other public places (article 8); ensure that warning signs cover up to 50% but not less than 30% of the tobacco package (article 11); undertake a comprehensive ban of all tobacco advertising, promotion and sponsorship (article 13); and ban accessibility of tobacco products to minors, e.g. access to tobacco vending machines (article 16).

Even though most countries have in principle endorsed the FCTC, many and especially those in the poor regions of the world, lack the political will to translate the tenets of the framework into legislation or policy. For example, Ghana played an active role in the drafting and was as well one of the first 40 countries to ratify the FCTC (WHO 2005) but as of the year 2010 there was no evidence of any national

legislations restricting tobacco sales or use contrary the mandates of the FCTC (Wellington et al. 2010).

Apart from the FCTC, there have been some global efforts regarding surveillance of tobacco use. These include the Global Youth Tobacco Survey (GYTS) developed by the WHO and CDC. The GYTS was established to enhance the capacity of countries to monitor tobacco use among youth aged 13 to 15 years and to guide the implementation and evaluation of tobacco prevention and control programmes, using standardised methodology (WHO 2010a). While acknowledging the importance of the GYTS in shedding light on youth tobacco use, the non-inclusion of important variables such as socioeconomic indicators in the survey hugely limits the use of the data. Furthermore, some of the GYTS surveys are conducted in only capital cities thus excluding adolescents living rural areas.

Global School Health Survey (GSHS) is another important contributor to global tobacco surveillance. The GSHS is a WHO surveillance system designed to help countries measure and assess behavioural risk factors including tobacco use, and protective factors in 10 key areas among young people aged 13 to 15 years (WHO 2010b). In addition to the limitations of the GYTS, the age ranges of both surveillance systems is a major flaw considering recent findings that adolescents defer tobacco initiation to later age (e.g. Rimpelä et al. 2007).

2.7 Tobacco use in developing countries, with emphasis on sub-Saharan Africa

There is a large lack of complete and accurate statistics on tobacco use in sub-Saharan Africa, the poorest region of the world. The fragmented nature of studies from the region makes it difficult to obtain an overall picture of the tobacco epidemic. Recent studies from 14 countries show a considerable variation in the prevalence of tobacco in the region (Figure 3; Pampel 2008). The prevalence of cigarette smoking among males, for example, ranges from less than 10% (in Ghana and Nigeria) to nearly 30% in the Southern African countries and the Madagascar. Among the females, the prevalence of cigarette smoking in most countries is less than 2% (Pampel 2008; Townsend et al. 2006a). Thus, based on this scanty data one can conclude that the tobacco epidemic is male dominant in sub-Saharan Africa. Furthermore, most of the countries studied have lower prevalence compared to the other developing countries in the regions of the Americas (32.0%), Eastern Mediterranean (35.3%), Southeast Asia (48.1%) and Western-Pacific (61.2%) (Guindo and Boisclair 2003). One pitfall of Pampel's (2008) recent estimates is that it does not include the former French colonies such as Benin, Cameroon and Senegal, where the activities of the tobacco industry are most rampant and thus the prevalence of the epidemic is likely to be higher (White 1997; IUHPE 2005). Furthermore, most of the studies reviewed by

Townsend et al. (2006a) were small using non-representative samples with varying age groups and methodology and covering a wide range of study time periods (some studies were conducted in 1970s and others in the 1980s, 1990s and 2000s).

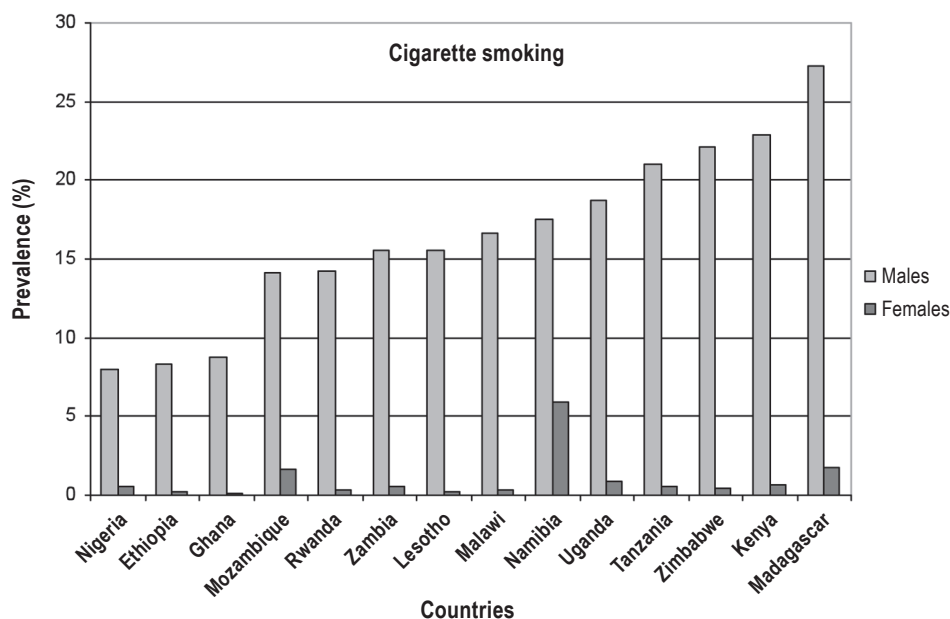


FIGURE 3 Cigarette smoking prevalence in some sub-Saharan African countries by gender
Source: Pampel 2008

2.8 Tobacco cultivation, manufacturing, use and control in Ghana

2.8.1 History of tobacco cultivation and manufacturing in Ghana

Being the first country in the sub-Saharan Africa to attain independence from colonial rule, Ghana had had a long history of tobacco cultivation and manufacturing. Tobacco commerce started in 1948 in the Gold Coast (now Ghana) by the British American Tobacco (BAT) company after the World War II, mostly driven by the demand from the returned war veterans who learned the smoking habits overseas during the war (Owusu-Dabo et al. 2009a). The Gold Coast Tobacco Company (GCTC) Ltd and the Pioneer Tobacco Company Limited (PTC) were established by BAT in 1951 and 1952, respectively, to develop tobacco cultivation and manufacturing in the then Gold Coast. In 1976, International Tobacco Ghana (ITG) in partnership with Rothmans UK joined the Ghanaian tobacco market and broke the monopoly enjoyed by PTC (Owusu-Dabo et al 2009a). In order to produce

the needed raw material for the manufacturing of cigarettes, BAT registered farmers who were granted loans, provided with incentives and technical assistance to cultivate tobacco leaves. This strategy made the tobacco cultivation a lucrative business and provided enough tobacco leaves for the local industry with 20 percent surplus for export. In 1989, the ITG was caught for huge tax evasion which forced it to sell its assets to the Meridian Tobacco Company Ltd (MTC), also a partner of Rothmans UK. BAT monopolised the tobacco industry in the last 1990s through a merger with MTC, and flourished with a record net profit of over 30,000 million USD in 2005. In December 2006, however, BAT folded up in Ghana and relocated in Nigeria.

2.8.2 Tobacco prevalence in Ghana

Like in many African countries, information on tobacco use in Ghana is scanty. The few studies conducted so far are hardly representative of the entire nation as they were mostly conducted in the capital city, Accra. The scant information available suggests that the prevalence of smoking in Ghana is low, despite the long history of tobacco growing and manufacturing (Owusu-Dabo et al. 2009b; Adu-Mireku 2003). In a review of studies on smoking in Ghana Pobee, Larbi and Kpodonu (1984) presented the profile of the Ghanaian smoker as “an urban male cigarette user who starts in adolescence and at 20–29 years he find himself in the age group with the highest prevalence rate”. They continued, “He does not smoke much in the early adult years but becomes a heavier smoker in the middle aged. He is as likely to belong to a lower socioeconomic or to the higher income group but he is likely to smoke heavily if he belongs to the latter group”. Later, a study conducted in nine Secondary Schools in Accra reported prevalence of 31.1% ever smokers and 10.3% regular users. Furthermore, it was found that 32.6% of ever smokers belong to the higher SES group as measured by paternal educational level (Amonoo-Lartson and Pappoe 1992). While these earlier studies provide important information regarding tobacco use in Ghana, a major flaw in this study is that it failed to provide a year in which the study was conducted as well as how the questionnaire was administered, all of which affects the reliability of the results. Another limitation of these studies is that they were conducted in only the capital city, Accra or one region, therefore their generalisability is restricted. In the most recent survey in one region (Ashanti) out of the ten regions, Owusu-Dabo et al. (2009b) found that 4% of Ghanaian adults smoke, (male 9% and females 0.3%), and the prevalence was higher among those in the lower SES groups by educational attainment compared with those in the higher SES groups but no statistically significant difference was found by ownership of radio, television, telephone or car.

2.8.3 Tobacco control policies and measures in Ghana

Ghana was one of the countries that took active role in the drafting, promulgation and ratification of the world's first public health treaty, the Framework Convention on Tobacco Control (FCTC) of the WHO but evidence of the extent to which this is being implemented in the development of a national tobacco control policy is lacking (Owusu-Dabo et al. 2010). There have been several attempts of tobacco control since the 1980s but all of these have been in the form of directives, speeches and media communications from government officials and anti-tobacco organisations with no legal backing (Wellington et al. 2010). For example, in 1982 a desire for a ban of all tobacco advertisements was expressed by the then military government but this was never passed into any legislation. Not until the mid 2000s, the front views of the then two prominent markets in the country, Kaneshie and Kejetia markets in Accra and Kumasi respectively were painted by the British American Tobacco company (BAT) with their brand packet colours. In 1993, the first Tobacco Committee was established by the Ministry of Health to oversee tobacco control in the country but no specific achievement in tobacco control can be traced to that committee. In 2001 another committee, the National Tobacco Steering Committee (NTSC) was set up by the government with the mandate to draft a tobacco control bill for passage into legislation. This drafted tobacco bill was presented to the cabinet since 2005 but it has never got to parliament for debate and passage into legislation. Given the activity of the tobacco industry in the past the issue of lobbying against this bill by the industry cannot be ruled out as accounting for the low priority give to the bill and its slow progress.

In brief, there is no documented evidence of legislations restricting on tobacco sales or use. The product can be bought wherever, whenever and by whomever. Thus, restriction of minors from tobacco purchase or use, in e.g. schools or public places is purely on religious or moral grounds.

3 Literature Review

3.1 The smoking epidemic

The epidemiological transitional of the smoking epidemic has been described to take place in four stages (Lopez et al. 1994; Lopez 1995; Cavelaars et al. 2000). In stage one, smoking prevalence is relatively rare in the population. Among males the prevalence is under 15% while female smoking prevalence does exceed 10%. During this stage, deaths from smoking related diseases are rarely evident and tobacco prevention strategies are normally non-existing. Stage two of the epidemic is characterised by male dominance, reaching a peak of 50–80%, low cessation and a rising female prevalence. The smoking prevalence during this stage is mostly similar in all socioeconomic groups or slightly higher among the high socioeconomic group. Smoking related mortality among men is about 10% but low among females and smoking prevention strategies are still low.

In stage three, male smoking begins to decline and cessation particularly among middle-aged and old men rises. At the latter phase of stage three, smoking prevalence among females also begins to decline from a peak of 35–45%. The declines in the prevalence are often higher among the higher socioeconomic groups because, although comprehensive smoking prevention strategies are implemented during this stage, these groups are more favoured by these strategies than the lower socioeconomic groups. Furthermore, at this stage men's smoking related mortality rises rapidly. Later, a similar mortality rise is observed among women too and the society's tolerance to smoking begins to fade out. Stage four of the epidemic is marked by continuous decline in smoking prevalence among both genders and continuous rise in male smoking related mortality at the early phases of this stage before declining in the latter phase, while female mortality continues to rise but lower than among the males. Thereafter, smoking related mortality declines among both genders. During the latter stage of the epidemic, marked socioeconomic differences persist or widen up to the disadvantage of those in the lower socioeconomic groups (Lopez et al. 1994).

The Nordic countries and some other developed countries were said to have passed through all the four stages (Cavelaars et al. 2000). In brief, the smoking

epidemic follows the pattern of diffusion of innovation (Rogers 1995), such that, the epidemic first begins among high socioeconomic groups, diffuses to lower socioeconomic groups and recedes among high socioeconomic groups (Lopez et al. 1994; Lopez 1995; Rogers 1995). In the light of this epidemic model, in Western countries, studies have shown that decreases in smoking have been greater among higher socioeconomic groups, resulting in socioeconomic differences in smoking among adults (Pampel 2005).

Sub-Saharan African countries were suggested to be in the first stage of the epidemic whereas other developing countries in Asia, Latin America and North Africa were thought to have already been through the second or even the third stages (Lopez et al. 1994; Pampel 2005). Adolescent smoking has not been examined in this framework either in the Western countries or other continents.

3.2 Adolescent tobacco use

3.2.1 Theoretical models explaining adolescent tobacco use

Several behavioural models have been used to explain smoking initiation, continuous use and cessation among adolescents. The social cognitive theory by Bandura (1977) and the problem behaviour theory developed by Jessor and Jessor (1977) are the most commonly used models to describe substance use behaviours including smoking among adolescents. These are reviewed below.

3.2.1.1 *Social cognitive theory*

Social cognitive theory (SCT) was developed by Albert Bandura (1986) based on the social learning theory (Bandura 1977). It is perhaps the most extensively theoretical model used to explain how smoking behaviour as well as other substance uses are acquired and maintained, particularly among adolescents (Engels et al. 1998; Tyas and Pederson 1998; Turner et al. 2004). SCT is a component of behaviourism, and attempts to explain why people and animals do what they do. It postulates that there is a subtle but complex interaction between an individual and his or her environment, mediated through cognitive processes, which influence behaviour. One concept of SCT is the concept of reciprocal determinism. In this perspective, behaviour is explained in terms of a triadic, dynamic, reciprocal and continuous interaction of the environment, personality traits and behaviour. The direction of the behaviour whether conformity or deviant depends on the balance of the influence exerted on the behaviour (Akers 1996). In the context of smoking, for example, in a school where most are non-smokers and intolerant to the behaviour smokers would be less

likely to smoke even in the absence of smoking regulation. Thus the smokers may need to modify their behaviour.

According to Bandura (1986), three cognitive factors namely vicarious capability (observational learning), self-efficacy and perceived outcome of the behaviour (reward and punishment) are important predictors of behaviour. People learn by observing behaviour and its consequences from others. This is sometimes referred to as observational learning, social learning or role modelling. With regards to tobacco use it has been reported that many young people acquire and maintain tobacco use behaviour through the modelling by peers and parents who smoke (Turner et al. 2004; Schepis and Rao 2005; Gilman et al. 2009; Villanti et al. 2010). Self-efficacy is the ability to believe in one's own ability to undertake or change a particular behaviour. For non-smokers self-efficacy is displayed in the ability to successfully refuse the temptation of smoking while for smokers in the ability to quit. Adolescents who have low self-efficacy have low chances of quitting smoking (Engels et al. 1998; Lichtenstein et al. 1998). Regarding perceived outcome of a behaviour, among adolescents, studies have shown that perception of the harmful effect of smoking is related to its initiation, continuous use and quitting (Tyas and Pederson 1998; Rudatsikira et al. 2010).

3.2.1.2 The problem behaviour theory

Apart from the social cognitive theory, problem behaviour theory (PBT) has been extensively employed to explain behaviour in adolescence, including smoking and other drug addictions.

The problem behaviour theory postulates that all behaviour results from the interrelationship between the environment system (e.g. legislation, peer influence and parental support), personality system (e.g. beliefs, attitudes, values and orientation towards self and society), the perceived and the behaviour system (e.g. school performance and delinquent behaviours) (Jessor and Jessor 1977).

According to Jessor and Jessor (1977) problem behaviour is behaviour that is largely accepted by society as a problem, as a source of concern, behaviour that breaks societal norms, an illegal act which attracts sanctions from others or society. In this perspective health compromising behaviours can be regarded as problem behaviour because they constitute a deviation from conventional behaviour. Smoking has not only been documented to be harmful to health several decades ago (e.g. the report of the Surgeon General 1964), but also the behaviour is largely rejected by society and it constitutes a deviation from conventional norm as well as a rejection of social model of good demeanour.

In line with this theory, adolescent problem behaviours, e.g. tobacco use and alcohol use, are inter-correlated and form a premature way of uptake of an adult's behaviour and assertion of adulthood. Adolescent smoking in particular has been

associated with well known problem behaviours such as illicit drug use, membership of a gang, shoplifting and having problems with the police (Tyas and Pederson 1998; Turner et al. 2004; Yanovitzky 2006; Chassin et al. 2007). Furthermore, adolescent smoking has been found to be a way of testing and breaking the boundaries of parental control in a quest for independence (Turner et al. 2004). Adolescent smoking behaviour is therefore clearly problem behaviour as confirmed by empirical studies that specifically tested this theory (Basen-Engquist et al. 1996; Turbin et al. 2000; Costa et al. 2007). However, the association between other problem behaviours and smoking can be in both directions and reciprocal in that the use of other substance leads to smoking and smoking can also be a cause of other substance use (Walkschlag et al. 2003).

3.2.2 Tobacco use among adolescents in sub-Saharan Africa

The scarce available evidence suggests that there is a large country variation in the prevalence of tobacco among adolescents in sub-Saharan African region. The prevalence of smoking is lowest in Zimbabwe (1.4%; Acuda and Eide 1994) and Nigeria (1.5%; Adelekan et al. 2001). In other countries, Ghana (7.5%; Adu-Mireku), Kenya (10.5%), Burkina Faso (13.6%) and South Africa (28.8%) (Townsend et al. 2006a), the prevalences are relatively higher, howbeit these prevalences are lower than those in most Western countries.

In a review of tobacco use among sub-Saharan youth, Townsend et al. (2006a) reported that there were consistent age and gender differences such that tobacco use was most common among older youth and boys than among younger youth and girls, respectively. Townsend et al. (2006a) further observed that differences in tobacco use between adolescents in urban and rural regions seemed to be gender and country-specific. In South Africa, tobacco use was more prevalent among urban than rural populations, but in Nigeria, Gambia and Sudan tobacco use was higher among rural population than urban. On the other hand, in Swaziland, urban females have higher prevalence than their rural peers, nonetheless rural males have higher prevalence compared to urban males (Townsend et al. 2006a).

Only a handful of studies have assessed SES differences in adolescents' tobacco use in developing countries in general and in sub-Saharan Africa in particular. Two small studies conducted among secondary school students in the capitals of Ghana (Accra) and Kenya (Nairobi) found that adolescents in higher familial SES were more likely to smoke than those in lower SES (Amonoo-Lartson and Pappoe 1992; Kwamanga et al. 2003). In the Accra study, an adolescent's SES was measured by father's occupation while adolescents type of school attended (private vs. public) was used as measure of adolescents' SES in the Kenyan study.

3.2.3 Tobacco use among Finnish adolescents

Prevalence and trends

Tobacco use trends among adolescents in Finland have been monitored in the Adolescent Health and Lifestyle Survey (AHLS) since 1977. The AHLS data which is based on national representative samples of 12–18-year-old boys and girls provides a comprehensive picture of tobacco use among Finnish adolescents. From the period 1977 to 2009 the proportions of adolescent experimental smokers have declined drastically, particularly among the 12-year-olds. Among 12-year-old boys, experimental smoking declined from the peak of 50% in 1977 to 17% in 2009. Similarly, among girls of the same age group there was a decline from 32% in 1977 to 10% in 2009. Although this decline occurred in all age groups, the margin was smaller among those aged from 16 to 18 years and even much smaller among 16–18-year-old girls compared to their male counterparts. Over the years therefore, the gender differences in experimental smoking became narrower as male prevalence decreased faster than the prevalence among females. The only exception was that among 12-year-olds, the prevalence is still higher among boys than girls (Rainio et al. 2009a).

Unlike experimental smoking, the trends in daily smoking among Finnish adolescents have not been consistent over the decades. Overall, however, daily smoking has decreased among boys remarkably over the years whereas among girls the decrease has been less marked. Consequently, the gender differences observed in the 1970s and 1980s have disappeared. In recent years, among 14- and 16-year-old girls, daily smoking is even slightly higher than among their male peers. One consistent trend has been that the low prevalence of daily smoking among 12-year-old boys and girls persisted over the years (Rainio et al. 2009a).

3.2.4 Tobacco use among Ghanaian adolescents

Similar to what pertains in the general population and as in many African countries, information on adolescents tobacco use is skimpy. The scant information available suggests that low prevalence also exists among Ghanaian adolescents. A small study of urban adolescents in two schools in the capital city of Accra shows that lifetime cigarette use was 7.5% (Adu-Mireku 2003) while the Global Tobacco Survey (GYTS), 2005 shows that 4.5 % and 3% of males and females respectively were smokers. No detailed study of adolescents' tobacco use in Ghana has been published. Apart from cigarette smoking other forms of tobacco use such as pipe smoking, chewing, snuffing and other smokeless tobacco use exists in Ghana but data on these products and their use is lacking. Furthermore, to the best of my knowledge no study has examined SES differences or other factors relating to adolescents' tobacco use in

Ghana, with the exception of Adu-Mireku's study conducted in Accra a decade ago and Amonoo-Lartson and Pappoe's (1992) study also conducted in greater Accra, although in an unknown year.

3.2.5 Environmental factors and adolescent tobacco use

Tobacco advertisement

A systematic review of nine longitudinal studies on the impact of tobacco advertising and promotion on adolescents' smoking behaviours concluded that tobacco advertising and promotion increases the likelihood that adolescents will start to smoke (Lovato et al. 2003). Several other studies have consistently confirmed these findings and extended the evidence that not only tobacco advertising and promotion but also smoking in movies, tobacco magazines, as well as promotion in other media enhance positive attitude towards smoking, intention to smoke, and eventually smoking initiation and continued smoking among adolescents (Sargent et al. 2002; Turner et al. 2004; DiFranza et al. 2006; Wellman et al. 2006; Rudatsikira et al. 2007). Hanewinkel et al. (2010) found that among German adolescents, exposure to cigarette adverts, but not other adverts, was associated with intention to smoke, smoking, and a dose-response relationship exists between cigarette adverts and these variables.

Accessibility and availability

In most countries, the main aim of tobacco taxation is to raise prices in order to deter people from initiation, reduce the level of consumption and encourage quitting. To achieve this, the demand for cigarettes or tobacco products must be price elastic. The impact of taxation or price increases on tobacco use has been of intense debate, yet only few studies (mostly from the US) have specifically attempted to address this discourse and most of these reported mixed findings. Some studies have found that increase in cigarette prices reduces the probability of smoking and encourages cessation (Lantz et al. 2000; Turner et al. 2004; Carpenter and Cook 2008; Tworek et al. 2010). It has been suggested that this relationship may occur through the reduction of parental and peer effect, and the decreased availability of cigarettes at home or from friends both of which are likely to be price elastic.

Furthermore, because of the shorter years of smoking, nicotine dependence is less in adolescence than in adults resulting in adolescents being more likely to be responsive to price changes (Lewit et al. 1981; Chaloupka 2003). Chaloupka (1999) even argued further that the responsiveness among adolescents to prices is higher than among adults. On the contrary, others found no association between price or tax increases and adolescent smoking (DiCicca et al. 2002; DiCicca et al. 2005).

Overall, however, there are more studies supporting the conclusion that higher prices of cigarettes tend to reduce initiation, consumption and lead to high probability of cessation among adolescents.

Place of residence

Previous studies have reported conflicting results regarding the association between place of residence and adolescent tobacco use behaviour (Cronk and Sarvela et al. 1997; Sarvela et al. 1997; Flisher and Chalton, 2001; Fatoye and Morakinyo 2002; Fatoye 2003; Unger et al. 2003; Plotnikoff et al. 2004; Völzke et al. 2006; Lutfiyya et al. 2008). Some studies found that adolescents from rural residences were more likely to smoke than those from urban areas (Sarvela et al. 1997; Flisher and Chalton 2001; Aloise-Young et al. 2002; Plotnikoff et al. 2004; Doescher et al. 2006; Lutfiyya et al. 2008). This relationship was not found in other studies (Unger et al. 2003; Shakib et al. 2005) while other studies found higher probability of tobacco use among those of urban residences compared to those of rural (Fatoye and Morakinyo 2002; Fatoye 2003; Völke et al. 2006).

The discrepancies in the findings could be partly due to differences in the definition of rural/urban and the differences in sample sizes. The mechanism through which a place of residence impacts on tobacco use is not clearly understood. Living in urban areas may be more stressful than living in rural areas and, consequently, urban population may engage in health compromising behaviours, including smoking as a way of coping (Colby et al. 1994). Furthermore, adolescents in urban areas are said to be more likely to be exposed to tobacco promoting, and tobacco use is likely to be more socially acceptable behaviour in urban settings than in rural areas. On the other hand, higher prevalence among rural folks is likely to be explained by less exposure to health education on the dangers of tobacco use than those in urban cities. Also, in tobacco producing countries, the product may be more accessible to rural folks who are most likely to live in cultivation regions compared to those in urban areas (Smith et al. 2005; Doescher et al. 2006).

Impact of school on adolescent smoking

The ecological hypothesis suggests that an individual's behaviour is influenced by the immediate and broader environment (Durkheim 1951; Hauser 1974; van den Eeden 1982). The school is not only an immediate environment for its pupils but also constitutes an organised system where behaviours such as smoking can be shared, promoted or prevented. Consequently, the impact of the school setting, including the school social environment (e.g. particularly teacher-pupil relations), school health policy and practices, pupils' attitude towards school, and school processes on adolescent smoking has been of intense interest in the past couple of decades

(Wakefield et al. 2000; Aveyard et al. 2004; West et al. 2004; Evans-Whipp et al. 2004; Lovato et al. 2007; Lovato et al. 2010).

A number of previous studies (e.g. West et al. 2004; Henderson et al. 2008; Lovato et al. 2010) and two review studies (Evans-Whipp et al. 2004; Sellström and Bremberg 2006) have found that in general, schools with more comprehensive and strictly enforced anti-tobacco policies, cordial teacher-pupil relationships, higher involvement of pupils with education or pupils' positive attitude towards school were associated with less chances of smoking. On the other hand, one review (Aveyard et al. 2004) and a few studies (e.g. Maes and Lievens 2003; Aveyard 2005) did not find any conclusive evidence regarding the association between the contextual effect of schools and adolescent smoking, independent of pupils' compositional factors.

Parental smoking

Consistent with the social cognitive theory (Bandura 1986), parental smoking has been established to increase the probability of smoking among their offspring (Tyas and Pederson 1998; Turner et al. 2004; Hill et al. 2005; Schepis and Rao 2005; Otten et al. 2007; Siziya et al. 2007; Kyrleski et al. 2007; Fildler et al. 2008; Gilman et al. 2009; Rainio and Rimpelä 2009), but few study studies did not find this association (e.g. Avenevoli et al. 2003). The overwhelming evidence of the impact of parental smoking on adolescents' smoking behaviours from these studies highlights the influence of parents as role models to their children. The diffusion of innovation pattern of the spread of the cigarette epidemic also exemplifies the role model nature of tobacco use and smoking in particular (Lopez et al. 1994; Lopez 1995; Rogers 1995). A Finnish study has shown that the relationship between parental smoking and that of their children has persisted for three decades (Rainio and Rimpelä 2009).

What is even overwhelming is the evidence, although isolated, that the influences of parental smoking on their children's smoking persist even years after parent(s) had given up smoking (Milton et al. 2004). Some studies have found that both paternal and maternal smoking predicts adolescent smoking (Hu et al. 2006; Peterson et al. 2006), but this was not confirmed by others (Botvin et al. 1992; Jensen and Overgaard 1993) while still others found the relationship for either paternal smoking or maternal smoking but not both (Brook et al. 2004; Jarvelaid 2004). By gender, many studies have reported that the relationship was significant for girls only (Tyas and Pederson 1998). Previous studies that investigated the influence of same-gender parental smoking on child smoking found conflicting results (Tyas and Pederson 1998).

Peer smoking

Similar to parental smoking, a number of review studies have demonstrated that peer smoking strongly predicts both smoking initiation and maintenance of

smoking (Tyas and Pederson 1998; Turner et al. 2004; Schepis and Rao 2005; Villanti et al. 2011). Taylor et al. (2005) found a dose-response relationship between peer smoking and adolescent smoking so that the probability of smoking increases as the number of friends or peers who smoke increases. Most adolescents usually smoke in the presence of other adolescents. Adolescent smoking is hence predominantly a social behaviour. As a consequence, adolescent smoking may be fuelled by a desire for belongingness and affirmation in a group (of smokers). In the company of smokers, smoking behaviour is reinforced, cigarettes are likely to be accessible and non smokers are more likely to initiate the behaviour while those who are already smokers may smoke more, even in the absence of direct pressure to smoke (Turner et al. 2004; Hoffman et al. 2006; Reid et al. 2008). Apart from parental smoking and peer smoking, sibling smoking has also been established to increase the chances of smoking among adolescents (Tyas and Pederson 1998; Turner et al. 2004; Schepis and Rao 2005). It is possible that the combined effects of role modelling and belongingness play a part in this association.

3.2.6 Individual factors and adolescent tobacco use

Age

Age is consistently related to both tobacco initiation and use. Most tobacco users began the behaviour in adolescence and the prevalence increases with age (Mermelstein 1999; Kim et al. 2006; Townsend et al. 2006a; Rimpelä et al. 2007). Research has shown that if smoking behaviour is not initiated during adolescent age, then it is likely it will never begin (US Department for Health and Human Services 1994). Moreover, the probability of cessation among adolescents is inversely related to the age at initiation (Combs et al. 1992; Breslau and Peterson 1996). In the United States, adolescent tobacco use takes place during early adolescence ages 10 to 13 years, (Centers for Disease Control 2006; Marshall et al. 2006). Similarly, in Finland smoking experimentation starts at age 11 or 12 years (Rimpelä et al. 2007), while in a review of tobacco use among sub-Saharan African youth in 15 countries shows that in most countries tobacco use initiation begins during ages 12–14 years (Townsend et al. 2006a).

Gender

Gender difference in adolescent tobacco use is well known (Mermelstein 1999; Galanti et al. 2001; Global Youth Tobacco Collaborating Group 2003; Hublet et al. 2006; Rimpelä et al. 2007; Schnohr et al. 2008). In Sweden, boys are more likely to experiment with both cigarettes and smokeless tobacco but girls have the higher probability of progressing towards advanced experimentation or regular use (Galanti

et al. 2001). This pattern of tobacco initiation is typical in countries where smoking prevalence is female dominant (Sasco et al. 1993). In a study among adolescents in 27 European countries no overall gender difference emerged with daily smoking. However, gender differences in smoking within countries were found (Schnohr et al. 2008). Boys had higher probability of smoking than girls in Austria, Estonia, Lithuania and Ukraine. However, the gender differences were narrower in Austria and Germany. On the other hand, in Finland, Czech Republic and the United Kingdom, girls had higher smoking prevalence than boys (Schnohr et al. 2008).

Taken together, in most non-Western countries, tobacco use is substantially higher among boys than girls (Global Youth Tobacco Collaborating Group 2003; Centers for Disease Control and Prevention 2006; Rudatsikira et al. 2006; Townsend et al. 2006a). The gender differences in tobacco use have been narrowing over the years, mostly in Western countries but also in a few non-Western countries (Global Youth Tobacco Collaborating Group 2003; Rimpelä et al. 2007; Schnohr et al. 2008; Talay and Altin 2008).

Ethnicity and race

Ethnic or racial differences in adolescent tobacco use have been reported in earlier studies (Wills and Cleary 1997; Mermelstein 1999; Steyn et al. 2002; Swart et al. 2003; Khuder et al. 2008; Villanti et al. 2011). In South Africa, black youth had lower rates of tobacco use than other racially classified social groups across all ages and in both rural and urban settings. However, in the same studies it was found that smoking behaviour among black youth were increasing but not among coloured youth (Steyn et al. 2002; Swart et al. 2003). A US study found that in 281 middle school students in the Mississippi Delta area, Caucasian students were more likely to have ever tried smoking, smoked daily, lived with someone who smokes, had seen a parent or guardian who smokes, had used smokeless tobacco products, and had friends who smoke than were African American students (Muilenburg et al. 2006). Other studies found that African-American youth were less likely to have full bans on smoking inside the home (Gilpin et al. 1999; Muilenburg et al. 2009). Overall, the literature supports the conclusion that the risk of smoking is higher among white adolescents, followed by Hispanics and least among blacks (Tyas and Pederson 1998; Turner et al. 2004).

What accounts for the differences still remains unclear. The mechanism is even complicated by the fact that most of the predictors of smoking such as low SES, unemployment, or low level of education are more prevalent in black communities than in the other ethnic groups. Some authors suggest that differences in the context of smoking among these groups may account for the differences in the smoking prevalence (Tyas and Pederson 1998; Turner et al. 2004). It is suggested that smoking among white youth may be a means of socialisation and hence more likely to be

influenced by peer smoking (Headen et al. 1991). Mermelstein (1999) on the other hand proposed that the ethnic differences may be due to differences in the perception of smoking. Non-white girls perceived smoking as uncultured behaviour for a lady and both genders regarded smoking as disrespectful to their parents. Furthermore, non-white, particularly African-American parents have been cited to be more firm in promoting non smoking norms among their wards (Turner et al. 2004).

Genetic factors

Despite the documented support in the literature for the influence of environmental factors such as parental smoking, peer smoking and exposure to tobacco advertisement on adolescent tobacco use, there is mounting evidence that genetic factors influence smoking initiation and nicotine dependence. Twin studies have shown that genetics play a role in the initiation and maintenance of smoking behaviours (Carmelli et al. 1992; Sullivan and Kendler 1999; Swan 1999; Hernandez and Blazer 2006). A study found that genetic factors explain more than half of the chances to start smoking (Sullivan and Kendler 1999) and account for 7 out of 10 of the differences in the transition from experimentation to addiction (True et al. 1999; Sullivan and Kendler 1999), while another study revealed that genetic influences play a vital role even in the age of onset of smoking (Heath et al. 1999).

The genetic pathways for smoking have not been clearly understood. Perry et al. (1999) suggests that neuronal nicotine receptors play a significant role in one's responses to nicotine. In animal models, exposure to prenatal tobacco smoke was associated with increased nicotine cholinergic receptors (Slotkin et al. 2002). Others have also suggested that neurotransmitter pathways could also account for the genetic effect on smoking behaviour (e.g. Lerman and Berrettini 2003; Kendler et al. 2004; Hernandez and Blazer 2006). Overall, it seems the hereditary factors interact with environmental factors to influence smoking behaviour (Kendler et al. 2004; Hernandez and Blazer 2006).

Other risky behaviours

Unhealthy lifestyles tend to co-occur. A colossal amount of studies have shown that health damaging behaviours such as smoking, alcohol use, drunk driving and risky sexual activity often cluster (Igra and Irwin 1996; Turner et al. 2004). Those who engage in these behaviours are also less likely to practice healthy lifestyles such as physical activity, wearing of seat belts and healthy dietary intake (Igra and Irwin 1996; Crockett et al. 2006; Wiesner and Windle 2006; Ludden and Eccles 2007). It has been documented in two reviews of large number of studies that adolescents who practice other health damaging behaviours especially alcohol and drug use are most likely to smoke (Tyas and Pederson 1998; Turner et al. 2004).

3.2.7 Adolescent specific tobacco control efforts

Tobacco control measures that seek to reduce tobacco use among adolescents are designed to change the environment and influence knowledge of and attitude towards tobacco use, and consequently prevent young people from beginning to smoke and reducing the likelihood that they will sustain their smoking behaviours (Wakefield et al. 2000; Tauras 2005). These measures are purported to decrease accessibility to and availability of tobacco products through such tools as prohibition of vendors from selling tobacco products to minors, raising the price of tobacco products and a ban on the distribution of free tobacco products to minors. In addition, such measures as bans on advertising and smoking in public places and school create an environment where smoking is less tolerant. The interactions between these environmental factors and an individual's knowledge of and attitude towards tobacco use are important determinants among adolescents (Wakefield et al. 2000; Tauras 2005). Likewise, awareness of the harmful effects of tobacco to health through health education and anti-tobacco messages or counter-advertising are important tobacco control strategies that can discourage the youth from smoking. The availability and enforcement of these restrictions are effective in reducing tobacco use among adolescents (Wakefield et al. 2000; Stead and Lancaster 2005; Tauras 2005).

3.3 Measurement of socioeconomic status

3.3.1 The concept of socioeconomic status – historical background

Various concepts and terminologies such as social class, social position, socioeconomic position (SEP), socioeconomic status (SES), have been used in health inequality research to describe the social and economic stratification or the socioeconomic condition of both society and the individuals within society (Krieger et al. 1997; Bartley 2005). These concepts of social stratification mostly originate from the work of two theorists, Karl Marx (1867/1971) and Max Weber (1914/1978; Weber 1946). According to them, occupation classifies people into groups defined by the employment conditions and relationships. First, there are those who own assets such as factories and firms which determines whether an individual needs to work or has sufficient ownership of a factor of production which annuls the need to work for pay.

Second, social class shows the relationship between those who work for a living (employees) and those who are worked for (employers), the latter being those who own and manage the means of production. In this respect society is divided into two factions of property owners and property less labourers. Marx (1867/1971)

particularly emphasised that social stratification and social relations evolved from a structure relation of the conflict between exploited workers and the exploiting owners who control the factors of production. On the other hand, Weber (1914/1978; Weber 1946) perceived that society is hierarchically stratified along many dimensions that create homogenous groups with similar opportunities. The use of multiple indicators in health inequality research emanates from Weber's concept of multi-dimensionality of social stratification.

In the mid 1980s, Erik Olin Wright (1985; 1997) expanded the work of Marx (1867/1971) and Weber (1914/1978) using three distinctive classifications. The first involved a class schema that differentiated those who owned property from those who did not. Wright classified those who owned enough capital to hire people and do not work themselves as the bourgeoisie, those who possessed sufficient capital to hire people but need to work themselves also as small employers, and those who owned adequate capital to work for themselves but cannot hire other workers as petty bourgeoisie. The second classification criterion was based on the control of work of others in the organizational groups. In this way, people with occupations which place them to have supervisory or managerial role over others were considered as having more organisational assets. People with such positions are favoured by the benefits that arise from the toil and sweat of their subordinates.

The third classification by Wright (1985; 1997) was based on the concept of skill or credentials as a form of asset or property that people with skills or credential own and can sell on the market. Besides, the skills or credential place these people in a position where they can exploit their subordinates, establish themselves as independent professionals or at least such skills and credentials shield them from being exploited by those with organizational assets.

Many other classifications of social class such are the Goldthorpe schema (Goldthorpe et al. 1980) which classified occupation based on the system of authority, control and the degree of autonomy as well as the Goldthorpe-Erickson schema (Erickson and Goldthorpe 1992) based on ownership of companies or other properties were developed based on these earlier works.

In this study, the term socioeconomic status is used to encompass both the Marx (1867/1971) and Weber's (1914/1978; Weber 1946) concepts to study the relationship between socioeconomic circumstances and smoking among adolescents. Specifically, the socioeconomic framework of this study conceptualised that social and structure relations (whether material, economic or family structure) between groups within society are important determinants of lifestyles and health behaviours within each group with consequences on health.

Abel et al. (2000) also discussed the Weber's hypothesis in the perspective of the interplay of choice and structure in determining lifestyles of people. According to them, choices and constraints interact to determine the lifestyle of individuals

and groups. They put forth that although people have freedom in making many choices, they are not entirely free in determining their lifestyles. Instead they have the freedom to choose within the social constraints that is applicable to their life circumstances. Consequently, lifestyle constraints such as to smoke or not to smoke originate from socioeconomic circumstances such that those who desire a particular lifestyle and have the means can choose while those who do not have the means may not be able to choose easily. The lifestyles of those who cannot choose easily are thus more likely to be influenced by external circumstances. The concept of the relationship between socioeconomic status and adolescent tobacco use in the dissertation is based in this hypothesis.

3.3.2 The measurement of socioeconomic status in health inequality research

Traditionally, epidemiological studies have used educational attainment, occupational status and income as the measures of socioeconomic status (Galobardes et al. 2006a; Galobardes et al. 2006b). These three measures were said to measure a wide range of social factors which could possibly account for any disparities in health across the social ladder (Galobardes et al. 2006a; Galobardes et al. 2006b).

Education as a measure of socioeconomic status is linked to the Weberian theory which perceives knowledge and skill as an asset which places the individual on a hierarchy in society (Liberatos et al. 1988; Lynch and Kaplan 2002). Education influences health behaviours, such as tobacco use, and consequently health outcomes in various ways. Firstly, education strongly predicts occupation and income in the future (Lynch and Kaplan 2002). It is a proxy measure of the material, intellectual, and other resources of the family of origin and in some cases it determines the place of residence (Galobardes et al. 2006a). As all of these affect health behaviours, education therefore influences health behaviour choices. Secondly, education equips the individual with knowledge and skill to make informed and better health behaviour choices which positively affect health in the long run. Thirdly, not only does education enable the individual to secure stable job which has less stress but also equips one to cope with stress that may arise from work and daily living (Galobardes et al. 2006a). Fourthly, well educated people mostly also have peers who are also well educated. Education thus shields the individual from the health compromising behaviours through a social network of peers among whom health compromising behaviours, including tobacco use are rare.

In health inequality research, education is measured as the number of years of completed education or the completion of an educational level such as primary school, secondary school or tertiary education (Galobardes et al. 2006a). Education is a useful measure of SES, because information on education is relatively easy to obtain and can be assessed across the whole life course. However, one major

limitation of the use of education is the differences in educational systems within and between countries. This makes it difficult to compare SES, measured by education, across countries with varying systems of education. Adding to this, in most non-Western countries information on the educational level of individuals may not be available. Furthermore, in societies where most people do not possess formal education, its use as a measure of SES in such cultures is hugely limited. Also in inequality research where adolescents are the response they may not have attained any complete education hence education cannot be used as a measure of their SES. Moreover, in surveys adolescents are unable to provide complete information on their parental educational attainment (Currie et al. 1997).

Occupation as a measure of SES is also based on Marx (1867/1971) and Weber's (1914/1978) theories which views occupation as relating to a person's standing in society (Liberatos et al. 1988). Occupation is related to both income and education. Therefore it determines material living standards, prestige in society, control and autonomy, level of stress and social networks. Occupation thus affects health behaviours and health (Laaksonen et al. 2003; Galobardes et al. 2006a). People's current occupations are often used as their occupational status. Others use the occupation of the head of the family as the indicator of the SES of the dependants of the household (Galobardes et al. 2006a). Information on occupation is relatively easy to obtain and often available in population census database in most developed countries. A major setback of occupation as an indicator of SES is that it often excludes social groups who are outside regular employment, including retirees, students, the unemployed, those working in unpaid jobs or inside the home particularly women. Occupation as a measure of SES is particularly problematic in developing countries where many people work outside the formal sector. Additionally, in adolescents health inequality research the use of occupation as a measure of SES is inadequate because at that age most of them might be in school and hence outside the labour market.

Income is related to material resources and can influence health behaviours through the affordability of health choices such as healthy food or sports equipment (Duncan et al. 2002). It also promotes self-esteem and raises one's prestige in society (Laaksonen et al. 2003; Galobardes et al. 2006a). Income is often measured by people's absolute earnings or in relation to e.g. the level of poverty. It can also be measured at the individual level or at the household level. The latter is particularly useful in places where women do not earn income. Although income is an unambiguous measure of standard of living, in many places income is a sensitive issue and therefore people are less likely to provide information on their income. Another limitation is that income changes very frequently over time and varies across the life course. Furthermore, in many low and middle income countries, income fluctuates over time and economic

worth is stored in other assets such as livestock rather than income. Moreover, income is limited in revealing other possessions of people and families.

Material resources

Unlike in Western countries, in the developing world, there are many challenges involved in measuring the socioeconomic status using the traditional indicators (education, occupation and income). This is because information on these indicators is not readily available, and where there are, their applicability across the culturally and economically diversified nature of the society presents a great challenge (Durkin et al. 1994). Consequently, the few studies on SES among adults in developing countries used material resources such as type and material of housing, source of drinking water, sewage system, type of domestic fuel, land ownership, education, occupation, familial living conditions, and demographic conditions (Crontinovic et al. 1993; Durkin et al. 1994; Fiadzo et al. 2001; Galobardes et al. 2006a; Galobardes et al. 2006b).

3.3.3 The measurement of adolescents' socioeconomic status in health inequality research

Measuring an adolescent's SES in health inequalities research presents challenges because adolescence is a period of transition from familial SES (origin/assigned) to individual SES (achieved/individual). Assessments of an adolescent's SES should therefore take into account this transitional nature of adolescence and should be conceptualized in two dimensions. First, familial SES, reflecting the social class of origin, and second, the adolescent's individual social position in relation to his/her peers (Koivusilta et al. 2003; Paavola et al. 2004; Koivusilta et al. 2006; Richter and Leppin 2007).

Familial SES indicators such as parental education, occupation and income have been traditionally used as a measure of adolescent's SES. There are problems in collecting data on these indicators from adolescents partly because they are often unable to provide accurate information on their parents (Currie et al. 1997; Molcho et al. 2007; Currie et al. 2008). Consequently, surveys involving obtaining parental SES information from adolescents result in large missing data (Currie et al. 1997; Wardle et al. 2004; Molcho et al. 2007; Currie et al. 2008). This has led to a rising interest in exploring other non-parental measures of adolescent SES in health research (Currie et al. 1997; Wardle et al. 2002; 2004; Koivusilta et al. 2006). Moreover, conceptually, the use of adolescents' familial SES to assess adolescents' SES is debatable because social stratification is a phenomenon that has multiple pathways and varies across the life course trajectory, and such indicators do not wholly capture this variation or multidimensionality of SES.

Some previous studies have highlighted the need to use multiple SES indicators to assess the complex mechanisms and pathways through which socioeconomic status results in health inequality (Currie et al. 1997; Laaksonen et al. 2005; Currie et al. 2008; Laaksonen et al. 2009). A wide range of both conventional and non-traditional indicators have been used in adolescents' health and health behaviour inequality research. Currie et al. (1997) have used information about the number of telephones in the household, the number of cars in the family, and having own unshared bedroom to construct a family affluence scale (FAS) based on the deprivation index proposed by Townsend (1988) and Carstairs and Morris (1991). Wardle et al. (2002) also proposed the use of home affluence scale (HASC) developed from car ownership, computer ownership, house tenure and benefiting from free school meals. Both studies recommended that these scales present a good alternative to the traditional indicators (parental income, education and occupation).

In more recent years several other indicators for assessing adolescents' SES in health research have been proposed. For example, in their study of the psychosocial resources and health behaviour in early adolescence, Iversen and Holsen (2008) used the number of books at home and perceived wealth among others as measures of adolescents' socioeconomic position (SEP). They concluded that SEP indicators differ in their relationship with various health outcomes, and hence there is a need to further research to develop indicators suitable for adolescent research.

However, studies conducted so far are from Western countries, Europe and the US (Alvarez-Dardet 2000; Morris et al. 2000; Mullan and Currie 2000; Currie et al. 2004; Boyce and Dallago 2004; Currie et al. 2008). As SES is a concept that varies according across culture, social structure of the society and in different economic settings (Wardle et al. 2004; Currie et al. 2004), these findings from Western countries might not be entirely generalisable to developing countries. Our knowledge is therefore limited on the measurement and the concept of adolescent's SES in developing countries.

3.4 Socioeconomic differences in tobacco use among adolescents

3.4.1 Familial SES factors in relation to tobacco use

Also among adolescents, studies have shown socioeconomic differences in tobacco use to the disadvantage of those in the lower socioeconomic groups (Hanson and Chen 2007a; Richter and Leppin 2007). A low educational level of both the father and mother has been shown to increase the probability of smoking among adolescents (Hanson and Chen 2007a). Adolescents in a lower socioeconomic group, as assessed

by parental occupation are more likely to smoke compared to those whose parents have a higher occupational status (Hanson and Chen 2007a).

Parental education has been consistently shown to be associated with adolescent smoking in a colossal amount of previous studies (Hanson and Chen 2007b; Bergstrom et al. 1996; Townsend 2006b; White et al. 2004; Finkelstein et al. 2006; Soteriades and Difranz 2003), but a couple of studies did not find any relationship between parental education and adolescent smoking (Friedstad et al. 2003; Pederson and Skrondal 1999). In most of these studies higher parental education was found to be associated with a smaller likelihood of tobacco use among adolescents (Hanson and Chen 2007b; Finkelstein et al. 2006).

The mechanisms explaining the link between parental education and smoking behaviours of their children is inconclusive. It has been suggested that parents of lower education may be smokers themselves and thus model the behaviour to their children. Similarly, parents with higher education have been thought to exert the benefits of better education on their children through role modelling and the provision of better life opportunity, while at the same time providing them with health education about the harmful effects of smoking (Hanson and Chen 2007a). Soteriades and Difranz (2003) and many others (e.g. Finkelstein et al. 2006; Ringlever 2010) have found that the association between parental education and adolescent smoking persists even after controlling for potential mediators such as parental smoking and adolescent stress.

Parental or family income often measured as the average income of the family or the highest income of the head of the family, has also been established to relate to adolescent smoking in that those from a lower family income background have an increased probability of smoking than those from lower family income background (Georgiades et al. 2006; Goodman and Huang 2002; Maurer et al. 2003; Bluem et al. 2000; Soteriades and Difranz 2003).

Parental occupation as a proxy measure of an adolescent's SES has been reported in previous studies to relate to adolescent smoking in a similar way as parental education and income. The higher the parental education the less chances there are that an adolescent would smoke (Huure et al. 2003; Hanson and Chen 2007b).

Overall, the associations between parental education, occupation and income have all been explained as relating to the negative effect of lower SES on health behaviour, albeit the mechanisms through which these operate remain unclear.

Apart from the above traditional SES measures, the *material resources* of an adolescent's family are known to inversely relate to their health behaviours including smoking behaviour so that those from lower material resource families have higher likelihood of smoking compared to those of higher material resource backgrounds (Currie et al. 1997; Hanson and Chen 2007b).

Family structure

In a large study of the association between family structure and smoking among adolescents in eleven European countries, it was revealed that living in the nuclear family with both biological parents lowers the risk of cigarette smoking compared to living in a single parent family or other family types (Bjarnason et al. 2003). Several other studies have consistently confirmed these findings (Narring, Michaud and Sharma 1996; Moore, Manlove, Gleib et al. 1998; Darling and Cumsille 2003; Griesbach et al. 2003; Langille et al. 2003; Kestila et al. 2006; Otten et al. 2007; Fidler et al. 2008), including three longitudinal studies among Scottish (Glendinning et al. 1997; Sweeting et al. 1998) and American adolescents (Brown and Rinelli 2010) and a systematic review of a large pool of studies (Tyas and Pederson 1998). Also, children in non-intact families have been shown to have low self-esteem, difficulties forming friendships, academic failure, and weak emotional ties to parents (Amato and Keith 1991; Amato 2008)

3.4.1 Individual social measures in relation to tobacco use

School performance

School achievement, educational aspiration as well as commitment to school have been consistently documented to be related to smoking (Tyas and Pederson 1998; Bergen et al. 2005) and other health behaviours (Bergen et al. 2005). In most studies high school performance or academic achievement was protective of tobacco use (Tyas and Pederson 1998; Lee et al. 2002; Bergen et al. 2005; Schepis and Rao 2005; O'Loughlin et al. 2009).

School career

Only few studies have examined the relationship between the career paths of adolescents and their health behaviour in general and tobacco use in particular. However, there is amounting a body of evidence that career choices of adolescents stratify them already at an adolescent age such that some career choices are more related to detrimental health behaviour including smoking while others lead to more health promoting behaviours (Tyas and Pederson 1998). In addition to school career, adolescents who have discontinued or have no plans of continuing their studies after compulsory schooling are more likely to smoke than those in more promising educational careers or those who have an aspiration to continue their education (e.g. Brown et al. 2001).

There are however, a few exceptions where the association between adolescent tobacco use and SES was found only for some ages, genders or SES indicators (Paavola et al. 2004; Hanson and Chen 2007a). On the whole, an adolescent's own

individual social position tends to be more predictive of health behaviours such as smoking than their parental SES (Currie et al. 2004; Paavola et al. 2004). Generally, this association exists whether the adolescents' SES was measured by their parental indicators such as education, occupation and income or by their own individual social position indicators such as school performance and school career. However, the latter type of indicators has been less researched (Hanson and Chen 2007a). In particular, studies using both sets of SES measures in the same study are scarce.

3.5 Summary of the factors associated with adolescent tobacco use

The summary of the evidence regarding the association of the factors associated with young people's tobacco use are presented in Table 2.

TABLE 2. Summary of the associations of social, environmental and individual factors associated with adolescent tobacco use

Indicators	Association	Direction of association
Socioeconomic status		
<i>Familial SES</i>		
Parental education	Yes	Higher probability in lower parental educational groups (e.g. Hanson and Chen 2007a**)
Parental occupation	Yes	Higher probability in lower parental occupational groups (e.g. Hanson and Chen 2007a**)
Parental income	Yes	Higher probability in lower parental income groups (e.g. Hanson and Chen 2007a**)
Family structure	Yes	Higher probability among those in non-nuclear families (e.g. Bjarnason et al. 2003*)
<i>Individual social measures</i>		
School performance	Yes	Higher probability among those with poor performance (e.g. Schepis and Rao 2005**)
School career	Yes	Higher probability among those with less promising educational career path (Brown et al. 2001)
Environmental factors		
Exposure to tobacco advertisement	Yes	Higher probability among those exposed to advertisement (e.g. Lavoto et al. 2003**)
Tobacco taxation	Yes	Consumption decreases as prices increases (e.g. Turner et al. 2004**)
Place of residence	Mixed	Unclear (e.g. Tyas and Pederson 1998**)
School factors	Yes	More comprehensive and strictly enforced anti-tobacco policies, cordial teacher-pupil relationships, etc. were associated with less smoking (e.g. Sellström and Bremberg 2006**)
Parental smoking	Yes	Higher probability among those exposed to parental smoking (e.g. Schepis and Rao 2005**)
Sibling smoking	Yes	Higher probability among those exposed to sibling smoking (e.g. Tyas and Pederson 1998**)
Peer smoking	Yes	Higher probability among those exposed to peer smoking (e.g. Schepis and Rao 2005**)
Individual factors		
Age		Increases with age (e.g. Kim et al. 2006)
Gender	Yes	Mixed evidence: higher among girls in most highly industrialized countries but male dominant in most developing countries (Hublet et al. 2006*)
Genetics	Yes	Not applicable (Sullivan and Kendler 1999)
Ethnicity/race	Yes	Lower probability in ethnic/racial minority (e.g. Turner et al. 2004**)
Attitude towards smoking/smokers	Yes	Higher probability among those with positive attitude towards smoking/smokers (e.g. Tyas and Pederson 1998**)
Knowledge of the health effects of smoking	Yes	Mixed evidence (e.g. Rudastsikira et al 2010)
Risk behaviours and lifestyle	Yes	Higher probability among those with health compromising lifestyles and behaviours (e.g. Ludden and Eccles 2007; Turner et al 2004**)

* International study

** Review

4 Aims of the Study

This dissertation was designed to explore the socioeconomic differences in tobacco use among Ghanaian adolescents and to make a comparison with Finnish (a country with a comprehensive tobacco control policy) adolescents.

To achieve this aim the following specific objectives were set:

1. To explore the association between the social environment and individual factors and smoking and tawa (smokeless tobacco) use among Ghanaian adolescents.
2. To develop a scale for measuring material affluence circumstances of adolescents in health inequalities research in developing countries.
3. To investigate the association between socioeconomic status (SES) and tobacco use among Ghanaian adolescents, using multiple SES measures.
4. To investigate the changes in socioeconomic differences in the trends of tobacco use among Finnish adolescents from 1977 to 2007, using multiple SES measures.

5 Study Subjects and Methods

5.1 The study setting

5.1.1 Ghana

Ghana is a multicultural democratic West African country in sub-Saharan Africa (Figure 4). Ghana is bounded by Côte d'Ivoire to the west, Burkina Faso to the north, Togo to the east, and the Atlantic Ocean (Gulf of Guinea) to the south. Ghana has a total area of 238,533 sq km, comprising 227,533 sq km of land and 11,000 sq km of water body. In 1957, Ghana gained independence from British colonial rule to become the first country in sub-Saharan Africa to attain independence.



Source: <http://www.countryreports.org/images/crimage.aspx?image=GH&imagetype=-area>. 09/12/2010

FIGURE 4. The globe showing the location of Ghana within West Africa

The country has a total population of 24 339 838 (2010) people of which 43.8% live in the urban cities and 56.2% in the rural settings. The age structure is made up of 41.3% under 15 years of age, 53.4% are between 15–64 years and 5.3% are above 64 years. The gender ratio is 49.5% males and 50.5% females. Other indicators are presented in Table 3.

5.1.2 Finland

Finland (Figure 5) is a Nordic country bounded to the east by Russia, to west by Sweden and the Gulf of Bothnia (Baltic Sea), to the north-west by Norway and the south by the Baltic Sea (Gulf of Finland). The capital city is Helsinki. Finland has a population of 5,255,068 (2010) living on a geographical area of 338, 145 sq km, most of which is covered by about sixty thousand lakes (those larger than 1 hectares 10 000 m², Finnish Environment Institute 2010). Finland gained independence from Russian rule on 6th December 1917 and has since enjoyed enviable peaceful multi-party democratic governance. It has been described in a number of reports as one of the most peaceful places on the planet earth (e.g. Newsweek reports of the world's best countries 2010). In January 1995, Finland joined the European Union (EU) and on 1st January 1999 it adopted the EU common currency, the euro to replace the Finnish marks. Table 3 shows other key indicators.



Source: <http://www.google.fi/imgres?imgurl> Accessed 20.04.2011

FIGURE 5. A map showing the location of Finland within Northern Europe

TABLE 3. Key indicators of Finland and Ghana

Indicator	Finland	Ghana
Human Development Index Value*	0.959	0.526
Life Expectancy*	79.5 years	56.5 years
Infant mortality rate*	3.47/1000 live births	76/1000 live births
Total fertility rate (births per woman)*	1.8	5.3
Combined gross enrolment ratio in education*	101.4 %	56.5%
Adult literacy rate (% aged 15 and above)*	99.0	65.0
Gross Domestic Product (GDP)*	34 526 US dollars	1 334 US dollars
Government expenditure on health per capita*	1,940 US dollars	36 US dollars
Ratio of the richest 10% to the poorest 10%*	5.6	16.1
Official language	Finnish and Swedish	English
Tobacco cultivation	N/A	Yes
Raw Tobacco	N/A	2700 tons

*Source: Human Development Reports 2009, UNDP

5.2 Study population and data collection

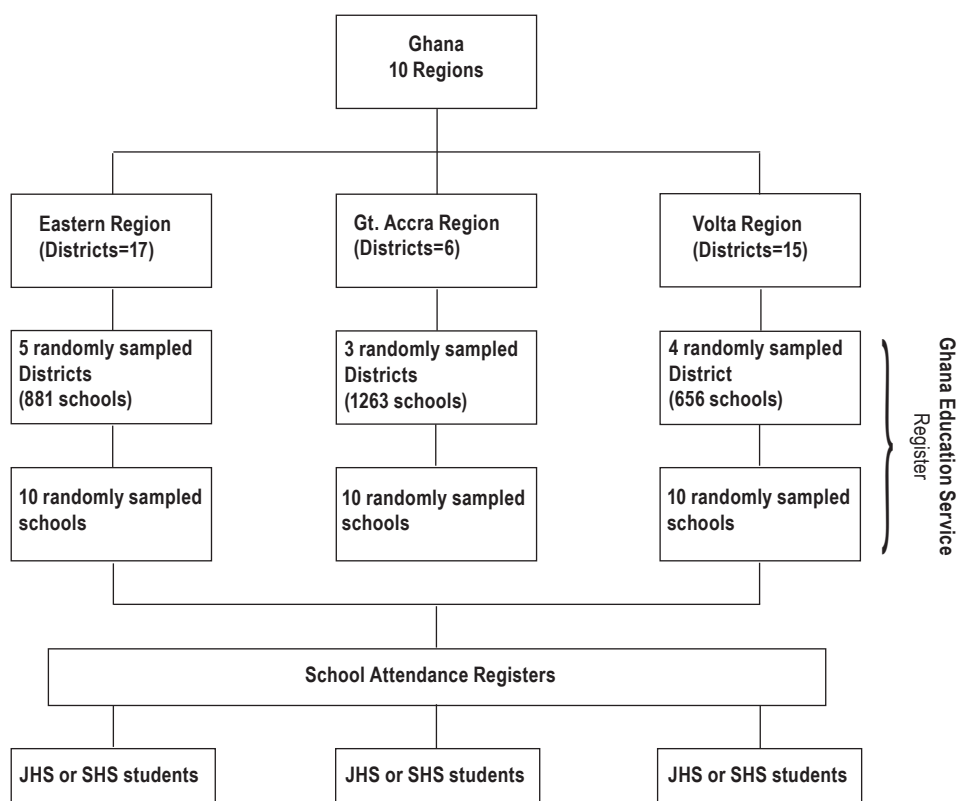
5.2.1 Ghana Adolescent Health and Lifestyle Survey (Studies I–III)

A cross-sectional survey was conducted in 2008 on health behaviours and lifestyles among adolescents in schools as well as in a sample of those not in schools in three of out the ten administrative regions in Ghana (Table 4). The three regions are located in two of the three zones in Ghana. Thirty schools were randomly sampled, ten per region, from Eastern, Greater Accra and Volta Regions. The Ghana Education Service's School Health Programme register of schools in the country was the source used in sampling the schools. The schools were selected so that they comprised of four public Junior High Schools, two private Junior High Schools, three public Senior High Schools and one private Senior High School in each region in order to reflect the school types in Ghana. All students whose names were found in the class attendance registers of the randomly selected classes were eligible to participate in the survey. Figure 6 shows a flow chart of the data sampling procedure. The eight page questionnaire was anonymous and self-administered and was tested with an initial pilot sample of 50 children in three schools. It was designed to exclude any information that would reveal the identity of the participants. One trained supervisor was assigned to each classroom during the filling of the questionnaire. The survey commenced simultaneously in all the participating classes in a given school. Participants were asked to drop their questionnaires in an envelope placed in front of the class on completion. Only one pupil denied answering. The study

protocol was approved by the ethical committee of the Ghana Health Service Research Unit in Accra, Ghana.

TABLE 4. Frequency and percentage distribution of the Ghanaian respondents by school and region

Schools	All pupils	Boys	Girls	Mean age (years)
Private Junior High School	188 (15.6)	85 (17.1)	95 (14.7)	14.1
Public Junior High School	471 (39.4)	248 (49.8)	203 (30.8)	15.3
Private Senior High School	101 (8.5)	36 (7.2)	62 (9.4)	17.0
Public Senior High School	437 (36.6)	129 (25.9)	297 (45.1)	16.8
Total	1195	498	659	
Regions				
Eastern	400 (33.5)	172 (34.5)	217 (32.9)	15.4
Greater Accra	443 (37.1)	183 (36.7)	247 (37.5)	15.6
Volta	352 (29.5)	143 (28.7)	195 (29.6)	16.4
Total	1195	498	659	



JHS=Junior High School

SHS=Senior High School

FIGURE 6. A flow chart of data sampling procedure for the school data collection in Ghana

In one of the schools, the junior high school was not in session. When we enquired, we were told the teachers all of whom lived in the next town were not in school because the trotros (local name for public transport) did not run their route on that day. The primary six pupils (N=23), they were supposed to be in junior high school the following school term, were sampled in place of the junior high school students. However, the responses of these schools were not different from the others, and hence they were included in the analyses. For simplicity, these respondents have been added to the junior high school respondents.

Out of the 1566 respondents who completed the questionnaires, only students aged 12–18-year-old (N=1195) were included in Study I while only students aged 13–18-year-old (N=1165) were included in Studies II and III.

The structure of the student sample was as follows: 41.5% (483) boys and 55.3% (644) girls while 312 did not indicate their gender. The mean ages for boys and girls were 15.8 years and 15.9 years, respectively. The response rate for the students' sample was 89.7% (the sample was based on academic year's register of pupils).

5.2.2 Adolescent Health and Lifestyle Survey AHLS (Study IV)

The data were collected as part of a national monitoring system on adolescent health and health behaviours, the Adolescent Health and Lifestyle Survey (AHLS). The survey instrument consists of a 12-page self-administered questionnaire mailed biennially since 1977 to nationally representative independent samples of adolescents aged 12, 14, 16 and 18 with two reminders to non-respondents (N=2,832–6,503; response rate 88–59%, total respondents N=96,747, Table 5), except that in 2007 a third reminder was sent to non-respondents with the expectation of securing more responses. The samples were selected so that the average ages of respondents were 12.6, 14.6, 16.6 and 18.6 years. The Finnish Population Register Centre was the source of the samples. The data were collected from February to April of each study year. The data collection methods, timing of the survey and questions were maintained as similar as possible to enhance the comparability of the results between study years. The Ethical Committees of the Department of Public Health at the University of Helsinki and the Pirkanmaa Hospital District, Finland, approved the study protocol.

In this Study (IV), the study years were categorised into four periods: 1977–83, 1985–89, 1991–99 and 2001–2007 according to the changes in smoking prevalences (decreasing, increasing, stable and decreasing, respectively) in the Finnish adolescent population (Rimpelä et al. 2006) in order to investigate whether such changes could also be found by socioeconomic status. The response rates have been declining over the years, particularly among boys. Table 5 shows the number of respondents and response rates (%) according to age, gender and the survey year.

TABLE 5. Number of respondents and response rates in the Adolescent Health and Lifestyle Surveys in 1977–2007, by gender and age

Age and gender	Year															
	1977	1979	1981	1983	1985	1987	1989	1991	1993	1995	1997	1999	2001	2003	2005	2007
Number of respondents																
Boys																
12	369	491	483	450	353	414	406	426	399	395	427	442	351	368	395	298
14	345	565	488	429	395	1128	361	1196	1203	1177	1168	1186	1251	1092	1092	912
16	386	528	535	413	452	1183	362	1008	1168	1232	1126	1110	892	1003	806	677
18	347	523	519	489	401	1134	328	893	1029	1071	1088	1112	774	570	681	580
Total	1447	2107	2025	1781	1601	3859	1457	3523	3799	3875	3809	3850	3268	3033	2974	2467
Girls																
12	341	540	514	440	359	367	430	399	437	424	440	407	425	390	418	344
14	367	535	548	482	433	1202	431	1337	1299	1301	1347	1315	1485	1245	1189	1115
16	347	579	529	509	497	1284	380	1272	1389	1469	1379	1332	1138	1296	985	1002
18	330	512	524	509	463	1401	407	1103	1265	1313	1415	1315	976	797	937	912
Total	1385	2166	2115	1940	1752	4254	1648	4111	4390	4507	4581	4369	4024	3728	3529	3373
Grand total	2832	4273	4140	3721	3353	8113	3105	7634	8189	8382	8390	8219	7292	6761	6503	5840
Response rates																
Boys																
12	90	88	88	85	80	81	76	77	73	78	76	79	72	69	67	56
14	88	86	87	78	74	81	75	74	74	75	69	74	66	66	64	57
16	85	83	85	75	76	77	70	68	70	72	68	68	62	59	57	49
18	83	78	81	75	68	69	63	61	66	67	60	63	53	50	49	41
Total	86	83	85	78	74	76	71	69	70	72	67	69	62	60	58	50
Girls																
12	91	90	92	91	84	83	82	82	84	86	87	85	82	75	75	71
14	94	91	92	86	88	90	90	86	86	85	84	85	79	78	75	73
16	89	91	91	91	87	89	82	86	87	88	87	85	82	79	76	73
18	88	85	88	87	83	84	80	82	83	86	83	80	76	74	68	70
Total	91	89	91	89	86	87	84	84	85	86	85	83	79	77	73	72
Grand total	88	86	88	83	80	81	77	77	78	79	79	76	70	69	66	61

5.3 Measurements (Ghana data, studies I–III)

5.3.1 Measurement of adolescent tobacco use

Smoking was assessed by the question, “Have you ever tried cigarettes or any other tobacco product?” The response options were “No” and “Yes, which?” In studies I and III smokers were adolescents who responded “yes” to this question (excluding those who mentioned a smokeless tobacco product).

Tawa (traditional smokeless tobacco) use was assessed by the question, “Have you ever tried snuff (tawa) and how many times altogether?” The response options were, “No”, “Yes, I have tried once”, “I have used snuff 2-50 times”, “I have used snuff more than 50 times”. In studies I and III, tawa users were those who chose any of these responses other than “No”.

Both outcomes of tobacco use were dichotomous.

5.3.2 Measurement of socioeconomic factors

5.3.2.1 *Familial SES*

Material affluence scale

A material affluence scale (MAS) of five categories (poorest, poor, average, affluent and most affluent) developed in Study I was used. Nine items (own bedroom, electricity at home, ownership of television, computer, fridge, car, radio and house, and types of house) were used in the construction of MAS from an initiation screening of 21 items which covered three aspects of material circumstances: household assets (own bedroom, electricity at home, ownership of television, computer, fridge, car, radio and house) and housing characteristics (types of house and overcrowding), other assets (ownership of cocoa farm, store/shop, oil palm farm/plantation, mango farm, more than ten cattle/ sheep/goats and corn mill machine/tractor and factory), and school related indicators (working, other than doing household chores, in the morning before doing to school and after school, having a private teacher, siblings not at school). The items of the scales are meant to envelop the key aspects of wealth as well as the material circumstances of the family. Material affluence epitomises the lack or availability of the resources and goods necessary for decent living in relation to what is generally available in the society (Townsend 1987).

Family structure

Family structure was measured in four categories (nuclear family, both parents alive but not living together, only one parent alive, or both parents dead). Family structure was categorized as nuclear family (parents alive and living together) and

non-nuclear family (all other family types) in the analyses (Study III). Adolescents living in a family other than where both parents were alive and living together were regarded as socially disadvantaged.

Parental education and occupation

Father's, mother's or other guardian's highest level of education were categorised into illiterate, basic education, secondary education and tertiary education according to the classification of the Ghanaian educational system (Ghana Education Service and Ministry of Education, Ghana 2008).

Parental occupational status was measured by respondents reporting their father's, mother's, or other guardian's occupation or employment status. These were categorised in grades A (chief in rank), B (professional and managerial), C (professional non managerial), D (skilled manual), E (unskilled manual) and unemployed according to grades in the Ghana Civil Service (Head of Civil Service 2000). None of the respondents fell into the A category. We stratified grades B and C as high grade and grades D, E and unemployed as low grade in the analysis (Studies II and III).

5.3.2.2 The adolescent's individual social position

School performance

Adolescents indicated their school performance in the previous end of term examination. These were coded into three categories high (excellent, very good), middle (good), and low (average, poor) (Study III).

Plans after graduation

Adolescents indicated their plans after graduation from the current level of schooling (continue schooling, learn a trade, look for job and not sure). These were categorised as continue schooling and not continue schooling (learn a trade, look for job or not sure) (Study III).

5.3.2.3 Predicted inter-generational social mobility

In addition to familial and individual social positions SES measures, two measures of inter-generational social mobility (upward mobility, stable high, stable low and downward mobility) were used. These proxy measures of adolescents' social mobility were applied to explore their tobacco use behaviours in relation to their transition between familial (original) SES in childhood and individual (achieved) social position in adulthood. Two combinations of social class of origin (measured by MAS and father's education) and achieved social position (measured by plans after graduation) were computed. These are referred to in this study as mobility 1 and 2, respectively.

Mobility 1: MAS was categorised into High (3=top 20%), Medium (2=next 40%) and Low (1=lowest 40%) while plans after graduation was categorised as continue schooling (1) and not continue schooling (0). Adolescents were classified as socially stable in the low SES (stable in low SES), if MAS=1 and Plans after graduation=0. And if MAS=2 and Plans after graduation=1 or if MAS=3 and Plans after graduation=1, they were classified as socially stable in the high SES (stable in high SES). Adolescents were classified as upwardly mobile, if MAS=1 and Plans after graduation=1. Adolescents were classified as downwardly mobile, if MAS=2 and Plans after graduation=0 or if MAS=3 and Plans after graduation=0.

Mobility 2: Father's education was categorised into High (3=tertiary education), Middle (2=secondary education) and Low (1=illiterate or primary education). Adolescents were classified as socially stable in the low SES (stable in low SES), if father's education = 1 and Plans after graduation = 0. And if father's education = 2 and Plans after graduation = 1 or if father's education = 3 and Plans after graduation = 1, they were classified as socially in the high SES (stable in high SES). Adolescents were classified as upwardly mobile, if father's education=1 and Plans after graduation = 1. Adolescents were classified as downwardly mobile, if father's education = 2 and Plans after graduation = 0 or if father's education = 3 and Plans after graduation = 0.

In both mobility 1 and mobility 2, adolescents who remained in the lower SES of origin (stable low) are referred to as having cumulative socioeconomic disadvantage.

5.3.3 Measures of tobacco promoting and restraining factors

In Study II, tobacco promoting and restraining factors were used to describe broadly the environmental and familial factors as well as adolescents' knowledge of and attitude towards tobacco use (Study II).

Environmental and familial tobacco promoting and restraining factors

Smoking on school compound was assessed by respondents responding, "yes", "no" or "I don't know" regarding whether smoking was allowed on their school compound. *Taught the harmful effects of smoking at school* was assessed by respondents answering, "yes", "no" or "I don't know" concerning whether adolescents were taught the harmful effects of smoking in school during the present school year. *Taught the harmful effects of smoking at home* was assessed by respondents answering, "yes" or "no" regarding whether any family member had discussed the harmful effects of smoking with them. *Refused cigarette sale due to age* was measured by responding, "yes", or "no" regarding whether or not they had ever been refused cigarette sale due to their age. *Exposure to tobacco advertisement* was measured by respondents indicating whether they had seen any tobacco advertisement during the past one month from the following options: billboard, cigarette car/van, newspaper, television, internet/

email or other sources. *Sources of tobacco products* were measured by respondents indicating from which sources they had acquired tobacco products. The response options were, “I bought by self”, “I gave money to someone else to buy it for me”, “I got it from friends”, “I got it from home”, “I stole it or got it from other sources”. The first two options were classified as commercial sources.

Indicators of knowledge of and attitude towards tobacco use

Adolescents indicated whether they completely agreed, slightly agreed, completely disagreed, slightly disagreed or were not sure with the following statements: “Smoking is harmful to one’s health”; “Tobacco products should not be sold to those under 18 years of age” and “Smoking is difficult to quit once started”. The responses were categorised as “agree” and “disagree/not sure”.

5.3.4 Other measurements

Parental smoking

Parental smoking was inquired in two separate questions in which adolescents were asked to indicate whether their fathers or mothers smoked at present, had never smoked, had smoked but had stopped, whether they couldn’t say anything about parental smoking or had no father or mother. Parental smoking was classified into three categories: “none”, “can’t say” and “one or both parents smoke” in Study II while in Study III, dichotomous (never vs. ever/current smokers) variables were made separately for maternal and paternal smoking.

Level of urbanisation

Level of urbanisation was based on the location of the schools so that schools located in the regional and district capitals were categorised as urban and all others as rural.

Religion

Religion was assessed by the question “Which religious denomination do you belong to?” The response options were, “Christian”, “Muslim”, “Traditional belief and” “Other, what? ____”. Christianity, Islamic and Traditional belief (the belief in lesser gods) are three main religious beliefs practiced in Ghana.

5.4 Measurements (Finnish data, Study IV)

5.4.1 Measurement of adolescent tobacco use

In Study IV, because there were differences in the prevalences of smoking between 12–14-year-olds and 16–18-year-olds, the analyses were performed separately for these age groups. Among 12–14-year-olds, smokers were those who had smoked two or more cigarettes in their lifetime. For 16–18-year-olds, smokers were those who reported having smoked more than 50 cigarettes in their lifetime, had smoked during the past week and smoked daily. The outcome was dichotomous.

5.4.2 Measurement of socioeconomic factors

5.4.2.1 *Familial SES*

Family structure

Family structure was assessed with a question regarding whether respondents lived with both parents (intact family) or not (non-intact family) (Study IV).

Father's occupation

Father's/guardian's occupation was classified into four categories: upper white-collar, lower white-collar, farmers (agriculture and forestry workers), and blue collar, based on the classification of Statistics Finland (Tilastokeskus 1989).

Father's and mother's education

Indicators of parents' educational level were classified as low (9 years or less of education), middle (9–12 years), and high (over 12 years). Father's and mother's educational levels were analysed separately. Mother's education was measured only in 1995 and from 1999 onwards (Stud IV).

5.4.2.2 *The adolescent's individual social position*

An adolescent's individual social position was measured by his/her school performance and school career.

School performance

Self-reported school performance (measured only for 12–14-year-olds) was based on the respondent's assessment of school performance in the previous end-of term report compared with the class average and classified accordingly as much better, slightly better, average, and poorer than average (Study IV).

School career

The adolescent's school career (measured only for 16–18-year-olds) was categorized as not in school, in vocational school/poor or average school performance, in vocational school/good performance, in high school/poor or average performance, and in high school/good performance (Study IV).

5.5 Statistical methods

Principal component analysis (Study II) and logistic regression analysis (Studies I–IV) were the main statistical techniques for the study. In addition, associations between variables were tested using Chi-square tests and Spearman correlation coefficients while the Cronbach's alpha coefficient was computed to assess the internal consistency reliability of the material affluence scale in Study II. Statistical analyses were done using the Statistical Package for Social Sciences (SPSS), version 16 (SPSS Inc, Chicago, Illinois). In all analyses, the level for statistical significance was set at $p < 0.05$.

5.5.1 Principal component analysis (Study I)

Principal component analysis (PCA) was used to construct a material affluence scale (MAS). The PCA was employed to determine the weight of each item on the material affluence scale. PCA is a multivariate statistical technique which is capable of reducing a set of variables in a data set into a smaller number of dimensions. It describes the variation of a set of variables as a set of linear combinations of the original variables, so that successive linear combinations which explain most of the variation in the original data are extracted (Pett et al. 2003; Pallant 2007).

In constructing the scale, the indicators with extremely low ownership in the study population (rural, urban or region) were excluded. When these items were included the Cronbach's alpha was below 0.5 and Kaiser-Meyer-Oiklin measure of sampling adequacy was less than the recommended 0.6, indicating non-internal consistency of the indicators meaning that they cannot be on a summated scale. Initial screening of the remaining material affluence indicators was done as follows. Items with communality less than 0.3 were excluded (Pett et al. 2003; Pallant 2007). Next, those with extremely low inter-item correlation, < 0.1 , with all the indicators on the scale were also excluded (Pett et al. 2003; Pallant 2007). After the initial screening of the indicators, the material affluence scale was constructed from the nine indicators (block house, house ownership, adolescent own bedrooms, electricity, fridge/freezer, television, radio, computer and car) which were retained in the final PCA model.

All the nine indicators showed positive scores indicating that their ownership constitutes wealth in the study population similar to those found in earlier studies (e.g. Sahn and Stifel 2003). The Cronbach's alpha value for the nine indicators that were retained was 0.622, demonstrating internal consistency of the indicators and justifying their use in a summated scale.

The first principal component extracted which summaries the highest latent structure common to all the indicators (Houweling et al. 2003) was considered as the scale. It was divided into quintiles to categorise adolescents into material affluence groups. Alternatively, others have used cut-off points of: the lowest 40% classified as poor, the highest 20% as rich and the rest as middle group (e.g. Gwatkin et al 2000; Filmer and Pritchett 2001). As both methods are arbitrary and similar, the use of the latter would not have altered the relationship between MAS and any of the outcomes. A robustness test confirmed this.

5.5.2 Logistic regression analysis (Studies I–IV)

Logistic regression analysis was used for univariate and multivariate analyses of the associations between parental SES, MAS and key health and health behaviour indicators (Study II), the associations between tobacco promoting/restraining factors and tobacco use (Study I), the associations between the socioeconomic indicators and tobacco use (Study III), and the associations between socioeconomic indicators and the changes in the prevalence of smoking over time separately for each gender and age group, 12–14-year-olds and 16–18-year-olds (Studies III and IV). Interactions between the indicators were tested as follows: In Study I, age-and-gender interaction between tobacco promoting/restraining factors and in Study III, age-and-gender interactions between socioeconomic indicators and in Study IV, interaction between socioeconomic indicators and the study period. The results of the logistic regression models are presented as odds ratios (OR) with 95% confidence intervals (CI).

5.5.3 Validity, reliability and representativeness of the data sets

Test-retest analysis of the AHLS data

A repeatability study on the Adolescent Health and Lifestyle Survey (AHLS) was conducted in 2001 to ascertain the reliability of the responses to the questionnaire as follows (Rainio et al. 2008): after the initial main survey, the same questionnaire was sent to a sub sample of 400 14-year-old adolescents. Of these 254 returned their responses. Analyses of the key variables showed very good reliability. The estimate for the Cohen's kappa coefficient (Cohen 1960) for the smoking variables were;

experimental smoking (0.75), daily smoking (0.77), maternal smoking (0.81) and paternal smoking (0.77).

Analyses of non respondents

Apart from the repeatability study, analyses of the non respondents in the AHLS data have been conducted (Rainio et al. 2009a). Three groups of respondents were identified based on whether they returned the initial questionnaire, the first re-inquiry or the second re-inquiry. In general, the probability of a child being an experimental or daily smoker increased with increased delay in returning the questionnaire. In a similar way, it was found that the probability of a respondent having smoking parents increased with increasing delay in returning the questionnaire. Therefore the prevalence of smoking is likely to be slightly under-estimated.

A convenience sample of non-students in the Ghanaian survey

Although the Ghanaian study was mainly conducted in schools, to ensure generalisability of the findings to the entire adolescent population, in addition to the student sample (N=1439), the questionnaire was administered to a convenience sample of non-students (N=127) in the capital city of Accra. Analysis of the responses of the key variables in this non-student group yielded largely a similar pattern of responses in comparison to their student counterparts. The prevalence of smoking in the non-student sample was 7.3% and that of tawa (smokeless tobacco) use was 3.6%, compared to 6.6% and 5.7 of smoking and tawa use, respectively in the students' sample.

6 Summary of the Results

6.1 Prevalence of tobacco use among Ghanaian and Finnish adolescents

The overall prevalence of tobacco use (smoking or tawa use or both) among Ghanaian adolescents was 9.1%. Boys had higher prevalence (11.5%) than girls 6.4%. The prevalence of smoking was 6.6% (boys 8.0%, girls 4.7%) and of tawa use it was 5.7%, comprising 7.3% boys and 3.9% girls. Among tobacco users, 43.9% both smoked and used tawa. No statistically significant differences were found in the prevalence of tobacco use by age (13–15-year-olds vs. 16–18-year-olds) or level of urbanisation (rural vs. urban).

TABLE 6. Prevalence (%) of smoking and tawa use among Ghanaian adolescents by demographic characteristics

	Smoking	Tawa use
Age (in years)		
13	6.0	6.7
14	6.0	4.6
15	9.2	8.0
16	4.5	5.8
17	4.2	3.4
18	10.0	6.2
13–15-year-old	7.5	6.6
16–18-year-old	6.0	5.1
Gender		
Boys	8.0	7.3
Girls	4.7	3.9
Level of Urbanisation		
Rural	7.0	6.3
Urban	5.9	4.7
Region		
Eastern	5.1	6.2
Greater Accra	5.9	4.7
Volta	9.2	6.4

The prevalences of daily smoking among Finnish adolescents by age and gender are presented in Figure 7.

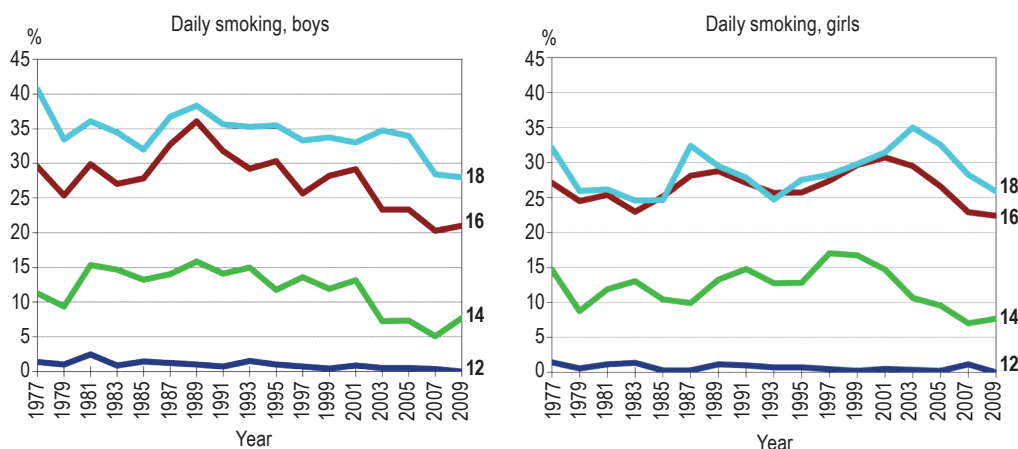


FIGURE 7. The prevalence of daily smoking among 12–18-year-old Finnish adolescents from 1977 to 2009 by age and gender reported in the Adolescent Health and Lifestyle Survey

6.2 Exposure to tobacco promoting and restraining factors in Ghana (Study I)

Study I investigated tobacco use and exposure to individual and environmental tobacco promoting and restraining factors namely: the sources of tobacco products, exposure to tobacco advertisement, ban on smoking in schools, knowledge of the health effect of smoking, parental smoking, and how these factors relate to smoking and tawa use among Ghanaian adolescents.

6.2.1 Exposure to tobacco promoting and restraining factors

Of adolescents who tried purchasing tobacco products, 53% of them were not prevented because of their age. Only 4% reported that smoking was allowed on their school compounds. Sixty-six percent were taught in school about the harmful effects of smoking. Adolescents were exposed to tobacco advertisement through television (26%), newspaper (23%), cigarette car/van (13%), billboard (11%), internet/email (6%) and other sources (4%) (Study I, Figure 2) and 53% were exposed to at least one kind of advertisement. Sources of tobacco products among those who had ever tried smoking were commercial sources (70%), friends (56%), home (20%), stolen (20%) and other sources (24%). What's more, 83% of adolescents perceived smoking as harmful to one's health, 72% perceived that smoking is difficult to quit, 81% believed that tobacco products should not be sold to minors.

6.2.2 Tobacco promoting and restraining factors explaining tobacco use

Multivariate analyses, adjusted for each environmental and familial factor revealed that, allowing smoking on school compound, not having been taught the harmful effects of smoking, exposure to tobacco advertisement, and parental smoking increased the probability of tobacco use. Similarly, perception that smoking is difficult to quit and an attitude that tobacco products should not be sold to minors independently predicted smoking and tawa use, respectively, after adjusting for age, gender, environmental and familial as well as the individual factors (Table 7; see also Study I Tables 2 and 3). There were no statistically significant differences in both the environmental and familial factors and the individual factors affecting tobacco use by level of urbanization, region nor religion.

TABLE 7. Odds ratios (OR) and 95% confidence intervals (CI) for tawa use and smoking by environmental and familial, and individual tobacco promoting/restraining factors among Ghanaian adolescents. Multivariate analysis.

Tobacco promoting /restraining factors	Tawa use OR (95% CI)	Smoking OR (95% CI)
Environmental and familial factors+		
<i>Smoking allowed on school compound</i>		
No	1.0	1.0
Yes	5.1 (2.1-12.4)	3.7 (1.3-10.6)
Don't know	6.8 (2.9-16.0)	1.9 (0.5-6.7)
<i>Taught harmful effects of smoking in school during present school year</i>		
Yes	1.0	1.0
No/Not sure	2.5 (1.4-4.4)	2.0 (1.1-3.8)
<i>Exposure to advertisement</i>		
No	1.0	1.0
Yes	2.2 (1.2-4.1)	2.0 (1.1-3.5)
<i>Parental smoking</i>		
None	1.0	1.0
Can't say	1.6 (0.3-8.5)	5.7 (1.6-20.4)
One or both parents smoke	4.5 (1.5-13.7)	2.3 (0.7-7.6)
Individual factors++		
<i>Perceive smoking as harmful to health</i>		
Agree	1.0	*
Disagree	1.8 (0.9-3.8)	
<i>It is difficult to quit smoking, once started</i>		
Agree	*	1.0
Disagree/not sure		3.7 (1.7-7.6)
<i>Tobacco should not be sold to those under 18 yrs of age</i>		
Agree	1.0	*
Disagree/not sure	2.6 (1.3-5.3)	

+ Environmental and familial factors+age + gender

++ Individual factors+age + gender + environmental and familial factors

*Not included in the multivariate model because it was not statistically significant in the univariate model

6.3 The development of material affluence scale (MAS) (Study II)

Study II has triadic aims namely to: (i) develop a material affluence scale (MAS) for measuring adolescents' SES in health inequality research in developing countries, (ii) examine the relationship between MAS and parental SES measures (parental occupation and education), and (iii) examine the external validity of MAS by evaluating its sensitivity in predicting key health and health behaviour indicators in comparison with the parental SES.

A material affluence scale (MAS) was developed using material affluence indicators which represent material living conditions in Ghanaian adolescents' reality. There were higher completion rates for the indicators measuring material affluence compared to those measuring parental SES. This is because adolescents were unable to neither provide their parental education and occupation nor give sufficient information on these indicators that could enable classifying them into the appropriate categories. In addition, sometimes no information on these indicators was provided by them.

Principal component analysis (PCA) was used to reduce eighteen (after an initial screening of twenty-one indicators) material affluence indicators to nine to construct the MAS. The PCA extracted three components summarising the underlying structure of the material affluence indicators. The first, second and third eigenvalues were 2.59, 1.42 and 1.11 respectively. The Kaiser-Meyer-Oiklin value was 0.727, exceeding the recommended value of 0.6 and the Bartlett's Test of Sphericity reached statistical significance ($p < 0.001$). As the first principal component summaries the largest amount of information common to all the indicators, it was assumed to be the measure of material affluence.

The first principal component was stratified into quintiles based on principal component scores and consequently adolescents were classified as poorest, poor, average, affluent and most affluent in accordance with their material circumstances (Figure 8). Additionally, material affluence scale (MAS) constructed has adequate internal coherence ($\alpha = 0.622$) and modestly correlates with the parental SES (maternal education $r = 0.32$, paternal education $r = 0.36$, maternal occupation $r = 0.17$ and paternal occupation $r = 0.29$, all at $p < 0.001$). The scale explained 14% of the variance in the parental SES when all the four parental SES indicators were combined ($r = 0.39$, $p < 0.001$). MAS and parental SES showed similar pattern of strength and direction of association with key health/health behaviour indicators (Table 8).

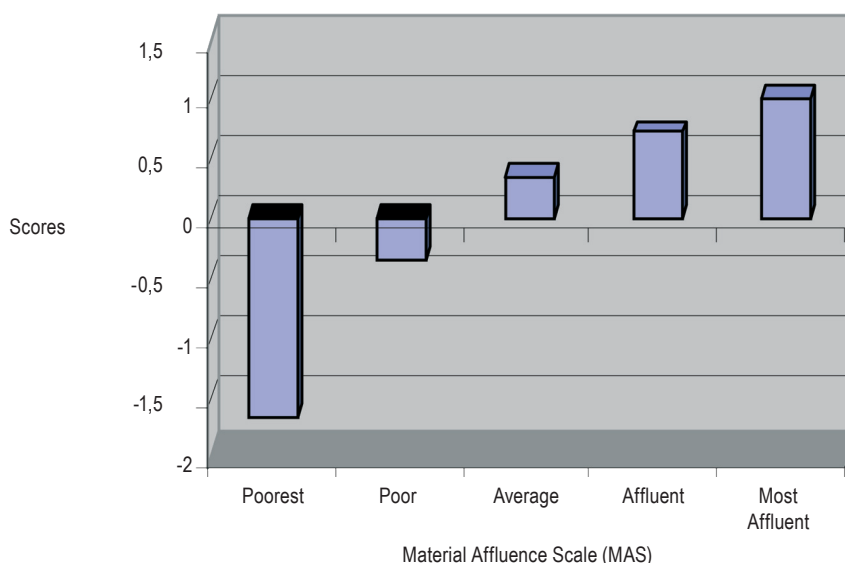


FIGURE 8. Categorisation of adolescents by material affluence groups.

TABLE 8. Statistical significance of the effects of material affluence scale (MAS) and parental socioeconomic status on health/health behaviour measures in logistic regression models

Health/health behaviour indicators	MAS	Parental SES
Self-rated health	+	++
Physical activity	+++	+++
Fruit in-take	ns	ns
Fried food in-take	ns	ns
Teeth brushing	+++	++

MAS and Parental SES p-values adjusted for age and gender. The plus symbol means that the health/health behaviour indicators were associated with high socioeconomic indicator. += $p < 0.05$, ++= $p < 0.01$, +++= $p < 0.001$ and ns=not statistically significant

6.4 Socioeconomic differences in tobacco use among Ghanaian and Finnish adolescents (Studies III and IV)

The aim of Study III was to employ multiple socioeconomic indicators to explore whether socioeconomic differences in tobacco use exist among adolescents in Ghana. Study IV was aimed at investigating the changes in smoking among 12–18-year-old Finns from 1977–2007 using multiple indicators of SES to determine whether differences between socioeconomic groups increased or decreased over time.

6.4.1 Ghanaian and Finnish adolescents' tobacco use by familial socioeconomic status

In Ghanaian adolescents, lower familial SES measured by material affluence scale increased the probability of tawa (smokeless tobacco) use independent of the other SES indicators and parental smoking, but this relationship was not found for smoking. Among the familial SES indicators, family structure was the strongest predictor of smoking with odds ratio of 5.6 (CI 2.1–14.8) for those in the non-intact family structure compared to those in the intact family structure in a multivariate analysis, and tawa use with a corresponding odds ratio of 7.7 (CI 2.7–21.1), (Study III, Table 2). There were no statistically significant associations between tobacco use and mother's education or father's or mother's occupation. Father's education on the other hand was statistically significant at only the univariate analysis level.

There were some age and gender variations in the differences in tobacco use by some of the SES indicators among the Ghanaian adolescents. Family structure and material affluence were associated with tawa use in the same direction for both genders but statistically significantly only for girls. When analysed separately in two age categories, younger adolescents (13–15-year-olds) and older adolescents (16–18-year-olds), the association between MAS and tawa use was statistically significant only among the younger adolescents. The interaction between age, gender and the socioeconomic indicators was not statistically significant.

Among Finnish adolescents, children of lower maternal or paternal educational levels had higher prevalence of smoking compared to those whose parents had higher educational levels. In the same manner, living in a non-intact family predicted higher probability of tobacco use compared to living in an intact family. These associations were found for both genders and in both younger (12–14-year-old) and older (16–18-year-old) adolescents. No clear relation between smoking and an adolescent's father's occupation was found (Study IV, Table 3).

6.4.2 Tobacco use among Ghanaian and Finnish adolescents by individual social position

Among Ghanaian, an adolescent's individual social position measured by plans after graduation strongly predicted smoking with odds ratio of 3.4 (CI 1.6–6.8) for those with plans to continue schooling compared to those without plans to continue, and tawa use correspondingly with odds ratio of 2.7 (CI 1.3–5.6). An adolescent's school performance on the other hand did not yield statistically significant relationships with their smoking or tawa use behaviours (Study III, Table 3). The associations between plans after graduation and both forms of tobacco use were statistically significant only for girls. On the whole, an adolescent's individual social position, measured by plans after graduation, was a stronger predictor of tobacco use than familial SES.

With regards to Finnish adolescents, strong socioeconomic differences in adolescent smoking were found for the two indicators that assessed adolescents' individual social position, school performance and school career. In both cases those in the lower SES groups had a higher prevalence of smoking compared to those in the higher SES groups (Study IV, Table 3).

Among 12–14-year-old Finnish boys, smoking behaviour increased among those whose school performance was poor from 1985–89 to 1991–99, but decreased in the other groups. From 1991–99 to 2001–07, smoking behaviour decreased in all socioeconomic groups, measured by school performance (Figure 9a). For girls, the increase in smoking from 1985–89 to 1991–99 was higher for those whose school performance was poor than for those in the other groups (Figure 9b). From 1991–99 to 2001–07, smoking decreased in all groups, but the rate of the decrease was much slower among those with poor school performance. During the same period (1991–99 to 2001–07), smoking increased among the 16–18-year-old girls who were not in school or who were in vocational school and had poor or average school performance (Figure 9c).

6.4.3 Tobacco use by Ghanaian adolescents' predicted inter-generational social mobility

Apart from SES differences in tobacco use by familial and an adolescent's individual social position, this study found that children expected to end up in adulthood in a lower SES than their families (downwardly mobile) or remaining stable in the low SES were more likely to use tobacco than children who were stable in the higher SES. However, no statistically significant differences in both smoking and tawa use behaviours were found for children who were upwardly mobile in comparison with those stable in the higher SES (Study III, Table 4).

6.4.4 Socioeconomic changes over time in tobacco use among Finnish adolescents

During the period 1999–99 to 2001–07 there were greater decreases in smoking with higher father's education among 12–14-year-old boys and girls (Table 9). No change in smoking behaviour was observed from 1991–99 to 2001–07 among boys aged 16–18 years with a low paternal educational level, whereas among those whose fathers had middle or high levels of education, smoking behaviour decreased during the same period (Table 9). Among 16–18-year-old girls whose fathers had a low education level, smoking behaviour increased from 1991–99 to 2001–07, but little change was observed in the other groups (Table 9).

By mother's education, from 1991–99 to 2001–07, the rate of the decrease in smoking was slower for 12–14-year-old girls whose mothers had low or middle levels of education than for those whose mothers had high levels of education. From 1991–

99 to 2001–07, smoking behaviour increased from 33% to 37% among 16–18-year-old girls whose mothers had a low level of education, but decreased from 29% to 27% and from 22% to 20% for those whose mothers had a middle or high educational level, respectively. In the same period, from 1991–99 to 2001–07, smoking behaviour decreased among 12–14-year-old boys in all occupational groups, including that of farmers (Table 9).

There was a statistically significant interaction between study period and family structure among 16–18-year-old girls. From 1985–89 to 1991–99, smoking behaviour decreased slightly among 16–18-year-old girls living in intact families but not in the non-intact families (Table 9).

TABLE 9. Prevalence of smoking among Finnish adolescents from 1977–83 to 2001–07 for parental socioeconomic status indicators that showed interaction with study period

SES indicator	Boys				Girls			
	1977–83	1985–89	1991–99	2001–07	1977–83	1985–89	1991–99	2001–07
					12–14-year-old			
Father's occupation								
Farmers	30.7	28.3	32.0	27.4				
Blue colour	40.1	37.6	36.9	25.0				
Lower white colour	38.9	36.4	35.8	23.6				
Upper white colour	34.1	34.4	32.1	19.8				
<i>P-value for interaction term*</i>			$p=0.031$					
Father's education								
Primary school	38.1	35.2	37.3	26.1	29.5	31.6	39.5	30.3
Comprehensive school	35.7	35.2	30.6	19.5	28.8	28.6	36.2	22.5
High school	32.8	35.4	31.2	17.9	22.5	26.6	32.8	21.5
<i>P-value for interaction term*</i>			$p<0.001$			$p=0.027$		
Mother's education								
Primary school							40.3	31.4
Comprehensive school							34.6	28.2
High school							35.1	21.6
<i>P-value for interaction term*</i>							$p=0.026$	
					16–18-year-old			
Father's education								
Primary school	32.8	34.9	33.4	33.3	25.9	29.6	28.8	33.6
Comprehensive school	25.8	32.5	30.3	22.0	26.6	26.1	24.3	25.5
High school	23.1	28.4	26.1	19.3	19.2	23.0	22.1	20.7
<i>P-value for interaction term*</i>			$p<0.001$				$p=0.030$	
Mother's education**								
Primary school							30.3	37.3
Comprehensive school							25.7	26.9
High school							24.2	21.0
<i>P-value for interaction term*</i>							$p<0.001$	
Family structure								
Non-intact family					34.9	41.2	40.4	41.4
Intact family					23.0	24.9	22.3	25.1
<i>P-value for interaction term*</i>							$p=0.026$	

*p-value for the interaction term between socioeconomic variables and period

**Mother's education was measured in 1995, and 1999–2007

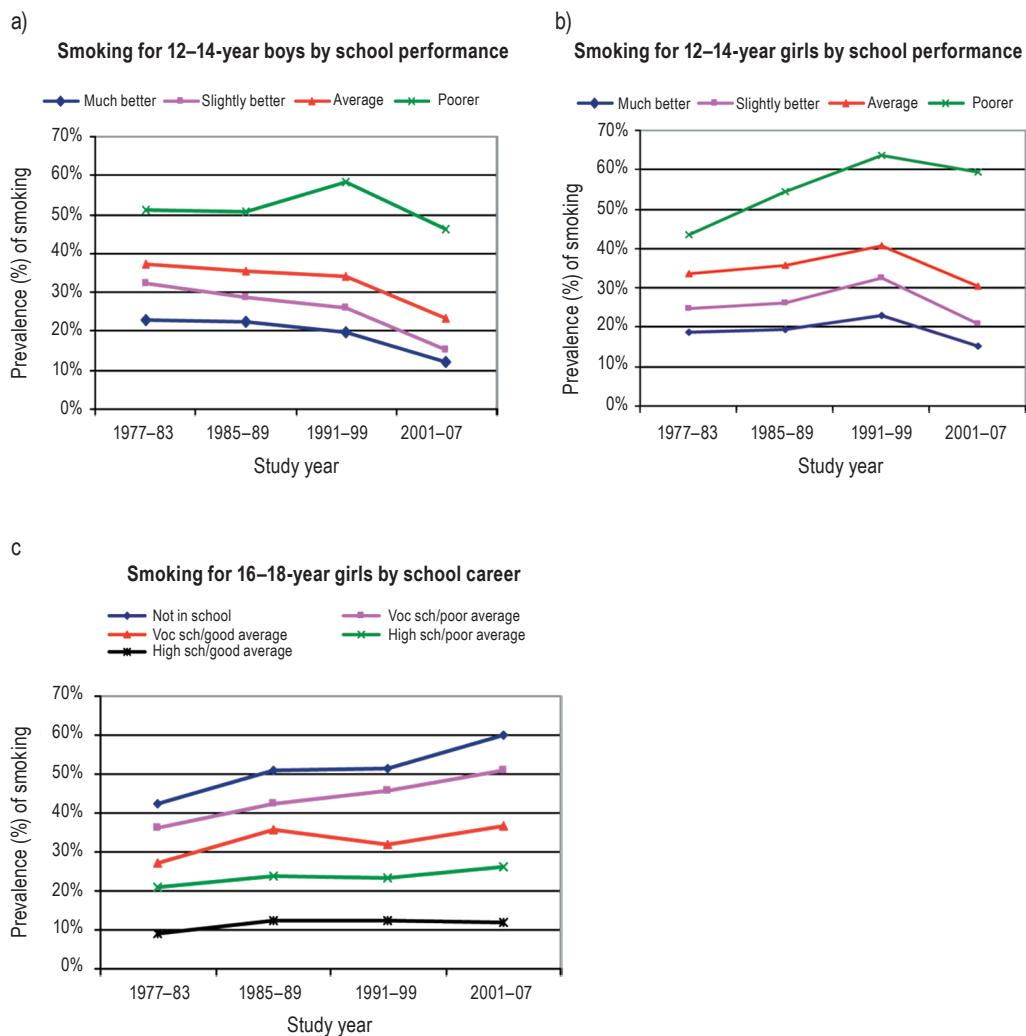


FIGURE 9. Prevalence of smoking from 1977–83 to 2001–07 for personal social position factors that showed interaction with study period

7 Discussion

7.1 Discussion of the main findings

7.1.1 Tobacco use behaviours among Ghanaian and Finnish adolescents

The prevalence of smoking was lower among Ghanaian adolescents compared to their Finnish counterparts. In previous studies, higher prevalence in smoking among adolescents has been reported in most Western countries (Hublet et al. 2006) compared to some developing countries. Especially those in sub-Saharan Africa have shown relatively low prevalence of smoking in particular and tobacco use in general (Townsend et al. 2006).

Ghana is a tobacco cultivating country, and it was therefore expected that tobacco use would be high among adolescents, since tobacco use is usually initiated in adolescence (Tyas and Pederson 1998; Kim et al. 2006; Marshall et al. 2006). Contrary to this expectation, we found that smoking was low though traditional smokeless tobacco use was relatively high. The low smoking prevalence is consistent with previous studies among Ghanaian youth in two schools in the capital city (Adu-Mireku 2003) and in the general population in one region (Owusu-Dabo et al. 2009b). It is however lower than those found in sub-Saharan youth in Zimbabwe, Nigeria and South Africa (Townsend et al. 2006a), in the Middle East (e.g. Siziya et al. 2007) and in most Western countries (e.g. Hublet et al. 2006). Nevertheless, the prevalence was higher than in two Eastern African countries of Uganda and Ethiopia (Mpabulungi and Muula 2000; Rudatsikira et al. 2007).

Tawa, the traditional smokeless tobacco is mostly used by elderly men and women therefore the prevalence in this study can be described as relatively high. No study has examined the socio-cultural context of tawa use in Ghana. Notwithstanding that, this study points to a new evidence that tawa use in Ghana cannot be regarded to be the reserved of the elderly. A recent study has found that smokeless tobacco use is becoming popular among youth in the Republic of Congo (Rudatsikira et al. 2010). It is not clear whether these findings are indications of an induction of a smokeless tobacco “culture” among the youth in the region.

One remarkable difference is the gender disparities in the prevalence of tobacco use between the two countries. Among Ghanaian adolescents, boys had a higher prevalence of both smokeless tobacco use and smoking compared to girls. On the contrary, among Finnish adolescents, gender differences were observed at the beginning of the survey (1977) but currently (2009) the prevalence is similar for both genders, even 18-year-old girls had slightly higher prevalence than boys of the same age. This phenomenon is related to the model of the smoking epidemic in Western countries (Lopez 1994; 1995, see section 7.1.5).

The gender differences between Ghanaian and Finnish adolescents is likely to reflect the gender disparities in tobacco use between Western and non-Western societies. In most Western countries where smoking has been declining in the past few decades, the decline is faster among boys than girls and in some cases it occurs only in boys (Hublet et al. 2006; Rimpelä et al. 2007). This may account for the narrowing gender differences. The higher prevalence of tobacco use among boys in non-Western countries could also be explained by the masculinity associated with tobacco use and consequently the likelihood of more societal tolerance for male tobacco use as opposed to female tobacco use in such regions (Barzani 2005; Aras et al. 2007). On the other hand, recent evidence shows that in some non-Western countries, particularly in Asia, there is rising incidence of tobacco use among girls thus narrowing the gender differences (Global Youth Tobacco Collaborating Group 2003; Talay and Altin 2008).

Similar to Finnish adolescents, among Ghanaian adolescents the probability of smoking increases with age. This is consistent with earlier studies (Kim et al. 2006; Townsend et al. 2006a; Marshall et al. 2006; Rainio et al. 2009). Previous studies found that the probability of cessation among adolescents is inversely related to the age at initiation (Combs et al. 1992; Breslau and Peterson 1996). Earlier report found that among Finnish adolescents the age of initiation of tobacco use is deferred to a later age (Rainio et al. 2009). No detailed study was found in the literature that has investigated how age relates to tobacco use in Ghana or in any sub-Saharan African country. Further studies that would unravel the context relating to the relationship between age and adolescent tobacco use in Ghana would inform tobacco control intervention.

7.1.2 Tobacco promoting and restraining factors and tobacco use

There were high exposures of various forms of tobacco advertisement, and the probability of tobacco use increased among those exposed to tobacco advertisement, in agreement with previous studies in Western countries (Lovato et al. 2003; Hanewinkel et al. 2010). The pathways through which tobacco advertisement affects adolescent tobacco use still remain unclear. It has been suggested that adverts may

exert normative influence on adolescent smoking behaviour (Wakefield et al. 2003). About half of those who tried to purchase tobacco products were refused due to their age, but social sources were the most common sources of acquisition of tobacco products. Social sources is known to increase the supply and demand of cigarettes among adolescents (Rainio and Rimpelä 2009; Richardson et al. 2009).

Ghana was one of the few sub-Saharan African countries that first ratified the framework convention on tobacco control (FCTC) in 2005 (WHO 2005). However, the high exposure of tobacco advertisement as well as the relatively high number of those who purchased tobacco products without age restriction suggests that even though Ghana agreed in principle to the recommendations of the FCTC, the implementation is still lacking. It is possible that similar scenarios exist in other developing countries, especially those in sub-Saharan Africa.

One striking finding was that smoking was banned in the majority of schools. There is no evidence of any documented tobacco control legislation in Ghana (Wellington et al. 2010), nonetheless it seems that some societal forces in the form of norms, values and culture prohibit and discourage smoking in schools, access to tobacco products and consequently tobacco use among adolescents. Despite that smoking was banned in the majority of schools, those who attended schools where smoking was not banned had an increased likelihood of tobacco use than those in non-smoking schools. Elsewhere too, it has been found that adolescents in schools with non-existence of smoking bans or regulations have an increased risk of being smokers (Wakefield et al. 2000; Aveyard et al. 2004; Piontek et al. 2008). The role modelling effects have been cited as the likely explanation for this relationship (Bandura 1986). Altogether, there seem to be some attempts to influence adolescent smoking and they seem to have an impact.

Parental smoking has been documented to increase smoking behaviours among their children (Tyas and Pederson 1998; Turner et al. 2004; Schepis and Rao 2005; Gilman et al. 2009; Rainio and Rimpelä 2009). The present study supports this evidence and extends it further that, not only smoking but also tawa use is predicted by parental smoking. Besides the role modelling plausibility of the impact of parental smoking on adolescent smoking, children with smoking parents may not only consider the behaviour as a norm but may also have access to cigarettes at home and thus be more likely to initiate and maintain the behaviour compared with those with non-smoking parents.

Awareness of the harmful effects of tobacco use, having been taught the harmful effects of smoking in school and attitude that tobacco products should not be sold to minors all independently decreased the risk of both smoking and tawa use among Ghanaian adolescents. This suggests that in Ghana health promotion in schools is likely to be effective in preventing the youth from the emerging tobacco epidemic.

Several review studies from Western countries (e.g. Tyas and Pederson 1998; Turner et al. 2004; Schepis and Rao 2005) have also found similar pattern of the relationship between tobacco use and environmental (e.g. tobacco advertising and parental smoking) and individual factors (e.g. attitude towards and knowledge of tobacco use) as found in this dissertation. On the whole, therefore, the findings in this study indicate that the risk factors relating to adolescent tobacco use are the same in both Western and non-Western countries hence adolescent tobacco prevention strategies that have been successful in Western countries can be adopted in developing countries.

7.1.3 MAS as a measure of adolescents' SES in health inequality research

7.1.3.1 Response rate for material affluence indicators compared to traditional indicators

Principal component analysis (CPA) was used to construct material affluence scale (MAS) from a variety of indicators that describe the overall material circumstance of adolescents, especially those in developing countries, based on Townsend's (1987) theory of material deprivation. The nature of indicators used also ensured higher numbers of responses from adolescents as they represent reality at that stage of life. Similar indicators have been used to assess adolescents' SES (Currie et al. 1997; Molcho et al. 2007). Consequently, there were lower missing responses for MAS indicators compared to the traditional indicators of parental education and occupation. This concurs with previous evidence that adolescents have difficulties in providing information on the traditional indicators (Currie et al. 1997; Wardle et al. 2004; Molcho et al. 2007; Currie et al. 2008).

7.1.3.2 Reliability and external validity of the material affluence scale

PCA is a statistical method that is commonly employed in the construction of scales in inequality research (e.g. Gwatkin et al. 2000; Filmer and Pritchett 2001; Houweling et al. 2003; Vyvas and Kumaranyake 2006). The use of PCA as the statistical tool enabled an exploratory analysis of the initial indicators. Other alternative method would have been the assigning of equal scores to the indicators and then summing them up (Currie et al. 1997; Montgomery et al. 2000; Morris et al. 2000; Wardle et al. 2004), but this alternative method does not permit the analysis of the relevance of the indicators on the scale. Additionally, the latter method cannot be used for data reduction.

Although the indicators used in constructing the scale are somehow Ghana specific, they do not differ very much from those widely used in both developing countries (e.g. the demographic and Health Survey in developing countries,

Croutinovic et al. 1993) as well as in Western countries (e.g. Currie et al. 1997; Molcho et al. 2007). Particularly, most of the nine indicators that were retained on the scale can, though with slight modification, be used as a measure of the material circumstances in Western countries too.

Additionally, the external validity of the scale was assessed in two ways. First, the scale was compared with two of the traditional SES measures namely parental education and occupation, and it showed moderate but strong statistically significant correlation with both. Second, when MAS was compared with parental education and occupation (parental SES) regarding their sensitivity in predicting key health/health behaviours, the results were similar. These imply that MAS is an alternative measure of adolescents' SES.

There are some limitations of the scale. First, measures of water and sanitation conditions were not measured in the survey and therefore not included in the scale. Previous studies (e.g. Filmer and Pritchett 2001) have shown that water and sanitation indicators highly correlated with electricity, and hence the non inclusion of the former items is not likely to affect the sensitivity of the scale. Secondly, most of the indicators on the scale were coded dichotomously as 0 and 1, and hence some information of the items was lost. However, this was method driven and necessary for an easy interpretation of the results. Thirdly, no validity or reliability studies have been conducted to ascertain the correctness of the responses given to the item questions. However, adolescents' self-reported ownership of similar material resources in health inequality surveys have been examined in a reliability study and have been found to be reliable (Molcho et al 2007). More so, concerning the use of principal component analysis (PCA), Filmer and Pritchett (2001) conducted a validation study in three countries and found that the scale constructed from PCA had a good prediction of school enrolment disparities in agreement with those found by the other more conventional approaches.

In a nutshell, MAS presents a reliable alternative method for measuring adolescents' SES where the information on the traditional indicators, namely parental education, occupation and income may be unavailable or difficult to obtain, particularly in developing countries.

7.1.4 Socioeconomic differences in tobacco use among Ghanaian and Finnish adolescents

7.1.4.1 Tobacco use by familial SES

In Finnish adolescents, familial SES measured by father's occupation, and mother's and father's education showed a gradient in smoking such that those in the lower groups had higher probability of smoking compared to those in the higher groups, except that this gradient was not consistent for the farmers' category of father's occupation. In contrast, parental occupation and education did not seem to stratify

Ghanaian adolescents by both smokeless tobacco and smoking. When SES was examined by material affluence scale (MAS), lower MAS predicted higher tawa use but not smoking among Ghanaian adolescents. Previous studies in Western countries have consistently shown higher probability of smoking among adolescents of low parental education (Hanson and Chen 2007a) consistent with what this study found among Finnish adolescents. It is not clear why parental education and occupation did not show any statistically significant differences in tobacco use among Ghanaian adolescents. It seems that in Ghana material circumstances of the family rather than parental education or occupation are more important predictors of adolescent smokeless tobacco use behaviours.

One consistent finding was that, in both countries, higher probability of tobacco use was found among adolescents living in non-intact families compared to those living in intact families. The mechanisms through which family structure affects adolescents' smoking behaviour is not so apparent. An appealing explanation could be that poorer socioeconomic circumstance might mediate this association, but an international data from eleven European countries revealed a strong independent association between family structure and adolescent smoking that was not explained by socioeconomic circumstances or family smoking patterns (Bjarnason et al. 2003).

An additional plausible pathway is through family attachment. Weak family-child attachment increases the chances that the youth will bond with a deviant peer cluster and will engage in deviant behaviours (Oetting and Donnermeyer 1998). Another most likely explanation could be assigned to less parental guidance in non-intact families. It is also likely that family socialization, support and control play a role. There is mounting evidence that a blend of high level of support and moderate control levels reduces the risk of smoking among adolescents (e.g. Scal et al. 2003; van den Bree et al. 2004) and two biological parents are said to provide, on the average, the optimum level of support and control (Thompson et al. 1994). All in all, the differences in tobacco use by family structure highlights the importance of the family social capital in the prevention of tobacco use among young people.

7.1.4.2 Tobacco use by adolescents' individual social position

A striking finding among both Ghanaian and Finnish adolescents is that individual social positions have shown stronger prediction of tobacco use compared to familial SES. Among Ghanaian adolescents individual social position measured by plans after graduation yielded a gradient in both smoking and smokeless tobacco use such that adolescents without plans to continue their education were more likely to use tobacco compared to those with plans to continue their education. Similarly, among Finnish adolescents, lower school performance and vocational school career both increased the probability of smoking compared to those with better school performance and those in high school, respectively. These findings

confirm previous studies that found higher tobacco use among adolescents with low school achievement, low educational attainment and lack of commitment towards schooling (Tyas and Pederson 1998; Lee et al. 2002; Bergen et al. 2005; Schepis and Rao 2005; O'Loughlin et al. 2009).

The pathways through which high school performance protects adolescents from smoking have been discussed. One explanation has been that this relationship might be mediated by the belief needed for academic discipline and belief in conventional rules (Tyas and Pederson 1998). Secondly, students who face academic difficulty may develop low self-esteem, stress and depression which may consequently result in anti-social behaviours such as tobacco use and rebelliousness as an inadequate way of managing the humiliation associated with the academic failure. From the perspective of the primary socialization theory (Oetting and Donnermeyer 1998), adolescents who find themselves in such a situation may also fall out with deviant peers resulting in the experimentation of deviant norms and behaviours in society together with their deviant peer group, parallel to the problem behaviour hypothesis (Jessor and Jessor 1977). The interaction between the individuals in such groups and their environment, mediated through the cognitive processes (Bandura 1986), may influence their behaviours e.g. smoking initiation, continuous use or cessation (Engels et al. 1998; Turner et al. 2004).

Among Ghanaian adolescents, however, school performance was not a statistically significant predictor of either form of tobacco use. Although school performance is important in determining an adolescent's school success and career, in Ghana, several other factors including the ability to pay, gender and other socio-cultural dynamics are also vital in predicting school achievement and consequently social position. It is possible that these socio-cultural specificities might account for the relationship between tobacco use and school performance found among Ghanaian adolescents in this study and thus form part of the differences found between the Ghanaian and Finnish adolescents.

Regarding school career, others argued that young people's lifestyles predict their school career pathways and subsequently their future social positions (Koivusilta et al. 2001; Koivusilta et al. 2003). Therefore the differences in smoking by school career found among Finnish adolescents predict differences in smoking and its related morbidity and mortality when adolescents reach adulthood. Among Ghanaian adolescents, downwardly social mobility and cumulative socioeconomic disadvantage (stability in the lower SES group of origin) were both found to be associated with the likelihood of tobacco use compared to those stable in higher SES. This finding is consistent with previous studies that found that health damaging behaviours such as smoking and alcohol use are more common among downwardly mobile adolescents than in their upwardly mobile peers (Karvonen et al. 1999; Hart et al. 2008).

7.1.5 The concept of smoking epidemic and SES differences in adolescent tobacco use

Over three decades (1977–2007) socioeconomic differences in smoking have persisted or widened among Finnish adolescents to the detriment of those in lower SES groups. The finding suggests that although over the years the prevalence of smoking has been decreasing; the decrease has been slower among the lower SES groups compared to the higher SES groups. The SES differences depict the diffusion of innovation theory of the developmental stages of the smoking epidemic (Rogers 1995; Pampel 2005). This study therefore suggests that adolescent smoking among Finns is in its latter stages as found also among adults in other Nordic countries (Cavelaars et al. 2000).

Apart from the theory of the diffusion of innovation another plausible explanation could account for the SES differences in smoking among Finnish adolescents. It can be argued that adolescents of lower SES groups are more deviant prone (Chassin et al. 2007) and smoking thus constitutes a problem behaviour (Jessor and Jessor 1977; Costa et al. 2007) given that they continue to smoke in a country like Finland which has strict smoking laws and a comprehensive anti-smoking policy, and where there is increasing denormalisation of smoking. Secondly, given that similar pattern of SES differences exists in adults' smoking, it is possible that lower SES adolescents have smoking parents as models (Schepis and Rao 2005; Villanti et al. 2010). It is also possible that adolescents of lower SES have low self-efficacy to quit smoking or resist the temptation of smoking initiation (Bandura 1986). More so, the postulation of higher nicotine dependence among lower SES groups cannot be ruled out in the relationship between tobacco use and SES (Bobak et al. 2000b).

In the European countries, including Finland, among adults, previous studies have reported that the smoking epidemic is in the latter phases and has thus passed its peak already, the only exception being that some countries in Eastern European still have a rising prevalence (Cavelaars et al. 2000). On the other hand, sub-Saharan countries have not been examined in the light of the stages of smoking epidemic, though it has been suggested that they are likely to be at the initial or middle stages (Lopez et al. 1994; Ezzati and Lopez 2004; Pampel 2005; Townsend et al. 2006b). Among the Finnish adolescents, Study IV suggests that the smoking epidemic is likely to be at its latter stages (stage 3), where male smoking declines, smoking is more prevalence among the lower SES group compared to the higher SES group and consequently SES differences in smoking. On the whole therefore, even though there is a relatively high smoking prevalence among Finnish adolescents, it represents a decline. However, among their Ghanaian counterparts, it is unclear whether the low prevalence represents a start of the epidemic or end of it.

Overall, the scanty information available shows that, the smoking epidemic has only reached the early stages in many of the countries in the sub-Saharan African region (Ezzati and Lopez 2004). Based on the findings in this dissertation, and in

line with the postulation by Ezzati and Lopez (2004), several reflections can be made regarding the smoking epidemic among Ghanaian adolescents in particular and sub-Saharan African countries or non-Western countries in general. First, it is possible that the epidemic among Ghanaian adolescents is at its initial stages rather than the latter stages (e.g. it is characterised by male dominance which is a typical feature of the early stages of the epidemic). In that consideration, a distinctive difference of this initial stage of the epidemic in the region compared to that of the Western countries, however, is that whereas in the latter countries the epidemic begun among the higher SES group, diffused to the entire population and then concentrating among the lower SES group in its latter stages, in sub-Saharan African adolescents the epidemic seems to have taken a reversed dimension, beginning first among those in the lower SES. If this postulation holds, one explanation could be that those in the high SES groups are aware of the health damaging effects of smoking and hence do not begin at all, a phenomenon that is also different from the pattern of the epidemic in the Western countries.

Second, it is also possible that the epidemic is at its latter stages, e.g. the SES differences which is a classical characteristic of the latter stages of the epidemic. This would mean that the smoking epidemic had not gone through the stages described in the Western countries or that there had never been a smoking epidemic at all in Ghana and other sub-Saharan African countries like Ethiopia and Uganda which still have low prevalence. If that is the case, are there some societal norms or cultural values or some other mechanisms that have “immunised” the populations in Ghana and other African countries against the “contagious” smoking epidemic? Future studies that would explore these questions would shed light on not only the differences in the epidemic between Western and non Western countries but would also provide useful information for global tobacco control.

7.2 Methodological considerations

7.2.1 Reliability and validity of the adolescents' responses to health inequality surveys

The reliability and validity of responses in health inequality research is crucial for the implementation of the findings. Responding to questions on health behaviours including tobacco use as well as socioeconomic status can be very sensitive. Respondents are therefore likely to over-report behaviours or socioeconomic statuses that are desirable in their societies while under-reporting those that are undesirable thus introducing bias to the findings (Evans et al. 1977). However, most recent studies have shown that adolescents' responses to questions on their smoking behaviour (e.g. Post et al. 2005; Dolcini et al. 2003) and socioeconomic status,

measured by parental education and occupation (Pueyo et al. 2007) were valid and reliable. Therefore the overall result and the conclusions reached in this dissertation are not in doubt. Furthermore, even if under-reporting or over-reporting occurred, it is more likely to have occurred across all socioeconomic groups hence unlikely to change either the results or the conclusions herein reported.

With regards to the Adolescent Health and Lifestyle Survey (AHLS) conducted among Finns, a repeatability study of the responses of the respondents about their own smoking behaviours as well as that of their parents have been conducted and found to yield good repeatability (Rainio et al. 2008). Also, although no repeatability or validity studies have been conducted to ascertain the accuracy of the self-reported tobacco use among Ghanaian adolescents reported in this study, the prevalence of smoking found in this study is similar to the previous smaller study conducted among Ghanaian adolescents in one city (Adu-Mireku 2003).

All the variables used were self-reported and this thus raises the issue of validity of the results. However, the relationships between SES and health/health behaviours among adolescents have been extensively studied (e.g. Hanson and Chen 2007a, Currie et al. 2004). Tobacco uses reported by adolescents in this study have not been cross-checked by biochemical methods. Nevertheless, previous studies of adolescents' self-reports on both smoking (Post et al. 2005; Dolcini et al. 2003; Kentala et al. 2004; Parker et al. 2002) and smokeless tobacco use (Post et al. 2005) behaviours have been found to be accurate and in agreement with biochemical measures. Based on research literature, self-reported assessment is not only the most common method that has been used for assessing both tobacco and SES but also it seems that it is the only feasible way by which the phenomenon can be studied in a survey directed at a large number of respondents (Rimpelä et al. 2007; Global Youth Tobacco Collaborating Group 2003; Hublet et al. 2006). Furthermore, in places like Ghana resources for biochemical assessment may be lacking and it is impossible to obtain official statistics on SES socioeconomic status of respondents.

7.2.2 Study strengths and limitations

The Adolescent Health and Lifestyle Survey (AHLS) data used in this study is a unique nationwide representative sample of Finnish 12–18-year-old adolescents. Several studies have been conducted since 1977 using this data set. The data provides an exclusive thirty-year time series information on tobacco use among Finnish adolescents. The results from this data therefore provide comprehensive information of the socioeconomic trends and its changes over time among Finns in this age group.

Studies on tobacco use from sub-Saharan countries are scanty. Only few studies on tobacco use among adolescents have been conducted in these regions. A data of

a representative sample of Ghanaian adolescents in both urban and remote rural areas was collected.

The Ghanaian study therefore adds to the literature regarding what is known about tobacco use as well as SES differences in tobacco use among adolescents in a non-Western country. In addition, as far as we know, this is the first study that has examined tawa (smokeless tobacco) use in Ghana. Apart from the school-based sample, this study also provides a snapshot of the prevalence of tobacco use among non-students which is also a pacesetter in this regard.

Altogether, the present dissertation provides a useful overview of both the smoking behaviours and the SES differences in tobacco use among adolescents in the two countries. Further, in a broader perspective the study sheds light on the SES differences in tobacco use in a developing country in comparison to a Western country.

Despite the above mentioned strengths, the present study has some limitations. This study being cross-sectional means that the cause and effect relationships cannot be emphasised as an etiological conclusion. On the other hand, it can be argued that SES is likely to precede tobacco use and not the other way round. In a review of the psychosocial factors associated with adolescent smoking, Tyas and Pederson (1998) found that the relationship between adolescent smoking and psychosocial factors, including familial SES and parental smoking were similar irrespective of whether the study was cross-section or longitudinal.

Regarding the Finnish Study (IV), one limitation is the continued decrease in the response rates in the Adolescent Health and Lifestyle Survey (AHLS) over the years. This may lead to underestimation of the smoking behaviour among Finnish adolescents as a result of the selection of non-respondents and hence bias the overall prevalence. Nonetheless, analysis of the non respondents from 1977 to 2007 indicated that the decreasing response rate did not change the observed trend in smoking (Rimpelä et al. 2007).

The low prevalence of tobacco use among Ghanaian adolescents could not permit detailed analysis of other categories of tobacco users other than ever users. As a result, ever tobacco users were the categories of smoking and tawa use employed as the outcome measure in studies I and III. One obvious limitation of this categorization of smoking is that it may also include ex-smokers or those who have just had a puff. Notwithstanding this limitation, overall, the findings reported in this study provide an overview of the stage of the tobacco epidemic among Ghanaian adolescents in particular and as well fills in a gap regarding what is known about the phenomenon in sub-Saharan Africa in general. In addition, we know that most ever tobacco users end up as regular users.

Due to scarce resources, only adolescents in schools have been included in the data from Ghana (Studies I, II and III), and hence the results herein reported can be argued

as not necessarily the same in the entire adolescent population. However, a sample of 127 non-students in the same age group showed similar pattern of responses for most of the key indicators measured in this survey. Moreover, the school enrolment rate in Ghana for the age group of our respondents is relatively high-78.8% for Junior High Schools (Ministry of Education, Science and Sport, Ghana 2008) therefore the findings herein reported is representative of the Ghanaian adolescents.

8 Conclusions

8.1 The main conclusions

The overall aim of this dissertation was to investigate socioeconomic differences in tobacco use among Ghanaian adolescents and to explore how similar or different these may be from their counterparts in a Western country using Finnish adolescents as an example. To achieve this aim, four sub-studies were conducted. These sub-studies allow the following conclusions to be drawn:

- Tobacco use is lower among Ghanaian adolescents compared to their Finnish counterparts. In Ghana, tobacco use is male dominant but currently the prevalence among Finnish adolescents does not show much gender differences.
- Contrary to the general perception in Ghana that tawa is only used by the elderly, this study shows that tawa use is not only prevalent among the youth but its prevalence can also be described as relatively high.
- The relationship between adolescent tobacco use and tobacco promoting and restraining factors (whether individual, environmental or familial factors) studied were similar to those found in Western countries.
- Using indicators that are tangible in an adolescent's life to assess their familial SES would ensure higher response rates and help overcome the challenge of low response to questions on the traditional indicators, i.e. parental education, occupation and income, in adolescents' health inequality research. The material affluence scale (MAS) is a feasible and reliable alternative for measuring adolescents' familial SES in countries where official statistics on the traditional indicators may be unavailable or difficult to obtain.
- SES differences in tobacco use among Ghanaian adolescents are similar to their Finnish counterparts. Among both Ghanaian and Finnish adolescents, lower socioeconomic status, whether measured by familial SES or individual social position, increases the probability of tobacco use, howbeit at varying strength of association in the two countries. Adolescents' individual social

position was a stronger predictor of tobacco use than familial SES in both countries. This study shows that different indicators measure different aspects of the multidimensional construct, SES. In this regard, the use of multiple SES indicators measuring both familial SES and individual social position is vital in adolescents' health inequality research, because the latter would shed light on their position on the life course when they transit from dependence in their families of origin to independence.

- Tobacco use in Ghana, and probably in sub-Saharan Africa or non-Western countries in general, do not seem to follow the pattern of the smoking epidemic observed in Western countries.
- In Ghanaian adolescents, cumulative socioeconomic disadvantage over generations (remaining in the lower SES group of origin) was observed to increase adolescent tobacco use. Among Finnish adolescents, socioeconomic differences in smoking have continued over the three decades and even slightly widened despite the well known Finnish comprehensive tobacco control policy measures. In both countries, these findings predict SES differences in tobacco related morbidity and mortality in the adolescents' adulthood.

8.2 Policy implications and future research

The rising tobacco use in low and middle income countries presents a great challenge for global public health and tobacco control in the twenty-first century. However, opportunities still exist for the control of the epidemic in these regions, especially in the sub-Saharan Africa, the only region where the epidemic is still at its initial stages in many countries. Comprehensive public health measures for tobacco control are needed to harness these opportunities so as to prevent the menace from rising to the advanced stages where the control would be more resource consuming and the health consequences devastating.

Ghana played an active role in the drafting and was as well one of the first countries to ratify the world's first public health treaty, the Convention Framework on Tobacco Control (FCTC), (WHO 2005). The FCTC, among other things, seeks to improve the environment in which smoking habits are initiated, e.g. smoke free environment, a ban on smoking in public places and on tobacco advertising. This study revealed a high exposure of tobacco advertisement suggesting that the FCTC policy measures are not yet applied in Ghana. This exemplifies that while most developing countries may be participating in the global tobacco control policy formulation, the political will to implement these treaties may be lacking.

Even if there is no evidence of tobacco legislations in Ghana, it seems there are some forms of social norms or cultural values in the Ghanaian community that restrain tobacco use among adolescents. These values should be explored and harnessed for tobacco control. Tobacco control measures at the national, familial and individual levels are needed in order to protect Ghanaian adolescents from the emerging tobacco epidemic.

Despite the relatively low prevalence of tobacco use among adolescents in Ghana, surveillance of both smoking and tawa (smokeless tobacco) use as well as the exposure to tobacco promotion among adolescents are essential for monitoring smoking trends and evaluating tobacco control efforts. The findings in this dissertation also highlight the need for a continuous monitoring of SES differences in smoking among Finnish adolescents. Future studies should investigate the social-cultural context of tobacco use in Ghana as a whole and among adolescents in particular.

Among both Ghanaian and Finnish adolescents, health promoting strategies aimed at reducing inequalities in tobacco use or health should be (re)designed to protect adolescents in lower SES groups, above all those who are likely to discontinue their education after the compulsory phase from tobacco use.

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11 Appendix I

Questions used from the Ghanaian survey (studies I–III)

1. How old are you? _____ years old
2. Sex
 1. Boy
 2. Girl
3. Which religious denomination do you belong to?
 1. Christian
 2. Muslim
 3. Traditional belief
 4. Other, what? _____
4. Are your parents alive?
 1. Both are alive
 2. Only mother alive
 3. Only father alive
 4. Both are dead
5. If your parents are alive, are they living together?
 1. Yes
 2. No
 3. No parents alive
6. Who is your guardian?
 1. Father/Mother
 2. Step-father/Step-mother
 3. Sister/brother
 4. Self
 5. Other family member
 6. Non-family member
7. What is your father's or guardian's highest level of education?
 1. No education
 2. Primary School
 3. Middle/ JSS
 4. O'level/SSS
 5. Technical /Vocational School
 6. A'level
 7. University
 8. Other _____
8. What is your mother's highest level of education?
 1. No education
 2. Primary School
 3. Middle/ JSS
 4. O'level/SSS
 5. Technical/Vocational School
 6. A'level
 7. University
 8. Other, what? _____
9. What is your father's or guardian's occupation?
 1. Unemployed
 2. Farming
 3. Carpentry
 4. Driver
 5. Teaching
 6. Selling
 7. Fishing
 8. Tailoring
 9. Accountant

10. Office work, where? _____
 11. Manager/Director
 12. Other, what? _____

10. What is your mother's occupation?

1. Unemployed
 2. Farming
 3. Selling
 4. Fishing
 5. Teaching
 6. Dress making/Hair dressing
 7. Accountant
 8. Secretary
 9. Office work, where? _____
 10. Manager/Director
 11. Other, what? _____

YOUR HOME

11. Which of the following best describes the house where you live?

1. Mud/bamboo/wood house with thatch roofing
 2. Mud/bamboo/wood house with sheet roofing
 3. Uncemented block house
 4. Block house cemented and painted
 5. Other, what? _____

12. Do you have electricity at home?

1. Yes
 2. No

13. Which of the following home appliances does your parent(s) or guardian have at home? You can choose more than one answer for this question

1. Computer
 2. Television
 3. Fridge/freezer
 4. Radio
 5. Other, what? _____

14. Is the house you live in owned by your parent(s) or guardian?

1. Yes
 2. No

15. How many people in your family are you living together with in the same house?

Write the number: _____

16. Do you have your own room?

1. Yes
 2. No

17. How many people do you sleep with in the same room?

Write the number: _____

FAMILY PROPERTY

18. How many cars does your family have/ own?

1. None
 2. One
 3. Two
 4. Three or more

19. Which of the following other properties does your parent(s) or guardian have? You can choose more than one answer for this question.

1. Store/shop
 2. Cocoa farm
 3. Oil palm farm/plantation
 4. Mango farm
 5. Sheep/Goats (more than ten) or Cattle
 6. Corn mill machine/Tractor
 7. Factory
 8. Other, what? _____

SCHOOL AND WORK

20. Do you work in the morning before going to school?

1. Yes
 2. No

21. Do you work when you close from school?

1. Yes, how many hours? _____
 2. No

22. Do you have a private teacher?

1. Yes
2. No
3. I had in the past but not now

23. What was your school performance in the last term examination?

1. Excellent
2. Very good
3. Good
4. Average
5. Poor

24. What do you plan to do after this level of schooling?

1. Continue schooling
2. Learn a trade
3. Look for job
4. I am not sure

YOUR BROTHERS AND SISTERS

25. How many brothers and sisters do you have?

Write the number: _____

26. How many of your brothers and sisters are of school-going age (6-15 years) but are not in school?

Write the number _____

TOBACCO USE & SMOKING

27. Have you ever tried cigarettes or any other tobacco product?

1. No
2. Yes, which? _____

28. And how many cigarettes have you smoked altogether until now?

1. None at all (go to question 35)
2. Only 1
3. About 2-50
4. More than 50

29. During the past one month (30 days), when did you last smoke a cigarette?

1. Yesterday or today
2. 2-4 days ago
3. About a week ago
4. About 2 weeks - 2 months ago
5. About 2-6 months ago

30. Which of the following alternatives best describes your present smoking?

1. I don't smoke presently (go to question 35)
2. I smoke once a day or more often
3. I smoke once a week or more often, but not daily
4. I smoke less than once a week
5. I have stopped smoking

31. Where did you get your tobacco product the last time? You can choose more than one answer for this question.

1. I do not use tobacco product
2. I bought it in a store, shop, or from a street vendor
3. I gave someone else money to buy it for me
4. I got it from my friends
5. I got it from home
6. I stole it
7. I got it some other way, which?

32. The last time you tried to buy cigarette or any other tobacco product did anyone refuse to sell it to you because of your age?

1. I never tried to buy cigarettes
2. Yes, someone refused to sell me cigarettes because of my age
3. No, my age did not keep me from buying cigarettes

33. Have you ever tried snuff (tawa) and how many times altogether?

1. No
2. Yes, I have tried once
3. I have used snuff 2-50 times
4. I have used snuff more than 50 times

34. Do you use snuff (tawa) at present?

1. No
2. Yes

35. Have you ever used any form of tobacco products other than cigarettes and snuff (tawa)?

1. No
2. Yes, which _____

36. During the past one month (30 days), have you seen or heard of any tobacco advertisement in Ghana in one of the following places? You can choose more than one answer for this question

1. On billboard
2. On the cigarette car/van
3. In a newspaper
4. On television
5. In Internet or e-mail
6. Somewhere else, where _____
7. I have not seen

37. Does your father or guardian smoke?

1. Never smoked
2. Has smoked but stopped
3. Smokes now
4. I have no father/guardian
5. I cannot say

38. Does your mother smoke?

1. Never smoked
2. Has smoked but stopped
3. Smokes now
4. I have no mother
5. I cannot say

39. Is smoking allowed on your school compound?

1. Yes
2. No
3. I don't know

40. During this school year, were you taught in school about the harmful effects of smoking?

1. Yes
2. No
3. I am not sure

41. Has anyone in your family discussed with you the harmful effects of smoking?

1. Yes
2. No

12 Appendix II

Question used from the Adolescent Health and Lifestyle Survey, AHLS (study IV)

1. Sex
 Girl
 Boy
2. Date of birth _____
3. Does your family include
 Mother and father
 Mother and step father
 Father and stepfather
 Only mother
 Only father
 Husband or wife (married or cohabiting)
 Other guardian, who? -----
4. What is your father's/guardian's (appointed guardian's) main occupation, job or activity?
 Write down the occupation as precisely as possible (e.g. mechanic, practical nurse, nursery owner). Avoid general titles (e.g. worker, engineer), degrees and honorary titles (e.g. bachelor of business, MA, municipal counselor). If he is retired, write his former occupation (e.g. retired, sales manager).

5. Have you ever smoked (tried) tobacco?
 No (you can go to question xx)
 Yes

6. **How many cigarettes, pipefuls and cigars have you smoked altogether until now?**
None at all (you can go to question XX)
Only one (you can go to question XX)
About 2–50
More than 50
7. **When did you last smoke a cigarette, cigar or pipeful?**
Yesterday or today
2–4 days ago
About a week ago
About 2 weeks – 2 months ago
About 2–6 months ago
More than 6 months ago (you can go to question XX)
8. **Which of the following alternatives best describes your present smoking?**
I smoke once a day or more often
I smoke once a week or more often, but not daily
I smoke less than once a week
I have stopped smoking temporarily or for good?

Tiivistelmä

Nuorten tupakoinnin sosioekonomiset erot ghanassa ja suomessa

Länsimaissa ja erityisesti aikuisilla tupakoinnin ja sosioekonomisen aseman välinen yhteys tunnetaan hyvin. Mitä matalampi sosioekonominen asema, sitä yleisempää on tupakointi. Aikuisilla erot tupakoinnin yleisyydessä eri koulutusryhmien välillä ovat merkittäviä. Nuorten osalta tutkimustieto tupakoinnin sosioekonomisista eroista on ollut vähäistä. Sosioekonomisen aseman ja tupakoinnin välisen yhteyden muuttumisesta pitkällä aikavälillä ei ole tietoa. Saharan etelänpuoleisessa Afrikassa, kuten Ghanassa, nuorten tupakointitutkimusta ei juuri ole tehty. Tupakankulutuksen vähentyessä läntisissä maissa tupakkateollisuus pyrkii etsimään uusia kuluttajia kehitysmaiden nuorisosta. Tästä syystä kehittyvät maat ovat kansanterveydellisestä näkökulmasta tärkeitä.

Väitöskirjassa tutkittiin nuorten tupakoinnin sosioekonomisia eroja Ghanassa ja Suomessa sekä verrattiin eroja keskenään. Tutkimus koostui neljästä osatutkimuksesta, joissa käytettiin kahta eri tutkimusaineistoa. Suomalaisena tutkimusaineistona oli valtakunnallinen Nuorten terveystapatutkimus, vuodesta 1977 lähtien joka toinen vuosi toteutettava postikyselytutkimus 12–18-vuotiaille. Ghanasta kerättiin vastaavanikäisiä nuoria edustava poikkileikkausaineisto koulukyselynä vuonna 2008. Nuorten tupakoinnin ja sosioekonomisen aseman välistä yhteyttä tutkittiin useita eri sosioekonomisia indikaattoreita käyttäen. Tässä työssä kehitettiin materiaalsen hyvinvoinnin mittari, joka sopii kehittyvien maiden nuorten sosioekonomisen taustan tutkimuksiin. Tilastollisina menetelminä käytettiin logistista regressioanalyysia sekä pääkomponenttianalyysia.

Ensimmäisessä osatutkimuksessa (I) selvitettiin ghanalaisnuorten tupakointitottumuksia sekä niihin yhteydessä olevia tekijöitä. Tuloksista ilmeni, että nuorten tupakointi Ghanassa oli selvästi vähäisempää kuin suomalaisnuorten keskuudessa. Toisaalta he altistuivat tupakkamainonnalle useammin sekä tunsivat tupakoinnin haitat ja tupakoinnin lopettamisen vaikeuden selvästi huonommin kuin suomalaiset.

Toisessa osatutkimuksessa (II) käytettiin perinteisten sosioekonomista asemaa mittaavien indikaattoreiden ohella uudentyyppistä materiaalsen hyvinvoinnin

mittaria. Tärkeä löydös oli, että mittari havaittiin luotettavaksi ja hyvin soveltuvaksi kuvaamaan nuorten sosioekonomista asemaa kehitysmaissa, missä perinteisten sosioekonomista asemaa mittaavien osoittimien käyttö (esim. vanhempien koulutus, tulot, ammatti) voi ajoittain olla vaikeaa.

Kolmannessa osatutkimuksessa (III) verrattiin nuorten tupakoinnin sosioekonomisia eroja Ghanassa ja Suomessa. Riippumatta siitä, millä sosioekonomisen aseman mittarilla tupakoinnin ja sosioekonomisen aseman välistä yhteyttä mitattiin, erot olivat selvät ja odotustenmukaiset molemmissa maissa. Samalla havaittiin, ettei ghanalaisnuorten tupakointi näytä seuraavan yhtä selvästi tunnettua tupakkaepidemian kehityskulun mallia kuin mikä on tyypillistä länsimaille.

Neljännessä osatutkimuksessa (IV) tarkasteltiin suomalaisnuorten tupakoinnin sosioekonomisten erojen pitkän aikavälin muutoksia (1977–2007) käyttäen useita eri sosioekonomisen aseman indikaattoreita. Tutkimuksen päätulos oli, että sosioekonomiset erot nuorten tupakoinnissa ovat säilyneet koko tutkimusjakson ajan samankaltaisina ja jopa lievästi kasvaneet Suomen aktiivisesta tupakkapolitiikasta huolimatta.

Tutkimuksen tulokset korostavat nuorten tupakointitrendien seurannan tärkeyttä: Ghanassa tulisi järjestää tätä mittaava tietojärjestelmä ja Suomessa tupakoinnin sosioekonomisten erojen seuranta tulisi edelleen jatkaa. Sekä Suomessa että Ghanassa nuorten tupakoinnin sosioekonomisten erojen kaventamiseksi terveyden edistämishjelmia tulisi kohdentaa siten, että niiden vaikutukset näkyisivät erityisesti alemmissa sosioekonomisissa ryhmissä ja erityisissä riskiryhmissä. Viimeksi mainittuihin kuuluvat etenkin ne nuoret, jotka keskeyttävät koulun tai eivät jatka koulunkäyntiä peruskoulutuksen jälkeen.

Original Publications

Indicators for Measuring Material Affluence of Adolescents in Health Inequality Research in Developing Countries

David Doku · Leena Koivusilta · Arja Rimpelä

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Abstract The aim of the present study was to (i) develop a material affluence scale (MAS) for measuring adolescent SES in health inequality research in developing countries, (ii) compare the association of the MAS with the parental SES measures (parental occupation and education), and (iii) evaluate the association of parental SES and MAS with key health and health behaviour indicators. We used school-based cross-sectional survey conducted in thirty districts within three administrative regions in southern Ghana (a West African country) among adolescents ages 12–18-year old ($N=1,195$) as an example. Principal Component Analysis (PCA) was used as the main statistical technique. MAS categorised adolescents into material affluence groups (MAS scores for the poorest, poor, average, affluent and most affluent were -1.679 , -0.355 , 0.354 , 0.725 and 1.022 from the first principal component quintile respectively), it has adequate internal coherence ($\alpha=0.622$) and moderately correlates with parental SES ($r=0.39$, $p<0.001$). MAS and parental SES showed similar pattern of strength and direction of association with selected health and health behaviour indicators. MAS presents a viable alternative method for measuring adolescent's SES in health inequality research in developing countries and could be useful as well in western countries.

Keywords Inequality · Socioeconomic status · Adolescents · Health behaviour · PCA · Ghana · Africa

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1 Introduction

Research in health inequalities among adolescents has increased in recent decades (Currie et al. 1997; Wardle et al. 2004; Koivusilta et al. 2006; Marmot 2005, West 1997). Traditionally, epidemiological studies have used the educational attainment, occupational status and income as the measures of socioeconomic status (Galobardes et al. 2006a, b). These three measures were assumed to measure a wide range of social factors which could account for disparities in health (Galobardes et al. 2006a, b; Durkin et al. 1994).

Concerning adolescents, there have been problems in collecting data on the parental income, occupation and education from adolescents partly because they are unable to provide accurate information on their parents or sometimes unwilling to do so (Currie et al. 1997; Molcho et al. 2007). Consequently, surveys involving obtaining parental SES information from adolescents have resulted in large proportions of missing data (Currie et al. 1997; Molcho et al. 2007; Wardle et al. 2004). This has led to a rising interest in exploring non-parental measures of adolescent SES in health research (Currie et al. 1997; Wardle et al. 2004; Koivusilta et al. 2006; Molcho et al. 2007).

The development of the Family Affluence Scale (FAS) by Currie et al. (1997) in the Health Behaviour in School-Aged Children (HBSC) study based on the earlier works of Townsend (1987) and Carstairs and Morris (1991) was a significant road map in researching adolescents' SES in the health sciences in the western countries. FAS seeks to address the difficulties involved in obtaining SES information from adolescents which often resulted in misclassification and particularly low completion rates. FAS uses simple multiple indicators measured by non-sensitive questions which are relevant to the setting and reflect the family affluence in a household (Currie et al. 1997). Initially, items on the FAS were: the number of telephones in the household, the number of cars in the family, and having own unshared bedroom (Currie et al. 1997). Later, FASI and FASII were developed and the items on the scale were modified to include the number of family holidays and the number of computers in the family while the number of telephones was removed (Currie et al. 2004; Boyce and Dallago 2004; Mullan and Currie 2000).

Research has increased on the inequalities in health among adolescents in recent years. However, studies conducted so far are from western countries, Europe and America (Durkin et al. 1994; Alvarez-Dardet 2000; Morris et al. 2000; Currie et al. 2004; Boyce and Dallago 2004; Mullan and Currie 2000; Currie et al. 2008). Admittedly, the SES is not a static concept but varies according to culture, social structure of the society and in different economic settings (Wardle et al. 2004; Currie et al. 2004). In the developing world, there are many difficulties involved in measuring the socioeconomic status owing to the inappropriateness of the indicators used, their non-applicability across the culturally and economically diverse nature of the society. The few studies on SES among adults in developing countries used indicators such as type and material of housing, source of drinking water, sewage system, type of domestic fuel, land ownership, education, occupation, living conditions, and demographic conditions (Crontinovic et al. 1993; Durkin et al. 1994; Fiadzo et al. 2001; Galobardes et al. 2006a, b). Even among adults obtaining information on these indicators poses a great challenge (Durkin et al. 1994).

Regarding adolescents, SES and its association with health outcomes and health behaviours have been hugely understudied in the developing world, especially in sub-Saharan Africa, despite the revelation that inequalities in health have widened over the years (World Bank 2006).

2 The Theoretical Framework

Our concept of material deprivation is based on the work by Townsend (1987). According to Townsend, “Deprivation takes many different forms in every known society. People can be said to be deprived if they lack the types of diet, clothing, housing, household facilities and fuel and environmental, educational, working and social conditions, activities and facilities which are customary, or at least widely encouraged and approved, in the societies to which they belong.” Material deprivation is perceived as the lack of the resources and goods necessary for decent living in relation to what is generally available in the society. Individuals who are materially deprived may encounter conditions that may be detrimental to their health, for example poor diet, inaccessibility to health care, poor environmental conditions, health damaging behaviours such as smoking and sedentary behaviours as well as stress due to the shame and humiliation associated with the deprivation. We employed a wide range of indicators which capture the key aspects of wealth as well as the material circumstances to investigate the underlying structure of familial material circumstances of adolescents.

The aim of the present study was to develop a material affluence scale (MAS) that could be used to measure the socioeconomic status of adolescents in health inequality research in developing countries, compare the scale to be constructed with the traditional measures of SES (parental education and occupation) and test its association with key health and health behaviour indicators. We used a school-based survey data from Ghana, a West African country, as an example.

3 Method

3.1 Data

This study is based on a cross-sectional survey on health behaviours and lifestyles of school-aged adolescents in three administrative regions in southern Ghana. The data were collected from June to August 2008.

3.1.1 Sample

The sample comprised of thirty stratified random sample schools, ten per region, from each of three sampled regions in southern Ghana, (Eastern, Greater Accra and Volta Regions of Ghana). The Ghana Education Service’s School Health Education Programme register of schools in the country was the source of the sampled schools. A letter of support obtained from the Ministry of Education School Health Education Programme unit was sent to the schools.

The schools were selected so that they comprised of four public Junior High Schools, two private Junior High Schools, three public Senior High Schools and one private Senior High School in each region in order to reflect the school types in the country. In each school, one or two classes of about fifty students were selected at random. All students whose names were found in the class attendance register of the selected classes were eligible to participate in the survey. The study protocol was approved by the ethical committee of the Ghana Health Service Research Unit in Accra, Ghana.

3.1.2 Sample Size and Response Rate

The characteristics of the respondents according to age, gender and school type are presented in Table 1. In all, 1,195 out of the 1,566 respondents who completed the questionnaire have been used in this study. We excluded those outside the age 12–18-years. The response rate was 89.7% (based on academic year's register), it was not clear whether those absent had stopped schooling or were just absent. Only one pupil denied answering.

3.1.3 Questionnaire Administration

The eight page questionnaire was anonymous and self-administered. It was designed to exclude any information that will reveal the identities of the participants.

One trained supervisor was assigned to each classroom during the answering. The survey commenced simultaneously in all the participating classes in a given school. Participants were asked to drop their questionnaires in an envelope placed in front of the class on completion. In two of the rural schools, the students could not understand the questions so it was translated into the local language by a teacher (in one school) and by the principal investigator in the other school. Also, in one of the remote public schools the Junior High School (JHS) was not in session as the teachers did not come to school due to lack of transportation to school on the survey day hence the primary six pupils (they were supposed to be in JHS in the following 2 months when new academic year begins) were selected to replace the absent JHS. The three schools altogether constitute only 4.3% of total respondents, besides the responses of these schools were not different from the others hence they were included in the analysis. For simplicity, we added the primary six respondents ($N=26$) to the junior high school respondents in Table 1.

Table 1 Characteristics of respondents by age, gender and school type

School type	Mean age (years)	Boys	Girls	Total
Private Junior High School	14.1	85	95	188
Public Junior High School	15.3	248	203	471
Private Senior High School	17.3	36	62	101
Public Senior High School	16.8	129	297	437
Total	15.8	498	659	1195

3.1.4 Socioeconomic Indicators

Parental SES (Parental Education and Occupation) Parental educational status was measured by the questions “What is your father’s/guardian’s highest level of education?” and “What is your mother’s highest level of education?” The respondents were asked to choose from, ‘no education’, ‘primary school’, ‘middle school/JSS’, ‘O’level/SSS’, ‘technical/vocational school’, ‘A’level’, ‘university’ and ‘other’. They were to mention the level of education if they chose ‘other’ (unknown) as the answer. The responses were coded (0–3) into illiterate, basic education, secondary education and tertiary education according to the classification of the Ghanaian educational system. Parental occupational status was measured using the questions, “What is your father’s/guardian’s occupation?” and “What is your mother’s occupation?” Pupils were asked to choose one of the following; ‘unemployed’, ‘farming’, ‘fishing’, ‘carpentry’, ‘driver’, ‘selling’, ‘dress making/tailoring’, ‘hair dressing’, ‘secretary’, ‘accountant’, ‘office work’, ‘teaching’, ‘manager/director’, and ‘other’. They were asked to mention what kind of work if they chose ‘office work’, manager/director or ‘other’ as response. The responses were then condensed into six categories: unemployed, (unknown), grade E, grade D, grade C and grade B) according to the occupational classification in the Ghanaian civil service (Head of Civil Service 2000): A, chief in rank; B, professional and managerial; C, professional non managerial; D, skilled manual; and E, unskilled manual. None of the respondents fell into the A category. This was further coded 0–4, excluding the unknown category. We computed parental SES by summing up the scores for parental education and occupation to produce a composite scale (0–18) which was further categorised into three referred herein as low (0–8), middle (9–10) and high (11–18) parental SES for those who completed both questions.

3.1.5 Material Affluence Indicators

Adolescent material affluence was measured by twenty one indicators made up of three broad categories; household assets and housing characteristics; other assets; and school related indicators.

Household Assets and Housing Characteristics The questions were as follows: “Which of the following home appliances does your parent(s) or guardian have at home?” You can choose more than one answer. Options: 1 = Computer, 2 = Television, 3 = Fridge/Freezer, 4 = Radio, 5 = Other, what? Dichotomous response variable (0, 1) was created for each response; “Do you have electricity at home?” (0 = no, 1 = yes); “How many cars does your family have/own?” Options : (0 = no, 1 = yes, 2 = two cars, 3 = three or more cars) recoded 0 = no car, 1 = one or more cars; “Is the house you live in owned by your parent(s) or guardian?” 0 = no, 1 = yes; “Do you have your own room?” 0 = no, 1 = yes; “How many people do you sleep with in the same room?” Write the number:... Recoded: 0 = less than three, 1 = more than three persons per room; “Which of the following best describes the house where you live?” Options: 1 = Mud/bamboo/wood house with thatch roofing, 2 = Mud/bamboo/wood house with sheet roofing, 3 = Uncemented block house, 4 = Block house cemented and painted, 5 = Other, what? We

coded 'other' into the appropriate categories. Recoded 0 = non-block house (responses 1, 2 and 3), 1 = block house (response 4).

Other Assets The questions were as follows: "Which of the following other properties do your parent(s) or guardian has? You can choose more than one answer". Options: 1. = Store/shop, 2 = Cocoa farm, 3 = Oil palm farm/plantation, 4 = Mango farm, 5 = Cattle/Sheep/Goats (more than ten), 6 = Corn mill machine/Tractor, 7 = Factory, 8 = Other, what?...Dichotomous response variable was created for each response.

3.1.6 School Related Indicators

The questions were as follows: "Do you work in the morning before going to school?" Options: 0 = no; "Do you work when you close from school?" coded 0 = no, 1 = yes; "Do you have a private teacher?" Options 1 = yes, 2 = no, 3 = I had in the past but not now, recoded 2 as 0 = never had, 1 and 3 as 1 = ever had; "How many of your brothers and sisters are of school-going age (6–15 years) but are *not* in school?" Write the number, recoded as 0 = none, 1 = one or more. We clarified to the respondents that: working before and school refers to any work apart from normal household chores such as sweeping the compound and fetching water into the pot in the morning before going to school or in the evening when school closes.

3.1.7 Indicators of Health and Health Behaviours

Self-rated health at the time of inquiry was measured by the question, "How do you describe your health in general?" Options: 'excellent', 'very good', 'good', 'fair', and 'poor'. These were collapsed into, 'poor'('fair' and 'poor') and 'good' ('excellent', 'very good' and 'good') self-rated health.

Fruit in-take was measured by: "During the past 1 week (7 days), on how many days did you usually eat fruit, such as oranges, pineapple, watermelon, banana, guava, pear, sweet apple, mangoes, or pawpaw?" Options: 'not once', '1–3 days', '4–6 days', and 'everyday'. These were dichotomised into categories 'rarely' (not once and 1–3 days) and 'often' (4–6 days and everyday).

Fried food in-take was measured by: "During the past 7 days on how many days did you usually eat fried foods?" Options: 'not once'; '1–3 days'; '4–6 days'; and 'everyday'. The responses were recoded into dichotomous responses, 'rarely' (not once and 1–3 days) and 'often' (4–6 days and everyday).

Teeth brushing was assessed by: "How often do you clean/brush your teeth?" 'never', 'about once a week or less often', '2 to 3 times a week', 'about 4 to 5 times a day or more', 'about once a day', 'about 2 to 3 times a day or more' were the alternatives given. These were categorised into 'less than daily' and 'daily'.

Physical activity was investigated by: "How physically active are you?" Options: 'not physically active', 'a little physically active', 'physically active' and 'very physically active' were recoded into dichotomous responses, 'less physically active' (not physically active, a little physically active) and 'physically active' (physically active and very physically active).

3.1.8 Statistical Analysis

Construction of the Material Affluence Scale (MAS) We employed the statistical method of principal component analysis (PCA) to determine the weight of each indicator on the material affluence scale. PCA is a multivariate statistical technique which is capable of reducing a set of variables in a data set into smaller number of dimensions. It has the ability to describe the variation of a set of variables as a set of linear combinations of the original variables, so that successive linear combinations which explain most of the variation in the original data are extracted.

In constructing the scale, we excluded the indicators “mango farm”, “Corn mill machine/tractor” and “Factory” due to extremely low ownership of these items in the study population (both rural/urban and in regions). When we included these items the Cronbach’s alpha was below 0.5 and Kaiser-Meyer-Olkin measure of sampling adequacy was less than the recommended 0.6, indicating non-internal consistency of the indicators meaning that they cannot be on a summated scale. Initial screening of the remaining eighteen material indicators was done as follows. Overcrowding was excluded because of having communality less than 0.3, (Pett et al. 2003; Pallant 2007). Sheep/goats, store/shop, cocoa farm, oil palm farm/plantation, working in the morning before going to school, working in the evening after school, having siblings who were of school going age but are out of school and having a private teacher were excluded because they had extremely low inter-item correlation, <0.1 , with all the indicators on the scale (Pett et al. 2003; Pallant 2007). The nine remaining indicators (fridge/freezer, television, radio, computer, electricity, car, house ownership, own bedroom and block house) were then subjected to the final Principal Component Analysis (PCA) model using SPSS version 16. The first, second and third eigenvalues were 2.59 1.42 and 1.11 respectively. The Kaiser-Meyer-Oiklin value was 0.727, exceeding the recommendation value of 0.6 and the Bartlett’s Test of Sphericity reached statistical significance ($p < 0.001$).

The associations between variables were tested using chi-square tests and Spearman correlations. Cronbach’s alpha was computed to assess the internal consistency reliability of the scale. Logistic regression analysis was used for bivariate and multivariate analyses of the association between parental SES, MAS and health and health behaviour indicators.

4 Results

4.1 Missing Values

A large number of adolescents were unable to neither provide their parental education and occupation nor give sufficient information on these indicators that could enable us to classify them into the appropriate categories. This has resulted in relative large missing values. On the other hand, there was very high completion rate for the material affluence indicators. All adolescents were able to report whether or not their parents own fridge/freezer, Television set and computer (Table 2).

No statistically significant differences were found in the parental SES completion rate by material affluence scale, age and gender ($p=0.110$, $p=0.263$, $p=0.110$,

Table 2 Frequency and percentage distribution of parental socioeconomic status measures and material affluence indicators

Indicator	N	%	Indicator	N	%
Parental SES indicators					
Father's/guardian's occupation			Mother's occupation		
Unemployed	46	3.8	Unemployed	44	3.7
Grade E	605	50.6	Grade E	906	75.8
Grade D	69	5.8	Grade D	43	3.6
Grade C	234	19.6	Grade C	110	9.2
Grade B	94	7.9	Grade B	17	1.4
Unknown	120	10.0	Unknown	51	4.3
Missing	27	2.3	Missing	24	2.0
Father's/guardian's education			Mother's education		
Illiterate	95	8.2	Illiterate	189	16.3
Basic education	362	31.3	Basic education	494	42.7
Secondary education	358	30.9	Secondary education	316	27.3
Tertiary education	281	24.3	Tertiary education	110	9.5
Unknown	24	2.1	Unknown	18	1.6
Missing	37	3.2	Missing	30	2.6
Parental SES					
Low	381	31.9			
Medium	232	19.4			
High	351	29.4			
Missing	231	19.3			
Material affluence indicators					
Household asset and housing characteristics					
Cars			TV ownership		
Yes	590	49.4	No	323	27.9
No	587	49.1	Yes	834	72.1
Missing	18	1.5	Computer		
Radio			No	840	72.6
No	279	24.1	Yes	317	27.4
Yes	876	75.7			
Missing	2	0.2			
Fridge/freezer			Electricity at home		
No	536	46.3	Yes	915	79.1
Yes	621	53.7	No	227	19.6
			Missing	15	1.3
Block house			House ownership		
No	253	21.2	No	462	38.7
Yes	834	69.8	Yes	733	61.3
Missing	108	9.0			
Own bedroom			Overcrowding		
No	752	62.9	No	760	63.6

Table 2 (continued)

Indicator	N	%	Indicator	N	%
Yes	419	35.1	Yes	434	36.3
Missing	24	2.0	Missing	1	0.1
Other assets					
<i>Store/Shop</i>			<i>Oil palm farm</i>		
No	669	56.0	No	1036	86.7
Yes	525	43.9	Yes	157	13.1
Missing	1	0.1	Missing	2	0.2
<i>Cocoa farm</i>			<i>Goat/Sheep</i>		
No	971	81.3	No	974	81.7
Yes	223	18.7	Yes	218	18.2
Missing	1	0.1	Missing	3	0.3
School related indicators					
<i>Work before school</i>			<i>Siblings not in school</i>		
No	281	23.5	No	748	62.6
Yes	902	75.5	Yes	446	37.3
Missing	12	0.1	Missing	1	0.1
<i>Work after school</i>					
No	206	17.2			
Yes	823	68.9			
Missing	2	0.2			

$p=0.510$ respectively). Girls had slightly higher completion rates for maternal occupation ($p=0.039$) than boys. Likewise boys had slightly higher completion rates for paternal occupation ($p=0.043$) than girls. We did not find such statistically significant gender differences by paternal and maternal education ($p=0.758$ and $p=0.559$). No statistically significant differences in the completion rates by age and gender were found for the questions that assessed the material indicators ($p=0.531$, and $p=0.238$ respectively). Over all, only 80.7% of the adolescents completed parental SES measures information compared to 94.2% completion rate for the material affluence indicators. It implies that 13.5 of those who could not provide information on the parental SES measures were able to provide information on the material affluence indicators.

4.2 Material Affluence Scale (MAS)

The principal component analysis revealed the presence of three components with eigenvalues exceeding 1, explaining 28.7%, 15.8% and 12.3% respectively of variance. As the percentage of adolescent with missing data was relatively low (5.8% for MAS indicators combined) inclusion or exclusion of the missing case did not change the association between MAS and the health and health behaviours so the missing cases for each indicator were excluded pairwise. The Cronbach's alpha for

nine indicators was 0.622, indicating internal consistency of the indicators and justifying their use in a summated scale.

For the purposes of this study the first principal component was assumed to be the measure of material affluence because it summaries the largest amount of information common to all the indicators. Table 3 shows the factor scoring from the first principal component analysis of the nine indicators. Fridge/freezer ownership (0.749) and house ownership (0.074) were assigned the highest and lowest scores respectively. The higher the weight of an item the more relevant it is on the scale. Household with more assets would obtain a higher score on the MAS and vice versa. Ownership of fridge/freezer, television, car, having electricity at home, and living in a block house showed consistent trend across the material scale affluence quintiles.

The first principal component was divided into quintiles, so that adolescents were classified as poorest, poor, average, affluent and most affluent in terms of the material status.

Over all, the differences were wider between the lower MAS groups than the upper groups. The differences in the mean scores of the material affluence scale between the groups by urbanisation level and region of residence are similar to those observed in the total population (Table 4).

4.3 Association Between the Material Affluence Scale and Parental SES Indicators

The association of MAS quintiles with parental occupation and education are presented in Table 5. The material affluence scale (MAS) was modestly correlated with the parental SES ($r=0.32$; 0.36 ; 0.17 and 0.29 for maternal education, paternal education, maternal occupation and paternal occupation respectively, all at $p<0.001$). The scale explained 14% of the variance in the parental SES when all the four parental SES indicators were combined ($r=0.39$, $p<0.001$).

Table 3 Factor scoring, mean, standard deviation for material affluence indicators and mean quintiles extracted from the first principal component

Indicator	Component score	Mean	Std. dev.	Poorest	Poor	Average	Affluent	Most affluent
Fridge/freezer	0.749	0.530	0.449	0.030	0.270	0.450	0.970	1.100
Electricity	0.731	0.800	0.400	0.164	0.864	0.990	1.000	1.000
Television	0.709	0.720	0.449	0.140	0.530	0.950	1.000	1.000
Block house	0.679	0.744	0.418	0.246	0.657	0.940	0.994	1.000
Computer	0.480	0.275	0.446	0.077	0.207	0.088	0.546	0.505
Car ownership	0.443	0.499	0.500	0.285	0.455	0.472	0.631	0.651
Own room	0.259	0.358	0.480	0.285	0.371	0.486	0.435	0.107
Radio	0.080	0.750	0.434	0.860	0.550	0.630	0.850	0.890
House ownership	0.074	0.610	0.487	0.670	0.730	0.600	0.860	0.220
Material affluence Scale				-1.679	-0.355	0.354	0.725	1.022

Table 4 Material affluence scale by urbanisation and region of place of residence

Population	N	Poorest	Poor	Average	Affluent	Most affluent
Rural	702	-1.521	-0.599	0.163	0.906	1.116
Urban	424	-1.718	-0.096	0.400	0.578	0.854
Volta region	329	-1.680	-0.396	0.371	0.727	1.027
Eastern region	373	-1.739	-0.331	0.332	0.737	1.020
Gt. Accra	424	-1.555	-0.344	0.353	0.717	1.017
Total	1126	-1.679	-0.355	0.354	0.725	1.022

4.4 Relationship Between the Scale and Health/Health Behaviour Indicators

We investigated the ability of the scale to predict key health and health behaviour indicators in comparison to the parental SES measures. The results are presented in Table 6.

The parental SES and MAS showed very similar pattern of strength and direction of association for all the health and health behaviour indicators. There were positive associations between high SES (both parental and material affluence scale) and physical activity, good self-rated health and daily teeth brushing. The associations between both measures of SES and fruit in-take and fried food in-take were not statistically significant.

5 Discussion

5.1 Summary and Interpretation of Results

In this study, a material affluence scale (MAS) was constructed using material affluence indicators which represent material living conditions in Ghanaian adolescents' reality. Principal component analysis (PCA) was used to reduce eighteen material affluence indicators to nine to construct the MAS. The first principal component had adequate internal coherence and moderately correlated with parental SES measures. The MAS and parental SES showed similar pattern of strength and direction of association with key indicators of health and health behaviours suggesting that MAS presents a viable alternative method for measuring adolescents' SES in health inequality research in developing countries and could as well be used in western countries.

5.2 The Construction of the Material Affluence Scale (MAS)

Principal Component Analysis (PCA) was employed as a statistical technique to determine the weight of each variable on the MAS. The World Bank commonly uses PCA in the construction of its asset based socioeconomic indices which are often used in assessing health differences within and between countries (Gwatkin et al. 2000). Many other studies have also used PCA to construct socioeconomic indices

Table 5 Distribution of parental occupation, parental education, parental socioeconomic status by material affluence scale quintile groups

Parental SES indicator	MAS quintiles (N=1126)				
	Poorest (N=224)	Poor (N=228)	Average (N=233)	Affluent (N=216)	Most Affluent (N=225)
Father's occupation (N=1048)					
Unemployed	3.3	5.4	4.7	5.0	3.3
Grade E (lowest)	80.8	60.3	59.6	39.2	40.8
Grade D	3.7	9.5	5.6	8.3	7.0
Grade C	10.3	19.1	22.1	32.0	31.0
Grade B (highest)	1.9	6.0	8.0	15.5	17.9
Total	100	100	100	100	100
Mother's occupation (N=1120)					
Unemployed	4.1	3.4	3.5	3.6	4.8
Grade E (lowest)	91.2	83.9	86.1	71.1	71.2
Grade D	1.5	3.9	2.6	8.8	3.4
Grade C	2.3	7.3	6.9	14.4	18.2
Grade B(highest)	0.9	1.5	0.9	2.1	2.4
Total	100	100	100	100	100
Father's education (N=1133)					
Illiterate	21.3	10.4	5.7	3.4	0.5
Basic education	46.2	39.2	35.5	20.4	19.9
Secondary education	25.3	27.8	30.3	36.4	44.2
Tertiary education	7.2	22.6	28.5	39.8	35.4
Total	100	100	100	100	100
Mother's education (N=1146)					
Illiterate	31.7	18.2	17.7	9.0	8.8
Basic education	55.0	45.9	49.6	35.2	34.0
Secondary education	9.6	24.4	26.2	41.4	42.3
Tertiary education	3.7	11.5	6.5	14.4	14.9
Total	100	100	100	100	100
Parental SES (N=964)					
Low	70.0	42.7	36.8	18.8	18.8
Medium	15.0	26.5	30.9	26.9	21.8
High	15.0	30.8	32.3	54.3	59.4
Total	100	100	100	100	100

for measuring inequality (Filmer and Pritchett 2001; Houweling et al. 2003; Schellenberg et al. 2003; Vyvas and Kumaryake 2006). The overriding advantage of the PCA method used here is that, it determined the weights of the variables in the scale and thus gave an 'objective' contribution of each variable to the scale

Table 6 Significance of effects of material affluence scale (MAS) and parental socioeconomic status on health/health behaviour measures in logistic regression models adjusted for age and gender

Health/health behaviour indicators	MAS	Parental SES
Self-rated health	+	++
Physical activity	+++	+++
Fruit in-take	NS	NS
Fried food in-take	NS	NS
Teeth brushing	+++	++

MAS and Parental SES p-values adjusted for age and gender. The sign shows the direction and strength of the independent association of each indicator. Plus symbol means that the health/health behaviour indicators were associated with high socioeconomic indicator

NS not statistically significant

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

constructed. In scale construction using PCA, usually the first principal component is considered to be the scale as we did here too (Filmer and Pritchett 2001; Houweling et al. 2003; Vyvas and Kumaryake 2006). Studies using PCA commonly use arbitrary cut-off points; the lowest 40% classified as poor, the highest 20% as rich and the rest as middle group. Others also divide the subjects into quintiles (Filmer and Pritchett 2001; Gwatkin et al 2000). Both approaches are arbitrary, yet they yielded similar correlation with the parental SES ($r=0.35$ and $r=0.39$ respectively, $p < 0.001$ for both) as well as similar pattern of association with the health and health behaviour indicators as reported in previous research (Filmer and Pritchett 2001). We employed the quintile approach in this study, based on the assumption that SES is uniformly distributed. Some studies found negative principal scores for ownership of certain material indicators (Gwatkin et al. 2000; Houweling et al. 2003) implying that such items were associated with lower SES. However, in this study all the items yielded positive scores meaning their ownership indicated material advantage and consistent with those reported in some previous studies (Schellenberg et al. 2003; Sahn and Stifel 2003; Vyvas and Kumaryake 2006). Similar pattern of scores were found when the analysis was done separately for rural, urban and region of residence confirming that these assets represent wealth in the study population irrespective of urbanization level or region.

We used housing characteristics (block house, house ownership, whether adolescents have their own bedrooms) and availability of amenities and movable properties (fridge/freezer, television, radio, computer and car) to assess material circumstance. These housing characteristics and household assets used in this study are not only markers of material circumstances but may also be related with some mechanisms of health. For instance, overcrowding can aid the spread of infectious disease. These indicators are particularly useful in adolescent survey because questions relating to these are relatively easy to answer by them as they represent reality in adolescents' lives. However, one major limitation is that these indicators could be setting specific and might need modifications when applied in other settings. Electricity, for example, can be classified as a consumer as well as capital good. It is in one way related to expenditure but on the

other hand it could be regarded as a measure of deprivation of home facilities (Townsend 1987) because its availability or otherwise could be an indication of the material circumstances of the family and in a wider perspective it could be a proxy for the measure of the neighbourhood characteristics. These consumer and capital goods are proxy for income and therefore have a direct effect on material resources. Income affect the quality of resources, access to services (e.g. health care) boost self-esteem and is linked to behaviour. In a developing country where information on income may not be available, and especially in adolescent survey these indicators could be useful proxy for income inflow and outflow-material circumstance of households in general.

There was no clear trend across the quintiles for the indicators; house ownership, radio, computer and having adolescent's own bedroom. In Ghana ownership of a house is not as important as the type of house because in the rural areas folks can own many mud houses but this might not necessarily measure wealth since living in a rented apartment could even be more prestigious than owning a mud house. We examined the mean MAS scores by rural/urban and found higher house ownership among those in the lower quintile consistently across but not in the urban setting. This also could explain the not clear trend in the scores for house ownership and having own bedroom. The inconsistent trend in the scores for radio and computer ownership across the material affluence quintile could be contributable to the relatively high ownership of radio and the rare ownership of computer in the study population.

An alternative method commonly used for scale construction is the arbitrary approach of assigning equal weights to each variable and simply summing them up (Currie et al. 1997; Montgomery et al. 2000; Morris et al. 2000; Wardle et al. 2004). One major pitfall of this arbitrary method is that it cannot be used for exploratory analysis involving data reduction and hence only suitable where few indicators are measured. In addition, it does not show the contribution of the individual indicators to the scale.

5.3 Reliability of the Indicators Used for the Construction of MAS

It has been recommended that the measures of SES should be setting specific and relevant at the time of the study (Currie et al. 2004). All the same, almost all the eighteen indicators that we measured have been measured and used in the construction of SES index in the Demographic and Health Survey (DHS) in developing countries (see e.g. Crontinovic et al. 1993; Durkin, et al. 1994; Filmer and Pritchett 2001; Houweling et al. 2003; Vyvas and Kumaranyake 2006). Studies from the DHS surveys are comparable both across and within countries. Besides, the point we seek to make is that the nine indicators which were retained in the PCA and in the MAS could be useful measures of adolescent's material circumstances in studies where measuring parental education, occupation and income poses a problem.

5.4 External Validity of the Material Affluence Scale (MAS)

To assess the external validity of the MAS, we examined it association with the traditional measures (parental SES) commonly used in adolescents health inequality

research (Currie et al. 1997; Wardle et al. 2002). The first principal component had adequate internal coherence and moderately correlated with parental SES measures but highly statistically significant. As socioeconomic status is a multidimensional and complex construct, it is unlikely that examining the association between alternative measures would produce high correlation because different indices of SES measure different aspects of the phenomenon. Studies comparing parental SES and other scales found pretty similar results as ours (Currie et al. 1997; Wardle et al. 2002). Parental education is linked to adolescents (who are generally considered as dependants) in the family. It reflects not only the material resources but also intellectual and other resources of the family of origin. The effects of parental education on both adolescence and adult life on health and health behaviours have been well established (e.g. Koivusilta et al. 2006). Similarly, parental occupation affects adolescent's health and behaviour at different stages of the life course. Indeed, occupation is strongly related to income and thus may affect in similar ways as material resources and as well proxy for living standard and health among others. One major limitation of parental education and occupation in adolescent survey is the inability of the respondents to produce relevant and sufficient information which can be useful in classifying them into parental educational and occupational categories. This often results in high missing data in adolescent surveys. Previous studies indicates that there are difficulties in obtaining information on the parental education, occupation and income from adolescents leading to a growing interest in exploring other alternative measures of adolescents' SES (Currie et al. 1997; Wardle et al. 2004; Molcho et al. 2007). In this study, completion rate was relatively high for all the variables measured, still over all, the parental occupation and education indicators scored comparatively low completion rate compared to the material indicators as observed in other studies (Currie et al. 1997; Wardle et al. 2004; Molcho et al. 2007). This suggests that MAS could be an important tool not only in developing countries but could also be used in the western countries where obtaining parental SES information possess a problem.

5.5 Relationship Between the Material Affluence Scale and Health/Health 454 Behaviour Indicators

The MAS and parental SES showed similar pattern of strength and direction of association with selected indicators of health and health behaviours suggesting that MAS and parental SES were distinct yet related scales measuring various aspects of a multidimensional phenomenon. The findings of similar pattern of association between parental SES and the MAS for all the health and health behaviour indicators used in this study further suggest that MAS presents an authentic alternative for parental SES (parental occupation and education) where obtaining the latter gives more missing values and coding of occupation is time consuming and expensive.

5.6 Study Limitations and Further Research

This study is not a call to discard the traditional SES measures in adolescent survey neither do we claim that the MAS developed is the optimal method for measuring adolescents material circumstance in health and health behaviour inequality research.

The point of this study is to add knowledge to measuring SES of adolescents in developing countries and as well motivate further discussions on the subject.

Owing to resource constrains, only adolescents in schools have been included in this study hence the results herein reported might not necessarily be same in the entire adolescent population. However, a sample of 127 non-students in the same age group showed similar pattern of responses not only for the material indicators but also for most of the key indicators we measured in our survey. Besides, the school enrolment rate in Ghana for the age group of our respondents is relatively high-78.8% for Junior High Schools (Ministry of Education, Science and Sport, Ghana, 2008).

Regarding the household indicators, it would have been interesting to include the indicators that measure water and sanitation conditions of the household, on the other hand, these indicators highly correlate with electricity hence the non-inclusion of the water and sanitation variable is not likely to affect the result.

We neither considered the reliability of the health and health behaviour indicators nor the parental and material indicators used in this study. However, regarding the use of PCA, validation study from Indonesia, Pakistan and Nepal showed that scale constructed from PCA had good prediction of school enrollment disparities as the other more conventional approaches (Filmer and Pritchett 2001). Nonetheless, one obvious limitation of the use of the PCA is that it leads to lose of information due to summary coding of responses but this was necessary for easy interpretation of the weights (Filmer and Pritchett 2001). Validation study which examines inter-rater and test-retest reliability on these indicators among adolescents in developing countries would give more insight into researching adolescent's health in such countries. Future studies wishing to use similar approach used in this study must bear in mind the need to consider material affluence indicators that are applicable to the study setting and also relevant at the time of study.

6 Conclusions

The debate on both the search for a more appropriate measure of adolescents SES as well as the method for measuring socioeconomic status in general is still ongoing. Many studies have highlighted the issue of low completion rates and inappropriate responses of the traditional SES indicators in adolescent surveys mainly, in western countries. Material indicators have relatively higher completion rates compared to parental SES indicators (parental occupation and education). PCA is an easy statistical technique that has an advantage of using data that is relatively easy to answer in adolescent survey, because they represent facts in adolescent's reality, and as well uses many variables in reducing the dimensionality of the data, compared to other statistical methods, to construct material affluence scale. Material affluence scale constructed in this study has adequate internal coherence and good external validity when compared with the traditional SES measures (parental education and occupation). The material affluence scale was similar to the parental SES in terms of their strength and direction of association with health/health behaviour indicators. MAS presents an authentic alternative method for measuring adolescents SES where that latter is unavailable or difficult to obtain, particular in developing countries.

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RESEARCH ARTICLE

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Do socioeconomic differences in tobacco use exist also in developing countries? A study of Ghanaian adolescents

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Abstract

Background: In Western countries, tobacco use is most prevalent among adolescents in lower socioeconomic groups. The association between socioeconomic status (SES) and tobacco use among adolescents in developing countries is unexplored. Using multiple SES measures, we investigated this association among adolescents in Ghana.

Method: A school-based survey of a representative sample of 13-18-year-old Ghanaians (N = 1,165, response rate = 89.7%) was conducted in three regions, in 2008. Logistic regression analysis was used to evaluate the relationship of smoking, tawa (smokeless tobacco) use with familial SES (parental occupation and education, material affluence scale, family structure), an adolescent's individual social position (school performance, plans after graduation) and inter-generational social mobility (predicted by the differences of familial and individual positions).

Results: Socioeconomic differences existed in tobacco use whether measured by familial SES or individual social position with higher prevalence in lower socioeconomic groups. Low father's education and living in a non-nuclear family were associated with both forms of tobacco use while low material affluence was associated with tawa use only; individual social position measured by plans after graduation was the strongest predictor of both smoking and tawa use. Inter-generational downward social mobility and particularly staying in low SES was related to both forms of tobacco use.

Conclusions: Similar to Western countries, lower SES is related to an adolescent's tobacco use also in developing countries. Cumulative socioeconomic disadvantage over generations increases the probability of tobacco use.

Background

Socioeconomic inequality and its impact on health is a growing global public health concern [1]. Smoking has been identified as the single biggest cause of inequality in morbidity and mortality between rich and poor people in many countries [2]. Studies from Western countries have reported an association between socioeconomic status (SES) and smoking to the disadvantage of those in lower SES groups [3]. Studies among adolescents have shown the same pattern, with some exceptions where the association was found only for some ages, genders or SES indicators [4-9]. In developing countries among adolescents, the relationship between socioeconomic factors and smoking

is unknown. In this study, we explore this relationship among adolescents in Ghana, a developing country in sub-Saharan Africa.

Unlike in Western and many other developing countries, the prevalence of smoking in sub-Saharan Africa is relatively low both among adolescents as well as adults, based on the scanty information available [10]. In Ghana, a small study of urban adolescents shows that lifetime cigarette use was 7.5% [11] and among adults, in one region, 4% were current smokers [12]. Thus the prevalence of smoking is relatively low despite a long history of tobacco cultivation and manufacturing [13], but still Addo et al. [14] found that the current prevalence of tobacco use among civil servants in the capital city of Accra represents a rise over a thirty year period. On the other hand, traditionally, the population has used smokeless tobacco, tawa, but how

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common this is at the population level or how it relates to SES is not known.

In Ghana, reminiscent of most African countries, there are very little or no tobacco control measures and accessibility as well as availability to minors are unrestricted [11], except on religious or moral grounds. Therefore in view of the little or no tobacco control measures, we expect lower tobacco use among adolescents in the higher socioeconomic groups, who are likely to be favoured by any available health education, parental education and other socio-cultural factors, but higher among those in the lower socioeconomic groups, resulting in socioeconomic differences in tobacco use similar to those found in Western countries.

Assessments of an adolescent's SES should take into account the transitional nature of adolescence and should be conceptualized in two dimensions: familial SES, reflecting the social class of origin, and the adolescent's individual social position in relation to his/her peers [5-9]. The individual social position measured by school career or school performance, predicts education in adulthood [15]. In addition to SES, inter-generational social mobility has been shown to relate to health behaviours including smoking [16-18]. Inter-generational social mobility can be conceptualized as the transition between familial (original) SES in childhood and individual (achieved) social position in adulthood.

The aim of this study was to investigate socioeconomic differences in smoking and tawa use among Ghanaian adolescents using multiple SES measures which assess familial SES and the adolescent's individual social position. Based on these two dimensions, we also explore how the inter-generational social mobility relates to tobacco use.

Methods

Data

A cross-sectional survey was conducted from June to August 2008 on health behaviours and lifestyles of school-aged adolescents in three administrative regions in Ghana. Thirty schools were randomly sampled, ten per region, from Eastern (total number of schools in the region = 2924), Greater Accra (total number of schools in the region = 1825) and Volta Regions (total number of schools in the region = 2184). The Ghana Education Service's School Health Programme register of schools in the country was the source of the sampling frame. The sampling was done as follows: First, ten schools were randomly selected so that they comprised of four public Junior High Schools (total number in the three regions = 5325), two private Junior High Schools (total number in the three regions = 1395), three public Senior High Schools (total number in the three regions = 171) and one private Senior High School (total number in the three regions = 47) in

each region in order to reflect the school types in Ghana. Second, in each school, all students whose names were found in the class attendance register of the randomly selected classes were eligible to participate in the survey. The eight page questionnaire was anonymous and self-administered. It was designed to exclude any information that will reveal the identities of the participants. One trained supervisor was assigned to each classroom during the questionnaire administration to address pupils' concerns when necessary. The survey commenced simultaneously in all the participating classes in a given school. Participants were asked to drop their questionnaires in an envelope placed in front of the class on completion. The study protocol was approved by the ethical committee of the Ghana Health Service Research Unit in Accra, Ghana.

The characteristics of the respondents are presented in Table 1. Out of the 1566 respondents who completed the questionnaire, only 13-18-year-old students were included in this study (N = 1165). They comprised of 41.5% (483) boys and 55.3% (644) girls. The mean ages for boys and girls were 15.8 years and 15.9 years, respectively. The response rate was 89.7% (the sample was based on academic year's register of pupils). Only one pupil denied answering. A convenient sample of 127 non-students in the same age group showed similar pattern of responses for most of the key indicators we measured in our survey. Among this group 3.6% and 7.3% were tawa users and smokers, respectively.

Indicators of socioeconomic status

Indicators of familial socioeconomic status

A material affluence scale (MAS) of five categories (poorest, poor, average, affluent and most affluent) was used based on our previous research [19]. The items on which the scale was based covered three aspects of material circumstances: household assets (e.g. television) and housing characteristics (e.g. types of house), other assets (e.g. farm ownership) and school related indicators (e.g. working, other than doing household chores, in the morning before going to school). Material affluence mirrors the lack or availability of the resources and goods necessary for decent living in relation to what is generally available in the society [20]. Various kinds of scales measuring material affluence have been constructed to capture the amount of these kinds of resources available in the families [19,21]. The items of the scales are meant to envelop the key aspects of wealth as well as the material circumstances of the family.

Family structure was measured in four categories (nuclear family, both parents alive but not living together, only one parent alive, or both parents dead). Adolescents living in a family other than where both parents were alive and living together were regarded as socially disadvantaged.

Table 1 Distributions (%) of the characteristics of the study subjects by gender

Variable	Boys (N = 483)	Girls (N = 644)	P-value for gender difference
Age (yr)			0.370
13	9.5	6.7	
14	14.1	13.4	
15	17.2	20.7	
16	19.7	21.6	
17	21.1	21.4	
18	18.4	16.3	
Material affluence scale (N = 1097)			0.001
Poorest	21.9	16.6	
Second poorest	23.4	14.9	
Average	20.7	19.4	
Affluent	13.7	21.3	
Most affluent	15.9	21.3	
Missing	5.0	6.5	
Family structure (N = 1159)			0.010
Both parents dead	5.2	2.0	
Only one parent alive	18.2	16.7	
Both parents alive but not living together	22.2	21.2	
Nuclear family	54.0	59.5	
Missing	0.4	0.6	
Father's education (N = 1103)			0.008
Illiterate	9.7	6.5	
Primary education	34.6	29.5	
Secondary education	28.2	33.5	
Tertiary	22.4	24.8	
Missing	5.2	5.6	
Mother's education (N = 1116)			0.001
Illiterate	18.2	14.6	
Primary education	46.6	40.1	
Secondary education	22.8	30.4	
Tertiary	7.5	11.2	
Missing	5.0	3.7	
Father's occupation (N = 1022)			0.060
Low grade	65.4	56.7	
High grade	25.3	29.3	
Missing	9.3	14.0	
Mother's occupation (N = 1092)			0.017
Low grade	86.3	80.3	
High grade	8.1	12.9	
Missing	5.6	6.8	
School performance (N = 1158)			<0.001
Low	8.5	16.8	
Middle	48.4	54.7	
High	42.2	28.1	
Missing	0.8	0.5	
Plans after graduation (N = 1157)			0.028
Won't continue schooling	14.5	10.1	
Continue schooling	84.3	89.9	
Missing	1.2	0.3	
Mobility 1* (N = 1090)			<0.001
Stable (low)	9.9	5.7	
Downward	3.5	3.7	

Table 1 Distributions (%) of the characteristics of the study subjects by gender (Continued)

Upward	34.4	25.5	
Stable (high)	46.2	58.3	
Missing	6.0	6.8	
Mobility 2** (N = 1095)			0.005
Stable (low)	7.5	5.4	
Downward	6.0	3.9	
Upward	36.2	30.6	
Stable (high)	43.9	54.2	
Missing	6.4	5.9	
Tawa use			0.018
Yes	6.8	3.7	
No	87.4	91.6	
Missing	5.8	4.7	
Smoking			0.122
Yes	7.5	4.3	
No	85.3	88.5	
Missing	7.2	7.1	
Paternal smoking			0.195
Ever/current	5.4	7.6	
Never	82.4	84.2	
Missing	12.2	8.2	
Maternal smoking			0.027
Ever/current	3.7	1.7	
Never	88.2	93.2	
Missing	8.1	5.1	

*Mobility from assigned socioeconomic status measured by material affluence scale to achieved social position measured by plans after graduation.

** Mobility from assigned socioeconomic status measured by father's education to achieved social position measured by plans after graduation.

Father's, mother's or other guardian's highest level of education were categorised into illiterate, basic education, secondary education and tertiary education according to the classification of the Ghanaian educational system. Parental occupational status was measured by respondents reporting their father's, mother's, or other guardian's occupation or employment status. These were categorised in grades A (chief in rank), B (professional and managerial), C (professional non managerial), D (skilled manual), E (unskilled manual) and unemployed according to grades in the Ghana Civil Service (Head of Civil Service 2000) None of the respondents fell into the A category. We stratified grades B and C as high grade and grades D, E and unemployed as low grade in the analysis.

The adolescent's individual social position

Adolescents indicated their school performance in the previous term examination. These were coded into three categories high (excellent, very good), middle (good), and low (average, poor). Adolescents indicated their plans after graduation from the current level of schooling (continue schooling, learn a trade, look for job and not sure). These were coded as continue schooling and not continue schooling (learn a trade, look for job or not sure).

Predicted inter-generational social mobility

Two measures of inter-generational social mobility (upward mobility, stable high, stable low and downward mobility) were used. Two combinations of social class of origin (measured by MAS and father's education) and achieved social position (measured by plans after graduation) were computed. Mobility 1: MAS was categorised into High (3 = top 20%), Medium (2 = next 40%) and Low (1 = lowest 40%) while plans after graduation was categorised as continue schooling (1) and not continue schooling (0). Adolescents were classified as socially stable in the low SES (stable in low SES), if MAS = 1 and Plans after graduation = 0. And if MAS = 2 and Plans after graduation = 1 or if MAS = 3 and Plans after graduation = 1, they were classified as socially stable in the high SES (stable in high SES). Adolescents were classified as upwardly mobile, if MAS = 1 and Plans after graduation = 1. Adolescents were classified as downwardly mobile, if MAS = 2 and Plans after graduation = 0 or if MAS = 3 and Plans after graduation = 0, Table 1.

Mobility 2: Father's education was categorised into High (3 = tertiary education), Middle (2 = secondary education) and Low (1 = illiterate or primary education). Adolescents were classified as socially stable in the low

SES (stable in low SES), if father's education = 1 and Plans after graduation = 0. And if father's education = 2 and Plans after graduation = 1 or if father's education = 3 and Plans after graduation = 1, they were classified as socially stable in the high SES (stable in high SES). Adolescents were classified as upwardly mobile, if father's education = 1 and Plans after graduation = 1. Adolescents were classified as downwardly mobile, if father's education = 2 and Plans after graduation = 0 or if father's education = 3 and Plans after graduation = 0, Table 1.

Indicators of tobacco use

Smokers were adolescents who had ever smoked a cigarette. Tawa users were those who had ever tried tawa. Tawa comes in two forms: *Fine-grain tawa*-tobacco that often comes in teabag-like pouches that users "pinch" or "dip" between their lower lip and gum, allow it sit there and spit out the juice and *chewing tawa*- tobacco which comes in shredded or twisted tobacco leaves that users put between their cheek and gum, chew it and spit out the juice.

Parental smoking was based on adolescents' responses to two separate questions regarding their mothers' and fathers' smoking measured in five categories (father or mother smoked at present, had never smoked, had smoked but had stopped, couldn't say anything about parental smoking or had no father or mother). Dichotomous (never vs ever/current smokers) variables were made for maternal and paternal smoking.

The proportions of missing data were relatively low for all the indicators (Table 1). The proportion of tawa users and smokers were 5.7% and 6.6%, respectively.

Statistical analysis

Pearson's Chi-square tests were used to test the associations between gender and each of the studied variables. Logistic regression analysis was used to model the associations between the socioeconomic indicators and tobacco use. The strength of the associations was expressed by odds ratios (OR) and 95% confidence intervals (CI). First, bivariate models (Model1) were fitted including each of the socioeconomic measures one at a time, controlling for age and gender. Second, multivariate logistic regression models were used to test whether individual SES measures were independently predictive of tobacco use. Model 2 included age, gender and all the statistically significant socioeconomic indicators and then Model 3 comprising of the indicators in Model 2 plus parental smoking. For the social mobility analyses models 2 was adjusted for family structure and model 3 was adjusted for family structure and parental smoking. In all analyses, those with the highest socioeconomic advantages were used as the reference categories.

Results

Tobacco use by familial socioeconomic status

A lower level of material affluence was associated with the likelihood of tawa use but the association was not statistically significant with smoking. Adolescents who lived in family types other than the nuclear family were more likely to smoke or use tawa compared to those who lived in the nuclear family. Lower paternal education predicted both smoking and tawa use (Table 2, Model 1). Adolescents whose fathers had primary education were more likely to use tawa compared to those whose fathers had tertiary education, albeit at borderline statistical significance. Adolescents who had illiterate fathers were more likely to smoke than those whose fathers had tertiary education. There were no statistically significant associations between tobacco use and mother's education, and father's or mother's occupation. In multivariate analysis, material affluence independently predicted tawa use when the effects of the other statistically significant familial socioeconomic measures (Table 2, Model 2) and parental smoking were controlled for (Table 2, Model 3). Similarly, family structure independently predicted smoking and tawa use.

Tobacco use by individual social position

There were striking differences in tobacco use by plans after graduation but not by school performance (Table 3). Adolescents who did not have any plans of continuing schooling after graduating were more likely to smoke or use tawa than those who planned to further their education. In multivariate analysis, plans after graduation independently predicted both smoking and tawa use even after controlling for MAS, family structure and father's education (Table 3, Model 2) and parental smoking (Table 3, Model 3).

Tobacco use and adolescents' predicted inter-generational social mobility

Tawa use and smoking were related to both downward social mobility and stable low SES whether mobility was measured by material affluence scale or father's education compared to being stable in the high SES (Table 4). In a multivariate analysis, tawa use and smoking were independently related to downward social mobility and particularly being stable in low SES by both indicators of social mobility, after adjusting for family structure (Table 4, Models 2) and parental smoking (Table 4, Models 3). The only exception was that relationship between tawa use and downward mobility disappeared after controlling for parental smoking. Upwardly mobile adolescents did not differ from those stable in the high SES by smoking or tawa use.

Age and gender differences

Family structure and material affluence were associated with tawa use in the same direction for both genders

but statistically significant only for girls. Also, the associations between plans after graduation and both forms of tobacco use were statistically significant only for girls. When analysed separately in two age categories, younger adolescents (13-15-year-olds) and older adolescents (16-18-year-olds), the association between MAS and tawa use was statistically significant only among the younger adolescents. There were more girls in the sample than boys (Table 1).

Discussion

The main findings are that, first, socioeconomic differences, measured by both familial and individual SES exist in tobacco use among Ghanaian adolescents to the disadvantage of those in the lower socioeconomic groups. The differences follow the same pattern as those found in Western countries. Second, an adolescent's individual social position, measured by plans after graduation, is a stronger predictor of tobacco use than familial SES. Third, children expected to end up in adulthood in a lower SES than their families (downwardly mobile) or remained stable in the low SES are more likely to use tobacco than those children who are stable in the high SES. Fourth, the socioeconomic pattern was similar for smoking and tawa use, except that material affluence scale was related to tawa use only.

Our finding of higher probability of tobacco use among adolescents in lower SES groups is mostly in line with previous studies [4,9]. Some studies have reported high prevalence of smoking among adolescents whose parents had a low educational or occupational position [4,9]. Contrary to our expectation, familial SES measured by father's or mother's occupation and mother's education were not important predictors of an adolescent's smoking or tawa use in this study. On the other hand, adolescents of lower familial SES measured by material affluence scale were more likely to use tawa compared to those on higher material affluence scale. The traditional tawa is likely to be cheaper, more available and accessible compared to cigarettes. It is also relatively easier to hide and use without anybody noticing since it is smokeless, and perhaps the Ghanaian society is more tolerant to its use than smoking. These and other socio-cultural factors could explain in part why material affluence scale was related to tawa use but not smoking.

An adolescent's individual social position indicated by plans after graduation was strongly related with both forms of tobacco use in a similar pattern as in Western countries [5] but school performance was not. Higher prevalence of both smoking and tawa use was found among adolescents who did not have plans to continue schooling after graduation compared to those who planned to continue. Previous studies using indicators

which capture the adolescents' individual SES have shown that adolescents of low individual SES are more likely to take up smoking and other health compromising behaviours, similar to our results [5,6,8,9,18]. For example, adolescents who discontinue school after the comprehensive school often engage in health-damaging behaviours typical of lower socioeconomic groups [5]. There are plausible explanations for the strong negative association between plans after graduation and tobacco use in our study. In Ghana, where there is high unemployment for even those with post-secondary education, having no plans to continue schooling after the Junior or Senior High School levels could therefore be a true sign of failure and hopelessness both for the present and the future. This may lead to low self-esteem, stress and depression and consequently result in tobacco use as a means of handling these frustrations [22]. This indicator is likely to reveal the hidden characteristic of an adolescent's individual social position independent of his or her familial status.

An adolescent's individual social position as indicated by school performance was not related with tobacco use. In Western countries, adolescents who have poor school performance have higher prevalence of smoking than those with good school performance [9]. Some explanations given for this association are that adolescents with poor school performance are likely to benefit less from health education than those of better school performance. Also, adolescents with poor school performance turn to smoking behaviour as a coping lifestyle in the face of the stress caused by educational demands [22]. In Ghana, and perhaps in most developing countries, although school performance is an important determinant of educational success and consequently future social position, factors such as gender, affordability as well as socio-cultural factors are equally important in determining the link between school performance, educational success and hence social position. It is not clear to what extent these factors account for the non-statistically significant relationship between school performance and tobacco use found in this study. Furthermore, school performance was self-reported as in most studies [e.g. [9]] but it is uncertain to what extent this might have affected the relationship between school performance and tobacco use reported here.

Adolescents living in a nuclear family had less likelihood of tobacco use than those in non-nuclear families, independent of parental smoking. Previous studies have highlighted the role of parents in the prevention of health compromising behaviours among adolescents [23-25]. Flisher et al. [26] found that among South African adolescents, not being raised by both parents was significantly associated with cigarette smoking among black and colored students. It was inversely associated

Table 2 Odds ratios (OR) and their 95% confidence intervals (CI) of tobacco use by parental socioeconomic measures among adolescents, statistically significant odds ratios in bold

Socioeconomic indicator	Tawa use			Smoking		
	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
MAS					*	*
Most affluent	1.0	1.0	1.0	1.0		
Affluent	0.4 (0.1-2.2) P = 0.303	0.4 (0.1-2.1) P = 0.280	0.4 (0.1-2.1) P = 0.291	0.3 (0.1-3.6) P = 0.093		
Average	1.6 (0.5-4.9) p = 0.432	1.3 (0.4-4.2) P = 0.684	1.4 (0.4-4.6) P = 0.0567	1.4 (0.5-3.6) P = 0.439		
Second poorest	4.6 (1.7-12.5) P = 0.003	4.0 (1.4-11.3) P = 0.009	3.1 (1.0-9.1) P = 0.040	2.2 (0.9-5.3) P = 0.066		
Poorest	3.5 (1.2-9.9) P = 0.016	3.1 (1.0-9.4) P = 0.041	3.2 (1.0-9.5) P = 0.042	1.6 (0.6-3.9) P = 0.333		
Family structure						
Nuclear family	1.0	1.0	1.0	1.0	1.0	1.0
Both parents alive but not together	1.4 (0.7-3.0) P = 0.362	1.6 (0.7-3.7) P = 0.205	1.6 (0.7-3.8) P = 0.213	1.4 (0.7-2.8) P = 0.325	1.3 (0.6-2.7) P = 0.446	1.3 (0.6-2.8) P = 0.420
Only one parent alive	2.4 (1.2-4.9) P = 0.011	2.7 (1.3-5.8) P = 0.010	2.2 (1.0-5.0) P = 0.054	2.5 (1.3-4.7) P = 0.005	2.2 (1.1-4.3) P = 0.021	2.5 (1.3-4.9) P = 0.006
Both parents dead	6.9 (2.8-17.2) P < 0.001	7.7 (2.7-21.4) P < 0.001	6.1 (2.0-18.3) P < 0.001	6.1 (2.5-15.0) P < 0.001	4.1 (1.5-11.4) P = 0.006	5.6 (2.1-14.8) P < 0.001
Father's education			*			*
Tertiary education	1.0	1.0		1.0	1.0	
Secondary education	1.4 (0.6-3.3) P = 0.190	0.6 (0.1-2.1) P = 0.463		1.4 (0.6-2.9) P = 0.411	1.4 (0.6-2.9) P = 0.418	
Primary education	2.3 (1.0-5.0) P = 0.041	1.0 (0.4-2.5) P = 0.913		1.0 (0.5-2.3) P = 0.889	0.9 (0.4-2.1) P = 0.889	
Illiterate	2.0 (0.7-5.9) P = 0.425	1.2 (0.5-2.9) P = 0.694		3.0 (1.3-7.3) P = 0.013	2.4 (1.0-5.9) P = 0.060	
Mother's education		*	*		*	*
Tertiary education	1.0			1.0		
Secondary education	0.7 (0.2-1.9) P = 0.437			0.4 (0.1-1.3) P = 0.138		
Primary education	1.0 (0.4-2.4) P = 0.936			1.1 (0.4-2.9) P = 0.774		
Illiterate	1.3 (0.5-3.7) P = 0.591			0.8 (0.3-2.5) P = 0.783		
Father's occupation		*	*		*	*
High grade	1.0			1.0		
Low grade	1.3 (0.7-2.5) P = 0.367			1.2 (0.7-2.2) P = 0.526		
Mother's occupation		*	*		*	*
High grade	1.0			1.0		
Low grade	1.1 (0.4-2.6) P = 0.873			0.6 (0.3-1.4) P = 0.647		

Model 1 = socioeconomic measure + age + gender (bivariate).

Model 2 = age + gender + statistically significant socioeconomic measures in model 1.

Model 3 = age + gender + statistically significant socioeconomic measures in model 2 + paternal smoking +maternal smoking.

* Not included in the model.

with cigarette use among black students. It is likely that difference in parenting upbringing style between family structures or perhaps less parental control among adolescents not living with both parents account for this association.

There is paucity of study on inter-generational social mobility and tobacco use among adolescents. Previous study shows that health compromising behaviours such as smoking and alcohol use are more frequent among downwardly mobile and less frequent among upwardly

Table 3 Odds ratios (OR) and their 95% confidence intervals (CI) of tobacco use by measures of adolescents' individual social position, statistically significant odds ratios in bold

Indicator of individual social position	Tawa use			Smoking		
	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
School performance		*	*		*	*
Above average	1.0			1.0		
Average	0.4 (0.1-1.3) P = 0.149			0.6 (0.2-1.4) P = 0.244		
Below average	0.6 (0.4-1.2) P = 0.151			0.7 (0.4-1.2) P = 0.202		
Plans after graduation						
Continue school	1.0	1.0	1.0	1.0	1.0	1.0
Not continue school	3.7 (2.0-6.7) P < 0.001	3.2 (1.7-6.3) P < 0.001	2.7 (1.3-5.6) P < 0.001	4.0 (2.5-7.0) P < 0.001	3.6 (1.6-6.8) P < 0.001	3.4 (1.6-6.8) P < 0.001

Model 1 = socioeconomic measure + age + gender (bivariate).

Model 2 = age + gender + material affluence scale + family structure + father's education.

Model 3 = age + gender + material affluence scale + family structure + father's education + paternal smoking +maternal smoking.

* Not included in the analysis.

mobile young people than their peers who have persisted in their SES of origin [17]. A recent study also found that among young people, risk behaviours like tobacco use were more prevalent among downwardly mobile or those stable compared to those upwardly mobile [18]. In our study, downwardly mobile adolescents and those staying in the low SES were more likely to use tobacco compared to those stable in the high SES

similar to the previous findings. Furthermore, our findings of higher probability of tobacco use among those stable in the low SES highlight the effects of cumulative socioeconomic disadvantage over generations on adolescents' tobacco use. We did not find any statistically significant difference in tobacco use among upwardly mobile adolescents compared to their peers who were stable in the high SES.

Table 4 Odds ratios (OR) and their 95% confidence intervals (CI) of tobacco use by adolescents' predicted social mobility, statistically significant odds ratios in bold

Social mobility indicator	Tawa use			Smoking		
	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
Mobility 1* (N = 1090)						
Stable in low SES	6.5 (2.7-15.7) P < 0.001	6.0 (2.4-14.8) P < 0.001	6.1 (2.4-15.3) P < 0.001	5.2 (2.2-12.1) P < 0.001	4.8 (2.0-11.5) P < 0.001	4.7 (1.8-12.1) P = 0.001
Downwardly mobile	2.9 (1.4-6.2) P = 0.006	2.4 (1.1-5.3) P = 0.025	2.1 (0.9-4.8) P = 0.064	3.1 (1.6-6.2) P = 0.001	2.5 (1.2-5.0) P = 0.009	2.6 (1.2-5.4) P = 0.011
Upwardly mobile	1.3 (0.6-2.9) P = 0.492	1.2 (0.5-2.8) P = 0.596	1.1 (0.5-2.7) P = 0.742	0.6 (0.2-1.2) P = 0.312	0.5 (0.2-1.4) P = 0.229	0.6 (0.2-1.7) P = 0.391
Stable in high SES	1.0	1.0	1.0	1.0	1.0	1.0
Mobility 2** (N = 1095)						
Stable in low SES	6.2 (2.8-13.7) P < 0.001	5.0 (2.2-11.5) P < 0.001	4.6 (2.0-10.9) P < 0.001	4.2 (1.9-9.1) P < 0.001	3.5 (1.6-7.8) P = 0.002	3.4 (1.4-8.2) P = 0.006
Downwardly mobile	3.3 (1.2-8.8) P = 0.017	2.8 (1.0-7.5) P = 0.046	2.6 (1.0-7.2) P = 0.058	3.9 (1.6-9.3) P = 0.002	3.2 (1.3-7.7) P = 0.010	3.8 (1.5-9.6) P = 0.004
Upwardly mobile	1.5 (0.7-2.9) P = 0.249	1.3 (0.6-2.6) P = 0.490	1.2 (0.6-2.5) P = 0.570	1.0 (0.5-2.0) P = 0.953	0.9 (0.4-1.7) P = 0.714	1.0 (0.5-2.1) P = 0.941
Stable in high SES	1.0	1.0	1.0	1.0	1.0	1.0

Model 1 = social mobility measure + age + gender.

Model 2 = social mobility measure+ age + gender + family structure

Model 3 = social mobility measure +age + gender + family structure + paternal smoking +maternal smoking.

*Mobility from assigned socioeconomic status measured by material affluence scale to achieved social position measured by plans after graduation.

** Mobility from assigned socioeconomic status measured by father's education to achieved social position measured by plans after graduation.

Strength and limitation

We used a representative sample of schools both in urban and remote rural areas in three regions which are representative of the entire country, the first study of its kind in Ghana. Some of the questions we used have also been used in other studies, for example, the Global Youth Tobacco Survey (GYTS) and the Global School-based student Health Survey (GSHS) which have been conducted in many African countries. Moreover, to the best of our knowledge our study is the first of its kind which has investigated the traditional smokeless tobacco (tawa) in Ghana.

Self-report is the only way to conduct large surveys but it could lead to recall bias or intentional misreporting which could affect the accuracy of the reports. However, this should not affect the relationships between SES and tobacco use among adolescents. Similar methods have been used in most previous studies [4,5]. The study was cross-sectional therefore the cause and effect relationship cannot be emphasised as an etiological conclusion, nonetheless it can be argued that at the adolescent age socioeconomic status is likely to precede tobacco use and not the reverse. During data collection an investigator was present in the classroom to address the concern of the pupils when necessary. Although we do not perceive that this might have affected the adolescents' responses, if it did, it would be more likely to have resulted in the under estimation of both the tobacco use prevalence and the socioeconomic status rather than over estimation. Our sample of students for the study was drawn from a sample of schools. The clustering of students may slightly change the standard error of our estimates, although unlikely to change neither the overall results nor the conclusion reached in this study. Due to scarce resources, only adolescents in schools have been included in this study. On the other hand, a similar pattern of responses for most of the key indicators in this study was found among a convenient sample of non-students in the same age group. Moreover, the school enrolment rate in Ghana for the age group of our respondents is high, 78.8% for Junior High Schools (Ministry of Education, Science and Sport, Ghana, 2008).

Conclusions

Our finding of higher likelihood of tobacco use among adolescents in lower socioeconomic groups suggests that in the future there will be differences in tobacco use as well as tobacco related morbidity and mortality in Ghana between adult socioeconomic groups which will follow into health differences similar to those seen in Western countries. Furthermore, this study shows that, during adolescence, tobacco use is more influenced by individual social position than familial SES. As an adolescent's

familial SES is an assigned status, its impact may be less on their health behaviours during the period of transition when adolescents move from dependent to independence. On the other hand, individual social position captures the transitional nature of adolescence as well as the social position within their peers. This study adds to the knowledge of socioeconomic differences in tobacco use among adolescents in developing countries, particularly in Africa. Health promotion and tobacco control strategies aimed at reducing adolescence tobacco use should pay attention to those of lower social and material statuses, and those in danger of discontinuing education after the basic level.

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Authors' contributions

DD, LK and AR were involved in the conception and design of the study. DD, SR and AR were involved in the drafting and the revising of the questionnaire. DD was the principal investigator during the data collection. DD analysed the data and drafted the manuscript. All authors were involved in the interpretation of data and the critical revision of the manuscript for important intellectual content. All authors gave final approval of the version to be published.

Competing interests

The authors declare that they have no competing interests.

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Original article

Socioeconomic Differences in Smoking Among Finnish Adolescents From 1977 to 2007

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Abstract

Purpose: Persistence of socioeconomic differences in smoking among adolescents over time is unexplored. We investigated the changes in smoking among 12–18-year-old Finns from 1977 to 2007 using multiple indicators of socioeconomic status (SES) to determine whether differences between socioeconomic groups increase over time, with reduced smoking in higher socioeconomic groups.

Methods: Nationwide biennial surveys were conducted since 1977 (response rate, 59%–88%; N = 96,747) using familial and individual social position (school performance/career) indicators. Associations between socioeconomic indicators and smoking were evaluated using logistic regression analysis.

Results: Socioeconomic differences in smoking measured by familial SES or individual social position persisted over time, with higher rates in lower SES groups. Individual social position was more strongly related to smoking than familial SES. Differences between groups assessed by individual social position increased over time: the difference in smoking prevalence between groups with the lowest and highest individual social position among 12–14-year-old girls and boys, respectively, was 22% and 28% in 1977–1983, and 45% and 34% in 2001–2007; and in 16–18-year-old girls, 33% in 1977–1983 and 48% in 2001–2007. Smoking differences in relation to father's education increased over time: the difference in 12–14-year-old girls and boys, respectively, between the lowest and highest SES groups was 6% and 5% in 1977–1983 and 9% and 8.5% in 2001–2007; and in 16–18-year-old girls and boys, respectively, 7% and 10% in 1977–1983 and 13% and 14.5% in 2001–2007.

Conclusions: Differences between socioeconomic groups among Finnish adolescents persisted or increased over 30 years, and predict differences in smoking-related diseases between socioeconomic groups in adulthood. © 2010 Society for Adolescent Health and Medicine. All rights reserved.

Keywords:

Adolescents; Smoking; Socioeconomic status; Trends

Evidence suggests that smoking prevention programs are less successful among adults with a lower socioeconomic status (SES), resulting in a widening of the gap in smoking behavior between different socioeconomic groups [1]. A lack of social support [2], lower confidence in the ability to quit smoking, and higher nicotine dependence among the less educated and the poor may contribute to the increased

difference [3]. The development of socioeconomic differences in smoking behavior in a population is consistent with the theory of diffusion of innovation [4]; four stages of the smoking epidemic have been described [5,6]. In the first stage, smoking pervades the higher socioeconomic groups (innovators). During the second stage, smoking spreads to the rest of the population, including the lower socioeconomic groups (laggards). The third stage is characterized by the start of cessation in the higher socioeconomic groups, male dominance, and a rise in female smoking. Finally, in the fourth stage, smoking declines among the higher socioeconomic groups, but remains high among lower SES

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groups. The Nordic countries, including Finland, are considered to be in the late stages of the epidemic [7]. Adolescent smoking has not been evaluated from this point of view.

As a typical Nordic welfare state, equality is an important goal of governance in Finland [8], which is reflected by the long tradition of an equitable social and health policy [9,10], as well as over 30 years experience with comprehensive tobacco control measures [11]. Despite the success achieved in reducing smoking among male adults, smoking remains relatively common among women, and the poorest and less educated adult population [12–14]. Although there have been increases and decreases in the smoking prevalence among adolescents from the 1970s to the 2000s, overall smoking behavior has declined since 2000 [15]. It is possible that tobacco control efforts have reduced smoking more among adolescents in higher socioeconomic groups than among those in lower socioeconomic groups, resulting in widening of the gap over time.

Adolescent smoking varies by SES [16,17], but some studies have found this association for only some ages or gender, or for only some socioeconomic indicators [16–18]. Only one published study examined the smoking trend using a reliable design. In one state in Germany, among a sample of 11,401 adolescents aged 11–15 years, differences in smoking behavior between socioeconomic groups, assessed by family affluence and school type, persisted between 1994 and 2002 [16]. The prevalence of smoking behavior in the highest and lowest SES groups, assessed by family affluence, among boys was 8.5% and 10.7%, respectively, in 1994, and 16% and 17.9%, respectively, in 2002. Correspondingly, the prevalence in girls was 11.8% and 15%, respectively, in 1994 and 14.4% and 16.9%, respectively, in 2002. Similar persistent socioeconomic differences in smoking behavior were found when SES was assessed by school type.

Assessments of SES in adolescents must take into account the transitional nature of the age period and should be conceptualized in two dimensions: familial SES, reflecting the social class of origin, and the adolescent's individual social position in relation to his/her peers [19,20]. The individual social position, when measured by school career or school performance, predicts education in adulthood [19]. To assess the SES of adolescents, we used both familial SES (based on family structure, father's/guardian's occupation, father's/guardian's and mother's educational level) and the adolescent's individual social position, based on school performance and school career. In this article, we investigated socioeconomic differences in relation to adolescent smoking in Finland and examined whether these differences increased between 1977 and 2007.

Method

Data source

The data were collected as part of a national monitoring system of adolescent health and health behaviors, the

Adolescent Health and Lifestyle Survey. The survey instrument consists of a 12-page self-administered questionnaire mailed biennially since 1977 to a nationally representative sample of independent samples of adolescents aged 12, 14, 16, and 18 years, with two reminders sent to nonrespondents ($N = 2,832$ – $6,503$; yearly response rate 59%–88%, total respondents $N = 96,747$). The samples were selected so that the average ages of respondents were 12.6, 14.6, 16.6, and 18.6 years. The Finnish Population Register Centre was the source of the sample collection. The data were collected from February to April each study year. The data collection methods, timing of the survey, and questions were maintained as similar as possible to enhance the comparability of the results between study years. The Ethics Committees of the Department of Public Health at the University of Helsinki and the Pirkanmaa Hospital District, Finland, approved the study protocol.

In this study, the study years were stratified into four periods: 1977–1983, 1985–1989, 1991–1999, and 2001–2007, according to changes in the smoking prevalence (decreasing, increasing, stable, and decreasing, respectively) in the Finnish adolescent population [21] to determine whether such changes were associated with SES.

Indicators of smoking

Because there were differences in the prevalence of smoking between 12–14-year olds and 16–18-year olds, the analyses were performed separately for these age groups. Among 12–14-year-olds, smokers were those who had smoked two or more cigarettes in their lifetime. For 16–18-year-olds, smokers were those who reported having smoked more than 50 cigarettes in their lifetime, had smoked during the past week, and smoked daily. Both outcomes are dichotomous.

SES indicators

Questions regarding family structure assessed whether respondents lived with both parents (intact family) or not (non-intact family). Father's/guardian's occupation was classified into four categories: upper white-collar, lower white-collar, farmers (agriculture and forestry workers), and blue collar. Indicators of parents' educational level were classified as low (9 years or less of education), middle (9–12 years), and high (over 12 years). Father's and mother's educational levels were analyzed separately. Mother's education was measured only in 1995 and from 1999 onwards.

The adolescent's individual social position was measured by the adolescent's school performance and school career. Self-reported school performance (a measure only valid for 12–14-year olds) was based on the respondent's assessment of school performance compared with the class average and classified accordingly as much better, slightly better, average, and poorer than average. The adolescent's school career (a measure only valid for 16–18-year olds) was categorized as not in school, in vocational school/poor or average school

performance, in vocational school/good performance, in high school/poor or average performance, and in high school/good performance. In Finland, compulsory education ends at age 16, after which adolescents continue to high school, vocational school, or end their education.

The distribution of SES measures by survey year is shown in Table 1. The correlations between parental SES indicators and an adolescent's individual social position are presented in Table 2. Father's occupation was excluded in the correlation analysis because the farmer category did not have the same low or high SES end scales as the other variables.

Statistical analysis

A logistic regression analysis was used to model factors related to smoking. First, bivariate models were fitted, including each of the explanatory variables one at a time and controlling for the survey period (1977–1983, 1985–1989, 1991–1999, and 2001–2007) and age.

In each of the models, the highest socioeconomic group and the period 1977–1983 were set as reference categories. The analyses were performed separately for both age group and gender. Second, a model including each socioeconomic indicator, the study period, and the interaction between them was fitted. A statistically significant interaction between a socioeconomic indicator and the study period indicates that the change over time in the prevalence of smoking was not the same for the different groups of that socioeconomic indicator. The change over time in smoking across the 30-year survey period in the different socioeconomic subgroups was further investigated graphically for those socioeconomic indicators that had statistically significant interactions with the study period when stratified by gender. The parameters of the logistic regression models are presented as odds ratios (OR) with 95% confidence intervals. Analysis was performed using the SPSS package, version 16 (SPSS Inc, Chicago, IL).

Results

Smoking by adolescent's familial SES

Children in lower socioeconomic groups smoked more than children in higher socioeconomic groups, whether measured by father's or mother's education (Table 3). The only exception was that smoking prevalence for adolescent boys whose fathers were farmers did not differ from the reference group and smoking prevalence was lower among adolescent daughters of farmers than among those of upper white-collar employees.

There was a statistically significant interaction between the study period and the familial socioeconomic indicators (Table 3). The higher the father's education, the greater was the decrease in smoking during the period from 1991–1999 to 2001–2007 among 12–14-year-old boys and girls (Figure 1A, B). Among boys aged 16–18 years whose fathers had a low education level, smoking behavior did not change during the period 1991–1999 to 2001–2007, whereas among

those whose fathers had middle or high levels of education, smoking behavior decreased during the same period (Figure 1C). Among 16–18-year-old girls whose fathers had a low education level, smoking behavior increased during the period 1991–1999 to 2001–2007, but little change was observed in the other groups (Figure 1D).

From 1991–1999 to 2001–2007, the rate of the decrease in smoking was slower for 12–14-year-old girls whose mothers had low or middle levels of education than for those whose mothers had high levels of education. From 1991–1999 to 2001–2007, smoking behavior increased from 32.7% to 37% among 16–18-year-old girls whose mothers had a low level of education, but decreased from 28.5% to 27% and from 22% to 19.8% for those whose mothers had a middle or high educational level, respectively. In the same period, from 1991–1999 to 2001–2007, smoking behavior decreased among 12- to 14-year-old boys in all occupational groups, including that of farmers (Figure 1E).

There were striking socioeconomic differences in smoking by family structure. Adolescents in non-intact families had a higher prevalence of smoking than those in intact families (Table 3). In both age groups, these differences were slightly greater for girls than for boys. There was a statistically significant interaction between study period and family structure among 16–18-year-old girls. From 1985–1989 to 1991–1999, smoking behavior decreased slightly among 16–18-year-old girls living in intact families (Figure 1F).

Smoking by school performance and school career

School performance and school career yielded the most striking differences in smoking behavior (Table 3). There was a significant interaction between study period and school performance for 12–14-year-old boys and girls, and for study period and school career for 16–18-year-old girls. From 1985–1989 to 1991–1999, smoking behavior increased among 12–14-year-old boys whose school performance was poor, but decreased in the other groups. From 1991–1999 to 2001–2007, smoking behavior decreased in all groups (Figure 2A). For girls, the increase in smoking from 1985–1989 to 1991–1999 was higher for those whose school performance was poor than for those in the other groups (Figure 2B). From 1991–1999 to 2001–2007, smoking decreased in all groups, but the rate of the decrease was much slower among those with poor school performance. From 1991–1999 and 2001–2007, smoking increased among the 16–18-year-old girls who were not in school or who were in vocational school and had poor or average school performance (Figure 2C). In the other subgroups, smoking by school career stayed stable or increased slightly.

Discussion

Summary of the results

Using a nationally representative large sample, this study shows that there are socioeconomic differences in smoking

Table 1

Distribution of socioeconomic variables, number of respondents (n), response rate (%), and smoking prevalence among 12–18-year-old Finns from 1977 to 2007

Indicator	Study period			
	1977–1983	1985–1989	1991–1999	2001–2007
Proportion of smokers (%)				
Boys 12–14-years	38	36	35	23
Girls 12–14-years	29	31	38	27
Boys 16–18-years	32	34	32	28
Girls 16–18-years	26	29	27	30
Number of respondents (N) and response rate (%)				
Boys 12–14-years	3,617 (86)	3,057 (78)	8,020 (75)	5,759 (65)
Girls 12–14-years	3,767 (91)	3,222 (86)	8,704 (85)	6,611 (76)
Boys 16–18-years	3,740 (81)	3,860 (70)	9,837 (63)	5,983 (47)
Girls 16–18-years	3,839 (89)	4,432 (84)	13,253 (86)	8,043 (75)
Father's occupation (%)				
Upper white collar	13	19	26	36
Lower white collar	26	27	28	24
Farmers	16	10	7	6
Blue collar	44	44	39	34
Total	100	100	100	100
Father's education (%)				
High	8	14	21	29
Middle	11	13	16	14
Low	81	73	63	57
Total	100	100	100	100
Mother's education ^a (%)				
High	*	*	29	41
Middle	*	*	20	15
Low	*	*	51	44
Total	*	*	100	100
Family structure (%)				
Intact	81	79	76	76
Non-intact	19	21	24	24
Total	100	100	100	100
School performance (%)				
Much better	15	15	13	13
Slightly better	29	30	29	31
Average	38	40	44	43
Poor	18	15	15	13
Total	100	100	100	100
School career (%)				
High school				
Good performance	20	24	27	27
Poor performance	21	27	31	31
Vocational school				
Good performance	12	10	10	12
Poor performance	23	23	22	25
Not in school	24	16	10	5
Total	100	100	100	100

^a Variable was measured in 1995 and 1999 onward.

behavior among Finnish adolescents. Smoking is more strongly linked to an adolescent's individual social position than to his or her familial SES. Over the 30-year period, the differences between socioeconomic groups persisted and, in some groups, even increased over time. An increase in smoking was observed among 12–14-year-olds girls whose school performance was poor, and among 16–18-year-old girls in lower SES groups, as assessed by school career, whereas smoking decreased in the other groups.

Comparison with previous research and interpretation

In contrast to a recent German study that found no changes in smoking by adolescents' SES over a 10-year period [16], we found changes in smoking prevalence among Finnish adolescents by SES measured by the adolescent's individual SES as well as by familial SES, to the disadvantage of those at the lower end of the socioeconomic ladder over a 30-year period.

Our findings of a higher prevalence of smoking among those in the lower socioeconomic groups confirm the

Table 2
Spearman's correlations between familial SES and individual social position measures

	Father's education	Mother's education	Family structure	School performance ^a	School career ^a
Father's education	1.000	.491	.031	.228	.314
Mother's education		1.000	.099	.233	.325
Family structure			1.000	.110	.144

All at $p < .001$.

^a Correlations between these variables were not calculated because variables were measured separately for age groups 12–14-year old and 16–18-year old.

findings of some previous studies [20,22–25]. One Finnish study reported that familial SES is not significantly associated with smoking in either adolescence or adulthood [18]. Other studies, mainly from European countries, reported relatively small or sometimes nonsignificant

differences in smoking behavior based on an adolescent's familial SES [17,22,23,26]. Our study revealed no age differences in the association between smoking and SES, in contrast to Glendinning et al. and Huurre et al. [26,27]. Furthermore, our study supports the finding that

Table 3
Odds ratios (OR) and 95% confidence intervals (CI) for smoking by socioeconomic indicators for 12–14 and 16–18 year-old boys and girls adjusted for age and study period

Socioeconomic variable	Smoking							
	Boys 12–14-year-old		Girls 12–14-year-old		Boys 16–18-year-old		Girls 16–18-year-old	
	N	OR (95% CI)	N	OR (95% CI)	N	OR (95% CI)	N	OR (95% CI)
Father's occupation								
Upper white collar	5,133	1	5,627	1	5,396	1	6,491	1
Lower white collar	5,035	1.2 (1.1–1.3)	5,768	1.3 (1.2–1.4)	5,931	1.4 (1.3–1.5)	7,151	1.4 (1.3–1.5)
Blue collar	7,694	1.3 (1.2–1.4)	8,362	1.4 (1.3–1.5)	8,856	1.6 (1.5–1.7)	10,633	1.5 (1.4–1.6)
Farmers	1,717	1.0 (.7–1.0)	1,731	.8 (.7–.9)	2,190	1.0 (.9–1.1)	2,500	.8 (.7–.9)
<i>p</i> -value for interaction term ^a	<i>p</i> = .031		<i>p</i> = .821		<i>p</i> = .087		<i>p</i> = .630	
Father's education								
High	3,993	1	4,318	1	4,048	1	4,663	1
Middle	2,886	1.0 (.8–1.1)	3,134	1.2 (1.1–1.3)	2,946	1.2 (1.1–1.4)	3,624	1.2 (1.1–1.4)
Low	11,891	1.3 (1.2–1.4)	13,156	1.4 (1.3–1.5)	14,791	1.6 (1.4–1.7)	17,844	1.5 (1.4–1.7)
<i>p</i> -value for interaction term ^a	<i>p</i> < .001		<i>p</i> = .027		<i>p</i> < .001		<i>p</i> = .030	
Mother's education ^b								
High	3,410	1	3,676	1	2,886	1	3,496	1
Middle	1,637	1.1 (.9–1.2)	1,620	1.2 (1.1–1.4)	1,476	1.2 (1.0–1.4)	1,826	1.2 (1.1–1.4)
Low	4,817	1.5 (1.3–1.6)	4,012	1.5 (1.4–1.7)	4,302	1.7 (1.5–1.9)	5,676	1.8 (1.6–1.9)
<i>p</i> -value for interaction term ^a	<i>p</i> = .056		<i>p</i> = .026		<i>p</i> = .208		<i>p</i> < .001	
Family structure								
Intact	15,982	1	17,196	1	17,386	1	20,031	1
Nonintact	3,787	1.7 (1.6–1.9)	4,566	2.1 (2.0–2.3)	5,192	1.9 (1.7–2.0)	7,045	2.2 (2.0–2.3)
<i>p</i> -value for interaction term ^a	<i>p</i> = .296		<i>p</i> = .330		<i>p</i> = .332		<i>p</i> = .026	
School performance ^c								
Much better	2,490	1	3,906	1				
Slightly better	5,258	1.5 (1.4–1.7)	7,148	1.7 (1.5–1.8)				
Average	7,983	2.3 (2.4–3.7)	8,308	2.7 (2.4–2.9)				
Poor	4,014	4.9 (6.9–10.5)	2,303	5.9 (5.3–6.7)				
<i>p</i> -value for interaction term ^a	<i>p</i> < .001		<i>p</i> < .001					
School career ^d								
High school								
Good performance					4,329	1	8,242	1
Poor performance					5,903	2.4 (2.2–2.7)	8,526	2.3 (2.2–2.5)
Vocational school								
Good					2,866	4.0 (3.5–4.5)	2,326	3.7 (3.4–4.2)
Poor					6,269	7.0 (6.3–7.8)	5,115	6.3 (5.8–6.9)
Not in school					3,198	9.1 (8.1–10.3)	2,914	8.1 (7.3–8.9)
<i>p</i> -value for interaction term ^a					<i>p</i> = .671		<i>p</i> = .042	

^a *p*-value for the interaction term between socioeconomic variable and period.

^b The variable was first measured in 1995, and 1999–2007.

^c Variable valid only for 16–18-year-old boys and girls.

^d Variable valid only for 12–14-year-old boys and girls.

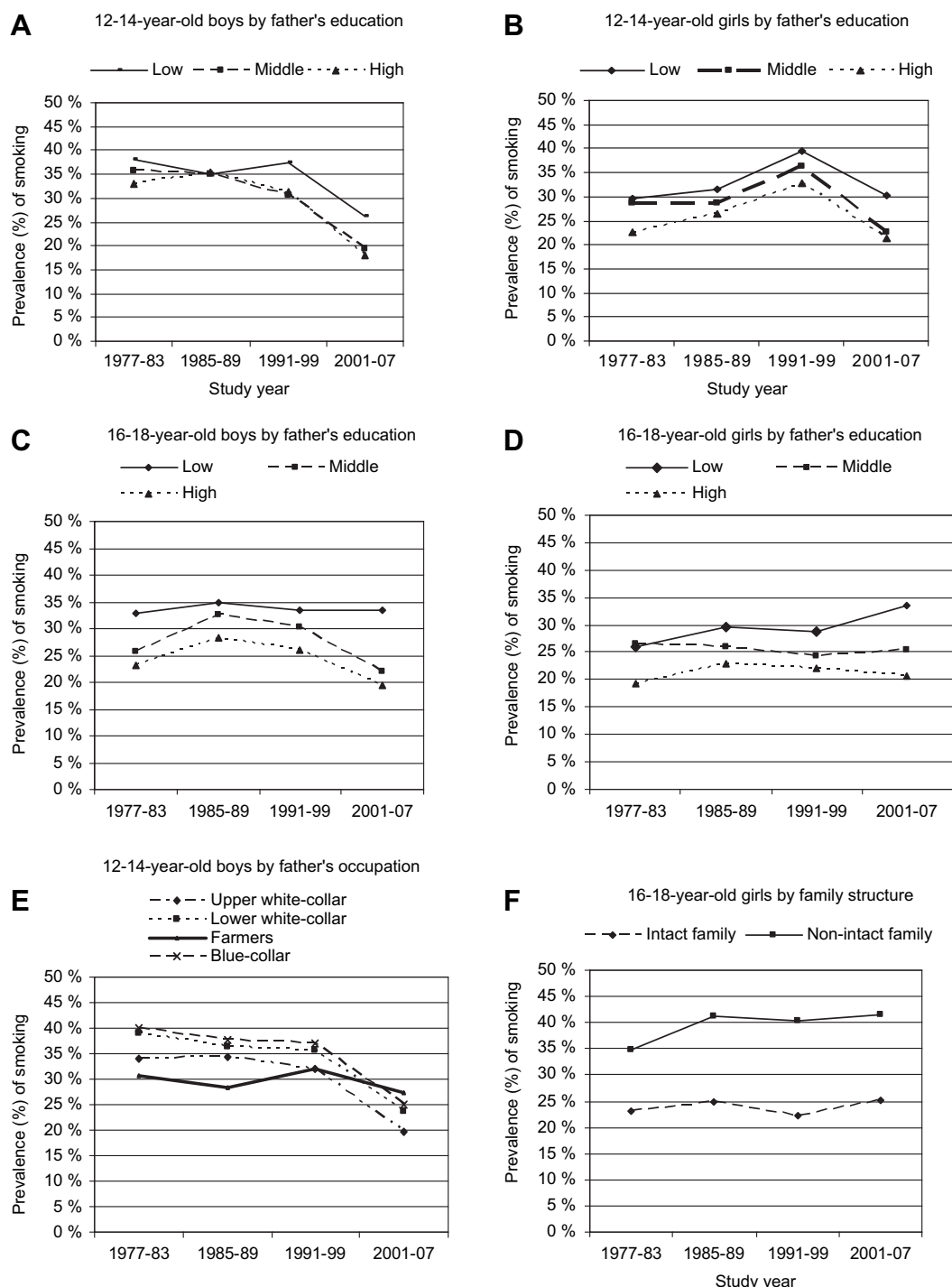


Figure 1. Prevalence of smoking in periods from 1977–1983 to 2001–2007 in relation to familial socioeconomic status factors that showed an interaction with the study period. (A) 12-14-year-old boys by father's education. (B) 12-14-year-old girls by father's education. (C) 16-18-year-old boys by father's education. (D) 16-18-year-old girls by father's education. (E) 12-14-year-old boys by father's occupation. (F) 16-18-year-old girls by family structure.

adolescent smoking behavior is more related to the adolescent's individual SES than to his or her familial SES [16,18].

A low educational level for both the father and mother increased the probability of smoking among adolescents, consistent with findings from other studies [17]. Adolescents in a lower socioeconomic group, as assessed by father's

occupation, had a relatively higher prevalence of smoking compared to the higher SES groups [17]. We did not, however, find consistent socioeconomic differences in smoking based on parental occupational status. In particular, children of farmers do not seem to follow the trends observed in other socioeconomic groups. In Finland, farming as an occupation has gone, and is still going, through major

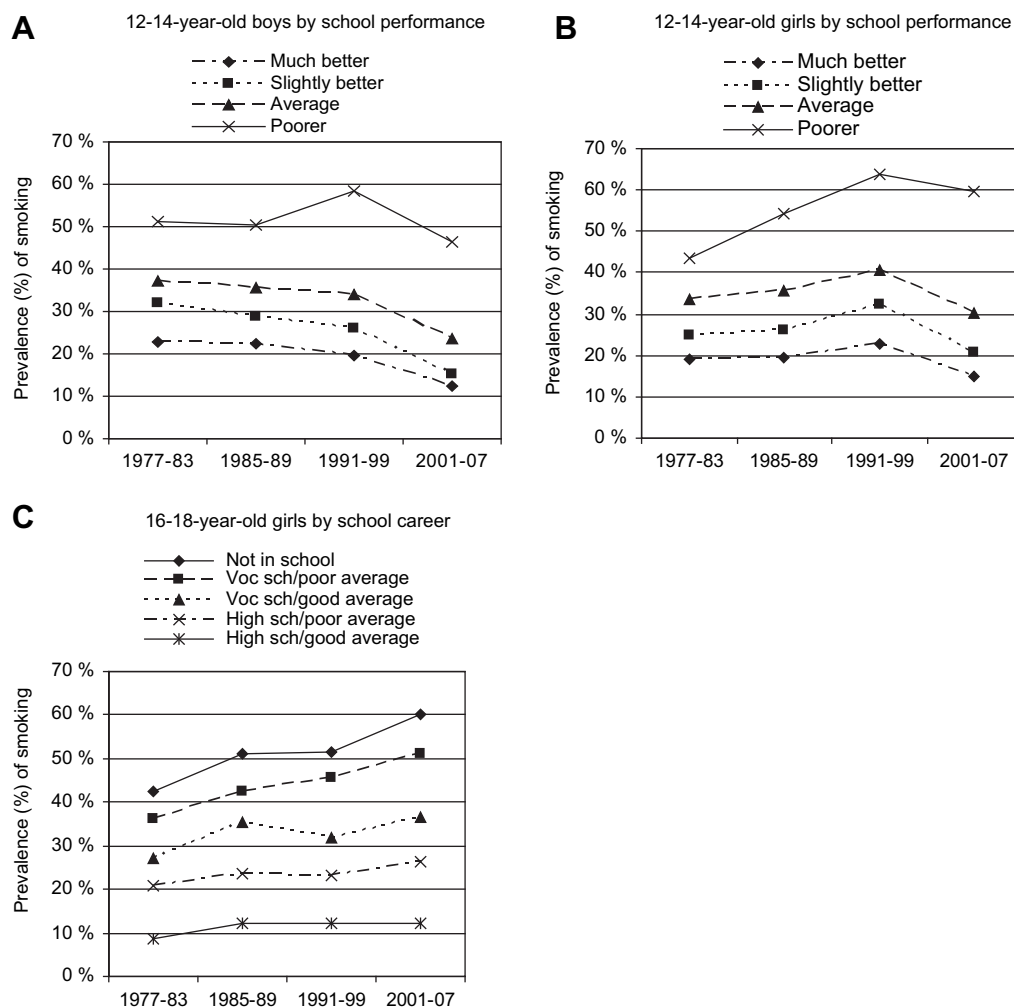


Figure 2. Prevalence of smoking in periods from 1977–1983 to 2001–2007 in relation to individual social position factors that showed an interaction with the study period. (A) 12-14-year-old boys by school performance. (B) 12-14-year-old girls by school performance. (C) 16-18-year-old girls by school career.

changes, from small-scale agriculture to large-scale mechanized farms. The social status of farming is likely to be more heterogeneous today than in previous decades. At the same time, the proportion of farmers and hence children of farmers has decreased to only 6%. This could explain why the smoking trend among farmers' children differs from that among the other lower SES groups.

Adolescents who do not live with both parents not only have a high prevalence of smoking [28,29], but also tend to experience more health problems, engage in high-risk behaviors, and have higher mortality rates [30]. Furthermore, adolescents from non-intact families have problems in their educational and family careers [31–33]. Consistent with these previous findings, our findings also indicate that living in a non-intact home increases the risk of smoking in adolescence.

School career was one of the most important socioeconomic factors that yielded differences in the prevalence of smoking among Finnish adolescents. Adolescents not performing well at school or discontinuing their studies after compulsory schooling had a higher prevalence of smoking than those in more auspicious educational careers. As an

adolescent's lifestyle is a predictor of his or her educational career and future social class [19,34,35], these differences predict socioeconomic differences in smoking-related diseases as adolescents reach adulthood.

In Finland, the choice of school career strongly predicts educational level and social position in adulthood [19,35,36]. This supports our idea of assigning adolescents their own individual social position. We found low, but statistically significant, correlations between familial SES and the adolescent's individual social position, indicating that SES is a multidimensional phenomenon and that these indicators measure different aspects of SES. Other studies that compared the correlation between multiple socioeconomic indicators found similar results [16,20].

The developmental pathway of the association between SES and smoking is complex and several explanations for the widening socioeconomic differences could be contemplated. Health-compromising behaviors such as smoking are often adopted by adolescents who have poor school achievement or moderate educational aspirations [37]. The uptake of such behaviors may be seen as inadequate or dysfunctional

coping styles in the face of stress caused by, for example, educational demands [38]. The increased stress among adolescents during the last decade has been shown when using health complaints as stress measures (*The Adolescent Health and Lifestyle Survey*, unpublished results). A second possible explanation is that adolescents in the lower socioeconomic groups are more “deviance prone,” and hence they have adopted smoking or increased their smoking behavior, despite increased smoking restrictions, anti-smoking campaigns, and the increasing demoralization of smoking [39]. Others suggest that the socioeconomic differences in smoking are due in part to the interplay of social and cultural mechanisms [13] that may have changed during the years.

The development of smoking behavior in the Finnish adolescent population over a 30-year period appears similar to the development of smoking behavior in an adult population in the later stages of the smoking epidemic [1,5]. In the initial period of our study, the years from 1977 to 1983, the prevalence of smoking was higher among the lower socioeconomic groups. In our latest period (the years from 2000–2007), the decrease in smoking behavior among the higher socioeconomic groups was followed by widened socioeconomic differences, typical of the latter stages of the smoking epidemic. There is, however, a difference in the dynamics of the epidemic between adults and adolescents. Among adults, the socioeconomic differences increase because the innovators (the higher SES groups) stop smoking. Among adolescents, they do not begin.

Study limitations

Response rates. Generally, in health-related studies, a high nonresponse rate is associated with poor school performance and negative health behaviors [40]. In this study, one of the challenging issues was the gradual though persistent decline in the response rates, a regrettable, common phenomenon in postal surveys in general [40]. An indirect analysis of the nonrespondents from 1977 to 2005 indicated that the decrease in the response rate did not change the direction of the smoking trend [15]. However, the prevalence of smoking is underrated in each survey because of the selection of nonrespondents.

Reliability and validity of measurements. As the questionnaires were sent to respondents in their homes, it is possible that their parents, siblings, and other members of the family influenced their responses, especially among younger respondents. The effect of these influences on the observed changes in the smoking trends is not known, but it is likely that this bias remained consistent over the years for all socioeconomic groups.

Conclusions

Despite efforts targeted at reducing health inequalities in Finland, the results of the present study indicate that there

are persistent or even increasing socioeconomic differences in smoking behavior among Finnish adolescents, whether measured by familial SES or the adolescent’s individual social position (school performance and school career), to the disadvantage of those in lower socioeconomic groups. Individual social position was, however, a more important predictor of smoking than familial SES. These findings suggest that health-promoting activities and tobacco control policies in Finland targeted at reducing smoking among adolescents should be restructured to concentrate on the special needs of those in the lower socioeconomic groups, especially those with poor school performance, those in vocational schools, and those who have stopped their schooling early.

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