

Better together?

Gender relationships and adolescents'
risky behaviors

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SUMMARY

The objective of this Phd thesis is to investigate, via gender socialization theories, how gender socialization shapes adolescents' behaviors and beliefs toward risky behaviors.

In Chapter 1, we will describe gender gaps in smoking, binge drinking, cannabis use and school performances. We will show that these gender gaps are narrowing with time, a trend that coincide with gender mixing at school. Complementarily, in Chapter 2, we will investigate gender socialization processes and, in particular, how gender socialization promotes risky behaviors among young men. Building on these two ideas, we will try to answer this question, in Chapters 6 and 7: "Do relationships with the other gender influence adolescents toward risky behaviors?" We will indeed make the hypothesis that girls befriending with boys are more likely to be influenced by their male friends' gender-situated norm of risky behavior. A hypothesis that our results will confirm. This would lead girls to display more risky behaviors, which would explain the reduction in the gender gap between boys' and girls' substance use. After having considered gender mixing in a peer-to peer perspective, we will take a step back and consider how the proportion of each gender in a school (the gender balance) may influence individual risky behavior. We will indeed show that girls in male-majority schools display more risky behaviors than girls in other types of school settings.

In chapter 3, we will consider the literature on the determinants of a behavior adoption, and in particular, the beliefs about this behavior. Adolescents might indeed start smoking because they believe that smoking would bring benefits in their life. Yet, so far, no study has investigated whether genders differ in their smoking beliefs, a question that we will address in Chapter 8. We will show that there are few gender differences in smoking beliefs, which might explain the reducing gap in smoking across genders. Yet, if belief are so important in the adoption of a behavior, one should not forget to consider the people who make these beliefs arise in an individual. In Chapter 3, we will see the important theoretical role of the prototype, which are people that one individual considers as both likable and similar to him/her. To study this question in the context of adolescent smoking, we will dedicate Chapter 9 to the answer of this question: "Do closer/best friend have more influence on belief sharing in an individual than less closer friends? And as friendship dynamics differ across gender, Does this influential power of friends differ between boys and girls?". This chapter will underline that smoking beliefs tend to be shared in close best friends peer groups, and that girls tend to share more beliefs with their friends, compare to boys.

Then, in Chapter 10, we will first acknowledge that traditional explanation of women smoking does not fit with adolescent reality, and will postulate, along with the Silne R project, that genders differ in their response to School Tobacco Policies, which might explain the reduction in the gender gap of smoking among adolescents. This chapter will show that young boys tend to be more influenced by school tobacco policies than girls, but that the mechanisms explaining a reduction in smoking play for both genders. We will also show that traditional sanction of smoking has actually no influence on adolescent smoking behavior.

To answer these questions, we will use data from the Silne R project, and will use social network analysis and measurement to help us measure friendship and friendship relationships. A complete description of the Silne R project and of our method and measurements is provided in Chapter 5.

GLOSSARY

Definitions

Gender homophily: concept that characterizes individuals who have (most of his/her) ties to friends of the same sex.

Same-sex friendship: characteristics of an individual who has most of its ties to friends of the same sex (girls with girls, for example)

Other-sex friendship: characteristics of an individual who has most of its ties to friends of the other sex (boys with girls, for example)

Gender balance of school: proportion of both genders in a single school.

Gender balanced school: school with a proportion of boys between 45% and 55%.

Female-majority schools: school with a proportion of girls that overpasses 55%.

Male-majority schools: school with a proportion of boys that overpasses 55%.

Social positive beliefs: beliefs about smoking that concern the social life of an individual and reinforce positive aspects of smoking (e.g. “Smoking helps me to become popular”).

Social negative beliefs: beliefs about smoking that concern the social life of an individual and reinforce the negative aspects of smoking (e.g.: “My friends will disapprove if I smoke”).

Individual positive beliefs: beliefs about smoking that concern the individual (health, body, feeling) and reinforce positive aspects of smoking (e.g.: “Smoking helps me losing weight”).

Individual negative beliefs: beliefs about smoking that concern the individual (health, body, feeling) and reinforce negative aspects of smoking (e.g.: “Smoking will give me lung cancer”).

Clique: is the close group of best friends of an individual. In social network analysis, a “clique” is defined as: “a maximal subgroup in which everyone is connected to everyone else, so that no one else could be added to the network without this condition being broken.”(Wasserman & Faust, 1994).

Community: compare to cliques, community is the broader circle of acquaintances to which adolescents belong. In social network analysis, we use the Louvain algorithm (Blondel, Guillaume, Lambiotte, & Lefebvre, 2008), which allocates each student to one community, depending on the whole network's configuration.

Abbreviations

SES: Socioeconomic Status

STP: School tobacco Policy

SSF: Same-sex-Friendship

OSF: Other-sex Friendship

SECTION 1 – THEORETICAL AND METHODOLOGICAL BACKGROUND

CHAPTER 1 – The public health
challenge posed by adolescent smoking
and risky behaviors

Smoking is responsible for many avoidable diseases that cause a reduction in life expectancy (Costanza, Salamun, Lopez, & Morabia, 2006). Furthermore, every year, tobacco kills 6 million people worldwide (World Health Organisation, 2015). Most smokers start using tobacco during adolescence, which is, therefore, a crucial period to investigate: the younger the age of initiation, the harder it will be for people to quit and the more serious the health consequences of smoking will be. Adolescence, moreover, is the period when people take up other risky behaviors that are also damaging to health, such as binge drinking or cannabis use. Tobacco use, binge drinking, and cannabis use, as well as poor performance at school, tend to be experienced for the first time during adolescence, sometimes at the same time. These risky behaviors impact men and women unequally. The socialization that men and women receive in relation to these behaviors is different and they use them differently. In the first chapter, we will provide recent European data on the gender gap in these behaviors. In a first section, we will focus on tobacco use (trends, consequences, and theoretical models of the gender gap). Tobacco smoking was the main topic of the Silne R project that we conducted during this Phd, from which all the data within these chapters originate. In the second section, we will give a broader perspective on adolescent risky behavior and provide similar data about other risky behaviors (binge- drinking, cannabis use, and poor school performance). The aim of this chapter is to provide a clear overview of the gender gap in risky behaviors among European adolescents.

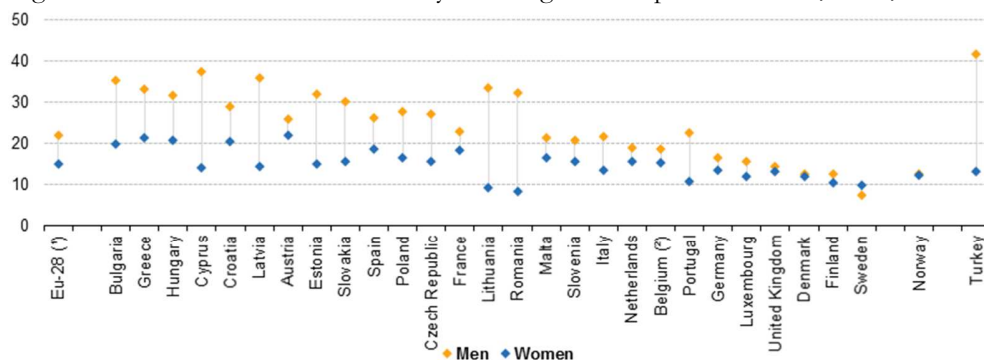
Tobacco smoking.

In Western European countries, tobacco smoking rates have dropped in recent decades. However, approximately one in five Europeans still smoked daily in 2014 (Sciensano, Rapport tabac,2013; Eurostat: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=hlth_chis_sk3e&lang=en).

The prevalence of daily smoking among adults differs, however, between countries and genders. In the majority of European countries, the rate of smoking among men still

exceeds the rate among women. Discrepancies between European countries (Hitchman & Fong, 2011; World Health Organization, 2015)) should, however, be acknowledged.

Figure 1.1 Gender differences in daily smoking in European countries, 2014, Eurostat.



Note: ranked on the overall proportion of daily smokers. 2014 data for Ireland not available
 (*) Estimates.
 (†) Data with low reliability.

In 2014, the gender gap (between the prevalence of smoking among men-and the prevalence of smoking among women) in daily smoking was 6.8 % in European countries, although geographical discrepancies must be acknowledged (Figure 1.1). Gender differences were greatest in Eastern European countries, with differences of more than 20% (Lithuania: 9.2% of women, 33.6% of men). In Southern European countries, the gender gap was approximately 8% (Spain: 18.5% of women were daily smokers, and 26.2% of men were daily smokers). In Western European countries, there was a gender difference of 3-4%, while in Northern European countries, it was lower than or equal to 2%. In Sweden, the gender gap in daily smoking was even negative, with 9.8% of women being smokers, as opposed to 7.5% of men.

In the seven European countries included in our study (see Chapter 5, below), the rate of daily smoking averaged 30% among males and 20% among females at the beginning of the

century (Table 1.1); Ireland (27% of women smoked in 2004) and the Netherlands (25.4% of women smoked in 2001) were exceptions. In all seven countries, the prevalence of daily smoking has dropped, though to varying extents between genders. Daily smoking rates among women have declined by 10% in the Netherlands and Ireland, but by 3.5% in Belgium and Germany, and only by 1.8% in Italy. Among men, daily smoking rates have declined by 12.2% in Finland and by 11.4% in The Netherlands, but by only 6% in Germany, Ireland, and Italy, which remains the country with the highest prevalence of smoking among males, while Ireland still had the highest smoking rates among women in 2016.

Table 1.1 Evolution (2001-2016) of daily smoking (%) in adult population (15 years +) in the seven European countries included in the Silne R project. OECD database.										
	2001		2004		2008		2013		2016	
Country	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Belgium	19.9	28.6	19.7	28	17.7	23.6	16.4	21.6	..	..
Finland	19.7	28.2	19.5	27.1	17.6	24	13.2	19.1	15	16
Germany	..	..	18.9	28.8	17.6	26.4	17.1	25.1	15.5	22.3
Ireland	..	..	27	27	22	25	..	..	17	21
Italy	17.1	31.6	17	30.0	16.4	28.9	15.9	26.7	15.3	25.1
Netherlands	25.4	32.3	22.3	28.6	20.8	25.9	16.3	20.9	15.2	20.9
Portugal	..	..	..	..	11	27.2	10.9	23.5	..	..
GER: 2004= mean 2002-2005; 2008=2009; 2016=2017; IRL: 2008=2007; 2004=2002; ITA 2004= mean 2003-2005; PORT 2008=2006; 2013=2014;										

Aside from the differences between European regions, another important factor to take into account is the generational gap¹ (Table 1.2). In 2014, daily smoking rates in Europe were highest within the 45-54 years age bracket among women (born between 1950 and 1959, 20.5%), and within the 25-34 years age bracket among men (born between 1980 and 1989, 29.6%).

Table 1.3 describes the evolution of daily smoking within the adolescent population (15-24 years old) in the seven countries included in the Silne R project. Since the beginning of the century, daily smoking rates have declined in all the countries for both genders, although with large differences between countries.

¹ Eurostat: https://ec.europa.eu/eurostat/statistics-explained/index.php/Tobacco_consumption_statistics#Daily_smokers_of_cigarettes

Table 1.2. Daily smoking (%) across genders and generations. Europe, 2014, Eurostat.																
	Males								Females							
	15- 24	25- 34	35- 44	45- 54	55- 64	65- 74	75+		15- 24	25- 34	35- 44	45- 54	55- 64	65- 74	75+	
European Union - 28 countries	17.4	29.6	27.8	25.8	22.2	12.2	5.5		13.5	19.2	18.9	20.5	16.8	8.4	3.2	
Belgium		24.5	24.5	21.4	20.7	12.7	5.7			11.3	18.7	20.7	20.5	12.1	1.7	
Germany	12.4	24.4	21.5	19.6	17.7	7.3	3.8		11.9	17.3	16.8	20.3	13.9	6.8	3.9	
Ireland	11.6	17.0	12.0	14.3	13.9	9.5	5.5		13.9	15.5	12.6	13.6	11.3	9.9	6.5	
Italy	15.1	31.0	29.7	24.5	21.9	14.7	6.6		11.2	17.0	14.9	17.4	18.1	10.3	3.7	
Netherlands	17.8	26.2	21.3	20.4	20.5	11.3	5.4		16.9	16.8	14.9	19.1	17.3	12.6	7.7	
Portugal	18.0	32.9	28.4	31.5	22.2	9.7	3.0		12.0	17.7	16.2	12.6	10.6	3.4	0.3	
Finland	12.3	16.7	10.7	15.2	16.6	10.4	1.3		10.9	14.2	11.5	11.9	13.5	6.9	2.5	

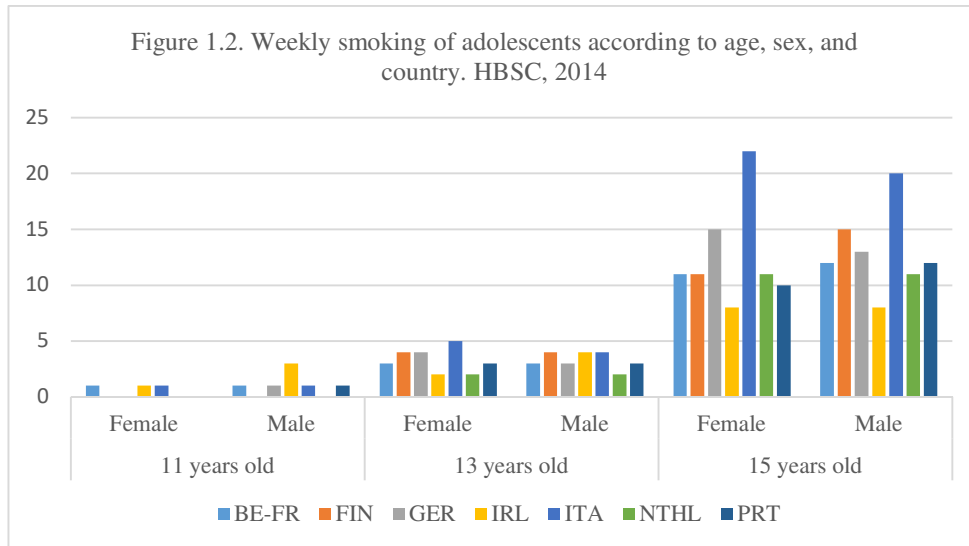
Table 1.3 Evolution (2001-2016) of daily smoking within the adolescent population (15-24 years old) in the seven European countries included in the Silne R project. OECD database.

Country	2001		2004		2008		2013		2016	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Belgium	22.8	26.4	17.9	28.2	16.5	20.9	19.1	15.4		
Finland	22.8	30.9	24.4	20.6	14.1	17.6	8.8	12.1	16.0	11.0
Germany			23.9	30.2	19.6	25.0	15.6	21.3	11.2	17.0
Ireland					26.0	28.0			15.0	12.0
Italy	15.9	27.1	17.1	26.8	15.8	27.3	14.8	25.5	15.7	21.0
Netherlands	26.9	30.8	20.9	25.3	16.4	22.4	15.3	19.7	11.9	14.3
Portugal					14.2	25.9	12.0	18.1		

GER: 2004= mean 2002-2005; 2008=2009; 2016=2017; IRL: 2008=2007; ITA 2004= mean 2003-2005; PORT 2008=2006; 2013=2014;

According to OECD data, daily smoking rates among young men have dropped by 6% (Italy), 11% (Belgium), 13% (Germany) and 20% (Finland). In Ireland, smoking rates among young people have declined by 16% in 8 years. Among young women, the reduction in daily smoking has been lower: 0.2% in Italy, 3.7% in Belgium, and 11 to 12% in Germany, Ireland, and Portugal. In Belgium, Finland, Ireland and the Netherlands, daily smoking rates are higher among young women than among young men.

The population of interest for this thesis is, however, a bit younger than the one considered in the OECD data. The population in the Silne R were all high school students, and more precisely in the two grades corresponding to the 14-16 years of age. This is an important population to study in terms of public health interest, because that is the period when adolescents start smoking. The World Health Organization has carried out a survey of early adolescents (Figure 1.2). As shown in Figure 1.2, most adolescent smokers start to smoke between the ages of 13 and 15. At age 15, more than 10% of adolescents in all the countries, except for Ireland, smoked at least once a week and rates among girls exceeded those among boys in Germany, Ireland, and Italy.



The health consequences of smoking across genders

In the previous section, we have acknowledged that tobacco use can differ between genders and looked at how this gap has evolved. There is, however, also a difference in the biological relationship with tobacco use between the genders. The public health challenge posed by tobacco use does not impact men and women equally. Women are more vulnerable to tobacco use than men. Regardless of the level or intensity of their smoking, women will develop the following health problems to a greater extent than men: respiratory system problems (decline in lung function, chronic pulmonary disease); cancer (lung, bladder, cervix, pancreas, kidney, larynx, esophagus, liver, and colon.); coronary heart disease, osteoporosis, cataracts, etc. Women are more likely to develop small-cell lung cancer and are also more likely to develop lung cancer with a lower level of smoking. They are also more likely to develop lung cancer because they are more likely to carry the gene mutation associated with this cancer (C.-C. f. s. a. treatment., 2009).

Smoking is also detrimental to their reproductive function: women smokers tend to experience delayed conception and infertility, amenorrhea, and estrogen deficiency and they also reach menopause at a younger age than non-smokers do (Center for Substance Abuse, 2009).

While smoking poses a challenge to public health, tobacco use among women is also a major health concern among the European population. Indeed, when women smoke, it is also damaging to their children's health, as research on epigenetics has shown. Exposure to tobacco in utero is associated with low birthweight and a higher risk of stillbirths and miscarriages and is also associated with a higher risk of the child developing cancer, type II diabetes, atherosclerosis, heart disease, and obesity (Godfrey & Barker, 2001; Murphy et al., 2012). Even before experiencing the health consequences of their tobacco consumption, the biological effects of nicotine, the main addictive component in cigarettes, on men and women are different. The rewards system engendered by smoking seems to operate more among men. This suggests that men are more influenced by the nicotine patterns of smoking. Women are less sensitive to the rewarding effect of nicotine: they experience relief smoking cigarettes, whether or not they contain nicotine. Men, on the contrary, experience more relief with nicotine cigarettes. Moreover, a high level of the stress hormone cortisol was associated with relapse after quitting in women, but not in men. Craving is higher among women when they experience stress, while men are more sensitive to environmental context (C.-C. f. s. a. treatment., 2009). Men are more influenced by the physiological effects of nicotine, while women are more impacted by the mood-related effects of the act of smoking itself. This might explain why nicotine replacement therapy is less effective for women. Women also tend to experience more side effects of nicotine replacement products than men do (C.-C. f. s. a. treatment., 2009).

The evolution of smoking-related disease indicators across genders

In addition to its effect on reproductive health and addiction, tobacco use has an influence on morbidity and mortality in Europe. Nowadays, the European population is well-aware of the health consequences of smoking. There are several diseases that result from tobacco use, respiratory and cardiovascular diseases and cancer being the most frequent. To illustrate these health consequences and their gender gaps, we will focus, in the following paragraphs, on lung cancer incidence, years lost, and numbers of deaths due to diseases of the respiratory system. Lung cancer is attributable to tobacco smoking in 9 out of 10 cases. The incidence of lung cancer per 100,000 inhabitants has declined among men between 2000 and 2012, with the exception of Portugal (33.9/100,000 in 2000, compared with 34.2/100,000 in 2012, Table 1.4).

Table 1.4. Incidence per 100,000 inhabitants of malignant neoplasms of the lung according to gender. OECD				
Year	2000	2002	2008	2012
Males				
Belgium	76.4	75.3	58	56.6
Finland	36.8	33.4	29.9	29.9
Germany	50.3	46.7	42.4	38.8
Ireland	39.5	39.8	37.9	36.1
Italy	59.4	58	45.4	38.5
Netherlands	62	59.7	46.1	44.4
Portugal	33.9	34.2	29	34.2
Females				
Belgium	11.2	12.2	16.2	19.8
Finland	8.9	10.1	10.8	12.2
Germany	11.4	12.7	16.4	17.9
Ireland	18.7	19.7	24.4	27.4
Italy	9	10.7	11.4	13.2
Netherlands	17.5	17.9	26.1	31.6
Portugal	5.5	6	6	8.3

Another indirect indicator of the health consequences of smoking is the number of years lost per 100,000 inhabitants due to diseases of the respiratory system, which is especially damaged by smoking (Table 1.5). Between 2000 and 2013, this indicator declined in all countries, for both genders. Except in the Netherlands, the male population is still losing a significantly higher number of years than their female counterparts.

Table 1.5. Years lost per 100,000 inhabitants (aged 0-69) due to diseases of the respiratory system, according to gender, OECD.						
	Females			Males		
	2000	2007	2013	2000	2007	2013
Belgium	113.3	106.9	100.9	211.9	173.2	168.3
Finland	78.5	55.2	35.4	195.1	107.4	72.2
Germany	74.4	73.6	85.7	147.1	130.9	139.9
Ireland	167.5	72.1	80	229.6	116.9	87.9
Italy	59.3	45	41.8	118.2	79.6	76.2
Netherlands	103.4	93.6	84.2	136.3	116.9	85.3
Portugal	109.4	76.9	70.6	274.1	188.7	146.3

In terms of mortality, smoking is the most avoidable cause of death in European countries. Taking into account that the crude death rate is approximately 1000 deaths per 100,000 inhabitants in Western European countries, Table 1.6 displays the recent evolution of the rates of crude deaths due to obstructive pulmonary disease and malignant neoplasms of the respiratory system, by gender. For both causes of death, in all European countries there has been an increase in crude death rates among women and a decrease among men between 2000 and 2012.

Table. 1.6. Evolution of the number of deaths per 100,000 inhabitants due to obstructive pulmonary disease and malignant neoplasm of the trachea, bronchus, or lung. OECD.								
	Females				Males			
	2000	2004	2008	2012	2000	2004	2008	2012
Chronic obstructive pulmonary disease								
Belgium	26.6	28.1	29.7	33.4	63.6	58.4	57.2	50.2
Finland	10.3	8.8	11.7	12.6	31.6	25.9	28.8	30.5
Germany	20.5	21.3	24.8	30.6	34.1	33.3	35.6	41.6
Ireland	38.8	31.9	26.2	31.4	48.8	37.8	30.4	34.1
Italy	22.6	23.2	26.5	27.4	44.8	43.6	44.9	44.8
Netherlands	30.9	27.7	32.9	37.4	52.7	42	42.8	44.8
Portugal	16.8	..	14.9	16.9	34.8	..	32.3	35.9
Malignant neoplasms of trachea, bronchus, or lung								
Belgium	21.5	24	28.8	30.6	102	94.6	95.5	83.9
Finland	17.1	18.4	22.6	26.6	55.1	53.9	53.2	54
Germany	23.4	26.2	30.7	35.9	72.6	71.4	73.3	75.6
Ireland	30.7	30.6	30.7	31.4	51.9	48.6	44.2	47.1
Italy	20.5	22.7	25.5	28.2	92.5	90.6	89	86.4
Netherlands	28.1	34.7	42.5	47.3	79.9	80.3	78.5	76.2
Portugal	10	..	12.6	14.8	471	..	51.7	57.1

Recent trends in smoking-related deaths have influenced and will continue to reduce the gender gap in life expectancy at birth. For decades, women have been expected to live longer than men. In recent years, however, this gap has narrowed, as presented in Table 1.8. At the beginning of the century, life expectancy at birth was approximately 81 among women in Belgium, Finland, Germany, and the Netherlands. In 2016, it reached 83 (Germany, Ireland,

and the Netherlands). Males at the start of the century had a life expectancy at birth of 75-76 years. In 2016, they could expect to live up to 79-80. In sixteen years, the gender gap in life expectancy has thus dropped from 6-7 years to 4-5 years.

Table 1.7. Evolution of life expectancy at birth, according to gender. OECD															
	Females					Males					Difference Females-Males				
	2000	2004	2008	2012	2016	2000	2004	2008	2012	2016	2000	2004	2008	2012	2016
Belgium	81	81.9	82.6	83.1	84	74.6	76	76.9	77.8	79	6.4	5.9	5.7	5.3	5
Finland	81.2	82.5	83.3	83.7	84.4	74.2	75.4	76.5	77.7	78.6	7	7.1	6.8	6	5.8
Germany	81.2	81.9	82.7	83.1	83.5	75.1	76.5	77.6	78.1	78.6	6.1	5.4	5.1	5	4.9
Ireland	79.2	81.1	82.4	83.1	83.6	74	76.1	77.9	78.7	79.9	5.2	5	4.5	4.4	3.7
Italy	82.8	83.7	84.2	84.8	85.6	76.9	78	78.9	79.8	81	5.9	5.7	5.3	5	4.6
Netherlands	80.7	81.5	82.5	83	83.2	75.6	76.9	78.4	79.3	80	5.1	4.6	4.1	3.7	3.2
Portugal	80.4	81.8	82.7	83.6	84.3	73.3	75	76.2	77.3	78.1	7.1	6.8	6.5	6.3	6.2

Having provided an overview of the health consequences of smoking across genders, we will now briefly focus on the social consequences of smoking.

The consequences of smoking for society

Smoking has considerable direct (health care expenditure) and indirect costs (loss of productivity) for society. Firstly, due to its impact on people's health, smoking is a huge burden on countries' health expenditure. According to Goodchild and colleagues (2018), 5.7% of total health expenditure worldwide is attributable to tobacco consumption. This burden is greatest in European and American countries, where the tobacco epidemic is most advanced. In the United States, a study by Xu and colleagues (2015) estimated that health expenditure due to smoking accounted for 8.7% of total health expenditure, corresponding to \$170 billion in the year 2010. In 2018, the Belgian health budget totaled 25.45 billion euros (Burgraff E, 2017), which means that health expenditure related to tobacco was close to 1.45 billion euros, with a rate of 5.7%.

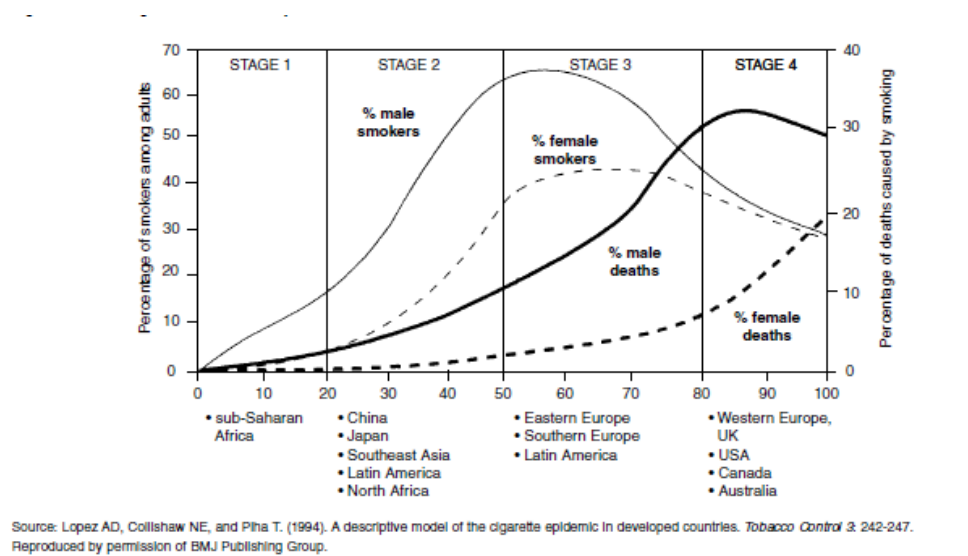
Tobacco consumption also has indirect costs. For instance, smokers are more frequently absent from work than non-smokers. They more frequently call in sick. According to Weng (2013) in the UK, smokers were absent from work for 2.7 days per year more than non-smokers. In a study by Tsai (2005) of the Taiwanese population, male smokers were found to be sick for 4.4 days per year, compared to 3.3 days for non-smokers, and women smokers were absent due to illness for 5.0 days, compared to 3.7 days for non-smokers. In 2011, the cost of smoking-related absenteeism was estimated to be £1.46 billion in the United Kingdom. When health expenditures and productivity losses are combined, the economic cost of tobacco smoking amounted to \$1852 billion in 2012 (1.8% of the world's GDP) (Goodchild et al., 2018).

Now that we have provided an overview of both smoking trends and related mortality rates, we will introduce a key model that has, for 25 years, been used to describe the tobacco epidemic (smoking rates and smoking-related deaths) across genders.

Describing and explaining the evolution of smoking across genders

In 1994, Alan Lopez provided a 4-stage transitional model of the evolution of the tobacco epidemic, based on long-term data from several countries (see Figure 1.4, Lopez, Tobacco Control, 1994). His model predicted that women would follow equivalent similar path through the stages that men follow, but with some delay.

Figure 1.4. Lopez four-stage model of the tobacco epidemic (Lopez A., 1994)



In the first stage, male smoking prevalence rises, while rates among women remain low. At this early point in the tobacco epidemic, smoking-related deaths are not obvious. In the second stage, smoking rates skyrocket among men, but increase slowly among women.

Tobacco-related deaths account for nearly 10% of all deaths in males, while the figure remains negligible for women. In stage three, tobacco prevalence decreases among men, but rates among women stagnate. During this stage, tobacco-related deaths among men increase to 30% of deaths and among women to 5%. In the final stage, smoking rates among men and women continue to decrease and the gap narrows. At the end of this stage, tobacco-related deaths among women peak. Following this model, most Western European countries are in stage four, experiencing a decrease in prevalence and male death rates, but an increase of deaths within the female population. According to Lopez, because tobacco-related deaths are no longer deniable, this stage is the key period for the implementation of tobacco control policies (Lopez, 1994). Two decades later, Thun and Lopez updated these results and concluded that there had been a slower decrease in smoking rates than expected (Thun, Peto, Boreham, & Lopez, 2012). They also concluded that, for more accuracy, country models should address male and female smoking rates and related mortality rates separately, because their evolution depends on economic, cultural, and political factors that vary across countries (Thun et al., 2012). Smoking rates among women are particularly sensitive to such differences in national context (collaborators, 2017).

As shown in stage one of Lopez's model, smoking rates among women were historically lower than among men, mostly for sociocultural reasons (Hitchman 2011), such as gender inequality. According to Hitchman (2011), three factors have contributed to the rise in smoking rates among women: changes in the social acceptance of women smoking, the amelioration of women's economic situation, and tobacco marketing strategies. Hitchman (2011), using WHO data, found a strong and significant correlation ($R^2=0.52$, $p<0.0001$) between measures of gender empowerment (participation of women in political and economic power and decision-making) and gender differences in smoking rates. Nonetheless, because adolescents have little political and economic power and because

adolescent smoking sales is forbidden in all European societies, Hitchman's explanations do not provide an adequate explanation for gender trends in smoking among adolescents.

This chapter has considered the recent gender trends in adolescent tobacco smoking. While smoking rates have decreased for both genders within the European population, we have seen a sharper decrease in male than in female rates. In the latest report published by *The Lancet* on the burden of diseases related to tobacco in 195 countries, the consortium of authors concludes that "as highlighted by more recent trends, maintaining past rates of decline should not be taken for granted, especially in women (page 1)" (collaborators, 2017). This report underlines the tobacco industry's role in raising smoking rates among women by targeting them specifically with advertising, especially since the 1990s. According to the authors, "these trends highlight how the tobacco epidemic, and corresponding industry forces, has expanded beyond a male-centred health challenge (page 15)". Consequently, recent trends in smoking across genders should raise awareness of future smoking rates among women, which may continue to equal or exceed the rates among men in some European countries, a phenomenon that was not anticipated in Lopez's model. This is a widely reported phenomenon and can no longer be considered a marginal exception to the Lopez model (Shafey O., 2003).

This highlights how current research needs to apply a gender perspective to analyzing tobacco consumption, which is the purpose of this dissertation. Additionally, adolescent smoking is a key indicator for evaluating the future evolution of smoking rates within the adult population (Shafey O., 2003).

Other risky behaviors among adolescents: binge drinking, cannabis use, and poor school performance.

In this first chapter, we have reviewed smoking trends across genders. Our dissertation, however, is not restricted to this particular risky behavior. The first section of the thesis will

also address binge drinking, cannabis use, and school performance among adolescents. Our aim is to analyze the influence of gender relationships on the main risky behaviors of European adolescents. Several reasons lead us to consider a number of different risky behaviors. Firstly, the theoretical framework for explaining the adoption of behaviors is not limited to one behavior in particular, although some authors suggest that risky behaviors should be studied separately from other behaviors (Chapter 3). Second, all aforementioned risky behaviors differ across genders, not only in their prevalence, but also in their social embeddedness. Looking at how gender relationships relates to these behaviors is, therefore, of similar importance to how it relates to smoking (see below). Moreover, as has been observed above with regard to smoking, recent gender trends in these behaviors also show a reduction in the gender gap, although gender differences are still larger for these behaviors than for smoking. From this perspective, smoking might be seen as a precursor to future gender trends in binge drinking, cannabis use, or school performance. Finally, looking at several outcomes will strengthen the conclusion of this thesis, as it might help us to state whether our results regarding smoking apply to a broader spectrum of risky behaviors.

But why can we consider low school performance a risky behavior for adolescents? Firstly, low school performers are more likely to drink, and to smoke tobacco and cannabis, than other students. Secondly, school performance is a good indicator of later socio-economic status, which is, in turn, correlated with health outcomes. In Belgium, for example, a highly educated 25-year-old man can expect to live another 57.1, compared to another 51.7 for a man with a low level of education². A similar educational gap is observed among women of the same age (57.3 years for women with a low level of education; 61.9 years for those with a high level of education). Thus, while performing poorly at school is not a health risk

² Healthybelgium.be <https://www.healthybelgium.be/en/health-status/life-expectancy-and-quality-of-life/life-expectancy>

behavior, it is nonetheless an indicator of later health risk. Yet, one should not forget that both school performances and substance use behaviors share a common structural determinant: socioeconomic status (Robert et al., 2019). It is moreover known that deprived areas concentrate more risky health behaviors than other part of a country, which in turn influence cause-specific mortality³ (Sánchez-Santos et al., 2013).

Aside from the health considerations, both substance use and school performance are important contexts for gender studies. Regardless of social circumstance, boys tend to have many advantages over girls (economic, cultural, political, etc.). As far as school performance and substance use behaviors are concerned, however, girls are in a more favorable position than boys. All things considered, for now, girls use substances less and thus live longer than boys and they also perform better at school than boys do. Analysis of both substance use and school performance should therefore be considered as a way of assessing whether these advantages for women will decrease in the coming years.

Nonetheless, the Silne R project, which this thesis originates from, is focused on smoking. The third section concerning smoking beliefs, and the fourth section concerning school tobacco policies, therefore, may not be replicated for binge drinking, cannabis use, or school performance. That is why we have focused, in this thesis, on tobacco smoking in particular, although we strongly encourage future research to develop a more inclusive overview of risky behavior and gender relationships in adolescence. In the following paragraphs, we will briefly report on gender trends in alcohol and cannabis use and school performance among European adolescents.

³ However, socioeconomic status and context is not the focus of this Phd. In Chapter 5, we will discuss how we integrate the social context of schools and students in our analysis.

Alcohol use

The World Health Organization (WHO) has been monitoring the health behaviors of European adolescents since the 1990s. The HBSC survey (Health Behavior in School-aged Children) provides statistics about alcohol consumption among adolescents aged 11, 13, and 15. As the population of interest in this PhD is adolescents aged 14-16, we will, in the following paragraphs, only report on gender trends relating to the 15 year-old age group, in the seven European countries that participated in the Silne R survey (see Chapter 5).

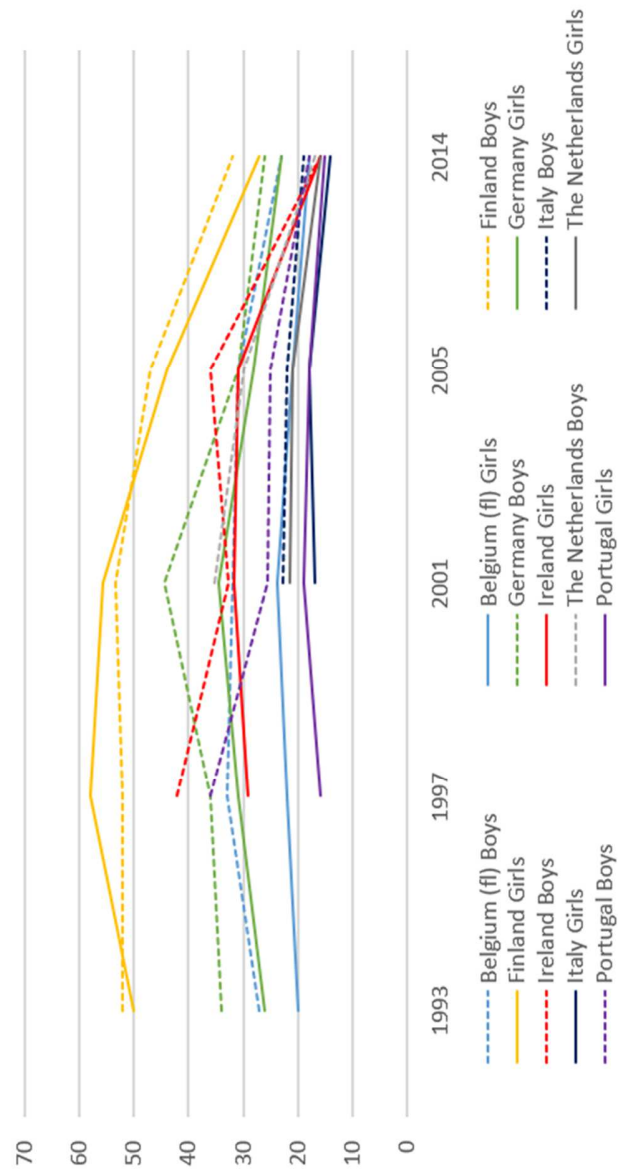
Figure 1.5 shows the evolution of both genders' weekly alcohol use among 15 year-olds, in the seven countries included in the Silne R survey. In 1993 and 1997, rates of weekly drinking were significantly higher among boys than among girls in all the countries. The gender gap varied, however, from 20% (Portugal, 1997), to 5% (Finland, 1997). In 2001, weekly alcohol use increased in all European countries, and among both genders, with the exception of Belgian, Portuguese, and Irish boys, for whom we observed a small decrease. In 2005, consumption continued to increase among Irish and Italian girls and among Belgians (of both genders), while we observed a decrease in other subsamples. In 2014, a decrease in weekly alcohol use was observed for all genders, in all countries. For both 2005 and 2014, weekly alcohol use thus remained more common among boys than girls and gender differences remained significant in all countries, except Ireland.

Figure 1.6 shows the evolution of the numbers of those who had been drunk at least twice in their lifetime among 15 year-old students from the seven countries included in the Silne R survey. Firstly, in every period, we observed country trends: Northern European adolescents (Finnish, Irish, and German) tend to have been drunk more often than Southern European adolescents (Portuguese and Italians). Secondly, in the 1990s, the gender gap was smaller for drunkenness than for weekly alcohol use in all countries except Ireland. In Finland, moreover, girls were more likely to have been drunk than their male

counterparts: in 1997, 58% of girls and 52% of boys had engaged in this behavior. Between 2001 and 2005, we observed a decrease in drunkenness in all countries and all genders, except in Italy. During the same period, the gender gap increased in Belgium, Finland, Ireland, the Netherlands, and Portugal, but it decreased in Germany and Italy. In 2014, the decrease in drunkenness continued in all countries. The gender gap, however, increased slightly in Italy and Finland, while it decreased in Belgium, Ireland, the Netherlands, and Portugal, to the extent that gender differences were no longer significant in any countries except Belgium and Italy, where drunkenness was still more common among boys.

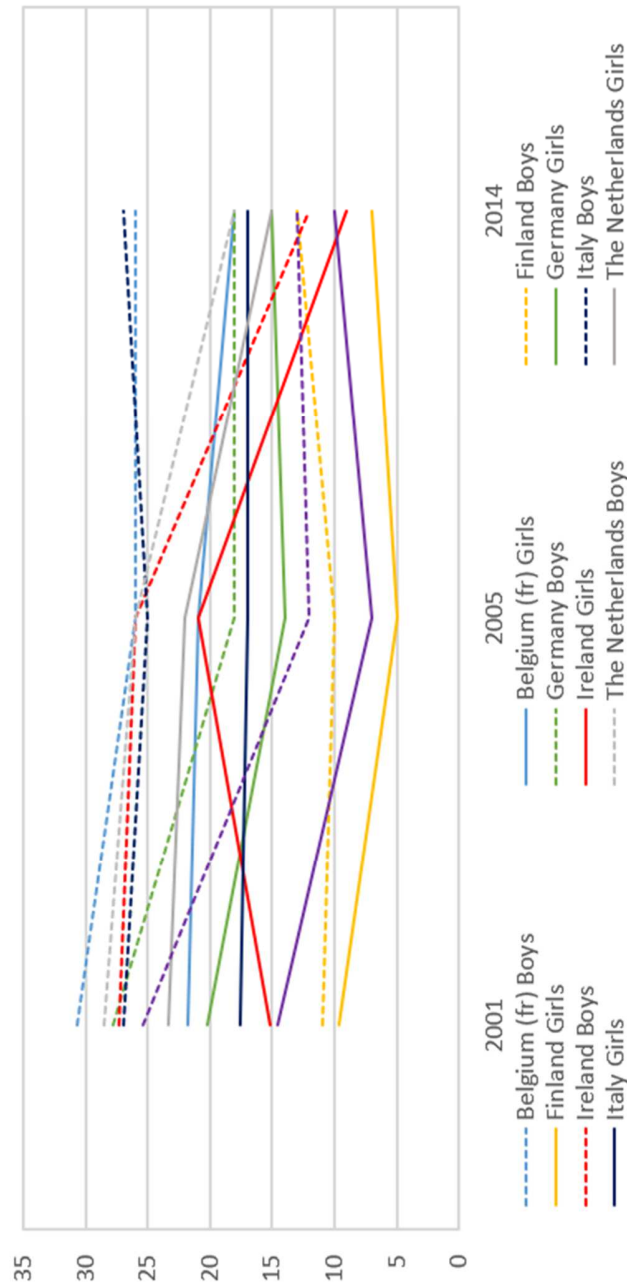
To sum up, in 20 years, alcohol use has decreased among European adolescents, a trend that is also observed among adults. Regarding gender evolution, we have observed that gender gaps in drunkenness have diminished in European countries, while they have remained significant for weekly alcohol use.

Figure 1.6. Evolution of having been drunk at least twice in a lifetime
among students aged 15. HBSC 1993-2014



*Belgian data concerned the Flemish Region in the 1990s, but the Walloon Region in the 2000s

Figure 1.7. Evolution of ever having used cannabis among students aged 15. HBSC, 2001-2014.



*Belgian data concerned the Flemish Region in the 1990s, but the Walloon Region in the 2000s

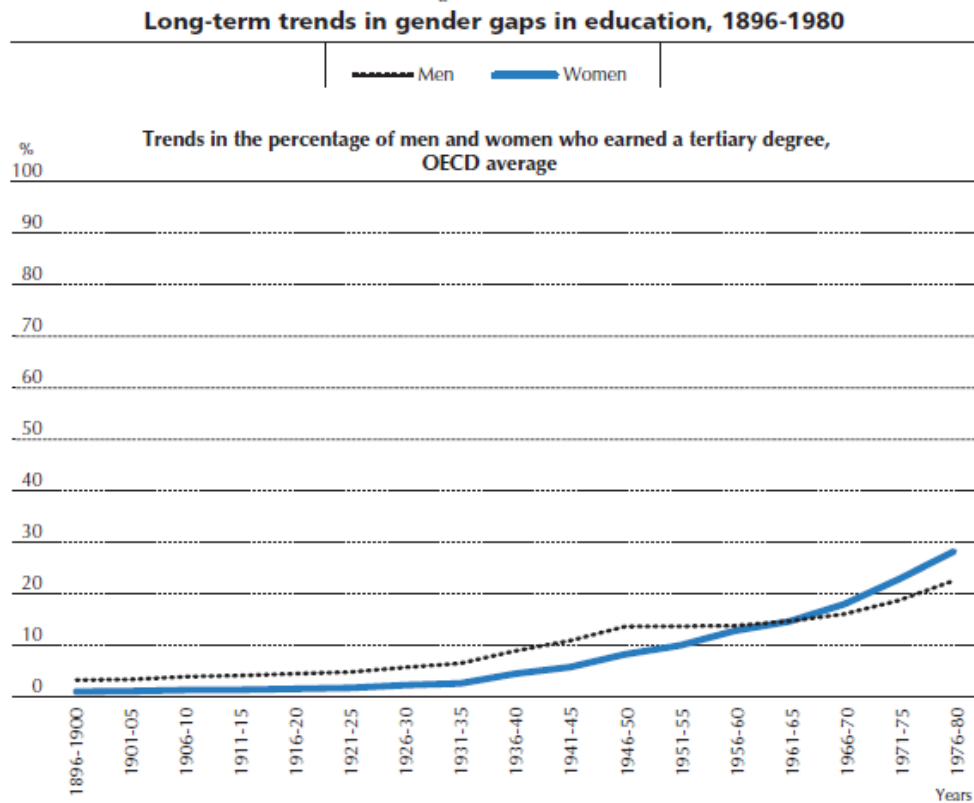
Cannabis use

As far as cannabis use over a lifetime is concerned, we can only report on its evolution between 2001 and 2014, due to the availability of data (Figure 1.7.). In this period, we observe a decrease in cannabis use in all the countries except Italy. Moreover, the decrease in use was significant among Irish boys (-15%), Portuguese boys (-12%), and Dutch boys (-10%). The evolution of Belgian and Finnish cannabis use, however, did not show major changes, although use in Belgium was more than twice as high as in Finland. In Germany, Portugal, and the Netherlands, the gender gap in cannabis use was no longer significant in 2014, but it remained more frequent among boys in other countries. Over 14 years, the gender gap in cannabis use has thus decreased in all countries but has remained stable in Italy and increased in Finland.

School performance

In the 20th century, girls school rates have grown and reached boys' one. Since the 1970s, boys and girls have tended to be increasingly mixed in schools. During the same period, girls' performances at school improved so that they outperformed boys' (Marry C., 2011) (Figure 1.8).

Figure 1.8. Long term trends in gender gaps in education, Barro and Lee, 2013



Source: Barro and Lee, 2013.

Nonetheless, girls still tend to follow less competitive paths at school (such as arts) to a greater extent than boys, who are still more involved in scientific subjects (Bereni L., 2012). This segregation operates even more in vocational school systems, where girls are still more likely to choose roles that are traditionally associated with girls (like nursing or hairdressing schools), while more boys still choose construction and other male-oriented roles (Rosenwald F., 2006). There is a large body of literature that describes how the school

context actively participates in reproducing gender inequalities (Bereni L., 2012; Duru-Bellat M., 1995).

As stated earlier, school performance is a very interesting topic in relation to gender differences in adolescence: school is the only social setting in which gender inequality is reversed: girls perform better at school than boys and they are also less likely to have to repeat a year (Bereni L., 2012; OECD, 2015). Moreover, young boys are more likely to be low achievers (12% compared to 9% of 15-year-old girls) and to leave school early than girls (OECD, 2015).

In recent years, however, this gender gap has narrowed in France and in other European countries (OECD, 2015). In 2015, the OECD, which is responsible for the well-known PISA study (Program for International Student Assessment), published a special issue on gender inequalities at school. According to this report, the fact that girls perform better at school is not due to girls having better learning abilities (such as IQ), but to other variables, which originate from gender socialization processes. For example, girls spend 1.3 hours more per week studying than boys. Their extra-curricular activities are also more likely to enhance their school performance: girls spend a significantly greater amount of time reading than boys, which is directly related to school performance (OECD, 2015). According to OECD experts, developing gender socialization equality at school and in the family should eventually reduce this gender gap.

Table 1.8. Evolution of PISA tests in mathematics and reading, by gender and country, and the evolution of the gender gap. PISA 2003-2015, OECD.

	Mathematics						Reading					
	2003	2006	2009	2012	2015	Female	2003	2006	2009	2012	2015	
Female												
Belgium	525	517	504	509	500	Belgium	526	522	520	525	507	
Finland	541	543	539	520	515	Finland	565	572	563	556	551	
Germany	499	494	505	507	498	Germany	513	517	518	530	520	
Ireland	495	496	483	494	495	Ireland	530	534	515	538	527	
Italy	457	453	475	476	480	Italy	495	489	510	510	493	
Netherlands	535	524	517	518	511	Netherlands	524	519	521	525	515	
Portugal	460	459	481	481	487	Portugal	495	488	508	508	507	
Male												
Belgium	533	524	526	520	514	Belgium	489	482	493	493	491	
Finland	548	554	542	517	507	Finland	521	521	508	494	504	
Germany	508	513	520	520	514	Germany	471	475	478	486	499	
Ireland	510	507	491	509	512	Ireland	501	500	476	509	515	
Italy	475	470	490	494	500	Italy	455	448	464	471	477	
Netherlands	540	537	534	528	513	Netherlands	503	495	496	498	491	
Portugal	472	474	493	493	497	Portugal	459	455	470	468	490	
Gender gap	2003	2006	2009	2012	2015	Gender gap	2003	2006	2009	2012	2015	
Belgium	8	7	22	11	14	Belgium	-37	-40	-27	-32	-16	
Finland	7	12	3	-3	-8	Finland	-44	-51	-55	-62	-47	
Germany	9	20	16	14	17	Germany	-42	-42	-40	-44	-21	

Table 1.8. shows the results of the PISA survey, organized among 15-year-old students in OECD countries (Silne R countries only), in reading and mathematics. In every country, girls perform better than boys in reading and boys perform better than girls in mathematics, with the exception of Finnish girls, who also perform better in mathematics than their male counterparts. Gender gaps were, however, larger in reading than in mathematics.

As demonstrated throughout this first chapter, gender is a central concept when analyzing recent trends in risky behaviors among adolescents. The next logical step would be to provide a definition of the concept of gender, which will be done in the next chapter (Chapter 2). Furthermore, this first chapter has already mentioned some elements of gender socialization that explain gender trends in school performance. The next chapter will also provide an insight into the gender socialization theory, which is integral to gender studies literature. In the next chapter, we will consider how gender socialization affects substance use in boys and girls to a different extent.

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Websites

OECD databases: <https://stats.oecd.org/#>

Eurostat databases: <https://ec.europa.eu/eurostat>

CHAPTER 2 – The concept of gender and the gender socialization process

Gender studies: going beyond the constructivist-naturalist opposition

In their *Introduction aux études de genre* (“*Introduction to Gender Studies*”), Bereni and colleagues (Bereni, Chauvin, Jaunait, & Revillard, 2012) define gender studies as “all research that takes men and women as its research topic” (Our translation). The premise of gender studies is that what is expected of men and women in society largely depends on time period and culture. For almost half a century, **gender studies have developed within a constructivist framework**, and gender has progressively come to be defined in terms of four core concepts:

- (1) Gender is a social construct.
- (2) Gender is a relational process that operates via a symbolic opposition between men’s and women’s characteristics.
- (3) Gender is a hierarchical power relationship
- (4) Gender is articulated through other social hierarchical relationships, such as social class, and ethnicity.

In feminist studies, gender was initially used to describe “social sex”, which encompasses all the differences between men and women that do not result from biological differences (Bereni et al., 2012). As Simone de Beauvoir and Margaret Mead observed, your biological sex alone does not make you a man or a woman; you become one as a result of the society you live in (de Beauvoir, 2014). Historically, constructivism was developed as a reaction to naturalism, which recognizes only two biological sexes, which possess different characteristics (such as a natural male tendency to display aggressive behavior or seek power and a natural female tendency to take care of children) (Hoquet, 2016). Constructivism came about in response to this biological determinism and had both scientific and political aims:

too often in history, biological determinism had justified inequality, discrimination and worse (consider socio-biology and Nazism)(Hoquet, 2016).

According to **naturalists and biologists**, for the human species to reproduce, the biological characteristics of men and women have been selected to maximize those that are favorable for reproduction (Houston, 2016). From a biological point of view, therefore, humans did not evolve with multiple genders, but with two. Yet, even when taking only biological features into account, we cannot say that sex is a strictly binary, determinist concept (Hoquet, 2016). “Real” biological sex is unassignable. It is, in fact, composed of several criteria/levels (G. Dreyfus, 1972; Hoquet, 2016):

1. *Genetic/chromosomal sex*: which refers to the DNA of individuals. In mammals, males are heterogametic (XY pair of sexual chromosomes), while females are homogametic (have an XX pair of sexual chromosomes)⁴.
2. *Gonadic sex*: which is determined by the organs that produce gametes. Among humans, males have testicles, while females have ovaries.
3. *Gametic sex*: gametes are the reproductive cells capable, after fecundation, of developing into a new individual. In biology, this is the only criterion which is strictly binary, and which is used by biologists to categorize animal⁵ species into male and female: males produce large quantities of small gametes (such as

⁴ But this is not the case for all animals. Among birds, for example, it is the other way around (Rigaud T., 2009).

⁵However, 96% of vegetal species produce both types of gametes (Gouyon, 2009; Hoquet, 2016)

spermatozoids in the human species), and females produce small quantities of large gametes (such as ova in humans).

4. *Internal gonophore sex*: which is determined by the genital tubes in the belly that allow gametes to move out of gonads.
5. *Perineal sex*: which describes the morphology of the perineum. In humans, males have a penis and a scrotum, while females have a vagina and labia.
6. *Hormonal sex*: which is determined by the concentration of several hormones (e.g. a high concentration of testosterone for males, and a high concentration of estrogens for females), and their use by receptors.

In medical science, sex encompasses all these markers within one system of classification: male and female. These criteria, however, are not always binary and do not systematically coincide⁶. To understand why, it is first important to consider how human embryos develop in utero.

During fecundation, female and male gametes join, and after meiosis, the sexual chromosome of the future individual has already been determined. However, during the first six weeks of development, male and female embryos are strictly similar. At week 7, embryos start to produce hormones that allow gonads to develop into genitals: female genitals tend to become a clitoris, labia, vagina, and uterus, while in males, a penis, scrotum, and testicles form (Hoquet, 2016). Due to variations in hormones, chromosomes, and

⁶ Nor do they among animals: in several species, females are bigger than males, males carry children, males have XX chromosomes, or males breastfeed children. For a complete overview of these phenomena, see the sixth chapter of T. Hocquet's *Des sexes innombrables*.

environment, however, genital evolution also may vary, and does not always lead to polarization.

At birth, some babies are considered intersex. Intersex babies are babies that have a clitoris >1cm or a penis <2.5 cm (Kessler S., 1998). This is different from hermaphroditism (having both genitals), which is so extremely rare in humans that no statistics exist on the topic (Hoquet, 2016). Intersex babies are considered to be outside the norm by pediatricians. They receive hormonal treatment and are even operated on. In the 1970s, if hormone treatment didn't work, baby boys with XY chromosomes, but a penis that was considered too small, were operated on and were assigned the female gender, while baby girls with a clitoris that was considered too big were operated on to reduce it (Kessler S., 1997). In the large majority of cases, intersex babies are assigned the female gender (A. Fausto-Sterling, 2012). It is interesting, therefore, to note that perineal sex determines sex assignment in the human species. Parents are often informed of the perinatal sex during the second-trimester ultrasound⁷, or at birth, if parents do not want to know their baby's sex during pregnancy. Returning to the different biological criteria for sex, we must first state that not all humans have XX or XY sexual chromosomes (Hoquet, 2016). For instance, the Turner syndrome is a genetic mutation whereby individuals have only one sexual chromosome (X) (Ford, Jones, Polani, De Almeida, & Briggs, 1959). This syndrome affects 1/2500 girls, most of whom die in utero. Survivors, while unable to produce ova, can however carry children with an ovum donation (Ford et al., 1959). Other genetic mutations lead to having three sexual chromosomes: an XXX combination, which occurs in 1/500 female births, and an XYY combination, which occurs in 1/500 male births, neither of which display any symptoms. Klinefelter syndrome, which corresponds to an XXY combination, is the result of a problem occurring during meiosis: the sexual chromosomes of the parental gametes do not

⁷ By then, gender “makes sense”. The social construction of gender, therefore, begins very early.

split (Klinefelter H. F., Reifensten C., & Albright F, 1942; Nieschlag, 2013). Baby boys with this syndrome suffer from shrunken testicles and sterility. This situation occurs in 1/500 male embryos. By comparison, 21-trisomia occurs in 1/700 cases, cystic fibrosis in 1/2000 cases, and myopathy in 1/500 cases⁸.

Aside from these exceptions in chromosomal sex, there are also exceptions in hormonal sex. The (in)action of hormones can lead to maldevelopment of the gonads in utero. This is most commonly associated with a syndrome which causes insensitivity to testosterone (SIT) (Hoquet, 2016). This does not lead to any problems for XX fetuses. In XY fetuses, however, the “Y” role is not activated by testosterone, which leads to a maldevelopment of the gonads (testicles) (Gottlieb, Pinsky, Beitel, & Trifiro, 1999). This syndrome occurs in 1/10,000 cases (Hoquet, 2016). At birth, these “chromosomal boys” have female genitals, because testosterone has been unable to make perinea evolve to the point of developing penis growth or of closing the scrotum. Because perinea morphology is the main criterion for assigning biological sex, however, these babies are considered girls at birth. Nonetheless, they do not have vaginas, and will not menstruate at puberty (Gottlieb et al., 1999).

When walking down a street, people are, however, able to assign pedestrians to one of the two categories (male/female), without having any idea about the morphology of their perinea, their DNA code, or the levels of their hormones. This means that, in a society, there are supplementary criteria to take into account when considering gender. To the six aforementioned levels of the definition of sex, Gilbert Dreyfus added four additional levels (G. Dreyfus, 1972; Hoquet, 2016):

⁸All numbers provided come from the Institut de Veille Sanitaire Française: Estimation Nationale 2011-2012, cited by Hoquet T. (Hoquet, 2016)

7. *Somatic sex*: which corresponds to the general morphology of an individual, like breasts, hairiness, and other secondary sexual characteristics.
8. *Legal sex*: the civil sex assigned at birth, often included on ID.
9. *Psychological sex*: which can be seen as the sexual identity of an individual who can self-identify as male, female, or as a non-binary (queer) individual.
10. *Libidinal sex*: which is the sexual orientation of an individual (heterosexuality, homosexuality, asexuality, bisexuality, etc.)

These ten levels of sex require us to go beyond the opposition between nature and culture and between the biological and sociological approaches to gender, as several authors have already suggested (Anne Fausto-Sterling, 1993; Haraway, 1989; Vidal & Benoit-Browaey, 2014). A desire to overcome this opposition, however, is not enough. In the next few paragraphs, we will try to describe more precisely what kind of gender perspective this PhD thesis adopts.

Like the philosopher Nancy Huston, we consider the male and female genders to be the two central pillars of human societies. This is due to billions of years of genetic selection, even if the social meaning of gender has become, in the most recent years of human evolution, multiple and complex and goes far beyond biological sex (Huston, 2016). Moreover, according to the philosopher Thierry Hocquet (2016), we recognize the reality of biological sex and its ancestrality: before the creation of society, male and female gametes were already present and reproduced together. This means that, before society, and thus before any cultural/historical discourse about sex, there was biological sex. Moreover, if humankind and all the mammals disappear one day, along with all their socioeconomic and cultural systems, biological sex will not stop existing, and the reproduction of gametes will

continue in some way. The ancestrality and reality of biological sex, however, do not mean it is the prime aspect of gender (Hoquet, 2016).

This is why authors have for long plead for biology to be introduced into the social sciences (Anne Fausto-Sterling, 1993; Vidal & Benoit-Browaey, 2014), yet with two main conditions (Hoquet, 2016): always keep in mind (1) that female/male does not mean women/men and (2) that what we consider to be male and female is situated culturally and historically⁹.

The recent evolution in gynecology practices is worth noting. As mentioned earlier, perineal morphology used to be the main criterion for biological sex assignment (whether during a second-trimester ultrasound or at birth). Since the summer of 2017, however, the Belgian health system has been reimbursing genetic tests performed during the 12th week of pregnancy. These tests aim to identify any genetic problems in the embryo (such as 21-trisomia), but also provide another option for parents: to know the chromosomal sex of the embryo. The criterion upon which biological sex is assigned has thus recently changed in Belgian society. Accordingly, babies with the syndrome of insensitivity to testosterone (SIT) mentioned above would have been categorized as girls before summer 2017, but as boys thereafter. This example shows that even biological sex, in some rare cases, is a social construct: for these babies, the change in the way we assign biological sex has changed their gender identity.

⁹ It is also interesting to note that the fact that we want to reintroduce biology into the traditional constructivist approach to gender studies is also situated in the present time, a period in which health, biology, and genetics are becoming increasingly important in the media, in social movements, and in the everyday lives of individuals (T. Hocquet).

While females have biological characteristics that males do not have (they are able to carry children and breastfeed, and they menstruate), and vice versa (males can ejaculate and have a prostate), these characteristics should never have been considered a “natural” justification for social behavior¹⁰.

Because it is situated at the intersection of medical and sociological sciences, public health should, more than any other discipline, seek to reconcile the biological and sociological approaches to gender. There are, for instance, interactions between biological sex and gender in diagnostics: historically, myocardium infarctus was underestimated in the female population, because it was associated with the stressful life of hard-working men (Botbol, 2015); in mental health, symptoms of depression vary by gender: sleeping problems, anxiety, suicide, aggressive behavior, risk-taking, and substance use are all significantly predominant in one gender (Seedat et al., 2009).

Thus, carrying out gender studies in the field of public health requires us to consider gender as the intersection of biological and sociological features. Consequently, sex differences should always be seen in the light of the social meaning of male and female genders, a conceptual approach that we will use implicitly by referring to the term gender throughout this thesis. Nonetheless, using the terminology of gender comes with two additional difficulties:

¹⁰ To the strict naturalists who claim that females are naturally oriented towards caring for babies, we recommend observing the behavior of animals. In penguins, toads, and seahorses, males have a larger role than females in caring for the young. In 90% of birds, there is equality between male and females in caring for their young. This is also the case for 10% of mammals (Hoquet, 2016).

First, the French speaking literature, the term “*genre*” was first used as the social sex but is now also defined as a hierarchical social relationship that implies a social construction, a relational process, and an articulation with other social hierarchical relationships (see above).

Second, taking into account the gender of a person is very difficult in quantitative research because it requires many questions that address gender role and identity, which were not included in the questionnaires we have used for this Phd (see chapter 5 for details on the silne-R survey). Moreover, our thesis findings lay on statistical methods, which clustered individuals into groups. Consequently, the operationalization of a fine-grade gender concept in our statistical analysis was impossible. This explains why, in our statistical analysis, we used biological sex as a (limited, and very unsatisfactory!) way of measuring gender, via two clusters. In the explanation of our findings, however, we will endeavor to integrate the social aspects of gender by referring to gender socialization theory.

Gender socialization and smoking

In sociology, socialization theory has been of great help in defining how a society influences individuals via different institutions (family, school, social class, etc.). Bernard Lahire, in *L'homme pluriel* (Lahire, 1998), demonstrated that each of the institutions that an individual encounters in his or her life leaves a mark that eventually creates a single configuration, making the person a “plural” individual. Muriel Darmon has taken this theory one step further and applied it to gender (Darmon, 2010). She has demonstrated how family, school, social class, workplace, and hobbies convey specific ideas of what it is to be a woman or a man. She defines socialization as “all the processes via which an individual is constructed – we may also say ‘formatted’, ‘modeled’ or ‘conditionnated’- by the local and global society he is living in. During this process, the individual acquires – ‘learns’, ‘interiorizes’, ‘incorporates’ – ways of doing, thinking, and being that are socially situated.” (Darmon,

2010) Gender socialization is, therefore, the social process whereby each individual learns what behaviors and attitudes society expects from him/her as a man or a woman and learns how to act accordingly (see box 1 for a description of the gender socialization process). In the next few paragraphs, we will review some findings related to gender socialization and how they relate to child and adolescent behaviors, and risky behaviors in particular.

Box 2.1. Description of the gender socialization process.

Gender socialization is a process that begins very early in life (Stockard, 2006). Once they learn the biological sex of their child-to-be, parents start to represent, make predictions, and behave according to what they expect a child of this gender to be (Hoquet, 2016). As they grow, toddlers rapidly turn into either little princesses or little scamps, and develop in different play environments (Stockard, 2006). Little girls develop in sweet-colored environments, with toys that make them act according to their future mother role (playing with little kitchens, dolls, supermarkets), encouraging quiet and school-oriented behavior (sitting down to draw, read, etc.) or encouraging them to work on their appearance (make-up, dressing, etc.) (Bereni L., 2012). Boys, however, are expected to embrace more physical (playing outside with a ball or a bicycle), competitive activities or “risky” role playing (playing as a knight, cowboy or Indian, Jedi, soldier, policeman or thief, etc.), use fake guns and swords, or wrestle to beat their opponent. What is expected from them in terms of behavior is, accordingly, different. It is generally acceptable for little girls to be shy or sad. They are encouraged to express their feelings with art, words, and tears. Very early on, girls learn that it is okay to have emotions and to express them. Thus, with time, they may become better able to identify and deal with them (Kring & Gordon, 1998; A. J. Rose & K. D. Rudolph, 2006). Growing up as a boy is a different matter. Boys are encouraged to be brave in scary situations, to “get over” disappointment or sadness, not to cry. When they are angry about another child’s behavior, they will be expected to wrestle with him rather

than to go to a teacher to complain. They essentially learn to disengage from their emotions, and to limit their expression: emotions are “girlish” and little men-to-be are supposed to be anything but girls (Chodorow, 1974; Stockard, 2006).

During puberty, adolescents’ bodies undergo an important change: hormones pour into their brains and organs, breaking their emotional balance, initiating new sensations, and deeply changing their physical appearance (Hoquet, 2016; Stockard, 2006): all this can be overwhelming and difficult to deal with. Because they have been socialized differently, however, girls may be better equipped to deal with their emotions than boys are. Additionally, society expects them to demonstrate their emotions through tears, anxiety, or even depression. Boys, however, have to “man up”, bury their feelings, or exteriorize them through sport, violence, disobedience, or risky behaviors (Bereni L., 2012). As a consequence, substance use and disengagement from school expectations are a gender behaviors that are traditionally associated with boys. Dealing with their emotions, and getting help when they need it is so difficult for boys that they experience suicide at a far higher rate than girls (Freeman et al., 2017)

In recent decades, however, Western society has made great progress in terms of gender equality. Education has become a driving force of the feminist movement (Bereni L., 2012). Little girls started to be encouraged to play with cars, play outside, practice sports, wear trousers, etc. To sum up, they were permitted and encouraged to gain access to men’s spheres of activity and started to take advantage of what had previously been reserved for boys only (Bereni L., 2012). The “empowered” girl was, for example, targeted by commercials as a potential user of tobacco and alcohol. For adolescent girls, using tobacco became a way of displaying a women-like attitude, attracting the opposite gender, and gaining independence, by looking grown-up (collaborators, 2017).

Nevertheless, gender equality has not yet become a two-way process or, in any case, the move towards corresponding changes in the gender socialization of boys is in its early

stages. The gender socialization of little boys has yet to adapt to embrace emotional expression, school-oriented behavior, and (self-)care. Thus, while boys' norms in relation to risky behavior are progressively being spread among girls, girls' norms, which would protect boys from substance abuse, are not spreading into the male sphere. Furthermore, since the 1970s, girls and boys have started attending the same, mixed, schools. Together for eight hours a day, the spread of boys' norms and behaviors among girls has thus accelerated.

Firstly, girls are socialized to be more discreet than boys are. For example, parents tend to tolerate less screaming, shouting, and misbehavior from girls than boys (Bereni et al., 2012). In a developmental psychology study, 52 pairs of parents were asked to imagine their child in a risky home situation. While authors did not find significant differences between fathers' and mothers' reactions, they did find that parents of girls tended to display more disappointment; displays of anger were more likely among the parents of boys. Moreover, parents of boys were keener to associate misbehavior with their child's personality, while, in girls, they attributed it to an exceptional situation. They were also more likely to think that their girl child could be more easily taught to follow rules at home than were the parents of boys (Morrongiello, Zdzieborski, & Normand, 2010).

Furthermore, gender socialization comes with different games and "playing universes". For boys, games tend to promote competition, self-affirmation, contesting authority, and risk-taking, while girls' games tend to encourage respect for rules, relationship building, and body-expression (Cromer Sylvie, 2010). In a study of outdoor play injuries, Rosen and colleagues found that parenting differences (in encouragement and warnings) partially explained boys' risk-taking behaviors and the resulting higher risk of injury among boys than girls (Rosen & Peterson, 1990). Another explanation can be found in boys' and girls'

entertainment culture. In a study carried out with 120 children aged 4 to 11 years old, Pfeffer and colleagues (2009) found that boys' favorite television programs contained 6.4 risky behaviors per episode, compared to 2.6 risky behaviors in girls' favorite programs. Moreover, actual injuries occur twice as frequently in boys' favorite programs than in girls' and male characters were four times more likely to suffer from injuries than female characters. In another study of 91 young children's books, D. Epiphane analyzed the gender roles associated with characters. He underlined how traditionally male professions (like firemen, policemen, or construction workers) were represented by male characters in 97% of cases. Overall, females were far less present in profession-related literature (22% against 78% of characters, altogether), while they were the most represented in education-related professions (79%) (Epiphane, 2007).

Thirdly, girls' gender socialization stresses the importance of appearance: not only of body shape, but, more generally, the social image they present of themselves (Bereni et al., 2012). Girls' gender socialization tends to avoid displays of a public "deviant" image (Depoilly, 2012a); it promote an attractive, seductive body image. Tobacco use may, therefore, be a tool for displaying this seductive image (J. L. Bottorff et al., 2014; S. Mrug, C. Borch, & A. Cillessen, 2011). For example, advertising for cigarette smoking has, for a long time, based its campaigns on the sexy smoking woman (Carpenter, Wayne, & Connolly, 2005), as explained in the box below (see Figure 2.1).

Box 2.1. Gender and the tobacco industry

The tobacco industry has used gender roles to create specific advertising targeting women. Since the 1920s, it has been coming up with women-specific images to associate smoking with “glamour, sophistication and style, luxury, class and quality, romance and sex, sociability, enjoyment and success, health and freshness, emancipation and, last but not least, being slim.”(Haglund, 2010). The tobacco industry has been targeting middle-to-upper class women since the 1950s, a time when women had recently acquired new purchasing power, in Western countries. In the 1970s, people began to acknowledge the health consequences of smoking, so tobacco strategies started to target less educated, working class women, displaying messages about emancipation, equality, social progress, and stress-management (Haglund, 2010) (WHV Women and Tobacco).



11



12

¹¹ <http://www.amywaggs.com/why-advertising-works/>

¹²

http://tobacco.stanford.edu/tobacco_main/images_body.php?token1=fm_img1835.php

Sources:

Fourthly, girls are socialized to adhere to school expectations and attitudes at school to a greater extent than boys (Bereni et al., 2012; Darmon, 2010; Depoilly, 2012a). Gender socialization consequently impacts on behavior at school : compared to girls, boys are more likely to display disruptive behaviors and to be more physically active and are less likely to raise their hand and to wait their turn to speak (Matthews J.S., 2009). Boys are also less likely to listen and pay attention to their teacher before starting an activity, which jeopardizes their ability to succeed in it (Matthews J.S., 2009; OECD, 2015). When they become teenagers, at school, “boys tend to be less self-disciplined than girls: they are less likely than girls to be able to delay gratification, plan ahead, set goals, and persist in the face of frustrations and setbacks.” (OECD, 2015), p.53. Gender socialization can also explain, according to OECD specialists, why girls still perform worse than boys in mathematics and are less likely to engage in scientific fields: among high-achieving students, girls are less confident in their ability to solve scientific problems, compared to boys, because they receive less encouragement and support to follow scientific paths (OECD, 2015). According to S. Depoilly’s study on gender behavior at school, girls were as likely as boys to break school rules (speak with each other during lessons, use mobile phone, etc.), but they did it more secretively than boys (Depoilly, 2012a). Girls will, for example, wait for the teacher to be at the other side of the classroom before they start breaking a rule, while boys will do it more openly, in a defiant way. This gender difference in rule-breaking may also apply to rules related to health behavior at school.

Finally, parents and school teachers are not the only vector of socialization. During adolescence, friends become increasingly important in young people’s lives. As a result, adolescents progressively shift from being under their parents’ influence to being under that of their peers. In recent decades, the influence of peers on adolescent behavior has been widely recognized in the literature on substance use and risky behaviors (Kayo Fujimoto & Thomas W Valente, 2012; Go, Green, Kennedy, Pollard, & Tucker, 2010; N. Kiuru, Burk,

Laursen, Salmela-Aro, & Nurmi, 2010; C. M. Lakon, Hipp, Wang, Butts, & Jose, 2015; McGloin, Sullivan, & Thomas, 2014; T. W. Valente, Fujimoto, Unger, Soto, & Meeker, 2013). Nonetheless, because peers have such a strong influence on an individual's behavior, the gender of their peers must also be taken into account (Deutsch, Steinley, & Slutske, 2014; N. Kiuru, Nurmi J-E., Aunola K., Salmela-Aro K., , 2009; McMillan, Felmlee, & Osgood, 2018; S. Mrug et al., 2011; C. C. Poulin & Poulin, 2007). Moreover, gender socialization promotes same-gender play and games, so children tend to develop same-sex friendships to a greater extent than other-sex friendships. Gender socialization can thus be reinforced via the influence of same-sex peers.

Gender socialization, as explained above, promotes risk-taking among boys and substance use is a risky behavior. Moreover, because society as a whole now asserts that drinking and smoking are bad for your health (Chapman & Freeman, 2008), smoking, drinking, and smoking cannabis are ways of opposing authority, which is a particularly salient aspect of adolescent boys' socialization (S. Aquatias, 1999; Sauvadet, 2006a). Substance use should thus be more frequent among boys, who will be keener to endorse deviant behaviors. Girls' behavior would, on the contrary, be more discreet and girls would more frequently avoid breaking school rules. Cigarette smoking has traditionally been associated with male characteristics too (the Marlboro cowboy), but it has, for decades, been promoted using female characteristics too (Carpenter et al., 2005). The impact of the gender socialization process on substance use among adolescents might, therefore, be substance-dependent. As gender socialization encourage boys to undertake risk as a way to demonstrate their male identity, it is expected that the riskier a behavior is, the more the proportion of boys declaring such behavior will be, while the lower the proportion of girls will be. Looking back at our first chapter, we have indeed shown that gender gaps were greater in cannabis use and binge drinking, compared to smoking and school performances. Cannabis use is particularly risky for girls to undertake: not only is it illegal in Europe, but it leads to a loss

of control that might put girls at risk for sexual abuse or injury (Déroff & Fillaut, 2015). A similar loss of control is also experienced in binge drinking, even though this behavior might be less risky than cannabis use, because it's not illegal. And if smoking is risky, it does not cause any loss of control, nor does low school performances. In this Phd, we will thus consider these behaviors as differently placed on the spectrum of risk, and thus as differently influenced by gender socialization processes.

Now that we have introduced how gender and gender socialization can be used to explain the different patterns in risky behaviors among boys and girls, it is important to take a step back and consider the adoption of adolescent behaviors. To do so, in the next chapter (Chapter 3), we will consider theoretical models than can help us understand why adolescents engage in risky behaviors.

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CHAPTER 3 – Explaining (risky) behavior with socio-cognitive models

In Western European countries, the major causes of mortality are avoidable and are largely associated with health behaviors: by avoiding/stopping certain risky behaviours, some mortality risks can be avoided/reduced¹³. For this reason, healthy lifestyles, such as having a healthy diet and avoiding alcohol and substance use, have received much attention from health promotion policy makers (Conner M., 2005b). In academia, researchers have been trying to understand the mechanisms that predict the adoption of health behaviors, in order to identify key determinants which health promotion should target. Social cognition models have been particularly useful in constructing theoretical models of health behavior. They take into account both extrinsic (taxation, legal restrictions, accessibility of healthcare), and intrinsic factors (socio-demographics, personality, knowledge, etc.) in order to explain health behavior adoption. In this chapter, we will provide a summary of the two current leading models: the Theory of Planned Behavior, and the Prototype Willingness Model.

The first model worth considering is the *Theory of Planned Behavior* (TPB). This model is an extension of the theory of reasoned action, which was also developed by Ajzen (I. Ajzen, 1991; Ajzen I., 1987). According to the TPB, the most proximate determinant of behavior adoption is the intention to perform the behavior: “a person’s motivation in the sense of her or his conscious plan, decision or self-instruction to exert effort to perform the behavior” (Conner M., 2005a) (p.10) That intention is, in turn, caused by three kinds of factors:

- (1) Attitudes: “*a learned disposition to respond in a consistently favorable or unfavorable manner with respect to a given object*” (Conner M., 2005a). Attitudes are determined by beliefs

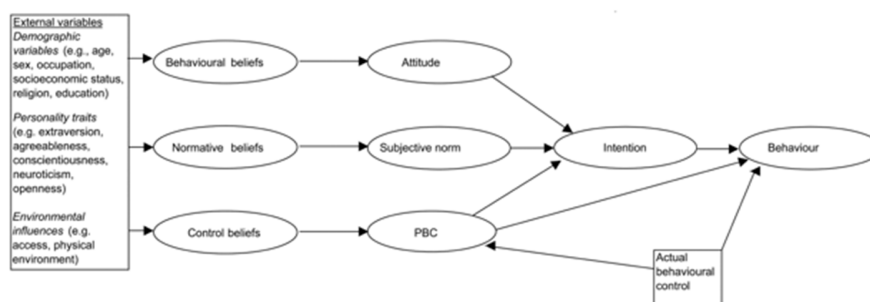
¹³ This does not mean that smokers are responsible for the cancer they later develop. Smoking remains a socioeconomically embedded behavior, with a large social gradient: the lower a person’s socioeconomic situation, the more likely they will be to smoke. Moreover, as argued in this thesis, the more friends/parents who smoke one has, the more likely one is to be a smoker. As smoking is a social behavior, society must be held responsible for its prevention and consequences.

about the likelihood of the consequences of a behavior and the evaluation of those consequences (Peak H., 1955). An attitude is, therefore, the sum of every beliefs, and requires both the likelihood and the evaluation of each belief's consequence to be taken into account.

- (2) Subjective norms: "person's beliefs about whether significant others think he/she should engage in this behavior, "which are also called injunctive norms, "multiplied by the motivation of the individual to conform to these expectations" (Conner M., 2005a).
- (3) Perceived behavioral control: the perception of how easy it is to adopt a behavior and the perception of control over that behavior; this is similar to the self-efficacy concept developed by Bandura (1977). This final factor includes opportunities to adopt the behavior (for example, whether tobacco is easily accessible and/or whether there are places where smoking is allowed), as well as intrinsic control variables, such as dependence or emotions.

In this model, intention is thus a function of attitudes (A), subjective norms (SN) and perceived behavioral control (PBC), which are caused by beliefs and which vary according to the behavior under consideration and the subject population.

Figure 3.1 Theory of Planned Behavior (Conner M., 2005c)



For the past few decades, the Theory of Planned Behavior has been the leading theory in explaining health behaviors. It was used to explain smoking by Godin and colleagues (1992), who found that PBC+SN+A explained 53% of the variance in smoking behavior. This theory has, however, been widely criticized.

The main criticism of the TBC concerns the underlining assumption that each behavior is adopted rationally by individuals, even though some determinants of behavior adoption are largely unconscious (Brandstatter, 2001; F. X. Gibbons, Gerrard, M., Blanton, H., & Russell, D.W., 1998; Uhlmann, 2004). Ajzen responded to this criticism (2011) and argued that, in his opinion, there was a continuum of reasoning that depended on the behavior: from in-depth processing of decision-making (for big decisions) to more “shallow” decisions that are made in everyday life (I. Ajzen, & Sexton, J., 1999). For example, most first attempts at risky behaviors (like smoking a cigarette for the first time) could be seen as more reasoned decisions comparable to brushing one’s teeth or getting dressed every morning.

Moreover, while Ajzen (2011) highlights the important correlation between intention and behavior in the literature (Armitage & Conner, 2001; Amanda Ravis & Sheeran, 2003; A. Ravis, Sheeran, & Armitage, 2011), he also recognizes that an individual may

not be consciously aware of the determinants of an intention (attitudes, subjective norms, and perceived behavioral control) (I. Ajzen, Fishbein, M., , 2000). People's behavioral intentions may be driven by biased or irrational beliefs that nonetheless make sense to the individual. For example, adolescents may think that adopting risky behaviors might help them to fit in with their peer group or to look cool, and that they will not become addicted from smoking their first cigarettes. However biased, these irrational beliefs are determined by norms, attitudes, and perceived behavioral control, according to Ajzen (2011).

Another important criticism of the TPB is the *measurement of the subjective norm*, which is considered to *insufficiently approximate the social pressure to endorse a behavior*. According to De Vries and colleagues (1995), both injunctive and descriptive norms should be addressed when measuring the influence of subjective norms on smoking behavior. This means that individuals are influenced both by the encouragement of peers to engage in risky behaviors (whether peers think they should smoke or not) and by their actual behavior (whether peers actually smoke). While Ajzen's (1991) initial model takes into account injunctive norms (what significant peers think about an individual's behavior), Ravis and Sheeran (2003) claim that observing the actual behavior of peers, not only their opinions, is crucial. In their meta-analysis of the role of descriptive norms on individual's behavior, they found that including descriptive norms in the TPB model significantly improved the variance explained by the model (+5%). Moreover, they highlight the importance of norms among adolescents, who are particularly sensitive to social influence, compared to adults, because adolescents are more likely to adopt a behavior if it helps them to fit in with a peer group where that behavior is the norm.

As well as describing peers' behaviors, other authors have suggested including an additional factor within the social component of behavior adoption: the role of group identification (Terry & Hogg, 1996). According to them, the more a behavior plays a

role in group norm identification, the more the group norm will influence the adoption of that behavior. For example, if an adolescent is part of a peer group that considers smoking an identification feature, the more members of that peer group will intend to smoke, in order to comply with the group norm (Fekadu & Kraft, 2002). This is the “influence” pathway of the peer effect. Other authors have claimed that adolescents tend to select their friends according to their behaviors, which is the “selection” pathway of the peer effect. For many years, proponents of selection and influence have argued over which of these pathways is involved in the adoption of risky behaviors such as smoking. Recent research, which applied social network analysis to friendship networks, found that both processes were relevant to explaining risky behaviors among adolescents of both genders (McMillan et al., 2018).

In order to address criticisms of the TPB, Gibbons and colleagues (1998) developed the *Prototype Willingness Model (PMW)*. According to these authors, the Theory of Planned Behavior is a very good model for predicting reasoned actions. It fails, however, to properly address how people engage in risky behaviors that are deeply socially embedded, like adolescent smoking. They therefore developed an additional pathway, the “social reaction pathway”, (Conner M., 2005a) to explain the adoption of this kind of behavior (A. Ravis, Sheeran, & Armitage, 2006). The PMW is based on three assumptions (Pomery, Gibbons, Reis-Bergan, & Gerrard, 2009):

- 1) Some behaviors are not reasoned, but are rather “reactions to circumstances that are risk conducive” (Pomery et al., 2009). Smoking initiation occurs at social events or, at least, in the presence of peers. Smoking uptake, therefore, occurs in social situations where individuals are given the opportunity to try smoking (F. X. Gibbons, & Gerrard, M., 1995, 1997).
- 2) These social behaviors are associated with specific social images, like the “typical smoker”, “the poor school performer”, or “the cannabis user”, which are called

prototypes (Nadler, 1992). Thus, a prototype is the social image associated with a behavior-adopter, which might be personified by a peer, a relative, or a member of a social circle.

- 3) When a risky social opportunity occurs, like a night out with friends, with alcohol and cigarettes available, these social prototypes influence the decision-making processes of adolescents.

Figure 3.2. The Prototype Willingness Model (F. X. Gibbons, & Gerrard, M., 1995)



Figure 3.2 provides an overview of the PWM. In this model, as in the TPB, attitudes and subjective norms predict the intention to engage in the behavior. This is the reasoned path in the PWM. Attitudes, subjective norms, and risk images (prototypes, via social comparison), however, also influence behavioral willingness in the social reaction pathway. Behavioral willingness describes the expected behavioral response by an individual in certain situations, while behavioral intention does not take situation into account (Norman P., 2005). For example, while adolescents may state that they will never smoke, they might nonetheless admit that, at a party where they would drink alcohol, they would say yes to a cigarette offered by a peer, because they think smoking is cool on that occasion.

Unlike the TPB, the PWM also takes into account previous behavioral experience (Conner M., 2005b). For example, after their first taste of a cigarette, the same individual in the same situation (a party with alcohol and cool kids) might remember their first disgusting puff and refuse the cigarette or, on the contrary, they might remember how good the party was at that time. In an interesting paper that discusses the continuum from willingness to intention, Pomeroy and colleagues (2009) describe how, with experience, the path explaining the adoption of a behavior mostly shifts from “reactive” (PWM) to “intentional” (TPB). According to them, the reactive/PWM best describes smoking initiation, while TPB explain subsequent usual, “reasoned” actions.

The PWM also recognizes the importance of the role of the social image associated with smoking (prototype). The adoption of a behavior is, according to the PWM, influenced by the social prototypes associated with the behavior. The influence of a prototype on an individual’s behavior depends on two factors: similarity and favorability (Todd & Mullan, 2011). On the one hand, individuals need to share some characteristics with the prototype they want to emulate, a precept that is similar to the homophily concept used in social network analysis. The more people are alike, the more they tend to behave similarly (McPherson, Smith-Lovin, & Cook, 2001). In a study testing the role of prototypes in

smoking among adolescents, Ravis and colleagues (2006) found that perceived similarity to prototypes was a key factor in explaining both healthy and risky behavior, including smoking. On the other hand, the prototype should be associated with a favorable, positive image in the individual's mind. For example, if an adolescent identifies with another student (prototype) with similar characteristics (age, peer group, socioeconomic background, gender), if that prototype has positive characteristics (he/she is popular, funny or easy-going, or, even better, is his/her friend), and that prototype smokes, the adolescent will be keener to start smoking. By identifying with such prototypes, the individual will be more likely to begin smoking, and even more so if a social opportunity for initiation occurs.

Nonetheless, as argued by Ravis and colleagues (2006) in their study on adolescent healthy and risky behaviors, including smoking, the behavioral willingness of individuals does not only depend on prototypes of *actors* of a behavior, it also takes into account prototypes associated with *abstainers* from that behavior.. For instance, adolescents may identify with the positive characteristics of abstainers, such as being strong-willed, and continue to abstain from smoking. Moreover, individuals do not only refer to the positive characteristics of prototypes; they also consider the negative characteristics of both actors and abstainers (A. Ravis et al., 2006). In a study of drinking, Gerrard and colleagues (2002) found that individuals were influenced by both actor and abstainer prototypes: people who abstained from drinking were influenced by the negative characteristics of drinking-actors, and by the positive characteristics of drinking-abstainers. That is why research should acknowledge both prototypes and their associated positive/negative characteristics. In Ravis's study (2006) both smoking-abstainer prototypes and smoking-actor prototypes influenced adolescents to a similar degree. Moreover, the inclusion of prototypes improved the variance of the model (+5%), compared to the TPB model. They also concluded that both types of prototype should be addressed by smoking interventions, as they both

influence individuals' behavior. The fact that abstainer prototypes are of equal importance in not undertaking a behavior is of major importance: it underlines that having abstainer role models who possess the positive characteristics of abstainers is important in avoiding the uptake of risky behaviors among adolescents.

Abstainer role models are also important to consider when addressing another concept that is lacking in the TPB model: the descriptive norms discussed above (Amanda Ravis & Sheeran, 2003). Ravis and Sheeran's meta-analysis concluded that the descriptive norms have a stronger influence on health-risk behaviors than on healthy behaviors. All things considered, both prototypes and descriptive norms should be acknowledged in socio-cognitive models for explaining adolescent smoking behavior.

In response to these criticisms, Ajzen recognized (2011) that TPB is open to new variables that have a theoretical background and improve the general variance explained by the model. These conditions are fulfilled by descriptive norms, as well as the prototype concept (Ajzen I., 2011).

In this PhD thesis, our purpose is not, however, to test these models, nor to elaborate an additional theoretical model explaining the adoption of risky behaviors. Nonetheless, at the end of this chapter addressing the socio-cognitive model's explanation of health behavior adoption, we will identify several points that we want to address further.

Firstly, TPB and PWM identify different kinds of norms and beliefs that explain behavior intention (behavioral beliefs, normative beliefs, control beliefs, subjective norms). The study of beliefs should, in our opinion, be conducted using a comprehensive but structured typology of beliefs.

Secondly, the prototype concept of the PWM seems very relevant, particularly among adolescents, in whom sensitivity to peer effect and homophily has been widely documented. Two aspects of the PWM are, however, unclear: (1) which aspects of similarity are of

importance and (2) how can we measure the (social) distance between a prototype and an individual (Norman P., 2005). To answer these questions, our thesis will use social network analysis techniques and measurements.

Thirdly, the TPB uses a black box of “socio-demographics” to assess the determinants of beliefs. The PWM doesn’t even mention these variables by name. In our opinion, however, gender is an active determinant in these models and should be placed outside this black box. We expect, for example, that the beliefs associated with a behavior, as well as the distance and similarity to a prototype, will vary depending on gender. Our thesis will, therefore, address gender in a systematic way. These gaps in knowledge, as along with others that this thesis aims to address, are explored in the next chapter (Chapter 4).

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CHAPTER 4 –First conclusions, knowledge gaps and research questions

In Chapter 1, we considered gender trends in smoking and other risky behaviors (binge drinking, cannabis use and school performance). We concluded that the gender gap in risky behaviors among adolescents has recently decreased. The second chapter of this introduction introduced the concepts of gender and gender relationships. Since the 1970s, high schools have shifted from being single-gender to mixed-gender environments. This PhD thesis is based on the assumption that consecutive gender relationships at school may partially explain gender differences in risky behaviors. For decades, it has been recognized within gender studies that gender socialization tends to promote risky behaviors for boys, and rule-oriented behaviors for girls. Parents, however, are not the only agents of gender socialization: during adolescence, peers play an increased role in adolescent socialization processes. Having friends of the other gender may, therefore, change the “traditional-gender” orientation toward risky behaviors.

To date, few studies have systematically addressed this gap in knowledge: **has gender-mixing at school influenced high school students’ risky behavior adoption? Do relationships with the other gender influence adolescents toward risky behaviors?**

To address this gap, we will analyze adolescent gender relationships and their association with four risky behaviors: smoking, binge drinking, cannabis use (Chapter 6, Section 2) and low school performances (Chapter 7, Section 2). In particular, we investigate whether (1) girls with a majority of male-gender friends tend to have higher level of risky behaviors (higher level of smoking, binge drinking and cannabis use, and lower school performance) than girls with a majority of female-gender friends? But as we want to look at both genders, we will also investigate whether (2) boys with a majority of female-gender friends tend to have lower level of risky behaviors (lower level of smoking, binge drinking and cannabis use, and perform better at school) than boys with a majority of male-gender friends? This section will eventually help to conclude whether peer relationships shape the traditional gender roles associated with risky behaviors in males and in females.

In the third chapter, we introduced two leading theories from current literature that explain behavior adoption: the Theory of Planned Behavior, and the Prototype Willingness Model, the latter being an adaptation to the former. The PWM shares many concepts with the TPB, such as the role of norms, attitudes, and behavioral intention in explaining behavior adoption. The PWM, however, is specifically aimed at addressing risky behaviors that are socially embedded and the adoption of which is not deeply rationalized by individuals, as is the case with smoking, and the other risky behaviors considered here. Although testing these models is not the purpose of this thesis, the analysis of socio-cognitive theory made in Chapter 3 leaves us with unresolved questions that we want to address in the third section of this thesis (Chapter 8 and Chapter 9, Section 3).

First, both the PWM and the TPB highlight the importance of norms and beliefs in the intention to adopt a behavior. Regarding smoking, however, several studies addressing smoking beliefs have had a very narrow focus. For example, some studies address the mood-related aspects of smoking (like its supposed stress-reducing effect), while others have focused on the social aspects of smoking (like its association with popularity or having fun with peers). In the third section (Chapter 8), we will therefore **develop a comprehensive, systematic, but easy-to-use typology of beliefs, in order to measure gender differences in smoking beliefs, which has never yet been systematically attempted.** Indeed, as main determinants of smoking, smoking beliefs may explain why smoking trends among boys and girls can differ. For instance, if girls are more likely than boys to believe in positive aspects of smoking, such as “smoking will help me to stay thin or lose weight”, that might explain why smoking has reduced to a greater extent among boys than among girls. To try to explain this difference, the third chapter will address gender differences in smoking beliefs. Furthermore, there is another dimension to the association between gender and beliefs that needs to be looked at in depth. In the first chapter of the introduction, we acknowledged that gender trends in smoking differ between European regions. We might,

therefore, hypothesize that gender differences in smoking beliefs may differ depending on the gender culture of a country. This last hypothesis has not yet been addressed in the literature and will therefore be the last hypothesis in Chapter 8. This chapter will thus answer the general research question: **do smoking beliefs differ between genders and across countries?**

Furthermore, smoking prevention programs use smoking beliefs as core messages, because they are associated with smoking uptake. **In Chapter 3, our presentation of the** Prototype Willingness Model **acknowledged** the importance of beliefs in the adoption of a behavior. In Chapter 9, we will therefore take one type of belief (social negative beliefs) as an outcome in order to investigate another important concept from the Prototype Willingness Model that explains the adoption of a behavior: the concept of the prototype. According to this concept, an adolescent is more likely to endorse a risky behavior if a prototype which is both likable and similar to him/her endorses this behavior. During adolescence, the influence of parents tends to decrease, while friends become increasingly important in young peoples' lives. Friends are thus crucial prototypes to investigate. However, not all friends have the same influence on adolescents, and **no study has yet addressed the social distance to prototypes**. Adolescents are members of different reference peer groups, which can be seen as social layers. They have a close group of best friends and a larger group of acquaintances, but they are also members of a larger circle of schoolmates. **Which of these social layers has the greatest influence on an adolescent has not yet been addressed by the literature, nor has it been addressed from a gender perspective**. Boys and girls have different peer group configurations: girls tend to belong to closer groups of best friends, which are based on intimacy, while boys tend to belong to larger peer groups that are based on shared activities. In answering these questions, social network analysis measurements and techniques will be of great importance (see Chapter 5).

Furthermore, while similarity is a key component of the influence of a prototype according to the PWM, **there have been no studies assessing how we should measure similarity components of prototypes in smoking.** In the ninth chapter, therefore, we will assess different similarity variables: gender, socioeconomic status and smoking status.

The aim of this **chapter is to identify which reference peer group should be preferred by interventions to spread anti-smoking messages carrying negative beliefs about smoking.** More precisely, this study wants to determine which level one should intervene on (close peer group of best friends, acquaintances, schoolmates), and, if possible, determine the best size for these reference peer groups. Furthermore, we want to determine whether peer group similarity (in terms of socioeconomic status, gender or smoking status) and reciprocity of friendship should be taken into account in such interventions. **Finally, this chapter will address whether different intervention strategies should be mobilized depending on adolescents' gender and smoking status.**

Finding efficient ways of addressing adolescent smoking across genders is, of course, one of the main objectives of this PhD. Smoking prevention campaigns are, however, not the most effective tool for tackling adolescent smoking. Together with the FCTC framework, European countries have developed Tobacco Control Policies and, more importantly for adolescent populations, School Tobacco Policies.

In the fourth of our thesis, we will analyze, along with the Silne-R project, whether gender gaps in adolescent smoking depend on School Tobacco Policies (STP). As we highlighted in the first chapter, gender gaps in smoking are decreasing among European adolescents. **This chapter (Chapter 10) will look at whether this gender gap in the decrease in adolescent smoking might be attributable to a gender differential response to STP.** More precisely, we will focus on the four mechanisms via which STP are expected to reduce adolescent smoking differently in girls compared to boys: the fear of sanction, the reduction of peer pressure, the increase in negative beliefs about smoking and control over the

decision not to smoke. First, we will review the literature and see whether these mechanisms should influence smoking differently in boys and girls. We will then test for the influence of such mechanisms on smoking for both genders, taking the gender context of the school into account. **In this chapter, we aim to identify which mechanism for explaining the influence of STP on smoking has the greatest influence on smoking for each gender. Eventually, this will help to better tailor STP to gender.**

Before trying to find an answer to these research questions and hypotheses, however, we will first dedicate some time to the methods used in this PhD thesis. To do so, Chapter 5 will describe the Silne R project and its setting as well as the key methods and measurements from the previous chapters.

CHAPTER 5 – Methods and setting – the SILNE R project

This chapter aims to provide complete information about Work Package 8 of the Silne R project setting (Part 1), and about the measurements used in this PhD project (Part 2).

PART 1: Setting

In 2012, the SILNE consortium received a research grant from the European Commission (FP7, Seventh Framework Programme). The aim of the Silne R research project was to help to explain social inequalities in adolescent smoking using in-depth analysis based on natural experiments. The first wave of data collection was conducted among adolescent students aged fourteen to sixteen in several schools located in six European cities: Namur in Belgium, Amersfoort in the Netherlands, Hanover in Germany, Tampere in Finland, Latina in Italy, and Coimbra in Portugal. The team in Belgium, directed by Prof. Vincent Lorant, coordinated the data collection and analysis of results. In addition to the data collection from students, two other questionnaires were completed: one by school staff members, in order to understand the school situation from a second point of view, and the other by the school principal, to collect general information about the school and its environment.

At the end of the first project, the SILNE consortium decided to submit a new proposal to the European Commission Horizon2020 research program, with an additional partner, the Tobacco Free Research institute, located in Dublin, Ireland. In this second project, we were responsible for coordinating the second wave of the data collection for WP 8 of the Silne R project. This research project financed our PhD for its first three years and provided us with all the data used in this thesis. As it represents a large portion of the work carried out during our PhD, we will therefore briefly describe the main milestones of the questionnaire's construction, data collection process, and data management and analysis in the next few paragraphs. As the first wave of data collection has been described elsewhere

(Lorant et al., 2015), the next section will focus entirely on the second wave of data collection (Silne R-WP 8).

SILNE R – description of the questionnaires, data collection, management, and analysis process

Updated version of the questionnaires

All in all, between the first and second wave, the focus of the WP 8 questionnaire and of the SILNE R project as a whole changed from smoking inequalities to tobacco control policies. In order to create an updated version of the questionnaire used in 2013, we first included new items corresponding to the new questions that we decided, with agreement from the consortium, to address in the second wave (2016/17). Smoking beliefs, school tobacco policies, and e-cigarettes were some of the new themes that needed to be included. The questionnaire was translated into the languages of the participating countries. Then, it was successfully piloted in one city in each country. Finally, we asked a graphic artist to create a “Silne R” layout that we applied to all the national questionnaires. The Belgian student questionnaire is provided in appendix 1 as an example. The two additional questionnaires, one for the school staff and one for the school principal, were also updated. The school questionnaire was similar to the one used in the first SILNE survey but we removed several questions (environmental context of schools) and added some others (educational consequences for students caught smoking at school, for example). The questionnaires were translated into the seven national/regional languages (see appendixes 2 and 3, for the Belgian versions of the staff and school questionnaires).

Ethical Committees

Each national team applied for national ethical committee approval. All teams received agreement to begin data collection on schedule, except the team in Germany, whose data collection was substantially delayed by the slow processes of local ethical committees. Moreover, ethical requirements varied slightly between countries. As we had to interview underage teenagers, we needed to comply with national ethical requirements related to parental consent. In Belgium, the Netherlands, Ireland, Portugal (except for one school), and Finland, passive parental consent was requested: we therefore sent an informative letter to all parents asking them to fill in a specific form if they objected to their child participating in the survey. In Italy and Germany, active parental consent was compulsory, meaning that parents had to state whether they agreed to their child participating in the survey. While this active parental consent did not lower participation rates in Italy compared to other countries, in Germany, it caused rates of participation to differ greatly between schools, depending on how the school organized and dealt with parental consent (see participation rates, below). References for the ethical committees are provided in appendix 4 and a copy of the Belgian passive parental consent form is provided in appendix 5.

Participation of schools

During the first wave of data collection, each national team had to choose a city whose socioeconomic situation corresponded to the national mean. In each city, we sought to recruit about six schools, from different socioeconomic backgrounds and educational orientations (where relevant). In each city, we expected to recruit about 2000 students aged fourteen to sixteen, so the number of schools recruited varied by country (in Germany, for example, more schools were needed to reach this sample size). In each school, we sampled all classes in the two grades with students between the ages of fourteen and sixteen. In 2016 (second wave), we re-contacted and recruited the schools from the first SILNE survey. As Ireland was not included in the first wave, new schools were recruited in Dublin. A large

majority of the schools decided to participate in the survey again. Where participating again was not possible, we asked our partners to recruit new schools in the same cities, taking great care to select schools that had the same socioeconomic background and educational orientation (vocational or non-vocational). In Table 5.1, we provide a summary of the new and re-participating schools.

Table 5.1. Number of schools that participated in SILNE data collections				
	Only in 2013	Only in 2016	2013 and 2016	Total
Belgium	0	0	7	7
Ireland	-	8	0	8
Finland	0	1	8	9
Germany	8	7	5	20
Italy	1	0	7	8
The Netherlands	3	1	5	9
Portugal	0	0	6	6
Total	12	17	38	67

Preparing for data collection

We organized the collection of data via the student, school principal, and school staff questionnaires. First, we created a common template for organization. In order to ensure the quality of the data, it was important to ensure that every partner involved in the data collection followed a similar process in collecting the data. We also collected information about the school and the city, as well as fieldwork documents in order to describe and document the data collection processes in each city and school. The fieldwork documents contained information on the number of students who were officially registered, present,

and absent during data collection and the number of students who agreed and refused to participate. We also included some questions to document the quality of the data collection environment, e.g. whether students sat close to each other and/or whether they were speaking to each other.

Data collection¹⁴

In each country, we collected quantitative data using the student, school principal, and school staff questionnaires. We administered the survey from September 2016 to May 2017. The paper-and-pencil questionnaire was delivered face to face during school hours in the two grades corresponding to the same age group as the first SILNE survey (fourteen to sixteen). Our objective was to collect about 2000 questionnaires in each city. We achieved an average of 1856 questionnaires per city and gathered information about the data collection via fieldwork documents. In total, the sample included 12,797 in 2016/17, with a participation rate of 79.9%, compared to 79% in 2013 (Lorant et al., 2015). In Box 5.1, we summarize the main issues that we encountered during WP 8 data collection.

Box 5.1. Main issues during data collection

Firstly, some schools were difficult to contact in order to organize the data collection. We therefore remained flexible and conducted the data collection on any date(s) they suggested. In some schools, several teachers did not know SILNE-R and were not aware that we were coming that day to have the questionnaires completed.

¹⁴ Please note that the data collection process followed in the first wave of the Silne R project has been presented elsewhere (Lorant et al., 2015).

Secondly, re-participation of schools was sometimes difficult to organize. In Finland, one school refused to participate again, but finally agreed to collect the data; however, many classes were absent during data collection. In the Netherlands, three schools refused to re-participate and another agreed to participate but took a long time to fix a date for the actual data collection. In Italy, one school also refused to participate a second time. In Portugal, there were some difficulties reaching some of the schools' principals to get their approval and commitment but they all participated again.

In Portugal, one of the schools required active parental consent, whereas the remaining schools allowed passive parental consent. This increased the number of refusals in that school. There were also concerns about the amount of time needed to fill in the questionnaire, which should not have required more than 40-50 minutes.

We had to answer many questions about the list of students and its anonymity. We needed to ensure confidentiality. In Finland, schools were not allowed to give lists of their students to anyone, so the social network methods used in Finland differed from those used elsewhere, as had also been the case in 2013.

In some cases, we observed a group effect in refusal to participate: once some students stated that they did not want to participate, their friends were more likely to express similar reluctance; this affected participation rates in some classes.

Finally, data collection was easier when students did not sit next to each other: distance creates formality and eliminates small talk. When many students filled in the questionnaire in a large auditorium at the same time, it was more difficult to maintain a quiet atmosphere. Data collection was easier in individual classrooms but took more time.

Appendix 6 gives the number of students who were officially registered, the number who were absent, the number who were present, the number of students who refused to participate, and the number of those who completed the questionnaires in each school.

Based on that information, we calculated two participation rates: gross participation rates (completed/registered) and net participation rates (completed/present). Details of participation were missing in Germany and in one Belgian school where fieldwork documents were not completed. Gross participation rates were 85.4% in Belgium, 81.1% in Ireland, 87.9% in Finland, 62% in Germany, 82.2% in Italy, 85.8% in the Netherlands, and 76.3% in Portugal. In total, 12,991 students completed the survey and 12,797 students were deemed valid for analysis, after the exclusion of blank forms. Because a significant number of schools refused to participate in the data collection a second time, Table 5.2 shows the main measurement of the Silne R project according to whether the school participated in only the first wave or in both waves of data collection. Compared to schools which participated in both waves, there were fewer weekly smokers, more females, more students of high socioeconomic status, more students who lived with both parents, more students who reported high school performance levels and fewer smoker friends in the sample of schools that only participated in the first wave.

Table 5.2. Smoking outcomes, exposure to smoking, and sociodemographic distribution by school participation status, SILNE R study 2013 and 2016: percentage and chi-square test (from “Trends in adolescents’ weekly smoking: a repeated cross-sectional survey in six European countries” by Lorant V., Grard A., et al., in review).				
	School Participation		Chi-2	p value
	Both waves	First wave only		
Covariate:	%	%		
Weekly smoker	14.7	10.2	20.4	<.001
Sex Male	47.8	51.2	5.9	0.015
Age group:				
14	28.0	34.1	25.8	<.001
15	45.5	43.8	.	.
16	26.5	22.0	.	.
Parental education:				
Unknown	1.3	1.1	44.0	<.001
Low	39.9	30.7	.	.
Middle	38.6	42.0	.	.
High	20.2	26.2	.	.
Subjective social status (/10):				
4 or less	6.7	5.7	9.7	0.002
5	14.0	13.1	.	.
6	19.2	16.5	.	.
7	27.5	29.0	.	.
8 or more	32.5	35.8	.	.
School achievement:				
Low	18.3	16.2	7.1	0.008
Middle	42.9	35.3	.	.

Table 5.2. Smoking outcomes, exposure to smoking, and sociodemographic distribution by school participation status, SILNE R study 2013 and 2016: percentage and chi-square test (from “Trends in adolescents’ weekly smoking: a repeated cross-sectional survey in six European countries” by Lorant V., Grard A., et al., in review).				
	School Participation			
	Both waves	First wave only		
Covariate:	%	%	Chi-2	p value
High	38.8	48.5	.	.
Family type: both parents	72.5	77.5	15.4	<.001
Parental smoking, one or +	37.7	36.1	1.3	0.256
Friends who smoke:				
None	67.5	77.2	47.3	<.001
Fewer than 50%	18.6	13.2	.	.
>=50%	13.8	9.5	.	.

Data entry

From January 2017 to August 2017, we organized data input and processing. The data entry web platform we used in the previous SILNE survey was updated and adapted to include new questions and a new country (Ireland). The data were stored in a central database in order to build a longitudinal database containing both the 2013 and the 2016-17 data. The national teams and the coordinating team checked the data for missing and inconsistent values and assessed the quality of the data entry. Data problems that were observed were discussed with national representatives and remedied when possible.

The data was stored in the university servers and regularly backed up. Data management was conducted carefully, first internally, then we released the first version of the questionnaire to our international partners, who gave us constructive feedback on how to

improve the databases and documentation. Finally, a final version of the database was released in April 2018.

The aim of the codebook was to describe the data in full so that any researcher would thoroughly understand all the variables when working with the databases. For each variable, the codebook describes: the title of the question (in the seven languages), the different values of the variable, and how it was coded in the database, the type of variable (numerical, categorical, or text), whether the question was also part of the first wave Silne R questionnaire, and whether the wording of the question had changed between the first and second wave. This last point is particularly important in ensuring that analyses take advantage of the repeated cross-sectional design.

We then made these databases and codebooks available to our partners via Dropbox, which was only accessible to identified research partners, who accessed it via a specific email invitation. We also asked each partner to systematically report any problems or questions related to the databases via a common template. In April 2018, we were able to deliver a final, revised version of the databases, which took the feedback from our partners into account, and the final codebook. The codebook is available upon request (adeline.grard@uclouvain.be).

PART 2: Measurements

In this section, we aim to describe the key measurements used in this thesis in detail, which will help to explain the methodological choices we made. We thus report on the main measurements used in the thesis but not on all of them. For example, we systematically describe the dependent and main independent variables in each of the thesis papers (Chapter 6 to Chapter10), but not the cofounders. A brief description of all the variables used, including cofounders, can, however, be found in the method section of each paper.

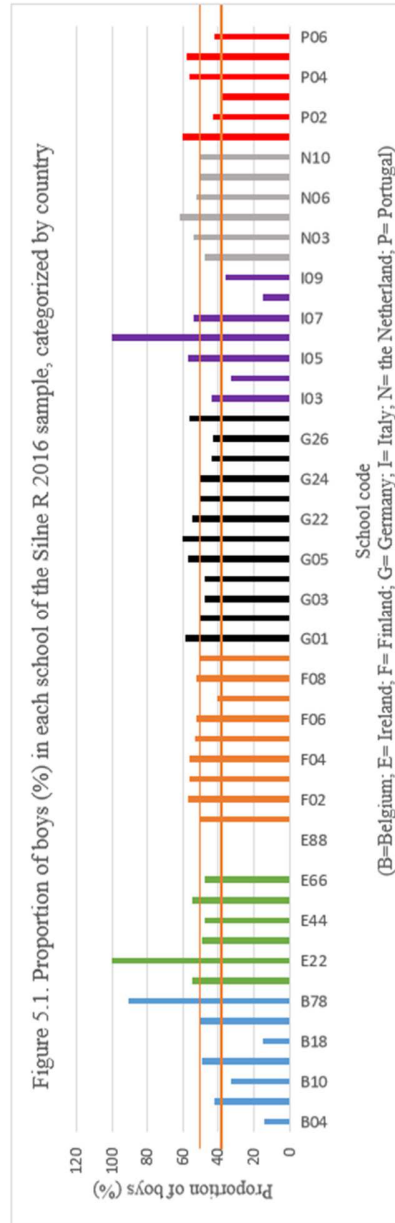
Gender

Adolescents' Gender

The gender of students was measured using the following question: “Are you a male or a female?” (see Q6 in the student questionnaire, appendix 1). More precisely, we classified adolescents as male or female according to their self-identification in response to the question “are you a male or a female?¹⁵” This term in no way encompasses all aspects of gender and is closer to the concept of biological sex. However, for the 2013 data collection, the German team added a gender identity question. Students were asked to answer to both these questions: “to what extent do you feel feminine?” and “to what extent do you feel masculine?” In the German sample, 2% of women felt “not so feminine” or “not feminine at all” and 0.5% of boys felt “not so masculine” or “not masculine at all”. Unfortunately, this question was not asked in 2016 or in other countries.

¹⁵ In French : “Es-tu de sexe masculin ou féminin?”

We provide a description of the gender distribution in every school in each city included in the samples in 2013 and 2016 in appendix 7. In 2013, 48% of all students in the sample were boys whereas, in 2016, the gender distribution was even more balanced (50%). In the individual countries, the gender balance varied from 48% male (Belgium, 2013) to 52% male (Finland, 2016) with the exception of Italy, where the national sample was 41% male in 2013 and 45% male in 2016. Gender distribution, however, varied greatly between schools (see Figure 5.1, below): in Belgium, for example, B04 was 14% male in 2016, while B78 was 91% male. In Italy, the gender balance of schools also varied greatly, with I04, I06, I08, and I09 being respectively 33%, 100%, 15%, and 36% male in 2016. In Ireland, there were two schools with only girls (E77 and E88) and one with only boys (E22). In Finland, the Netherlands, and Germany, however, gender distribution was more balanced, with boys making up 40-60% of all students. In several papers, we used the gender balance of the school as an independent variable and thus assigned schools to three categories: we calculated the proportion of boys in each school sample and classified them into three categories. Gender-balanced schools had a 45 to 55% gender distribution (39.5% of schools in 2016, 52% of schools in 2013). Male-majority schools were defined as those that were more than 55% male (27.9% of schools in 2016, 22% of schools in 2013) and Female-majority schools as those that were more than 55% female (32% of schools in 2016, 26% of schools in 2013).



Gender social homophily

The measure of gender social homophily is used in Chapter 6, Chapter 7, and Chapter 9. Gender social homophily is defined as having ties to friends of the same gender. The gender distribution in a school may, however, be uneven (see appendix 7), so a higher proportion of same-gender friendship ties may just occur by chance. It is, therefore, important to standardize gender social homophily according to the gender composition of each school. Gender social homophily was thus measured using the Coleman index, which ranges from -1 to 1 (Bojanowsky, 2011). A Coleman index score of > 0 meant that an ego's peer group had a higher proportion of same-sex members than a random selection in that particular school would have produced. A Coleman index score of < 0 meant that an ego had more other-sex friendships. Students who had a positive Coleman index score were then classified as same-sex-friendship students, while those with a negative Coleman index score were classified as other-sex-friendship students. The Coleman index of gender homophily was 0.66 in 2013 and 0.63 in 2016. Nonetheless, this index varied between countries. For example, regarding friendship ties in 2016, gender homophily was greater among Finnish (0.84) and Dutch (0.78) adolescents than among students from Italy (0.53), Ireland (0.57), or Portugal (0.47).

This measurement of gender homophily has several advantages. The first is a theoretical advantage: as already stated above, it allows the marginal gender distribution of the school to be taken into account. Being a boy who attends a school in which 80% of the students are girls means that you are less likely to be friends with boys than girls. The second advantage is statistical: the measure is a numeric variable, which provides a precise measurement of homophily, one of the central outcomes of our thesis. It is also the most suitable measurement for regression analysis and captures more variance than a categorical variable. Yet, the Coleman index of gender homophily standardizes the gender distribution in a school, which allows to compare very dissimilar schools in terms of gender socialization. Nonetheless, it comes with a cost: the gender distribution of a school, the real gender environment, disappears from the statistical analysis. The

alternative is, however, to classify adolescents in three categories: adolescents who only had same-gender friendships, those who only had other-gender friendships, and those with mixed-gender friendships. There were only 267 students (1.2 %), however, who only had other-gender friendships (both 2013 and 2016 together), including only 38 girls in 2013 and 36 girls in 2016. Those samples would have been too small for our analysis of other-sex friendship. Moreover, in order to take into account the gender composition of a school, we introduced the gender balance of the school (see above).

GINI index of gender inequality

In Chapter 8, we hypothesized that the gender context of a country would influence gender beliefs. We therefore classified the seven countries according to their gender culture using the gender index of inequality (GINI). According to the United Nations Development Program, there are three dimensions to the GINI index of gender inequality (United Nations Development Program 2016): health (maternal mortality rate and adolescent birth rate), empowerment (female and male population with at least a secondary education, female and male participation in parliament), and labor participation (female and male participation in labor forces). We classified the seven countries according to their scores in the GINI index of gender inequality (from the most equal (closest to 0) to the least equal (closest to 1)): the Netherlands (0.044, 3rd), Finland (0.056, 8th), Germany (0.066, 9th), Belgium (0.073, 12th), Italy (0.085, 16th), Portugal (0.091, 17th), and Ireland (0.127, 26th).

Substance use

Regular smoking

In Chapter 6 and Chapter 9, students were categorized as regular smokers if they smoked one cigarette a week. Weekly smoking was used in the HBSC study to assess tobacco use among the 15-year-old European population (Inchley, 2016; Moor, 2015). In 2016, regular smokers represented 11% of the sample, compared to 18% in 2013.

Smoking on school premises

In Chapter 10, we asked students who had smoked at least once to answer the following question: “In the last six months, have you smoked on school premises?” The answers were binarized and all students who had smoked on school premises at least once (10% in 2013, 5% in 2016) were given a score of 1. Students who had tried smoking but had never smoked on school premises received a score of 0.

Binge drinking

In Chapter 6, adolescents were classified as binge drinkers if they had drunk more than five drinks on at least two occasions in the last month (Weschler, 1994). In 2016 that was the case for 25% of the sample, compared to 15% of the 2013 sample.

Cannabis use

In Chapter 6, cannabis use was defined as a student having used cannabis at least once in their life (Weschler, 1994). In 2013, 16% of adolescents had used cannabis at least once, whereas 14% of students reported such behavior in 2016.

Beliefs about smoking

Adolescent beliefs about smoking is one major outcome measure of this PhD thesis. In Chapter 8, we developed an easy-to-use typology of beliefs with two dimensions. The first dimension is the positive-negative opposition: does this belief promote smoking (positive) or help to prevent its negative effects (negative)? The second dimension of our typology is derived from the opposition between intrinsic and extrinsic beliefs about smoking cessation (Curry, Wagner, & Grothaus, 1990). It is composed of individual (intrinsic) beliefs, which come from the individual, and social (extrinsic) beliefs, which result from their social environment.

To measure smoking beliefs, we used a scale based on that of Song et al. (Anna V Song et al., 2009), who used three factors related to the perceived benefits, long-term risks, and short-term risks of smoking. We selected and adapted the scale, removing some redundant items related to the health risks and disadvantages of tobacco, on which it

has been shown there is about 100% agreement. Moreover, as we were interested in the social rather than the individual dimension of smoking, we included additional social items (Do you think that smoking helps you to look grown-up, look masculine, look feminine, appear sexy/attractive, or get a boy/girlfriend?) and individual items (Do you think that smoking helps you to lose weight or stay thin or causes you to have less ability to exercise?). Then, to add some complementary items to the negative social beliefs dimension, which only included “Do you think that smoking gets you into trouble?” in Song et al., we used two items from the stigmatization scale (Stuber, Galea, & Link, 2008). We slightly adapted them to the context of adolescents: “Most people would not hire a smoker to take care of or babysit their children” and “Most smokers would be reluctant to date someone who smokes.” These items were selected because they were expected to vary according to gender, because boys and girls differ in their dating processes and involvement in babysitting (Weinstein & Rosen, 1994). Finally, we used two items from the stigmatization scale presented above and the remaining belief about “getting into trouble” and we also added friends’, parents’, and teachers’ disapproval of smoking to create the Negative Social Belief Scale (see below). For each belief, we asked students to state whether they agreed that smoking was associated with the belief (e.g. “Do you think that smoking helps you to get a boy/girlfriend?: “totally agree”, “agree”, “don’t agree”, “totally disagree”).

Each belief was then binarized into two categories (agreed or disagreed with the belief), which allowed us to find the percentage of agreement with each belief. In a further step, based on the typology presented above, we separated the beliefs into four categories and computed them into four belief scales, which allowed us to use them as dependent variables in a multinomial contrast analysis.

The positive individual belief scale contains the following beliefs: smoking increases your chances of “feeling relaxed” and “losing weight or staying thin” (Spearman-Brown coefficient: 0.44). The positive social belief scale was composed of “becoming popular”, “looking grown-up”, “looking masculine”, “looking feminine”, “appearing sexy or attractive”, and “getting a boyfriend or girlfriend” (Cronbach alpha: 0.78). We

computed the negative individual belief scale based on “getting lung cancer”, “having chronic trouble breathing”, “getting facial wrinkles”, and “having less ability to exercise” (Cronbach alpha: 0.70). Finally, we used two items from the stigmatization scale presented above with the remaining belief “getting into trouble” and added friends’, parents’, and teachers’ disapproval of smoking to create the negative social belief scale (Cronbach alpha: 0.45). As these scales contain different numbers of beliefs, we computed the arithmetic mean in order to scale them. Then, we reported the total score of each on a 0–1 scale to use them as dependent linear variables. The beliefs were analysed according to gender and country. The distribution of items according to countries is given in Table 5.3. Note that, in Chapter 9, we used the negative social beliefs as the dependent variable.

Table 5.3. Proportion of students who agreed with the following smoking beliefs in each country. Silne R, 2016

	Bel	Ire	Fin	Ger	Ita	NL	Por
Positive individual beliefs	49	46	26	36	52	51	41
Feeling relaxed	21	32	10	19	15	13	24
Losing weight	35	39	18	27	33	32	33
Positive social beliefs	12	17	7	8	19	14	11
Looking cool	10	32	10	19	23	19	12
Looking grown-up	7	16	7	11	10	11	7
Looking masculine	4	5	3	3	7	4	3
Looking feminine	4	8	5	4	8	5	5
Getting a boy/girlfriend	8	17	11	9	12	14	14
Becoming popular	4	9	4	3	14	5	7
Appearing sexy	7	15	6	8	13	10	8
Negative individual beliefs	51	88	86	80	67	75	72
Getting facial wrinkles	90	91	91	85	75	83	85
Having less ability to exercise	95	98	97	95	93	93	96
Getting lung cancer	93	95	93	95	91	92	93
Having trouble breathing	82	93	92	89	82	86	86
Negative social beliefs	69	88	91	89	77	69	65
Getting into trouble	50	66	76	63	45	66	30
Most people reluctant to date	95	98	98	82	95	97	97
Parents' disapproval	72	84	88	88	75	81	64
Most people would not hire a smoker to babysit	63	72	58	55	44	56	66
Best friends' disapproval	39	93	81	65	62	57	62
Teachers' disapproval	65	84	82	74	66	71	64

School performance

In Chapter 7, to measure school performance, we asked students to self-report their average marks in the previous academic year: “Which of the following best describes your marks during the past year?” Students had to choose between five categories that described their grades, ranging from the lowest to the highest, based on each country’s assessment system (Robert et al., 2018). As educational systems differed between countries, we asked each national team to carefully adapt the Belgian scale. Possible answers thus differed slightly depending on the country and the school system. We provide the possible answers in the seven countries in Table 5.4. For all countries, we recoded the variable as follow: 1= 4; 2=3; 3=2; 4=1; 5=0, which allowed the categories with the highest scores to receive the highest final scores. In Finland, as there were more possible answers, we recoded the variable as follows: 1 = 4; 2 = 4; 3 = 3; 4 = 2; 5 = 2; 6 = 1; 7 = 0; 8 = 0. Appendix 8 shows the distribution of each possible answer in the final score according to country. Despite great efforts to make the scale transferable from one country to another, we observed some disparities, mostly in the extreme values. Regarding the mean score, all countries had a score of between 2/4 and 2.4/4, with the exception of Italy (2.7/4). The Italian sample, however, had an unbalanced gender distribution, and a higher proportion of girls, which may also (partially) explain these differences.

Table 5.4. Distribution of the school performance score in each country. Silne R, 2013-2016.									
		Bel	Ire	Fin	Ger	Ita	NL	Por	Tot
School performance score									
0 (lowest)	N	432	86	457	53	48	71	97	1244
	%	11.5	4.1	14.5	1.9	1.2	1.7	2.6	
1	N	708	275	464	403	196	528	824	3398
	%	18.8	13.1	14.7	14.2	4.9	12.6	22.1	
2	N	1283	807	1106	1366	1377	2164	1504	9607
	%	34.1	38.4	35.1	48.1	34.4	51.8	40.3	
3	N	1127	674	596	840	1796	1182	965	7180
	%	30.0	32.1	18.9	29.6	44.8	28.3	25.8	
4 (highest)	N	207	260	532	180	588	233	345	2345
	%	5.5	12.4	16.9	6.3	14.7	5.6	9.2	
Total	N total	3757	2102	3155	2842	4005	4178	3735	23774
	Mean score	2.0	2.4	2.1	2.2	2.7	2.2	2.2	

School tobacco policies

In Chapter 10, in order to measure STPs, we followed a recent study by Mélard et al. that measured STPs using three dimensions: comprehensiveness (does the STP apply to all students, staff, and visitors), at all times (during school hours or outside school hours), and in all places (all school premises), formality (whether the STP is formally communicated by schools and by what means) and enforcement (whether the STP is actually enforced and whether there are sanctions associated with breaking the rules). The three scores were based on both student and staff perspectives and were computed

on a total of 10 points for each dimension and then added up to create the STP's total score (out of 10). They are detailed below (from Mélard N., Grard A., et al., School tobacco policies and adolescent smoking in six European cities in 2013 and 2016: A school-level longitudinal study, under review).

Comprehensiveness – staff's perception: The staff's perception of the comprehensiveness of the policy was captured using three questions (yes/no): (1) “where and to whom does the policy apply?”, (2) “when does it apply?”, and (3) “is there a smoking room for students, teachers, or visitors?” The comprehensiveness score was obtained by taking the mean score of all items, ranging from 0 (no) to 1 (yes) for each staff member. A score of 1 point was attributed for question (3) when there was no smoking room for students, teachers, or visitors, because the literature has found encouraging results for 100% smoke-free policies (Baillie, Lovato, Taylor, Rutherford, & Smith, 2008; Fallin, Roditis, & Glantz, 2015; Lee, Ranney, & Goldstein, 2011). The Kuder-Richardson Formula 20 (KR-20) was 0.84 in 2013 and 0.88 in 2016, implying good internal reliability.

Comprehensiveness – students' perception: Although the wording of the question had changed between the first and second data collections, the questions captured comparable information: whether or not there was a rule against smoking in their school. The score was either 0 (no rule or don't know) or 1 (existing rule) and was then averaged at the school level. For the second version of the question, a score of 0 was attributed even if students were allowed to smoke only in certain areas, in order to distinguish schools that were tolerant from those that adopted a proactive position, banning smoking not only indoors but everywhere on school grounds (Barnett et al., 2007).

Enforcement – staff's perception: The staff's perception of policy enforcement was measured using their reports about the consequences for students who had been caught smoking since the previous September. Previous research has shown that combining educational and disciplinary consequences reframes policy violations as an adolescent

health issue rather than a disciplinary issue (Hamilton, Cross, Lower, Resnicow, & Williams, 2003; Pentz et al., 1989; Schreuders, Nuyts, van den Putte, & Kunst, 2017b; Soteriades, DiFranza, Savageau, & Nicolaou, 2003). As a result, we classified consequences into two categories: those that treated policy infringements as a health issue (e.g. “encouraged but not required to participate in an assistance, education, or a program to help them quit smoking” or “encouraged and required to participate in an assistance, education, or quit-smoking programme”) and those that treated them as a disciplinary issue (e.g. warning issued, assigned to help out around the school) (Piontek et al., 2008). We assigned 2 points if the staff member reported using at least one of the health-related consequences and 1 point if they had used at least one of the disciplinary consequences, giving a maximum score of 3. We found the mean for each school staff member and divided it by 3 to get a score ranging from 0 to 1.

Enforcement – student perception: To capture students’ perceptions of the enforcement of the policy, we used the question that had been used to assess the existence of a policy (in the comprehensiveness dimension) but we focused on whether they believed it to be strictly enforced (1 point if strictly enforced, 0 if not).

Communication – staff perception: We captured the staff’s perception of the communication of the policy using two questions: (1) “what means of communication were used to communicate the policy” and (2) “what were the procedures for informing students, families, staff, and visitors about it and about the consequences of violations?”. Each question was composed of different items. For each question, we attributed one point for each item and calculated the average of both scores. The communication score was the mean score for the two questions for each staff member (Cronbach’s $\alpha = .55$ in 2013 and $.44$ in 2016).

Total scores: Overall student perception of the policy was calculated as the mean of the scores for student perception of comprehensiveness and enforcement (aggregated at the school level). We did likewise for the school staff perception but took into account comprehensiveness, enforcement, and communication (aggregated at the school level).

Finally, we computed a total STP score using the mean of both perceptions. The mean score of each dimension and the total score are provided in appendix 9.

Mechanisms of school tobacco policies

Fear of sanction (mechanism 1)

In Chapter 10, in order to measure the fear of sanction, we first asked students to state whether one of the following types of sanction had been applied in the past six months: a “harsh” sanction (e.g. students caught smoking were suspended from school), a “disciplinary” sanction (e.g. parents were warned or tobacco was confiscated), or a “remedial sanction” (e.g. students caught smoking received an educational talk about smoking and its consequences). If a type of sanction had been applied at least once, the sanction received a score of 1, otherwise it received a score of 0. Then, to be able to take fear into account, we first asked students whether they thought that smoking gets you into trouble, and then whether they thought their teachers would disapprove of them smoking. After testing for correlation between these sub-indicators and Cronbach alpha ($=0.48$), we calculated the final score for fear of sanction by multiplying the existence of a sanction by the sum of teacher disapproval and getting into trouble. The mechanism score was $/2$.

Peer pressure (mechanism 2)

In order to measure peer pressure, we asked students whether they would smoke a cigarette if one of their friends offered them one. Possible answers ranged from “definitely not” (1 point) to “absolutely” (4 points). We then asked them what proportion of their friends smoked (from “none” ($= 0$ point) to “most of them” ($= 4$ points)) and, finally, we asked them whether their friends would approve of smoking ($= 1$ if most of them would approve to 4 if most of them would disapprove). The peer pressure score was calculated, after testing for correlation between sub-indicators (Cronbach alpha $=0.68$), as the sum of those three indicators (total score $/12$).

Control over the decision not to smoke (mechanism 3)

We asked weekly smokers, who are considered dependent on tobacco, whether they had ever tried to quit smoking. Those who had tried to quit at least once were asked whether they would smoke a cigarette soon. To those who had smoked at least once but who would not smoke a cigarette soon, we attributed a score of control over smoking = 1; others who had smoked at least once received a score of control over smoking = 0. Cronbach alpha for this mechanism was, however, low (0.10).

Negative beliefs (mechanism 4)

The fourth mechanism was measured by asking students whether they were aware of the negative consequence of smoking for one's health. Students were asked whether they thought that smoking increased the odds of: "getting lung cancer", "having trouble breathing", "getting facial wrinkles", and "having less ability to exercise" (Cronbach alpha = 0.71). Each indicator was binarized (e.g. received 1 if they agreed with the belief, 0 if they disagreed). The final individual negative beliefs score was calculated by adding together the four sub-indicators (total /4). A description of the mechanism scores according to country is given in Table 5.5 Finnish and German students had higher scores for fear of sanctions, whereas peer pressure was higher in Italy and Belgium. Control over the decision not to smoke was stronger in the Netherlands but negative social belief scores were quite similar in all countries.

Table 5.5 Description of mechanisms according to countries. Silne R, 2013-2016					
	Belgium	Finland	Germany	Italy	The Netherlands
Fear of sanction (/2)	0.62	1.41	1.33	0.35	0.44
Peer pressure (/12)	5.96	5.47	5.13	6.96	5.66
control over the decision not to smoke (/1)	0.15	0.12	0.10	0.12	0.21
Negative beliefs (/4)	3.28	3.67	3.58	3.26	3.38
<i>Note: In this chapter (Chapter 10), Portugal was not included in the analysis because of an error on the Portuguese questionnaire in one of the items, as a result of which the results were not comparable with other countries. Ireland was not included either because the results of both waves were needed to calculate the scores.</i>					

Reference peer groups

Social network analysis relies on two main measures: nodes and ties. Nodes are the individuals included in a network. Ties are the friendships between those individuals. In order to collect social network data, the Silne R study asked each student to nominate his/her five best friends in the school. After collecting the data, we ended up with (1) a traditional database describing each individual adolescent and their characteristics/attributes and (2) an additional database describing relationships/ties between these individuals. In the former, we have information on the sociodemographic and smoking characteristics of each adolescent, named X1, X2, etc. In the latter, we see, for example, that adolescent X1 is friends with adolescents X2, X3, and X4.

Through the analysis of prototypes, which are based on the concept of homophily, we wanted to study how similar individuals are to each other. Following the example above, we will consider X1 to be gender-homophile with X3 and X4 because X1, X3, and X4 are girls. X1 is, however, gender-heterophile with X2, because X2 is a boy.

To analyse friendships, however, we had to pay attention to the types of ties that link adolescents to each other. Studies on social influence on adolescent substance use have, for a long time, used the concept of peer groups but they often fail to precisely describe

the structure of such peer groups and the configuration ties that link each member of the peer group to others, a gap that social network analyses have addressed successfully. According to the literature on peer effects, peer groups can have very different boundaries and there is no scientific consensus on what a peer is (a classmate? a friend? a schoolmate?) (Weihua, in Sage Handbook, Scott and Carrington, 2011). Adolescents have several types of friends: they tend to have a close group of best friends but they also belong to a larger group of acquaintances and they are also members of the larger group of schoolmates.

As the Silne R study is a social network study, each student was asked to nominate up to five students from their school that he/she considered to be his/her best and closest friends: “Who are your best friends in the grade/school year X and X+1? Boys may include girls who are friends or girlfriends, girls may include boys who are friends or boyfriends. Please identify the names of your best and closest friends on the list (maximum 5) and write their codes below.” Based on their nominations, we identified four social layers or reference peer groups, ranging from the closest (Clique 2) to the most distant (the schoolmates). The networks boundaries are thus adolescent in a same school. We did not include friends outside school, which might be a possible bias in our study: we cannot include outside-school friends’ influence.

Clique: Following Wasserman and Faust (1994), we used the concept of the clique to describe the closest peer group of each student, which is defined as: “a maximal sub group in which everyone is connected to everyone else so that no one else could be added to the network without this condition being broken”. To measure cliques, we used the `max_clique` procedure from the `igraph` R package, which allocates each student to (several) maximal clique(s) based on undirected ties. Each student may thus be a member of multiple cliques. In order to state whether the influence of cliques depended on the number of members in a clique, we separated cliques according to their size: Clique 2, Clique 3, Clique 4 and Clique 5, corresponding to cliques of two, three, four,

and five students. In total, 42,633 cliques were identified, (36% of Clique 2, 39% of Clique 3, 19% of Clique 4, 5% of Clique 5) and we selected 42,286 (99.2%) of them in our analysis. The remaining cliques were Clique 6 and Clique 7, which we chose not to include because it would have added two reference peer groups to our analysis, which would have complicated our model but would only have represented 0.8% of all cliques involved.

Community: we included the community as a measurement of the adolescents' acquaintances. We defined the community as the broader social circle to which they belong. We used the Louvain algorithm (Blondel et al., 2008), which allocates each student to one community, depending on the whole network configuration. In total, the sample contained 701 communities of, on average, 22.1 students (std = 13.3).

School: Finally, each student was part of a school, which was defined as the setting in which the data collection took place. In total, 55 schools were involved.

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SECTION 2 – SAME-SEX VERSUS OTHER-SEX FRIENDSHIP AND ADOLESCENT BEHAVIOR

CHAPTER 6 - Same-Sex Friendship, School Gender Composition, and Substance Use: A Social Network Study of 50 European Schools.

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Introduction

Same-sex friendship

Since the 1970s, gender co-education (mixing boys and girls in school) has been the norm in most European schools (Bereni, 2012). Yet, despite this mixing, same-sex friendship (SSF) is still predominant in peer groups at school from as early as three years of age, up to adolescence: most children and early adolescents have most of their friendship ties with same-sex children or adolescents (Dijkstra, 2007; Stockard, 2006).

Same-sex friendship is an important pattern of gender socialization, which promotes gender-specific leisure activities and peer preferences (Bereni, 2012; Stockard, 2006). Whereas most boys play sports in larger groups, girls generally prefer more intimate relationships in a smaller and more exclusively same-sex peer group (Bereni, 2012; Ridgeway, 1999). However, adolescence disrupts this trend toward same-sex friendship in the form of puberty and romantic interest in the other sex (Bearman, 2004; Kreager, 2012; Arndorfer, 2008). As a consequence, other-sex friendship (OSF) increases during adolescence (Connolly, 2004; McDougall, 2007).

Peer influence and substance use

At the time when they engage in other-sex friendships (OSF), adolescents also start to experiment with substances such as tobacco and alcohol (Poulin, 2011; Malow-Iroff, 2006). At 12 years of age, 14% of adolescents have tried smoking and 8% have used alcohol in the last month (Van Lier, 2009). Alcohol and tobacco were traditionally used more by males than females; in recent decades, however, gender differences in alcohol and tobacco use have narrowed (Hublet, 2006). For example, data from the HBSC (Health Behavior in School-aged Children) study has shown that girls now have similar smoking rates to boys in one out of every two European countries (Inchley, 2016). Nevertheless, boys still experiment with tobacco at a younger age than girls (Inchley, 2016).

Adolescent friendship has long been identified as a key factor in adolescent substance use, whether in the form of peer selection or peer influence (Mathys, 2013; Malow-Iroff 2006). Having a best friend who smokes, or having half of one's peer network who smoke is associated with more frequent smoking (Alexander, 2001). Yet, as peers are so important in substance use, their gender may also play a role. According to Malow-Iroff (2006) and Poulin (2011), other-sex friendship is positively associated with alcohol use among adolescents of both genders. However, other-sex friendship influence may vary according to gender and substance. For Mrug (2011), girls with other-sex friendship were five times more likely to smoke cigarettes than girls with same-sex friendship. The early work of the Chicago school of sociology showed that substance use is traditionally more frequently a male behavior (Shaw, 1931) and recent studies have found that substance use was still associated with male gender role (Mahalik, 2015; Iwamoto, 2013; Schulte, 2009), so boys would influence their peers toward greater substance use. This would lead girls in other-sex friendships and boys in same-sex friendships to engage in higher levels of substance use. Indeed, according to Arndorfer (2012), other-sex friendship was associated with substance use among girls, while same-sex friendship was more related to substance use among boys.

In addition, for Malow-Iroff (2006), substance use may help girls to achieve self-disclosure and to attract boys. Girls may also date older boys who may have more experience of, and opportunity for, substance use (Poulin, 2011). Other-sex friendship among boys, on the other hand, should diminish substance use, as girls may influence boys toward less substance use. However, Poulin et al. (2011), who tested this last hypothesis among adolescents, could not find any protective effect of other-sex friendship for boys.

School gender composition

Unfortunately, these studies of other-sex friendship and substance use did not take into account school context. It is important to consider the characteristics of schools in relation to adolescent substance use (Lovato, 2010). The gender composition of schools

has been found to influence substance use behavior. In a study of alcohol use among Irish high-school students, Barry (1993) found that girls in co-educational schools were more likely to drink alcohol than girls in single-sex schooling. Girls in co-educational schools were also more likely to show early onset of alcohol and tobacco use than girls in single-sex schooling (Curtin, 2004).

In this study, we analyzed the influence of same-sex friendship on substance use among adolescents in 50 schools in six European countries. We took into account the proportion of each gender group at the schools in the analysis.

Because boys traditionally have higher levels of substance use, we hypothesized that (1) girls in other-sex friendships (OSF) and (2) boys in same-sex friendships (SSF) have higher levels of substance use.

Then, we tested two concurrent hypotheses on the influence of the gender composition of schools on other-sex friendship. School gender composition is very important to consider, as it may help to disentangle two explanations of the effect of other-sex friendship on substance use. On the one hand, other-sex friendship may result from competition for the attention of the other gender: substance use may help students of the majority gender group to be noticed by students of the minority gender group. On the other hand, substance use may result from the adoption of the substance use behavior of the majority gender group, following a normative effect. In this article, we tested these two hypotheses. Accordingly, if the risk of substance use arising from other-sex friendship is much higher in the *majority* gender group, then it is more likely that it results from competition for the attention of the other sex. However, if other-sex friendship has a stronger effect on substance use for a gender group that is a *minority* in a school, the risk of substance use arising from other-sex friendship is more likely to result from normative pressure. Table 6.1, the end of the chapter¹⁶, gives a summary of these hypotheses and expected effects.

¹⁶ For chapters 6 to 10, tables are provided at the end of each chapter.

Method

Study design

In 2013, the SILNE (Smoking Inequalities: Learning from Natural Experiments) study was carried out in six European cities: Tampere (Finland), Hanover (Germany), Latina (Italy), Amersfoort (The Netherlands), Coimbra (Portugal), and Namur (Belgium). In each city, six to eight schools were recruited. All students registered in the two grades corresponding to 14-16 years of age were invited to participate and to fill out a questionnaire about their health behavior and friendship ties at school. In total, 11,015 adolescents from 50 schools completed the paper-and-pencil questionnaire (79% participation rate) and 10,932 could be included in our analysis after excluding respondents with too many missing values. Details of the survey design are available elsewhere (Lorant, 2015).

To define friendship ties, each student had to identify up to five best and closest friends from a directory of the school's students, which was handed to him or her during the survey. The list contained all adolescents from the two grades corresponding to 14-16 years of age. The wording of the question was similar to that in the Add Health survey (Harris, 2009): "Could you identify the name of your best and closest friends on the list (maximum 5) and write their codes below. Boys may include girls who are friends or girlfriends; girls may include boys who are friends or boyfriends."

Measurements

Substance use

Three types of substance use behavior were analyzed: regular tobacco use, binge drinking, and cannabis use; regular tobacco users were selected if they smoked 1 or 2 cigarettes per week. Weekly smoking is used by the HBSC study to characterize tobacco use among the 15-year-old European population (Inchley, 2016; Moor, 2015). Binge drinkers were characterized by having drunk more than 5 drinks on at least two occasions in the last month (Weschler, 1994). Cannabis use was estimated by at least

one cannabis use in the student's lifetime (Weschler, 1994). In this paper, these measures were also selected because they follow quite a similar distribution in our sample, making these behaviors more comparable (18.7% of regular smoking; 19.5% of binge drinking; 16.0% of cannabis use).

Gender social homophily: same-sex and other-sex friendship

Gender social homophily is defined as having ties to friends of the same sex. The gender distribution in a school may be uneven, so that a higher proportion of same-sex friendship ties may happen just by chance. It is thus important to standardize gender social homophily according to the gender composition of each school. Gender social homophily was thus measured by the Coleman index, ranging from -1 to 1 (Bojanowsky, 2011). Coleman index > 0 meant that ego had a more same-sex peer group than a random selection in the particular school would have produced. On the other hand, having a Coleman index < 0 meant that ego had more other-sex friendships. Students who had a positive Coleman index were then classified as same-sex-friendship students, while those with a negative Coleman index were classified as other-sex-friendship students.

Socio-economic deprivation (SES status)

In the questionnaire, we measured the socio-economic status of students (SES) via several indicators. The first was parents' education and employment; the second was FAS (Richter, 2009); the third was the MacArthur Scale (Goodman, 1999). We then computed a composite indicator of deprivation that counted the number of times a student was in the lower socio-economic category on parental education and employment, FAS, and MacArthur (Lorant et al., in review). A student whose parents had a low educational level, were unemployed, and were in the lowest category of the FAS scale and in the lowest category of the MacArthur scale, received the highest score (5). Students with highly educated and employed parents who scored high on the FAS and MacArthur scales received the lowest score (0).

Household composition

Household composition is important to consider in relation to substance use (Covey, 1990). To measure it, we computed a binomial variable with students living with both parents on the one hand, and with students living with one parent (mother = 21.7% of the sample, father = 3.9%) or without either of their biological parents (2.4%), on the other hand.

Gender balance of schools

Schools were then classified in three groups, according to the gender distribution of their students in the two grades corresponding to ages 14-15. Gender-balanced schools had a 45 to 55% gender distribution (N= 25 (50% of schools)). Male-dominant schools had more than 55% males (N=11 (22%)) and female-dominant schools had more than 55% females (N= 14 (28%)).

Statistical analysis

First, we described the study population according to gender and gender social-homophily status (Table 6.2). Then, we tabulated substance use, according to gender social-homophily status and gender balance of schools (Table 6.3). To that end, we created six different logistic regression models of substance use, according to gender and substances used (Figure 6.1). For each model, we looked at the gender social-homophily status and gender balance of schools as independent variables and controlled by the age, household composition, country, and socio-economic status of students. We finally stratified our previous models according to gender balance of school and gender social-homophily status and reported the results in Table 6.4. All statistical analyses were performed with SAS EG 5.1.

Results

Descriptive statistics

Compared with boys, girls were slightly younger, by 0.1 years (Table 6.2, $\chi^2=39.5$; $p<0.0001$), and more likely to have a lower socio-economic status. Gender distribution

was more unbalanced in Italy (more female). Overall, girls had a significantly lower prevalence of substance use than boys. For example, 2 boys out of 10 had tried cannabis as against 1 girl out of 8. The difference in prevalence for smoking, however, was very small (17.8% for girls, 19.2% for boys), but significant ($\chi^2=4.8$; $p=0.03$).

The proportion of adolescents with other-sex friendships was higher among boys (21%) than among girls (13.2%, $\chi^2=120.1$; $p<0.0001$), higher in older than in younger students, higher in adolescents living in single-parent homes, and higher in adolescents of a lower socio-economic background (Table 2). The proportion of other-sex friendship ties was also different across countries ($\chi^2=277.7$; $p<0.0001$), with the lowest proportion in Finland (Tampere) (8.5%) and the highest in Portugal (Coimbra) (23.6%). Compared with adolescents with more same-sex friendships, adolescents with other-sex friendships were more frequently regular smokers (24.4 % against 17.3%, $\chi^2=48.2$; $p<0.0001$), binge drinkers (23.8% against 18.5%, $\chi^2=22.9$; $p<0.0001$), and cannabis users (20.8% against 14.5%, $\chi^2=39.1$; $p<0.0001$).

Gender balance of schools

Table 6.3 describes substance use according to gender balance of school, other-sex friendship, and gender. Substance use was consistently more frequent in male-dominant schools, and less frequent in gender-balanced schools. Other-sex friendship was associated with more frequent smoking, binge drinking, and cannabis use among girls in all schools. Among girls, the group with the lowest smoking prevalence was made up of girls with same-sex friendship ties in gender-balanced schools, whereas the girls with the highest risk had other-sex friendship ties in male-dominant schools. Among boys, smoking rates were highest among other-sex-friendship boys, in all types of school. Nevertheless, as far as cannabis and binge drinking were concerned, risks depended on the gender balance of the school. In gender-balanced schools, boys with other-sex friendships had higher levels of use than boys with same-sex friendships. However, in both male- and female-dominant schools, boys with same-sex friendships reported more binge drinking and cannabis use than boys with other-sex friendships.

Multivariate analysis

Figure 6.1 shows odds ratios and 95% confidence intervals of substance use according to gender social-homophily status.

Regular smoking. Other-sex friendship was associated with more frequent regular smoking in both boys and girls, even after controlling for confounders (OR=1.31 (95%IC 1.07-1.59) for girls; OR=1.34 (95%IC 1.09-1.65) for boys). Male-dominant schools were associated with a greater risk of regular smoking, particularly among girls.

Binge drinking. Other-sex friendship was associated with more binge drinking, but the OR was no longer significant for boys when control variables were introduced. Boys and girls in male-dominant schools were also more frequently binge drinkers (OR=1.86 (95%IC 1.38-2.49) for girls; OR=1.34 (95%IC 1.09-1.65) for boys).

Cannabis use. Patterns were similar to binge-drinking models. Among girls, other-sex friendship correlated with cannabis use, but not among boys. Male-dominant schools were also associated with more cannabis use among girls and boys (OR=1.31 (95%IC 1.04-2.64) for girls; OR=1.13 (95%IC 0.95-1.35) for boys), but boys were also at greater risk in female-dominant schools.

Table 6.4 presents odds ratios for the stratification analysis according to gender, other-sex-friendship status, and gender balance of schools. Girls were more likely to use substances in a male-dominant context, whatever their gender social-homophily status. Boys used more cannabis and binge drank more frequently in male-dominant schools, especially when they had same-sex friendships.

Discussion

Adolescents' social ties matter for their health behavior and gender becomes an increasingly important component of those social ties as they get older. Our study is among the first to investigate the role of gender social homophily in substance use,

using an international social network survey capable of separating the effect of school composition from the effect of friendship composition.

This paper hypothesized that girls with other-sex friendship were more likely to engage in substance use, whereas boys with other-sex friendship were protected from it. This hypothesis was found to be true for girls, but not for regular smoking among boys, which was more frequent among boys with other-sex friendship.

Risky behaviors of students in other-sex friendships have been found elsewhere (Arndorfer, 2008; Malow-Iroff, 2006). Our study, however, underlined different patterns according to student gender and the substance used. There are three possible ways of explaining these associations between substance use and other-sex friendship (Mcdougall, 2007; Park, 2013; Poulin, 2011).

First, substance use may cause other-sex friendship. As they are engaged in substance use, students may group together, independently of gender, using alcohol and tobacco to support an interaction that contributes to group dynamic construction. For example, new friendships may occur when students meet outside school doors for smoking or when they go out for a drink. Along with this hypothesis, Mundt et al. (2012), using longitudinal data, found that similar drinking behavior in baseline predicted friendship in follow-up. This would suggest that associations between substance use and students with other-sex friendship would have been found for both sexes, which was not the case in our analysis: boys with same-sex friendship engaged in more binge drinking and cannabis use.

Alternatively, other-sex friendship may cause risky behavior. In this case, students with other-sex friendship would have particular group dynamics and interactions that contribute to risky behavior (Furman, 2009). According to Connolly, contacts with the other gender help one to meet potential romantic partners (Connolly, 2004). Consequently, adolescents may adopt risky behavior in order to attract a peer they want to be noticed by (Park, 2013; Poulin, 2011). In a longitudinal study, Kreager (2011) showed that a romantic partner's alcohol use has more influence on ego's alcohol

behavior than ego's previous alcoholic status. Moreover, when the romantic feelings are not reciprocated, the romantic focus's influence on ego is even bigger. Unfortunately, our study did not specifically ask for romantic-partner nomination.

Contextual influences: gender balance of school

Our study also hypothesized that school gender composition matters. There was indeed a greater risk of substance use, both for boys and girls, in male-dominant schools. However, no clear pattern emerged from female-dominant schools, which contradicted our hypothesis that those schools would have lower substance use rates.

Our results indicated a significant association between substance use and the gender balance of schools, which has not been explored elsewhere. In the literature, however, the gender balance of schools is associated with different outcomes. For example, Choi et al. (2015) showed that same-sex schools have higher Body Mass Index levels than schools with students of both genders. Sullivan et al. (2010) have shown that girls in same-sex schools perform better in school than those in co-educational schools. Park et al. (2013), after a random assignment of schools, also identified better entrance exam results and college attendance among students from same-sex schools.

All regression models showed a positive effect of gender-unbalanced schools on substance use. These school contexts are thus associated with substance use, which would help make a case for gender co-education in order to limit substance use among adolescents. Two different hypotheses may explain the influence of gender-unbalanced schools on substance use: competition hypothesis, in which the minority gender group in other-sex friendship will be keener to use substances; and the normative hypothesis, in which substance use behavior will follow the trend of the majority group.

First, on the assumption that substance use helps students to seduce other-sex peers (Kreager, 2011), we should consider gender-unbalanced schools as a particularly

competitive environment. For example, boys with other-sex friendship in predominantly male schools would be particularly engaged in substance use, in order to seduce one of the few girls in those schools. The same would apply to girls: girls with other-sex friendship in predominantly female schools would do the same. However, our stratification analysis did not corroborate this assumption. Indeed, whatever the model, no gender majority group (e.g. other-sex friendship girls in female-dominant schools, other-sex friendship boys in male-dominant schools) was particularly at risk for substance use. On the contrary, predominantly male schools, but not predominantly female schools, were places where substance use was significantly more frequent.

This rather pleads in favor of our second hypothesis, the role of norms: where males are outnumbered, their traditional trend toward substance use influences both boys and girls. As far as boys are concerned, we have known for a long time that risky behaviors are key elements of boys' manhood identification process (Shaw, 1931). More recently, Mahalik (2015) has confirmed that boys with the highest score on male-identity measurement are 70% more frequent users of alcohol and 79% more frequent cannabis users, compared to the boys who score the lowest on this scale. In France, Sauvadet (2006) and Aquatias (1999) have collected qualitative data on young male adolescents living in a poor suburban area in France. They both point out the important role of health risk behavior, such as cannabis use, in that male environment. Girls in predominantly male schools may thus be influenced by this norm. Iwamoto (2013) found a positive effect of male norm identification on girls' alcohol use. Indeed, according to tokenism theory (Kanter, 1977), in male-dominant environments, girls are pushed toward male norms¹⁷.

¹⁷ [addendum to the published version]: this does not mean that we plead for single-sex schooling, nor for retrieving girls for boys-majority schools. On the contrary, as we will explain in the General Discussion of the Thesis (Chapter 11), gender mixing at schools had provided great educational opportunities for girls, and their consequences on women's health far overpasses the detrimental effect of substance use. In the General Discussion, we will rather discuss how male gender norm toward risky behavior should be addressed and deconstruct in these particular school contexts.

Limitations

Our study is cross-sectional; this makes it difficult to ascertain causality or to discard confounding factors. Longitudinal social network surveys may help to disentangle the different hypotheses mentioned above.

Another limitation is that we did not ask for age of puberty, which is known to mediate the relation between other-sex friendship and substance use among girls, in that girls who experience early puberty have more other-sex friends and are more likely to engage in substance use (Poulin, 2011; Sullivan, 2010).

Moreover, our name generator that assessed friendship did not ask boys and girls separately. This may underestimate other-sex friendship. However, our questionnaire specified that adolescents could indicate both boy and girl friends, so that this underestimation is limited.

We did not ask about friendship outside school; we may thus have underestimated other-sex friendship, especially for girls who have more other-sex friends outside school than boys (Poulin, 2011).

An additional limitation is that the gender balance of schools was not measured within the whole school, but only within the two participating grades. The overall gender balance of schools may, accordingly, differ slightly from the balance we present. However, we could reasonably expect that students will be more influenced by their own age and grade contexts than by the whole school (Shrum, 1988).

Finally, we should mention that predominantly male schools might have other characteristics that may lead to more substance use, such as a lower socio-economic background. Nevertheless, this particular pattern persisted even after controlling for students' socio-economic status.

Conclusion

In this article, our contribution to the literature lies in the addition of a new dimension to the relationship between peers' gender and substance use: our conclusions underline the role of gender balance at school. Adolescents are best protected from substance use if they are in gender-balanced schools, but in same-sex friendship.

This implies a need to adapt substance use prevention programs to gender, peers' gender, and the gender balance of schools, as this gender context influences school norms toward substance use. Mixing boys and girls at school seems to have particularly affected girls in a predominantly male context, which may lead to the future deterioration of those girls' health status. As far as prevention is concerned, in those schools, we suggest having resort to substance use strategies that particularly focus on deconstructing the male norm in relation to substance use. More precisely, prevention programs might be aimed at girls in other-sex friendship and should disentangle the influence of boys' behavior from their substance use.

Tables

Table 6.1. Summary of hypotheses and related expected effects on substance use.					
Hypothesis	Gender status	social-homophily	Gender schools	composition of Expected effect on substance use	on
Competition	Other-Sex Friendship	GIRLS	Female-dominant schools	++	
Competition	Other-Sex Friendship	BOYS	Male-dominant schools	++	
Normative	Other-Sex Friendship and same-sex friendship	GIRLS	Male-dominant schools	++	
Normative	Other-Sex Friendship and same-sex friendship	BOYS	Female-dominant schools	--	

Table 6.2. Descriptive statistics according to gender and gender social-homophily status, proportion, Chi², SILNE, 2013, n=10932

	Gender		Gender social homophily status		
	Girls (%)	Boys (%)	Ch ² /F	Other-Sex Friendship(%)	Same-Sex Friendship(%)
Gender					120.1**
Male				21.2	78.8
Female				13.2	86.8
Age (mean)	15.2	15.3	39.5**	15.5	15.2
City-Country			58.2**		277.7**
Namur-Belgium	51.2	48.9		19.2	80.8
Tampere-Finland	50.2	49.8		8.5	91.5
Hannover-Germany	51.0	49.0		15.4	84.6
Latina-Italy	62.0	38.0		22.3	77.7
Amersfoort-Netherlands	51.0	49.0		8.7	91.3
Coimbra-Portugal	50.1	49.8		23.6	76.4
Student SES (mean)	1.4	1.3	17.2*	1.6	1.3
Household composition			2.9		9.1*
Single-parent family	54.3	45.7		18.6	81.4
Both parents	52.3	47.7		16.2	83.7
Coleman Index of Homophily (mean, -1 to 1)	0.7	0.6	35.3**	-0.4	0.8
Regular smoking (%)	17.8	19.2	4.8*	24.4	17.3
Binge drinking (%)	15.7	23.5	101.4**	23.8	18.5
Ever used cannabis (%)	12	19.7	117.1**	20.8	14.5
All	52.8	47.2		16.9	83.1

*p<0.05 **p<0.001

Table 6.3. Proportions of regular smokers, binge drinkers, and cannabis users according to gender social-homophily and gender balance of schools¹, SILNE, 2013, N=10796.

			Gender-balanced schools (%) (n=6138)	Female-dominant schools (%) (n =3160)	Male-dominant schools (%) (n=1498)	All (%)
Regular smoking						
Other-sex (n=736)	friendship	girls	19.8	25.0	28.9	23.6
Same-sex (n=4843)	friendship	girls	13.2	21.1	27.7	17.3
All girls			14.1	21.8	27.8	18,1
Other-sex (n=1073)	friendship	boys	19.7	24.3	26.4	22.3
Same-sex (n=3993)	friendship	boys	16.4	17.5	21.3	17.7
All boys			17.1	19.1	24.4	18.6
Binge drinking						
Other-sex (n=736)	friendship	girls	16.9	19.7	27.8	19.8
same-sex (n=4843)	friendship	girls	14.2	16.9	21.0	15.7
All girls			14.6	17.4	22.1	16.2
Other-sex (n=1073)	friendship	boys	23.9	19.6	26.0	23.5
Same-sex (n=3993)	friendship	boys	19.6	23.3	31.6	22.6
All boys			20.6	22.1	30.0	22.8
Cannabis use						
Other-sex (n=736)	friendship	girls	14.2	15.4	21.6	15.8
Same-sex (n=4843)	friendship	girls	8.9	14.3	17.9	11.6
All girls			9.7	14.6	18.5	12.1
Other-sex (n=1073)	friendship	boys	20.4	18.8	25.0	21.2
Same-sex (n=3993)	friendship	boys	14.9	24.0	25.0	18.4
All boys			15.9	22.6	25.1	19,0
¹ Results have been controlled by age; all chi ² test were significant at p<0.0001 levels						

Table 6.4. Stratification analysis of gender social-homophily status and gender balance of school among girls and boys for each substance use, Odds ratio and 95%IC, SILNE, 2013, N=10932									
GIRLS		Regular smoking-		Binge Drinking		Cannabis use		OR	95%IC
		OR	95%IC	OR	95%IC	OR	95%IC		
Female-dominant school (ref=gender-balanced) in OSF		0.9	(0.6-1.3)	1.1	(0.7-1.7)	0.7	(0.4-1.2)		
Female-dominant school (ref= gender-balanced) in SSF		1.3*	(1.0-1.5)	1.0	(0.8-1.3)	1.2	(0.9-1.5)		
Male-dominant school (ref= gender-balanced) in OSF		1.1	(0.6-2.0)	2.3*	(1.2-4.2)	1.4	(0.7-2.7)		
Male-dominant school (ref= gender-balanced) in SSF		1.9*	(1.4-2.5)	1.8*	(1.3-2.4)	1.9*	(1.4-2.8)		
BOYS		OR	95%IC	OR	95%IC	OR	95%IC	OR	95%IC
Female-dominant school (ref= gender-balanced) in OSF		1.3	(0.9-1.9)	0.7	(0.5-1.1)	0.7	(0.5-1.1)		
Female-dominant school (ref= gender-balanced) in SSF		1.0	(0.8-1.2)	1.0	(0.8-1.3)	1.5*	(1.2-1.9)		
Male-dominant school (ref= gender-balanced) in OSF		1.2	(0.8-1.8)	0.9	(0.6-1.2)	0.9	(0.6-1.3)		
Male-dominant school (ref= gender-balanced) in SSF		1.3*	(1.0-1.6)	1.5*	(1.2-1.9)	1.4*	(1.1-1.8)		
Results have been controlled by age, socio-economic status, country, and household composition.									
* p<0.05									

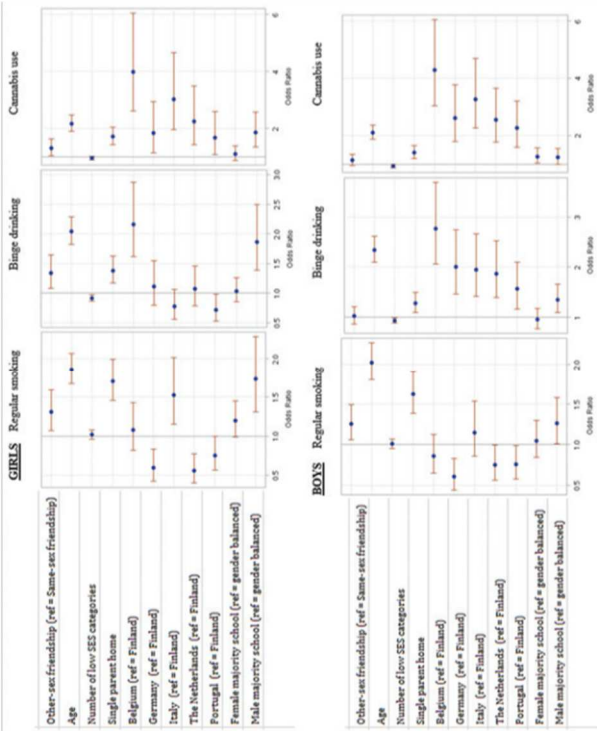


Figure 1. Odds ratios and 95% confidence intervals of substance use according to gender social-homophily status. SILNE, 2013, N = 10,932.

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CHAPTER 7 - Same-sex friendship and school performance of European adolescents, a social network study in seven European countries.

Background

For several decades, girls have been known to perform better in high school than boys (Borg E., 2013; Brolin Laftman & Modin, 2012; Crosnoe, 2003; Downey D.B., 2005; L. Bereni, 2012; Lam et al., 2012; Schwartz, Kelly, & Duong, 2013). Academic achievement is of high importance in public health. Indeed, low school performers are known to smoke, drink and use cannabis in a greater extent than high achievers, so that low school achievement may be seen as a proxy of substance use behavior (Hu, Lin, & Keeler, 1998; Kuntz & Lampert, 2013; Robert et al., 2019). More importantly academic achievement is a key-determinant of subsequent socioeconomic status, which is directly related to life prospects as lower educational level leads to more unhealthy behaviors and a shorter life expectancy (Martikainen, Ho, Preston, & Elo, 2013).

Several individual factors have been pointed out to be associated with academic performance, starting with intelligence (Roth B., 2015) and family educational level (Nordlander E., 2014). However, these two variables do not vary according to genders, so the gender gap in school performances is rather explained by other characteristics.

Another important determinant of academic achievement has been underlined more recently: school engagement (Ladd G.W., 2009). It is defined as the “*individual's cognition (i.e. attributions and goals) and values about learning at school*” (Eccles et al. 1998). School engagement theory argues that, to perform well academically, students have to do more than attend lessons, they have to personally engage in their learning environment (Ladd G.W., 2009). More precisely, school engagement is composed of three dimensions: (1) cognitive engagement (intellectual effort), (2) behavioral engagement (participation, learning initiatives, and non-disturbing behavior in the classroom) and (3) emotional engagement (good relations with teachers and peers that lead to affective well-being). As cognitive engagement (1) does not vary across genders (Nordlander E., 2014), the last two dimensions will hereafter hold our attention.

First, girls perform better at school because they develop *behavioral engagement* (L. Bereni, 2012). Via gender socialization, girls are more likely to develop behavioral characteristics enhancing their school performances. They tend to show higher level of motivation and subjective valuing of learning, and thus put more efforts to succeed at school. Moreover, they also develop higher levels of school identification and school compliance (Crosnoe, 2003; Dalen J.D., 2014; Downey D.B., 2005; Freudenthaler H.H., 2008; N. Kiuru, Nurmi J-E., Aunola K., Salmena-Aro K., , 2009; Lam et al., 2012; Wang & Eccles, 2012). According to the PISA survey of the OECD, girls spend a supplementary 1.3 hours/week of studying and are significantly more likely to read compared to boys, both these behaviors are proven to directly enhance school performances ((OECD, 2015). Among boys, working hard to perform at school is a behavior often defined as “laddish” and thus threatening boys’ masculine identity, particularly for those from low socioeconomic background (Borg E., 2013; Kessels & Hannover, 2008; L. Bereni, 2012; Maatta, Stattin, & Nurmi, 2006). Boys are consequently more likely to display a norm-breaking behavior at school, compared to girls (Maatta et al., 2006).

Second, *emotional engagement* largely depends on peers and the school environment. Having high-achievers peers has been associated with higher academic performances (Blansky et al., 2013; Campbell J.R., 1998; Chow, Tan, & Buhrmester, 2015; N. Kiuru, Nurmi J-E., Aunola K., Salmena-Aro K., , 2009; Wang & Eccles, 2012; Witkow M.R., 2010), through both selection and influence mechanisms (Crosnoe, 2003; Shin & Ryan, 2014a, 2014b). Students group together according to some of their characteristics (gender, socioeconomic status and/or academic achievement). But then, when the friendship develops, peer influence reinforces this initial homogeneity in characteristics, and adolescents then tend to behave even more similarly (McMillan et al., 2018). Good students become better with their high achievers peers support, while poor achievers influence each other negatively (Crosnoe, 2003). Being friend with a girl, who is more likely to have high school performance, may thus per se enhance a student’s school performance, as opposed to a friendship involving a boy.

Additionally, emotional engagement via peer collaboration also improves school performance: when two peers work together to solve a problem, they usually have a better understanding of the situation and more cognitive resources to solve it (Swenson L.M., 2008). Girls, moreover, score higher in peer collaboration for schoolwork as they tend to display a more collaborative behavior based on care, validation, guidance and closeness (Lam et al., 2012). Additionally, girls are more likely than boys to talk to friends about their schoolwork (Bishop J.H., 2004). Among boys, on the contrary, a school-oriented behavior is costly for peer relationship, as boys experience a pressure for the endorsement of a masculine identity (L. Bereni, 2012; Schwartz et al., 2013). Being a nerd – showing that you want to obtain good grades at school- is indeed more likely to be a sanctioned behavior by peers for boys than for girls, particularly among boys from low socioeconomic background (Bishop J.H., 2004). All things considered, the gender of friends and schoolwork mates is important to analyze (Swenson L.M., 2008). Having a same-sex friendship peer group may reinforce this virtuous circle of academic performance among girls, while it may undermine school performance for boys. According to Liem (2011), same-sex friendship is associated with higher school performance, although the results were not stratified according to gender. Other studies on same-sex versus other-sex friendship have, however, underlined differential effects of this pattern on several behavioral outcomes among adolescents (Grard et al., 2018; McMillan et al., 2018)). Moreover, same-sex peer group of girls have two additional characteristics that may strengthen the association between peers and adolescents performances. On the one hand, these same-sex peer groups are more cohesive, and cohesion in peer groups is associated with school performances among girls, but not among boys (N. Kiuru, Nurmi J-E., Aunola K., Salmena-Aro K., , 2009). On the other hand, girls are more influenced by their peers' school performances than boys are (Maatta et al., 2006).

Additionally, *emotional engagement* depends on the larger school environment, which is analyzed via school connectedness in several studies. School connectedness is indeed associated with school performance (Niehaus, Rudasill, & Rakes, 2012). In Waters'

study (2010), 25% of the variation in school connectedness is explained by school characteristics, like school socioeconomic background or school size. Smaller schools are indeed more supportive for students and thus enhance their school results (Crosnoe, 2003; Weiss, Carolan, & Baker-Smith, 2010).

In recent years, single-sex schools have been designated as environments allowing to bring up the average school performance and career expectations of girls. In a meta-analysis, Pahlke et al. (2014) look at the effects of single sex-schooling versus coeducational schooling on school performances among boys and girls. The authors acknowledge mixed results in the literature, but underlined a small advantage for girls in single-sex school or classrooms. Lawrie and Brown (1992) find that girls in single-sex schools have more opportunities to develop leadership and in turn follow high-achieving career paths more frequently than girls in coeducational schools. Similarly, Watson (2002) finds that girls in coeducational schools have lower career expectations than girls in single-sex schools, and that girls in coeducational schools experience a drop in their expectations, which was not observed in single-sex schools. Pahlke et al. further underlined that girls in coeducational schools are more gender stereotyped than girls in single-sex schools, which explained this differences in expectations (Pahlke R., 2014). Strict gender segregation of schools is, however, rare in the Western educational landscape. Schools are more likely to situate on a broader range of gender balance, from male-majority to female-majority school settings (Grard et al., 2018). Classical studies have, moreover, acknowledged how the proportion of individuals characteristics shape individuals' behavior (Simmel G., 1950), particularly as far as gender is concerned (Kanter, 1977).

Though many studies have acknowledged the gender gap in school performances, there is a gap in the literature concerning the role of both peers gender composition and school gender composition in adolescents' school performances. Although several studies look at single-sex schooling versus coeducational schooling, none of them analyses the role of gender on the gender-balance perspective in a more detailed way (female-majority, male-majority or coeducational school). In this study, we first use male

and female majority schooling as well as gender-balanced schooling as a way to capture gender balance, rather than a strict gender segregation context. Furthermore, we added peers' gender as a way to distinguish the impact of gender on school performance in a comprehensive way.

In this paper, we first hypothesize that boys would have lower levels of school performances, compared to girls. Second, we assume that girls involved in other-sex friendship have lower school performances than girls involved in same-sex friendship. On the contrary among boys, other-sex friendship will improve school performances. Third, we postulate that the gender balance of school will also play a role, and assume that both genders will perform worse in male-majority schools than in female-majority or coeducational schools.

Method

Setting

In 2013 and 2016, we conducted the Silne study in seven cities from seven different European countries: Namur (Belgium), Latina (Italy), Amersfoort (The Netherlands), Hannover (Germany), Tampere (Finland), Coimbra (Portugal), and Dublin (Ireland, in 2016 only). These cities were chosen because of their average socioeconomic position in the national distribution. We collected data on 67 different schools, some in both 2013 and 2016 ($n=38$), some in only 2013 ($n=12$) or 2016 ($n=17$). Among schools, every student was interviewed in grades corresponding to the age 14-16 years old (participation rate: 79% in 2013, and 79.9% in 2016). The study design of this study has been presented elsewhere (Lorant et al., 2015), and extensively in Chapter 5. The total sample of students reached 22227, and 19644 were included in regression analysis, after exclusion for missing values. Ethical approval was obtained separately in each country, depending on national requirements.

The Silne study is a social network study where students were asked to nominate up to five other students in the school as their best friends and/or as their schoolwork mates. More precisely, we first asked students “Which of your schoolmates are your best-friends? Please nominate maximum five schoolmates”; and then asked “Which of your schoolmates do you prefer to work with or ask for advice - Please nominate maximum five schoolmates”. These questions determined two types of peer networks: the best friendship network, and the collaborative network of each student.

Measurements

To measure school performance, we asked students to self-report their average marks in the previous academic year: “Which of the following best describes your marks during the past year?”. Students had to choose between five categories that described their grades from the lowest range to the highest, based on each country’s assessment system (Robert et al., 2018), see also Chapter 4 for a complete descriptive analysis.

Students’ gender was determined via the following question: “Are you a male or a female?”. We then constructed the gender composition of peer group using the Coleman index of homophily (Bojanowsky M., 2011; Grard et al., 2018)

Gender-balance of school was measured at the school level. We first calculated the proportion of each gender in the school and then categorized schools according to this proportion. Schools with less than 45% of girls were classified as male-majority (23 schools, 24.70% of schools), schools with more than 55% of girls were classified as female-majority (27 schools, 29.0% of schools), and the remaining schools were classified as gender-balanced (43 schools, 46.2% of schools).

We used school connectedness as first confounder. School-connectedness scores were computed as the sum of a five-item scale, each of them measured via a four-point Likert scale (ranking from “totally disagree” to “totally agree”, leading to a total score of 20 points (Prevention, 2010). As parental educational level is an important determinant of school performance and particularly the mother’s (Bishop J.H., 2004; Campbell J.R.,

1998; Nordlander E., 2014), we also included the educational level of the mother in our statistical analysis. The parental educational level was reported by students who situated their parents on a national-specific scale.

Moreover, as the socioeconomic background is important to consider in the relation between school achievement of peers and adolescents (Crosnoe, 2003) as well as with school connectedness (Niehaus, 2012), we used a subjective socioeconomic scale, referred to as the MacArthur scale, to approximate the socioeconomic status of each student. This one-item scale is apprehended via the following question: *“Imagine that this ladder pictures how [COUNTRY] society is made up. At the top of the ladder are the people who are the best off - they have the most money, the highest amount of schooling and the jobs that bring the most respect. At the bottom of the ladder are the people who are the worst off - they have little or no education, no job, or jobs that make little money. Now think about your family. Please tell us where you think your family would be on this ladder”*. Students situated their family on a ladder ranking from 0 (worst socioeconomic situation) to 10 (best socioeconomic situation).

As educational systems differ across the seven cities of our sample, we took countries into account, and use the place of sampling as a measurement: Belgium, Italy, The Netherlands, Germany, Finland, Portugal, and Ireland.

Analysis

We first described our sample (sociodemographic, dependent, independent variables and confounders) according to gender. Then, we repeat these analyses with a stratification according to gender, and the gender composition of peer group (Table 7.1 and Table 7.2), for both social network measures (best friendship and collaborative network). Third, we ran multilevel regression models to measure the association between gender, gender composition of the peer-group and gender balance of school

on school performance, controlling for confounders (Table 7.3). Finally, we repeated the multilevel regression models with a stratification by gender (Table 7.4). All these analyses were made via SAS EG 7.1.

Results

Table 7.1¹⁸ provides a description of the sample according to gender. Most cities have a balanced representation of both genders, except in Latina, where the proportion of girls is higher (57.4%). Both genders are also equally represented in each category of maternal and paternal education level. Boys are more likely than girls to be involved in other-sex friendship (18.2%, compare to 13.3% of girls). They are also more likely to designate other-sex schoolmates to describe their schoolwork collaborative network (23.4% of boys, 16.7% of girls). Both genders tend to have slightly more other-sex schoolwork mates than best friends. Half of the sample is made of students interviewed in a gender-balanced school. Girls are in our sample slightly younger than boys (15.1 years old and 15.2 among respectively), and have a lower subjective socioeconomic status (6.7 versus 6.8/10 respectively). Girls perform on average significantly better at school (2.4/4 compared to 2.1/4 for boys), however school connectedness scores are identical for both genders (10.3/15).

Table 7.2a details the previous table according to the gender-homophily status (same-sex versus other-sex friendship). There are no differences of school performances among boys, according to their friends' gender. Yet, girls perform better if they are involved in same-sex friendship (2.3/4, compare to 2.4/4 for other-sex friendship girls, $\chi^2=131/9$, $p<0.001$). Among both genders, adolescents involved in other-sex friends tend to be older, have a slightly lowest subjective socioeconomic status, are more likely to have a parent with lower educational level and a higher score of school connectedness compared to their same-sex counterparts. Adolescents with other-sex best friends are more likely to have other-sex schoolwork mates too.

¹⁸ For chapters 6 to 10, tables are provided at the end of each chapter.

Table 7.2b repeats table 7.2a results, but stratifies the sample according to the gender of schoolwork mates of each gender. There are no significant differences between table 7.2a and table 2b as far as sample distribution is concerned.

Table 7.3 presents results of multivariate regressions with a gender-mixed sample. Boys have significantly lower school performances than girls, even after controlling for other-sex friendship, which is negatively and significantly associated with school performances. Being in a male-majority school is associated with significantly lower school performances (-0.13, $p < 0.001$), compared to female-majority schools. Results are similar using schoolwork mates' gender instead of best friends' genders; yet, the negative effect of other-sex friendship are greater when considering schoolwork mates instead of best friends (other-sex best friends: -0.04, $p < 0.001$; other-sex schoolwork mates: -0.08, $p < 0.001$).

In table 7.4, we repeat multivariate regression models, but stratify our sample according to respondents' gender. Among girls, other-sex friendship are associated with significantly lower school performances, even more so when considering schoolwork mates, compare to best-friends mates. Among boys, we find a slight negative influence of other-sex friendship on school performances, yet results are only significant for school collaborative network, not for best-friends network. Being in a male-majority schools significantly diminishes school performances, yet in a greater extent among girls (-0.19, $p < 0.001$) than boys (-0.12, $p < 0.001$). Students in gender-balanced schools have also lower school performances than students in female-majority schools, although results are not significant.

Discussion

Main findings

Both genders are more likely to have same-sex best friends and schoolwork mates. Adolescents with other-sex best friends are also more likely to have other-sex schoolwork mates. Both genders adolescents with other-sex friends have significantly lower scores of school performances. Multivariate regression models indicate that

school performances are diminished by male gender, and other-sex friendship. Having other-sex best schoolwork mates is more detrimental for school performances than having other-sex best friends. Finally, adolescents in male-majority schools perform worse than adolescents in female-majority schools.

Interpretation

In this paper, we hypothesize that girls could have higher level of school performances than boys, which is indeed confirmed by our results. Yet, Girls' better school performances were long identified in the literature (Downey D.B., 2005; L. Bereni, 2012; OECD, 2015).

In this paper, we also postulate that other-sex friendship could have a negative influence on girls' school performances, but that it could improve boys' school performances. Our results indeed show proofs that other-sex friendship are associated with lower school performances for girls but only slightly for boys (and only for school work mates). Other-sex friendship are found to be detrimental for girls, but not for boys elsewhere (S. Mrug, C. Borch, & A. H. N. Cillessen, 2011). Nonetheless, the schoolwork collaborative network is more strongly associated with school performances. Likewise, in Lynch and Leventhal (Lynch, Lerner, & Leventhal, 2013), best friends' school performances are not related to adolescents' performances, but designated classmates peers' school performances are. This underlines the importance of considering the later type of friendship ties in school performances analysis.

Finally, we postulated that a male-majority school could diminish both boys and girls school performances, with both genders being influenced by boys' lower school-oriented behavior and engagement. This hypothesis is found to be true for both genders, but has a stronger effect on girls. The impact of school gender balance on girls' school performances was already acknowledged by Kessels et al., who found that girls performed better in single-sex classes than in coeducational classes (Kessels & Hannover, 2008). Yet, to the best of our knowledge, our study is the first to acknowledge a negative effect of male environment on both genders' school

performances. Detrimental effect of male-majority schools are, however, already acknowledge as far as other risky behavior are concerned (Grard et al., 2018).

Implication

These findings have several implications for the literature on gender mixing at school. It firstly pleads for reinforcing same-sex collaboration networks for both boys and girls. Having other-sex school work mates have a stronger detrimental effect on adolescents' school performances than having other-sex best friends. Consequently, our results would rather plead for same-sex collaborative groups than same-sex schools, as schoolwork collaboration mainly occurs between people attending the same class. However, according to Dalen (2014) and Brolin Laftman (2012), girls in classrooms with a larger proportion of girls tend to display higher levels of psychological distress than in other kind of classrooms. This remind us that we should not only focus on school performances, and that further studies including a broader range of outcomes, for instance mental health issues, which are still missing in the current literature on gender mixing at school. Moreover, our purpose here is not to plead for single-sex schooling, or other kind of gender segregation. On the contrary, as we will explain in the General Discussion of the Thesis (Chapter 11), gender mixing at schools had provided great educational opportunities for girls, and their consequences on women's health far overpasses the detrimental effect of substance use.

Our study secondly acknowledges that adolescents perform worse in male-majority schools than in gender-balanced or female-majority schools. This adds an additional piece of knowledge regarding the detrimental effect of male-environment on boys, and to a greater extent, girls' health. Indeed, being in a male-majority school was already found to increase the odds of smoking, binge drinking and using cannabis for boys, but even more for girls. Considering school performances as an indicator of subsequent socioeconomic status, which is in turn associated with higher life expectancy, we may postulate that being part of a male-majority school is detrimental for current and later health status. Further research should, however, address this question using longitudinal

samples. Yet, once again, our purpose is not to plead for retrieving girls from male-majority environment. On the contrary, in the General Discussion, we will rather discuss how male gender norm toward risky behavior should be addressed and deconstruct in these particular school contexts.

Strengths of the study

Our study is the first to use both peers and school gender balance in a comprehensive way to investigate the role of gender social environment on adolescents' school performances. Moreover, we take advantage of a social network design to investigate the respective influence of school collaboration and best-friendship networks on school performances. Additionally, our study goes beyond the traditional opposition between single-sex versus mixed gender schools, which has shown little to no evidence of higher level of school performance for girls in single-sex schools. Compare to the aforementioned literature on single-sex versus coeducational school, our study address both genders' school performances and uses a more fine grading measure of gender mixing at school, which is more adapted to the actual European school context (Pahlke R., 2014). Finally, this European study takes place in seven European countries, and already accounts for seven different educational systems, which allows a generalization of our results to the European educational landscape as a whole.

Limitations

Though our study is based on a large sample of European students using strong social network instruments, it still suffers from a handful of limitations. First, our study is cross-sectional, which enables us to debate on the respective role of selection and influence in the relation between peers' and adolescents' performances, yet not on any causality relation. We thus cannot conclude, for example, whether adolescents perform better because they are in same-sex friendship, or the other way around.

Second, our design restricted the designation of peers to the inside of the school, thus we were not able to look at the influence of best friends outside the school. Witkow (2010) found that having a larger proportion of friends in school, compared to out-school, is a predictor of school connectedness, and might thus influence the relation between friendship ties and school performance. Our design did not allow us to test for this hypothesis. Finally, we used self-reported grades to measure school performances, which may lead to a recall bias among students, and lead to a less accurate measure of school performance. Our study, moreover, controlled for country and adapted the school performance scale to each country context, yet a maladaptation of this scale may still remain, because of the diversity of educational systems across our sampled countries.

Conclusion

Our study underlines the detrimental association between other-sex friendship and collaborative networks for girls' school performances and pleads reinforcing same-sex collaboration. Moreover, both genders performed better in female-majority schools and gender-balanced schools, which sheds lights on the detrimental consequences of male-majority school environments, that should lead us to deconstruct the male norm toward risky behavior and school performances, in such particular contexts

Tables

Table 7.1. Description of the sample according to gender. Silne, 2013-2016. N=19664						
	Girls		Boys		Total	
	%/mean	N	%/mean	N		chisq pvalue
Country						85.28 <.0001
Belgium	50.7	1959	49.3	1901	3860	
Ireland	51.9	1097	48.1	1018	2115	
Finland	48.8	1577	51.2	1655	3232	
Germany	50.3	723	49.7	715	1438	
Italy	57.4	2327	42.6	1725	4052	
The Netherlands	49.1	2055	50.9	2134	4189	
Portugal	49.2	1851	50.8	1911	3762	
Education level of the father						8.72 0.12
Low	20.1	2325	19.2	2122	4447	
Middle	30.2	3499	30.2	3338	6837	
High	31.9	3701	32.0	3541	7242	
Other school leaving certificate	1.3	6	1.7	6	12	
Don't know	16.5	1907	16.9	1864	3771	
Education level of the mother						66.9 <.0001
Low	16.8	1952	15.5	1712	3664	
Middle	33.7	3911	32.8	3625	7536	
High	36.0	4170	34.6	3821	7991	
Other school leaving certificate	0.1	10	0.1	6	16	
Don't know	12.3	1427	15.7	1731	3158	
Gender homophily- friends						
Heterophile	13.3	1476	18.2	1907	3383	
Homophile	86.7	9631	81.8	8592	18223	
Gender homophily- working mates						
Heterophile	16.7	1866	23.4	2470	4336	
Homophile	83.3	9286	76.6	8082	17368	
Gender balance of school						1525.9 <.0001
Female majority school	36.2	4191	16.3	1801	5992	
Gender balanced	50.1	5811	54.2	5991	11802	
Male majority school	13.7	1587	29.5	3267	4854	
Age	15.1		15.2			90.5 <.0001
Socioeconomic status (/10)	6.7		6.8			29.0 <.0001
School performance (/4)	2.4		2.1			448.4 <.0001
School connectedness (/15)	10.3		10.3			0.0 0.9293
Total	51.2	11376	48.8	10851	22227	

Table 7.2.a Description of the sample according to gender homophily status (friends). Silne , 2013-2016, N=22227											
	OSF Girls		SSF Girls		OSF Boys		SSF Boys		Total	chisq	pvalue
Country	%/mean	N	%/mean	N	%/mean	N	%/mean	N	N	827.8	<,0001
Belgium	8.7	329	42.3	1594	9.6	362	39.4	1486	3771		
Ireland	3.9	63	45.2	725	4.4	84	45.6	732	1604		
Finland	2.6	83	46.4	1467	6.8	217	44.1	1397	3164		
Germany	6.4	88	44.1	611	9.2	128	40.2	557	1384		
Italy	12.2	469	47.6	1822	10.1	387	30.1	1150	4158		
Netherlands	3.2	133	45.9	1908	4.8	201	46.1	1916	3697		
Portugal	8.4	311	40.7	1504	14.3	528	36.6	1354	3728		
Education of the father										165.6	<,0001
Low	25.8	381	19.6	1886	23.0	438	17.6	1510	4215		
Middle	32.2	476	30.2	2910	30.6	583	30.0	2575	6544		
High	24.6	363	32.1	3087	24.9	475	34.6	2972	6897		
Other school certificate	0,0	0	0,1	6	0,1	1	0,0	5	12		
Don't know	15.0	222	16.9	1631	19.4	370	16.3	1400	3623		
Education of the mother										141.7	<,0001
Low	21.7	321	16.4	1580	18.6	355	14,3	1226	3482		
Middle	34.2	505	33.9	3269	32.3	616	32.5	2792	7182		
High	30.8	454	35.9	3460	30.7	585	36.2	3109	7608		
Other school certificate	0,0	1	0,1	8	0,1	1	0,1	5	15		
Don't know	11.7	173	12.7	1222	16.3	311	15.7	1350	3056		
heterophile work	56.1	818	10.6	1018	65.9	1227	14.0	1194	4257		
homophile work	43.9	640	89.4	8551	34.1	635	86,0	8536	17762		
Gender balance of the school											
Female majority school	50.1	740	31.8	3063	18.9	360	16.2	1394	5557	1469.2	<,0001
Gender balanced	34.8	513	54.3	5225	46.9	894	58.3	5013	11645		
Male majority school	15.1	223	13.9	1343	34.2	653	25.4	2185	4404		
Age		15,3		15,1		15,5		15,2		101.8	<,0001
Socioeconomic status		6,4		6,7		6,5		6,9		69.7	<,0001
School performance		2.3		2.4		2.1		2.1		131.9	<,0001
school connectedness		9.8		10,4		9.9		10,4		46.2	<,0001
Total	15,0	3182	36,2	7669	14,3	3020	34,5	7305	21176		

Table 7.2.b Description of the sample according to gender homophily status (schoolwork mates). [Silne](#), 2013-2016, N=22227

	OSF Girls		SSF Girls		OSF Boys		SSF Boys		Total		
Country	%/mean	N	%/mean	N	%/mean	N	%/mean	N	N	chisq/F	pvalue
Belgium	8.8	332	42.0	1589	10.1	384	39.1	1481	3786	941.0	<.0001
Ireland	3.4	55	45.9	738	5.4	87	45.3	729	1609		
Finland	3.1	100	45.7	1460	5.9	189	45.3	1447	3196		
Germany	5.4	77	45.0	635	6.8	96	42.8	604	1412		
Italy	11.7	450	48.2	1853	12.2	469	27.9	1071	3843		
Netherlands	13.4	560	35.7	1488	14.9	621	36.1	1505	4174		
Portugal	7.9	292	41.3	1523	16.9	624	33.8	1245	3684		
Education of the father										70.9	<.0001
Low	21.1	394	20.3	1886	22.0	543	17.5	1414	4237		
Middle	29.5	551	30.6	2845	28.6	706	30.5	2463	6565		
High	33.6	626	30.5	2834	31.7	784	33.2	2680	6924		
Other school certificate	0,0	0	0,1	6	0.0	1	0,1	5	12		
Don't know	13,8	257	17.3	1606	15.9	393	17.2	1391	3647		
Education of the mother										116.6	<.0001
Low	18.1	337	16.9	1568	18.4	455	14.1	1136	3496		
Middle	32.6	609	34.3	3189	30.5	753	33.0	2666	7217		
High	36.7	685	34.8	3234	34.9	861	28.48	2848	7628		
Other school certificate	0	1	0,1	9	0.0	1	0,1	5	16		
Don't know	11.0	205	12.9	1198	14,3	354	16,4	1322	3079		
Gender homophily friend										29832.9	<.0001
Heterophile	44.6	818	7.0	640	50.7	1227	8.0	635	3320		
Homophile	55.4	1018	93.0	8551	49.3	1194	92.0	7339	18102		
Gender balance of school										1155.5	<0.0001
Female majority school	38.5	718	33.5	3110	15.8	391	17.0	1374	5593		
Gender balanced	50.6	945	51.8	4814	55.7	1375	56.4	4556	11690		
Male majority school	10.9	203	14.7	1362	28.5	704	26.6	2152	4421		
Age	15,3		15,1		15.4		15.2			59.2	<.0001
Socioeconomic status	6,7		6,7		6,6		6,9			14.1	<.0001
School performance	2.3		2.4		2.1		2.1			150.6	<.0001
School connectedness	10,1		10,3		10,1		10,4			19.5	<.0001
Total	15,9	3376	35,5	7534	15,1	3207	33,5	7100	21217		

Table 7.3. Multivariate regression of the influence of gender, school connectedness, other-sex friendship (best friends and schoolwork mates), and gender balance of school on adolescents' school performances (estimates, pvalue). Siline, 2013-2016, N=19644					
	Model 1	Model 2a	Model 3a	Model 2b	Model 3b
Constante	4.36 ***	4.36 ***	4.36 ***	4.35 ***	4.35 ***
Boys (ref=girls)	-0.23 ***	-	-0.21 ***	-0.22 ***	-0.2 ***
OSF- (ref=SSF)		0.23 ***			
		-	-0.04 *	-0.08 ***	-0.09 ***
		0.04			
Male majority school (ref= Female majority school)			-0.13 ***		-0.13 ***
gender balanced school (ref= Female majority school)			-0.03		-0.02
Model fit: R-carré	0.13	0.13	0.13	0.13	0.13
Model 1: school performances = gender					
Model 2a: Model1 + gender homophily status (best friends)					
Model 2b: Model 1 + gender homophily status (schoolwork mates)					
Model 3a: Model 2a + gender balance of school					
Model 3b: Model 2b + gender balance of school					
All models are controlled for country, age, socioeconomic status, educational level of the mother, school connectedness					
p value: * p<0.05; **p<0.001; ***p<0.0001					

Table 7.4. Multivariate regression of the influence school connectedness, other-sex friendship (best friends and schoolwork mates), and gender balance of school on adolescents' school performances, stratified by genders (estimates, pvalue). Silne, 2013-2016, N=19644 (N=10182 girls; N=9462 boys)									
2GIRLS		Model 1a		Model 2a		Model 1b		Model 2b	
Constante		3.96	***	4.00	***	3.95	***	3.99	***
OSF- (ref=SSF)		-0,07	*	-0,07	**	-0,12	***	-0,13	***
Male majority school (ref= Female majority school)				-0,18	***			-0,19	***
gender balanced school (ref= Female majority school)				-0,02				-0,02	
R-carré		0.12		0.12		0.12		0.12	
BOYS		Model 1c		Model 2c		Model 1d		Model 2d	
Constante		4.54	***	4.55	***	4.54	***	4.55	***
OSF- (ref=SSF)		-0,01		-0,01		-0,06	*	-0,05	*
Male majority school (ref= Female majority school)				-0,12	***			-0,12	***
gender balanced school (ref= Female majority school)				-0,05				-0,04	
R-carré		0.13		0.13		0.13		0.13	
Model 1: gender homophily status									
Model 2: Model 1+ gender balance of school									
A= Girls with friends for gender homophily measure									
B= Girls with schoolwork mates for gender homophily measure									
C= Boys with friends for gender homophily measure									
D= Boys with schoolwork mates for gender homophily measure									
All models are controlled for country, age, socioeconomic status, educational level of the mother and school connectedness									
p value: * p<0.05; **p<0.001; ***p<0.0001									

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SECTION 3 – SOCIAL PATTERNS OF SMOKING BELIEFS

CHAPTER 8 – Smoking beliefs across genders, a comparative analysis of seven European countries

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Background

Adolescent smoking prevention

Over the last two decades, most European countries have seen a decrease in the prevalence of adolescent smoking. This decrease has, however, been patterned by gender: in one out of two countries, most of them in southern and northern Europe, boys no longer smoke more than girls. In some western European countries, moreover, smoking rates among girls now surpass those among boys (Inchley J., 2016). These prevalence trends suggest that the response to smoking prevention programs addressing adolescent smoking is patterned by gender. Some studies have suggested adapting smoking prevention strategies to gender contexts (Dedobbeleer, Béland, Contandriopoulos, & Adrian, 2004). Most policy programs dedicated to the prevention of smoking in adolescents address smoking beliefs (de Kleijn et al., 2015; Thomas, McLellan, & Perera, 2015), because smoking belief is associated with smoking status (Parkinson et al., 2009). These prevention programs aim to either deconstruct positive smoking beliefs or reinforce negative attitudes to smoking. Girls and boys, however, may respond differently. In this article, we aim to compare smoking beliefs among European adolescents and to see how they vary between genders and countries. This should eventually help to better tailor interventions related to smoking beliefs for boys and for girls.

Smoking beliefs

Several studies have focused on smoking beliefs among young people. One difficulty, however, is that they describe different beliefs, which are not always comparable. Some authors have highlighted the prevalence of social beliefs, about being popular or having fun with peers (ASPLPT, 2002; Kessels & Hannover, 2008), while others have focused on beliefs about the effects of tobacco, such as stress management (Palmqvist & Martikainen,

2009). Some of these studies, moreover, are old and/or only apply to the context of a specific country, whereas it is worth considering that smoking beliefs may have changed over time and may vary between countries. Nonetheless, following the current literature, smoking beliefs can be classified as promoting either positive or negative aspects of smoking and as relating to either individual or social concerns (Curry et al., 1990). In the following paragraphs, we will briefly examine gender differences in the four categories of smoking belief.

Positive individual beliefs. Several studies have focused on two positive individual beliefs about smoking. On the one hand, in adolescence, tobacco consumption is used to cope with mood-related problems more frequently by girls than by boys (ASPLPT, 2002; Hrubá & Zaloudikova, 2010; Reza-Najem G., 1997). On the other hand, girls are more receptive to the impact of smoking on weight reduction (H. P. Cremers, L. Mercken, H. de Vries, & A. Oenema, 2015; S. Grogan, M. Conner, G. Fry, B. Gough, & A. Higgins, 2009; Lowry, Galuska, Fulton, Wechsler, & Kann, 2002; 2008). These studies suggest that positive individual beliefs are more often held by girls than by boys.

Positive social beliefs. Smoking is also often associated with pleasure and activities with friends (Piasecki, Richardson, & Smith, 2007), which are, however, more frequently cited by boys than by girls (ASPLPT, 2002). Moreover, adolescents think that smoking enhances peer conformity (2009) and popularity (Hastier, Quinque, Bonnel, Leménager, & Le Roux, 2006; Cynthia M Lakon & Valente, 2012; Schaefer, Haas, & Bishop, 2012; Thomas W Valente, Unger, & Johnson, 2005), however, there is no difference in these beliefs between genders (2009). Furthermore, during adolescence, boys and girls are under more social pressure to adhere to gender roles (Galambos, Almeida, & Petersen, 1990; Hill JP, 1983). Smoking may help one to look grown-up or masculine (bad boy) or feminine (sophisticated, sexy). In Rugkasa's study (2003), smoking among girls was frequently associated with being attractive to boys, while smoking among boys was related with appearing grown-up or like hard men

(Rugkasa, 2003). According to Lucas and Lloyd (1999), however, smokers of both genders might smoke to be more attractive to the other gender.

Negative Individual Beliefs. Nevertheless, adolescents are nowadays well aware of the reasons not to smoke (Stjerna, Lauritzen, & Tillgren, 2004). Lundborg (2006) found that girls were more concerned about the health risks of smoking than boys. Moreover, girls were also more likely to quote smoking-related concerns about their physical appearance than boys (2010; Riedel, Robinson, Klesges, & McLain-Allen, 2002). Boys, on the other hand, were more likely to consider athletic performance a reason to quit smoking (Riedel et al., 2002). Thus, while girls are more likely to identify with reasons not to smoke that are related to health and physical appearance, boys may be more sensitive to arguments related to physical activity.

Negative Social Beliefs. With smoking increasingly considered a deviant behavior, the way that significant peers sanction smoking could be a meaningful consideration for adolescents. For example, in a study by Riedel (2002), both genders quoted other students' negative attitudes to smoking as a reason not to smoke (13% girls; 14% boys). In Grogan (2009), however, this was more frequently quoted by girls than by boys. With the increase in tobacco control policies, adolescents can also get into trouble, for instance if they are caught smoking at school, where it is forbidden. This should reduce the social attractiveness of smoking (Schreuders, Nuyts, van den Putte, & Kunst, 2017a). Nonetheless, for adolescents, transgression of a law could also be a reason to smoke, particularly among male peer groups (Schreuders et al., 2017a). It is widely acknowledged that boys are more often involved than girls in deviant behaviors, including substance use (Windle, 1990), while girls tend to display more rule-oriented behavior (Bereni et al., 2012). Thus, girls may be more sensitive to negative social aspects of smoking.

Gender equality and health behavior

Differences in smoking beliefs between boys and girls might also depend on the level of gender inequality within their country. A recent study among adolescents found a positive association between the gender equality of a country's culture (Gender Index of Inequality, GINI) and life satisfaction among adolescents (De Looze, 2017). A less masculine national culture was also found to be associated with less deviant behavior, such as bullying (Inchley J., 2016), and better mental health outcomes in adolescents (García-Moya I., 2015; Ottova V., 2012). In relation to smoking, a study by Kuntsche (2010) found a direct correlation between gender equality in the culture of a country and the female-to-male smoking ratio: the more gender-equal the country, the fewer differences there were in smoking rates between genders in adults (Hitchman S.C., 2011; Kuntsche E, 2010). This correlation might be explained by the fact that, in countries with gender-equal cultures, women both have greater financial resources to access tobacco or other substances and are targeted more by industries that promote images of independence and empowerment associated with smoking. We might thus expect girls in such equal countries to have more positive beliefs about smoking (Hitchman S.C., 2011; Kuntsche E, 2010; Simons-Morton B.G. , 2009). To our knowledge, however, no study has addressed the association between the gender equality of a country's culture and gender differences in smoking beliefs among adolescents.

Knowledge gap

Concluding from the literature summarized above, we acknowledge that there is a lack of studies which systematically address gender differences in a broad range of smoking beliefs. Here, we will therefore address gender differences in a broad range of beliefs, which are classified according to the typology presented above. Moreover, many previous studies have used national samples. We will thus use an international sample, which allows us to investigate the extent to which both smoking beliefs and gender inequality are imbedded within their context. Ultimately, a deeper understanding of these factors might help to

further improve and tailor smoking prevention programs. It could also be helpful in considering beliefs from an international perspective and could contribute to making such programs transferable from one context to another or, instead, tailoring them to the context of a specific country.

Hypothesis

In this article, we hypothesized (1) that smoking beliefs among adolescents differ according to gender. We expected girls to score higher on positive individual, negative individual (except for physical activity), and negative social beliefs (see Table 8.1¹⁹). We expected no gender differences in the social-status improvement beliefs (positive social beliefs). Secondly, we expected (2) gender differences in smoking beliefs to differ between countries. We hypothesized that countries with a more gender-equal culture would have less gender difference in beliefs, particularly social (positive and negative) beliefs about smoking, which should be more sensitive to contextual patterns than individual beliefs.

Methods

In 2016-2017, we carried out a paper-and-pencil survey in 55 schools located in seven European cities: Namur (Belgium), Dublin (Ireland), Tampere (Finland), Hanover (Germany), Latina (Italy), Amersfoort (The Netherlands), and Coimbra (Portugal). This survey was the second wave of a cross-sectional study conducted in 2013. In each country, research teams selected a single city with a medium-range socioeconomic situation, and sampled six to eight high schools in order to (1) reach a sample of 2000 students per city and (2) be representative of the socioeconomic situation of the city. About 81% of schools agreed to participate in the survey again in 2016/17. When schools refused to participate again, we sampled new schools with the same socioeconomic background. As Ireland was

¹⁹ For chapters 6 to 10, tables are provided at the end of each chapter.

not included in the first wave of the survey, we sampled eight new schools in the 2016 survey. The design used in both surveys has been described elsewhere (Lorant 2015). Among other subjects, each student was asked about his/her beliefs related to smoking and about sociodemographic information. However, as smoking beliefs were the subject of a new question in the 2016/17 questionnaire, this paper only uses data collected in 2016/17.

In each classroom where data were collected, we used the official students' register and carefully reported on the number of adolescents who (1) participated in the survey, (2) were absent, or (3) refused to participate. Participation rates were calculated as the percentage of adolescents registered in the classroom that actually participated in the survey. Participation rates were calculated in each classroom, then summed up at the school level and the country level. A total of 12 979 students aged 14–16 filled in the questionnaire in 2016/2017. For the whole sample, we achieved 79.9% participation, with slight differences between countries: Belgium (89%), Finland (89%), Ireland (81%), The Netherlands (89%), Portugal (88%), Italy (89%), and Germany (62%). Ethical approval was obtained for the second survey in all cities (see Acknowledgment); active written parental consent was requested and obtained in Germany and Italy, which might explain lower participation rates in Germany, and passive written parental consent was obtained in other countries. All adolescents, moreover, agreed to participate via written consent.

Measurement

In this article, we develop an easy-to-use typology of beliefs, with two dimensions. The first dimension is the positive-negative opposition: *does this belief promote smoking (positive) or work to avoid its negative effects (negative)?* The second dimension of our typology is derived from the opposition between intrinsic and extrinsic beliefs about smoking cessation (Curry et al., 1990). It is composed of, on the one hand, individual (intrinsic) beliefs, which come from the individual, and on the other hand, social (extrinsic) beliefs, which result from the social environment.

To measure smoking beliefs, we used a scale based on that of Song et al. (Anna V Song et al., 2009), who used three factors that identify the perceived benefits, long-term risks, and short-term risks of smoking. We selected and adapted this scale, removing some redundant items related to the health risks and disadvantages of tobacco, on which, it has been shown, there is about 100% agreement. Moreover, as we were interested in the social versus the individual dimension of smoking, we included additional social (looking grown-up, looking masculine, looking feminine, appearing sexy/attractive, getting a boy/girlfriend) and individual items (losing weight or staying thin, having less ability to exercise). Then, to add some complementary items to the negative social beliefs dimension, which only contained “getting into trouble” in Song et al., we used two items from the stigmatization scale (Stuber et al., 2008). We slightly adapted these to the context of adolescents: “Most people would not hire a smoker to take care of or babysit their children” and “Most smokers would be reluctant to date someone who smokes”. These items were selected because they were expected to vary according to gender, because boys and girls differ in their dating processes and involvement in babysitting (Weinstein & Rosen, 1994).

First, the positive individual belief scale contains the following beliefs: “Do you think that smoking increases your chances of feeling relaxed?” and “Do you think that smoking increases your chances of losing weight or staying thin?” (Spearman-Brown coefficient: 0.44).

Second, the positive social belief scale was composed of: “Do you think that smoking increases your chances of becoming popular?”, “Do you think that smoking increases your chances of looking grown-up?”, “Do you think that smoking increases your chances of looking masculine?”, “Do you think that smoking increases your chances of looking feminine?”, “Do you think that smoking increases your chances of appearing sexy or

attractive?”, and “Do you think that smoking increases your chances of getting a boyfriend or girlfriend?” (Cronbach alpha: 0.78).

Third, we computed the negative individual belief scale based on: “Do you think that smoking increases your chances of getting lung cancer?”, “Do you think that smoking increases your chances of having chronic trouble breathing?”, “Do you think that smoking increases your chances of getting facial wrinkles?”, and “Do you think that smoking increases your chances of having less ability to exercise?” (Cronbach alpha: 0.70).

Finally, we used two items from the stigmatization scale presented above (“Most people would not hire a smoker to take care of or babysit their children” and “Most smokers would be reluctant to date someone who smokes”) with the belief “Do you think that smoking increases your chances of getting into trouble?”, and also added friends’, parents’, and teachers’ disapproval of smoking (e.g. “My parents (would) disapprove if I smoked”, to create the negative social belief scale (Cronbach alpha: 0.45).

For each belief, we asked students to state whether they agreed that smoking was associated with the belief (e.g. “Do you think that smoking helps you to get a boy/girlfriend?”: “Totally agree”; “agree”; “don’t agree”; “totally disagree”). Each belief was then binarized into two categories (agreed (=1 point) or not (= 0 point) with the belief), which allowed us to describe the percentage of agreement with each belief. As the four belief scales contain different numbers of beliefs, we computed the arithmetic mean, in order to scale them. Then, we reported the total score of each on a 0–1 scale to use them as dependent linear variables. The beliefs were analyzed according to gender and country.

Gender was measured using the following question: “Are you a male or a female?”. Gender distribution was balanced in the total sample (50% of boys). The gender balance varied slightly between countries: 45% boys (Italy), 48% (Ireland) 50% (Belgium, Germany, and The Netherlands), 51% (Portugal), and 52% (Finland).

As smoking beliefs tend to differ across smoking status, we stratified our descriptive analysis of beliefs by smoking status. Students who had smoked at least once a week in the past 30 days were considered to be regular smokers (11.3%), while the remaining students were classified as “not weekly smokers” (88.7%).

As we hypothesized that the gender context of a country would influence the prevalence of beliefs in each gender, we classified the seven countries according to their gender culture using the Gender Inequality Index. According to the United Nations Development Program, there are three dimensions to the Gender Inequality Index (United Nations Development Program 2016): health (maternal mortality rate and adolescent birth rate), empowerment (female and male population with at least a secondary education, female and male participation in parliament), and labor participation (female and male participation in labor forces). We classified the seven countries according to their scores in the Gender Inequality Index (from the most equal to the least equal): the Netherlands (0.044, 3rd), Finland (0.056, 8th), Germany (0.066, 9th), Belgium (0.073, 12th), Italy (0.085, 16th), Portugal (0.091, 17th), and Ireland (0.127, 26th).

Finally, we controlled our models for other sociodemographic variables, all of which have been found to be related to smoking (Alves et al., 2016; E. Goodman, Adler, N.E., Kawachi, I., Frazier, A. L., Huang, B. & Colditz, G.A., 2001; Lorant, Rojas, Bécares, et al., 2016). First, we controlled for age (“How old are you?”, with possible answers between 12 and 18 years of age). There were slight differences between country samples regarding age: the mean age was 15 years in Belgium, Ireland, Finland, Italy, and The Netherlands, but was younger in Germany (14 years old) and older in Portugal (16 years old).

Then, we also controlled for migrant status (“Were you born in this country?” with “yes” or “no” as possible answers). Third, we controlled for the level of education of father and mother: “What was the highest level of schooling your father/mother attended?”, with the possible answers: “completed primary school or less”, “secondary school, not completed”

(both grouped into the Low category); “completed secondary school”, “college or university, not completed” (both grouped into the Medium category); “Completed college or university” (High category); and “I don’t know” (Unknown category). Fourth, we controlled for parental smoking: “Does any member of your family smoke cigarettes?”: adolescents with at least one parent (mother or father) currently a smoker received 1 point, other students received 0. Finally, we controlled for socioeconomic status, which was measured using the MacArthur scale (E. Goodman, 1999): each student was asked to situate his/her own socioeconomic position on a 0–10-point scale, with 0 = the worst socioeconomic situation of an inhabitant of his/her country and 10 = the best socioeconomic situation of an inhabitant of his/her country.

Statistical Analysis

First, we tabulated the description of our sample (Table 8.2). Then we displayed the frequency of beliefs by gender and by country (Table 8.3). To do so, we gave the percentage of agreement with each item of the four belief scales and used ANOVA (analysis of variance, F-test and p-value) to analyze significant gender differences and country differences. In order to control for multiple testing, we used the Duncan option of the ANOVA procedure (alpha: 0.05). Third, we repeated the same analysis with a stratification by gender and smoking status, in order to identify gender differences in beliefs across smoking statuses (regular smokers versus those who were not regular smokers) (Table 8.4). Fourth, we ran four multinomial regressions for each individual belief scale and ran a contrast analysis by gender and country, in order to identify whether gender differences in the four belief scales varied significantly between countries (Table 8.5). Fifth, we repeated this analysis with gender-country interaction and verified whether the interaction coefficient varied when the gender-country Gender Inequality Index was added to the model (results not presented). For all analyses, we used SAS 9.4.

Results

Sample description

Of the 12,979 students interviewed in 2016, 50.2% were girls and 8.5% had a migration background (Table 8.2). The boys were slightly older and of higher socioeconomic status than the girls (mean age = 14.9 for girls and 15.8 for boys; $\chi^2 = 79.3$; $p < 0.001$; mean SES = 6.7 for girls, 6.8 for boys; $\chi^2 = 39.0$; $p < 0.001$). About 1 out of 7 students had a least one parent who was a smoker and 11.3% of students were weekly smokers (at least one cigarette per week).

Gender differences in smoking beliefs

Table 8.3 shows the frequency of agreement with each smoking belief, by gender and by country. There were some gender differences: for 10 out of 19 smoking beliefs, gender differences were statistically significant, though the magnitude of the difference was mostly about 3–4%, with two exceptions: “smoking is associated with having facial wrinkles” (78% of girls; 70% of boys; $F = 93$; $p < 0.05$) and “my friends would disapprove if I smoked” (67% of girls; 53% of boys; $F = 265$; $p < 0.05$).

Out of the positive individual beliefs, girls were more likely to believe that “smoking helps you to lose weight”. As far as negative individual beliefs were concerned, girls agreed particularly frequently with: “smoking is associated with having facial wrinkles”, “smoking leads to lung cancer”, and “smoking gives you trouble breathing”. Moreover, girls more frequently held negative social beliefs: “my friends would disapprove if I smoked”, “smoking gets you into trouble”, and “my parents would disapprove if I smoked”.

On the other hand, boys were significantly more likely to believe in three social beliefs: that smoking helps you to “look masculine” (12% of boys, 8% of girls; $F = 33$; $p < 0.05$) and “get a boy/girlfriend” (7% of boys; 4% of girls; $F = 30$; $p < 0.05$), both positive beliefs, and that “most people would be reluctant to date a smoker” (57% of boys; 55% of girls; $F = 5$; $p < 0.05$), a negative belief.

Country differences in smoking beliefs

Regarding the differences in smoking beliefs between countries, we first acknowledge that all beliefs differed significantly between countries and negative social beliefs displayed the largest F-test coefficients. Teachers’ disapproval was the belief with the most pronounced differences between countries ($F=288$, $p < 0.05$). The belief that “most people would be reluctant to date a smoker” had the second largest chi-square value ($F = 1092$, $p < 0.05$). The beliefs that smoking “gets you into trouble” and elicits “parents’ disapproval” and that “most people would not hire a smoker to babysit their children” had, respectively, the fourth-, fifth-, and sixth-highest chi-square test values. More precisely, for both genders, “parents’ disapproval of smoking” was low in Germany, the belief that “most people would not hire a smoker to babysit their children” was low in Belgium and Portugal, the “best friend’s disapproval” was low among Italians, and the belief that smoking “gets you into trouble” was low in Portugal.

Aside from these variations in negative social beliefs, one negative individual belief also displayed a large F-test value for differences between countries: “getting facial wrinkles” ($F = 165$, $p < 0.05$). On the opposite end of the scale, positive social beliefs, though they differed significantly between countries, displayed the smallest chi-square test values, particularly for the belief that smoking helps you to “get a boy/girlfriend” ($F = 10$, $p < 0.05$) and the belief that smoking helps you to “look feminine” ($F = 10$, $p < 0.05$).

Smoking status differences in smoking beliefs across genders:

Almost all beliefs (18 out of 19) differed significantly between smoking statuses, and some beliefs were particularly embedded in weekly smokers' minds: "Do you think that smoking increases your chances of feeling relaxed?", "my best friend (would) disapprove if I smoke", and "smoking will get me into trouble". F-test values were particularly high for the negative social beliefs items. Looking at gender differences within each smoking status, however, we found results similar to those in the total sample (both smoking statuses together).

Gender differences in smoking beliefs: country contrasts

In order to answer our second hypothesis, we focused on the gender context of these countries, to see whether it was related to smoking beliefs. First and foremost, Germany and Belgium were the only countries with no gender differences in the four belief scales.

In Italy, girls scored significantly higher than boys on the positive individual belief scale ($b = 0.19$, 95%IC: 0.14-0.24). Moreover, regarding the negative individual belief scale, we found significant gender coefficients in Finland ($b = 0.06$; 95%IC: 0.03-0.10) and Portugal ($b = 0.05$; 95%IC: 0.02-0.08). Furthermore, more boys had positive social beliefs in Finland, Portugal, and Ireland, while more girls had negative social beliefs in the Netherlands and Ireland ($b = 0.07$; 95%IC: 0.03-0.10 for the Netherlands; $b = 0.07$; 95%IC: 0.04-0.10 for Ireland).

In a supplementary model, not presented here, we looked at the interaction between country and gender in a first step and added, in a second step, the interaction between gender and Gender Inequality Index. These did not significantly improve the model fit, nor did they change country coefficients: this shows that a country's score in the Gender Inequality Index is not significantly associated with any gender differences in the smoking belief scales.

Discussion

Main findings and interpretation

Our study aimed to test whether smoking beliefs among adolescents differ according to gender. We expected girls to score higher on positive individual, negative individual, and negative social beliefs, but postulated that there were no gender differences in positive social beliefs. We found that one out of two smoking beliefs differed significantly between genders, although the magnitude of differences was small, except for two beliefs. More precisely, negative social beliefs were more common in girls, while beliefs about the dating-related aspects of smoking, mostly positive social beliefs, were more common in boys.

In this paper, we have shown that negative social beliefs in particular, such as “getting into trouble” or “friends’ and parents’ disapproval”, were more often held by girls than by boys. This is consistent with Curry’s finding (Curry et al., 1990) that girls are more influenced by extrinsic motivators, such as friends’ opinions. Similar findings were presented in Grogan’s study (2009), which concluded that the most important predictor of a girl’s smoking status at 13 and 15 years of age was her friends’ and family’s negative opinions of smoking two years earlier. This also corroborates Cremers and colleagues, who found that intention to smoke among girls was related to low rates of negative beliefs (H. P. Cremers et al., 2015). In contradiction of our hypothesis, however, boys were more likely to hold positive social beliefs, though Cremers and colleagues also pointed out that boys had a greater intention to smoke when they had high levels of positive beliefs (H. P. Cremers et al., 2015). However, as far as positive individual beliefs were concerned, we found that girls were not more likely to believe in the relaxing effects of smoking. They agreed more with statements about the effects of smoking on body weight, however, which suggests a more ambiguous association between girls and the positive aspects of smoking than expected.

Secondly, we hypothesized that countries with a more gender-equal culture would have fewer gender differences in beliefs, particularly in social (positive and negative) smoking beliefs. With regard to this second hypothesis, we found no relation between a country's score in the Gender Inequality Index and gender differences in smoking belief scales, but we did find some variations between countries. In Belgium and Germany, there were no gender differences in smoking belief scales. Italian girls were significantly more likely to agree with individual positive beliefs than Italian boys. In other countries (the Netherlands, Finland, Portugal, and Ireland), though they had very different scores on the Gender Inequality Index, we found national gender contrasts, with girls scoring more highly for positive individual, negative social, and negative individual beliefs and with boys scoring more highly for positive social beliefs. This contradicts Piko (2007), who found that girls were more influenced by the social effects of smoking than boys in countries with a more traditional gender culture, compared to the US (Piko et al., 2007). There are two ways in which we might explain the absence of a relation between the Gender Inequality Index and smoking beliefs. Firstly, we might suggest that the Gender Inequality Index score concerns countries as a whole, whereas our data only concerns one city in each country. Secondly, we might consider the components of the Gender Inequality Index and acknowledge how much it focuses on aspects of adult life, not adolescent life. To get closer to the gender context of adolescent life, therefore, it may be necessary to broaden the sample to the whole country and/or look at the gender context within schools, which has been proven to influence gendered substance use in adolescents (Grard et al., 2018).

Policy implications

Our results underlined the important potential of negative social beliefs: they displayed the largest gender and country variations and also displayed the largest differences between regular smokers and those who were not regular smokers. Negative aspects of smoking have

been core elements of prevention strategies over the last few decades. The health effects of smoking have been broadcast widely but, as argued by Ruiz-Moral (2015), the fact that negative outcomes of smoking are mostly long-term risks makes them difficult to use in prevention for adolescents. Our study, however, underlined that negative outcomes can also be short-term, such as “getting into trouble” or friends’ disapproval. These negative social beliefs could thus be key elements of smoking prevention programs in the future, particularly in the Netherlands and Ireland. In these national contexts, therefore, four main negative social beliefs, related to short-term disadvantages of smoking, should be emphasized in girl-specific prevention programs. First, prevention programs could address the fact that some parents would not let a smoker babysit their children, a common form of income for adolescents. Second, knowledge of smoking bans at school and similar sanctions should be reinforced, in order to highlight how smoking at school might get students into trouble. Third, parents should be involved in both preventing and sanctioning smoking and should clearly state their disapproval of smoking. Last but not least, the disapproval of smokers’ friends is also a short-term consequence of smoking and, because friends are particularly important in an adolescent’s life, smokers’ friends could be a factor in smoking prevention. Thus, peer-led interventions to prevent smoking could be particularly effective and further studies should pay attention to gender patterns in these interventions (Campbell 2008).

Nonetheless, boys might also benefit from gender-specific programs. We found that they were more likely to believe in the dating consequences of smoking: they indeed believed that smoking helps you to look masculine and get a girl/boyfriend and were less likely to believe that most people would not date a smoker. Prevention programs should, therefore, address these beliefs in order to reduce the social attractiveness of smoking, particularly in Ireland, Finland, and Portugal, which displayed the largest gender contrasts on this belief scale, with boys scoring more highly. This belief scale displayed, however, lower F-test

values between smoking statuses, compared to those of the negative social beliefs scale. The impact of such prevention programs on reducing regular smoking could thus be limited, although further studies need to test for this hypothesis with a longitudinal sample.

Two opposing strategies can be derived from our results. On the one hand, policy-makers might capitalize on these gender differences and reinforce prevention strategies that address negative social beliefs for girls and dating aspects of smoking for boys. There is a risk, however, that this might increase gender differences in beliefs. On the other hand, policy-makers might choose to do the opposite by, for example, reinforcing negative social beliefs in boys. The risk then is that this might not work, if boys are not sensitive to these arguments. Moreover, as we underlined in the introduction, boys' gender socialization encourages them to break the rules and engage in more deviant behavior. Thus, emphasizing how smoking might get them into trouble or that their parents would disapprove of their smoking might produce the opposite effect and increase their willingness to smoke.

Limitations

First, this study is cross-sectional, which prevents us from establishing a causal relationship between smoking beliefs and smoking intention. Nonetheless, many studies using the theory of planned behavior (I. Ajzen, 1991; Guo Q., 2007) have found a direct causal relation between smoking beliefs and later smoking status. Further studies are needed, however, to link our results regarding gender and beliefs to the actual uptake of the behavior. Second, we did not interview students throughout each country, but rather chose a single city in each, which corresponded to the mean socioeconomic situation of the country (Lorant 2016). Moreover, our study would have benefited from more in-depth analysis of contextual influences on smoking beliefs: more local analyses are needed to understand why particular smoking beliefs are more prevalent in some contexts.

Conclusions

In this paper, we developed a typology of beliefs that allowed us to make two assumptions. Our hypothesis that smoking beliefs would differ across genders was true for one out of two beliefs. More precisely, negative social beliefs were more frequently held by girls, while beliefs about the dating-related aspects of smoking (mostly positive social beliefs) were more frequently held by boys. To develop gender-specific interventions to target these kinds of beliefs, two opposing strategies might be used, depending on whether such programs are aimed at boys or girls; these might result in counterproductive effects. To reach a conclusion on the influence of negative social beliefs on later gender smoking status, further longitudinal studies are needed. Furthermore, we could not conclude that the gender equality context of a country was associated with these beliefs. Further studies could investigate the influence of more local gender contexts on smoking beliefs, within schools, for example.

Tables

Table 8.1. Typology of smoking beliefs: expectations of gender patterns according to the literature		
	Positive	Negative
Individual	Feeling relaxed (G) Losing weight (G)	Health risks (G) Physical appearance (G) Physical activity (B)
Social	Social influence (G) Social status/popularity (B&G) Attractiveness (B&G)	Friends' influence (G) Getting into trouble (G)
Note: B: expected to be more frequently quoted by boys; G: expected to be more frequently quoted by girls		

Table 8.2. Socio-demographic description of the sample according to gender. Silne R, 2016, N = 12 979.					
	Gender				chisq
	Girls		Boys		
	% of mean	N	% of mean	N	
Subjective socioeconomic status (mean, /10)	6.7	6293	6.8	6141	39.0**
Age (mean)	14.9	6517	15.08	6452	79.3**
Migration status (%)					0.4
Born in another country	8.4	546	8.7	561	
Born in this country	91.6	5974	91.3	5898	
Country (%)					34.4**
Belgium	14.7	960	15.1	977	
Ireland	16.8	1097	15.8	1018	
Finland	12.9	838	13.9	897	
Germany	11.5	748	11.6	749	
Italy	16.7	1090	13.6	880	
The Netherlands	13.5	877	15.2	984	
Portugal	14	910	14.8	954	
Educational level of mother (%)					40.5**
Low	14.4	940	13.5	871	
Medium	32.4	2112	30.9	1993	
High	39.2	2556	37.9	2449	
Other	0.2	14	0.1	7	
Unknown	12.6	822	15.9	1024	
Missing	1.2	76	1.8	115	
Educational level of father (%)					4.8
Low	17.9	1169	17.4	1123	
Medium	28.3	1847	28.7	1856	
High	35.1	2286	34.4	2223	
Other	0.1	7	0.1	9	
Unknown	17.1	1116	17.5	1128	
Missing	1.5	95	1.9	120	
Parental smoking (%)					11.5**
No parental smoking	84.7	5519	86.7	5602	
At least one parent smoker	15.4	1001	13.3	857	
Weekly smoking of students (%)					0.1
Not weekly smoker	88.6	5778	88.8	5737	
Weekly smoker	11.4	742	11.2	722	

*p<0.05; **<0.001

*p<0.05; **<0.001

Table 8.3. Percentage of agreement with each smoking belief, according to gender and country of data collection, analysis of variance (ANOVA, p value). *Silne R*, 2016/17, N = 12 979.

	BOYS					GIRLS					ALL	ANOVA gender (F)	Chisq for country						
	Bel	Ire	Fin	Ger	Ita	NL	Po	ALL	Bel	Ire				Fin	Ger	Ita	NL	Po	ALL
Positive individual beliefs																			
Feeling relaxed	49	49	28	37	47	50	43	44	49	44	25	36	56	50	39	43	44	0.1	60.6*
Losing weight	22	30	10	15	13	12	22	18	20	33	10	22	16	15	27	21	20	10.7*	67.6*
Positive social beliefs																			
Looking cool	13	18	7	7	19	14	13	13	11	15	7	8	18	14	10	12	13	1.3	31.1*
Looking grown-up	10	33	11	18	20	19	12	18	11	31	9	19	25	18	11	18	18	0.5	89.7*
Looking masculine	8	17	8	12	13	14	9	12	6	15	6	10	7	9	5	8	10	33.5*	25.5*
Looking feminine	2	7	5	4	6	4	3	5	5	3	2	3	8	3	3	4	4	2.9	9.8*
Getting a boy/girlfriend	4	10	6	4	11	6	5	7	3	6	4	4	5	5	4	4	6	29.8*	10.2*
Becoming popular	7	21	11	7	12	15	13	12	9	13	11	10	12	13	14	12	12	1.4	17.4*
-Appearing sexy	4	9	3	3	13	5	7	7	4	10	4	3	14	7	6	7	7	2.3	39.7*
Negative individual beliefs																			
Getting facial wrinkles	47	84	82	79	63	70	66	70	56	92	90	81	71	77	77	78	74	93.1*	165.5*
Having less ability to exercise	90	90	88	87	74	82	85	85	90	93	94	83	76	81	86	86	86	1.7	53.7*
Getting lung cancer	94	97	95	94	92	92	95	94	95	98	98	96	93	93	97	96	95	18.3*	14.8*
Having trouble breathing	92	93	91	95	88	91	91	91	93	97	96	95	92	92	95	94	93	37.8*	7.7*
Negative social beliefs																			
Getting into trouble	69	85	89	90	75	66	62	76	69	91	93	89	79	71	68	80	78	27.8*	136.9*
Most people reluctant to date	49	65	75	64	49	67	31	57	52	66	77	61	41	64	28	55	56	4.6*	191.7*
Parents' disapproval	95	98	98	82	95	96	95	95	96	99	98	81	95	97	98	95	95	4.6*	116.6*
Most people would not hire a smoker to babysit	71	82	88	87	78	81	64	79	72	87	88	88	73	82	63	78	78	0	91.4*
Best friends' disapproval	57	63	50	52	37	46	59	53	69	79	67	58	49	68	73	67	60	265.1*	64.6*
Teachers' disapproval	38	90	86	68	62	56	60	66	41	96	76	63	61	61	64	67	66	0.8	288.1*
i: Bel = Belgium; Ire = Ireland; Fin = Finland; Ger = Germany; Ita = Italy; NL = The Netherlands; PO = Portugal; All = All countries; * = p < 0.05; We controlled for multiple testing using the DUNCAN (alpha=0.05) version of the ANOVA procedure																			

: Bel = Belgium; Ire = Ireland; Fin = Finland; Ger = Germany; Ita = Italy; NL = The Netherlands; PO = Portugal; All = All countries; * = p < 0.05; We controlled for multiple testing using the DUNCAN (alpha=0.05) option of the ANOVA procedure.

Table 8.4. Percentage of agreement with each smoking belief, according to gender and country of data collection, analysis of variance (ANOVA, p value). Silae R, 2016, N = 12 979.

	BOYS			GIRLS			All			Group comparisons			
										ANOVA		ANOVA	
	Weekly smokers	Not weekly smokers	all	Weekly smokers	Not weekly smokers	all	Weekly smokers	Not weekly smokers	all	gender weekly smokers (F)	gender in not weekly smokers (F)	in smoking status (all, F)	ANOVA
Positive individual beliefs													
Feeling relaxed	86	38	44	88	38	43	87	38	44	2	1	1364.0*	
Losing weight	27	17	18	26	20	21	26	19	20	1	14.3*	47.9*	
Positive social beliefs													
Looking cool	17	13	13	14	12	12	16	12	13	2	0	11.9*	
Looking grown-up	16	18	18	13	19	18	15	18	18	3	2	12.5*	
Looking masculine	15	11	12	5	9	8	10	10	10	48.1*	13.8*	0	
Looking feminine	5	4	5	7	4	4	6	4	4	2	6.3*	15.3*	
Getting a boy/girlfriend	9	6	7	6	4	4	7	5	6	6.0*	24.1*	10.6*	
Becoming popular	9	13	12	8	12	12	9	13	12	2	1	19.8*	
Appearing sexy	14	6	7	12	7	7	13	6	7	1	4.9*	103.2*	
Negative individual beliefs													
Getting facial wrinkles	48	73	70	59	80	78	54	76	74	15.2*	81.8*	346.8*	
Having less ability to exercise	68	87	85	72	88	86	70	88	86	3	1	334.4*	
Getting lung cancer	87	95	94	89	97	96	88	96	95	2	17.8*	149.1*	
Having trouble breathing	80	93	91	85	96	94	83	94	93	5.6*	41.4*	263.2*	
Negative social beliefs													
Getting into trouble	47	80	76	53	83	80	50	81	78	5.4*	24.8*	764.9*	
Most people reluctant to date	42	59	57	44	57	55	43	58	56	1	6.8*	115.7*	
Parents' disapproval	85	96	95	88	96	95	86	96	95	3	2	266.4*	
Most people would not hire a smoker to babysit	64	80	79	63	81	78	64	80	78	1	0	218.8*	
Best friends' disapproval	20	57	53	25	72	67	22	64	60	6.1*	288.6*	1004.9*	
Teachers' disapproval	46	68	66	52	69	67	49	69	66	4.0*	0	219.1*	

* p<0.05. Note: we corrected for multiple testing using the DUNCAN test option of the ANOVA procedure.

Table 8.5. Coefficients of country gender differences for each smoking beliefs scale. Contrast coefficients, 95% IC, country classified according to Gender Index of Inequality from the most equal (The Netherlands) to the least (Ireland), Silnes R, 2016, N = 12 979.												
	Gender effect in smoking beliefs (female versus male)											
	positive individual				negative individual				positive social			
	Beta	95%IC			Beta	95%IC			Beta	95%IC		
All countries	0.03	0.00	0.05		0.04**	0.03	0.05		-0.11**	-0.15	-0.07	
The Netherlands (low Gender Index of Inequality)	0.04	-0.01	0.10		0.02	-0.01	0.05		-0.08	-0.18	0.01	
Finland	-0.08	-0.15	-0.01		0.06**	0.03	0.10		-0.20**	-0.32	-0.08	
Germany	0.10	0.03	0.16		0.00	-0.03	0.04		0.05	-0.07	0.17	
Belgium	-0.03	-0.08	0.02		0.03	0.00	0.07		-0.02	-0.13	0.09	
Italy	0.19**	0.14	0.24		0.05	0.02	0.08		-0.08	-0.17	0.00	
Portugal	0.00	-0.05	0.05		0.05**	0.02	0.08		-0.20**	-0.31	-0.10	
Ireland (high Gini)	-0.04	-0.08	0.00		0.04	0.02	0.07		-0.22**	-0.29	-0.15	
Model -2LogL	-39516				-30042				-21534		-27175	
*	=	<	0.05;		**				=	p	<	0.001;

Note: the coefficients are contrast estimates from one model for each belief scale.

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