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Multiple risk behaviour: increasing socio-economic gap over time?

Sabine Drieskens, Herman Van Oyen, Stefaan Demarest, Johan Van der Heyden, Lydia Gisle, Jean Tafforeau

Background: Unhealthy behaviours often occur in combination. In this study the relationship between education and lifestyle, defined as a cluster of risk behaviours, has been analysed with the purpose to assess socio-economic changes in multiple risk behaviour over time. **Methods:** Cross-sectional data from the Belgian Health Interview Surveys 1997, 2001 and 2004 were analysed. This study is restricted to persons aged ≥15 years with information on those health behaviours and education ($n = 7431$, $n = 8142$ and $n = 7459$, respectively). A lifestyle index was created based on the sum of the four unhealthy behaviours: smokers vs. non-smokers, risky versus non-risky alcohol use, sedentaryness vs. physically active and poor vs. healthy diet. The lifestyle index was dichotomized as low (0–2) vs. high (3–4). For the assessment of socio-economic inequalities in multiple risk behaviour, summary measures as Odds Ratio (OR) and Relative Index of Inequality (RII) were calculated using logistic regression, stratified by sex. **Results:** Of the adult population, 7.5% combined three to four unhealthy behaviours. Lower educated men are the most at risk. Besides, the OR among men significantly increased from 1.6 in 2001 to 3.4 in 2004 ($P = 0.029$). The increase of the OR among women was less pronounced. The RII, on the other hand, did not show any gradient, neither for men nor for women. **Conclusion:** Multiple risk behaviour is more common among lower educated people. An increasing polarization in socio-economic inequalities is assessed from 2001 to 2004 among men. Therefore, health promotion programmes should focus on the lower socio-economic classes and target risk behaviours simultaneously.

Keywords: educational attainment, multiple risk behaviour, polarization, Relative Index of Inequality, socio-economic differences.

Introduction

Smoking, risky alcohol drinking, sedentary lifestyle and poor diet are the most important unhealthy behaviours which contribute to increase morbidity and mortality.[1,2] Separately, these unhealthy behaviours have a major impact on the health status of a person. Combining these unhealthy behaviours enhances the risk of developing a disease.[2] Individuals often tend to combine several unhealthy behaviours[2–5] which exerts a multiplicative effect on health.[6,7] As these behaviours are preventable, reducing or eliminating them can be beneficial for health.[2,8]

Only a few studies, specifically, searched for the relation between multiple risk behaviour and socio-economic status. A consistent relation was shown between socio-economic status and lifestyle: low socio-economic groups generally have less favourable habits.[2,7,9,10] Moreover, even less studies focused on the evolution over time of the socio-economic inequalities related to unhealthy behaviour.[11]

The purposes of this article are, on the one hand, to analyse the association between a lifestyle index, defined as a cluster of four unhealthy behaviours and educational attainment at household level as indicator for the socio-economic status. The lifestyle index provides a comprehensive measure of healthfulness by summarizing the unhealthy behaviours.[12] The added value of this study is that the socio-economic variation in clustering unhealthy behaviours can be examined in order to identify those that are the most at risk. On the other hand, this article also aims to assess if, in Belgium, the socio-economic gap in multiple risk behaviour has widened in the period from 1997 to 2004. If so, is it attributed to a polarization between the lowest and the highest socio-economic classes or to a gradient between the different classes? The overall trend is that people live healthier over time, but maybe the higher class increasingly takes up healthy behaviours. This study contributes to the efforts of the WHO European Region to monitor the trend of socio-economic inequalities over time.[13]

Scientific Institute of Public Health, Epidemiology Unit, Brussels, Belgium

Correspondence: Sabine Drieskens, Scientific Institute of Public Health, Epidemiology Unit, J. Wytsmanstreet 14, 1050 Brussels, Belgium, tel: +32-2-6425025, fax: +32-2-6425410, e-mail: sabine.drieskens@iph.fgov.be

Method

Study population

The Belgian Health Interview Survey (HIS) is a cross-sectional study conducted in 1997, 2001 and 2004. A representative sample of the Belgian population was selected from the National Population Register by a multistage stratified procedure in which the household was used as the selection unit. The methodology was described by Van Oyen *et al.*[14] A total of 10 221 citizens in 1997, 12 050 in 2001 and 12 945 in 2004 were interviewed. The overall response rate was ~60% for the three surveys. The data were collected simultaneously for the same person through a face-to-face interview (including questions on education and nutrition) and a self-completed questionnaire (including questions on physical activity, smoking and alcohol). The questions in the self-completed questionnaire addressed only persons of age ≥15 years. This article is thus restricted to this age group and to those with available information on the following unhealthy behaviours and educational attainment (7431, 8142 and 7459 cases, respectively).

Lifestyle index

We defined the different unhealthy behaviours as follows:

- Current smoking[2,3,5,10,12]: person that has smoked at least 100 cigarettes in his/her lifetime and is currently either a daily or an occasional smoker;
- risky alcohol drinking[2,10]: either binge drinking, which is the consumption of six alcoholic drinks or more on one occasion in the past 6 months, or heavy drinking defined as the consumption of more than 14 alcoholic drinks per week for women and more than 21 alcoholic drinks per week for men[15,16];
- sedentary lifestyle[2,3,10,17,18]: person that never participates in any physical activity. This indicator is defined by the WHO instrument[19] using a self-evaluation of the physical activity level (intense, moderate, low or none) during leisure time;
- poor diet[2,10]: defined through a food frequency questionnaire as the consumption of fruits and vegetables less than 5 times per week.

A lifestyle index was created based on these four behaviours: current smokers (never/ex) vs. non-smokers, risky vs. non-risky alcohol drinking, sedentaryness vs. physically active and healthy vs. poor diet. All healthy behaviours got a score of 0, and the unhealthy ones to a score of 1. The sum of the unhealthy behaviours (range 0–4) was defined as the lifestyle index.[12] This index was dichotomized as low (0–2) vs. high (3–4 risk behaviours).[4,10,11,20] A high index corresponds to multiple risk behaviour.

Socio-economic status

Education was chosen as an indicator for socio-economic status because it can increase opportunities for income and job security. Detailed information on educational attainment was recoded into four educational categories as proposed by the Organisation for Economical Collaboration and Development (OECD):[21] no or primary education, secondary inferior, secondary superior and tertiary education. In our study, educational attainment at the household level, defined as the highest degree among the reference person or his/her partner, was used so that children still following education would not be assigned to their temporary education attainment. Similarly, it avoids that older women, generally having a lower education attainment, would get a lower classification. Another study analysing the HIS data indicates that there are no significant differences between education on individual and on household level.[22]

Data analyses

A first graphic presentation of the crude prevalence of the four behaviours gives an overview of the distribution by educational attainment, gender and year. Furthermore, an overview of the adjusted prevalences of multiple risk behaviour is tabulated according to these background variables. Age-adjusted prevalences were calculated through a mathematical standardization based on a logistic regression model (weight and strata taken into account) with the Belgian population of 2004 as reference and performed with SAS® 9.1. All the analyses are stratified by gender.

To assess the evolution of socio-economic inequalities over time, summary measures are computed as proposed by Mackenbach *et al.*[13] The first two methods are measures of 'effect' and are an indication for polarization between the extreme socio-economic classes. A disadvantage of this approach is that it only takes into account inequalities between the two extreme educational levels. The prevalence difference is the absolute difference between the age-adjusted prevalence of the lowest vs. highest educational attainment. Educational differences are further expressed as Odds Ratios (OR) with the highest category as reference. A convenient way of calculating ORs is to apply a logistic regression analysis in which multiple risk behaviour (dependent variable) is related to education (independent variable). The highest educational attainment is used as reference. Stata™ 10.1 is used, because the survey binomial GLM procedure allows taking the complex survey design into account. Also the variable 'region' (Brussels, Flemish and Walloon Region) is retained in the model because of significant regional differences.

The Population Attributable Risk (PAR) is a measure to assess the 'total impact'. It is calculated as the difference between the overall prevalence of multiple risk behaviour and the prevalence of the highest educational level, expressed as a percentage of the overall prevalence. It indicates the percent change that would occur if the total population had the same lifestyle as that of the higher educational group. A high PAR is an indicator of major socio-economic inequalities.

Finally, the Relative Index of Inequality (RII) is calculated. This measure can be interpreted as the relative risk of multiple risk behaviour of those at the bottom of the socio-economic hierarchy compared with those at the top of this hierarchy, assuming a systematic association between multiple risk behaviour and the relative socio-economic position across all educational groups. The detailed methodology has been described elsewhere.[23] The RII is calculated in a similar way as the OR, except that the categorical education variable was replaced by the ranked variable, which specifies for each educational group its position on a scale from 0 to 1. If the two lowest educational groups are 15 and 20% of the population, the ranked position of these two groups is 7.5 and 25%, respectively. The advantage of the RII is that it does not only measure the differences between the lowest and the highest socio-economic level but it also takes into account the intermediate levels.[24] So with this measure it can be assessed whether a gradient exists between the socio-economic position and multiple risk behaviour.

Confidence intervals are calculated at 95% level. The relative change over time of the summary measures is obtained by the ratio of the measures of 2001 to 1997 and 2004 to 2001. To determine the socio-economic inequalities between the lowest and highest educational level or between the different years, the interaction test is used. This test calculates the *z*-distribution and the corresponding *P*-value can be assessed. This method is described by Altman *et al.*[25] and has been applied in similar studies.[22]

Results

Around 7.5% of the adult population (≥15 years) in Belgium combines three or four unhealthy behaviours in the study period 1997–2001–2004. Men (10%) are twice more likely to have multiple risk behaviour than women (5%) ($P < 0.0001$). The most common combination of unhealthy behaviours, both for men and women, is a sedentary lifestyle, together with smoking and risky alcohol drinking, but the proportion of this combination declines in the study period: from 80% in 1997 to 68% in 2001 and 2004 among men and, respectively, from 73% to 58% and 54% among women. This decline is compensated by an increase in the combination of poor diet, smoking and risky alcohol drinking, the second most common combination among men (from 55% in 1997 to 61% in 2004); among women, the second most common combination is poor diet, sedentary lifestyle and smoking, but the prevalence of this combination is declining (from 50% in 1997 to 44% in 2004).

Figure 1 gives an overview of the distribution of each unhealthy behaviour and multiple risk behaviour by

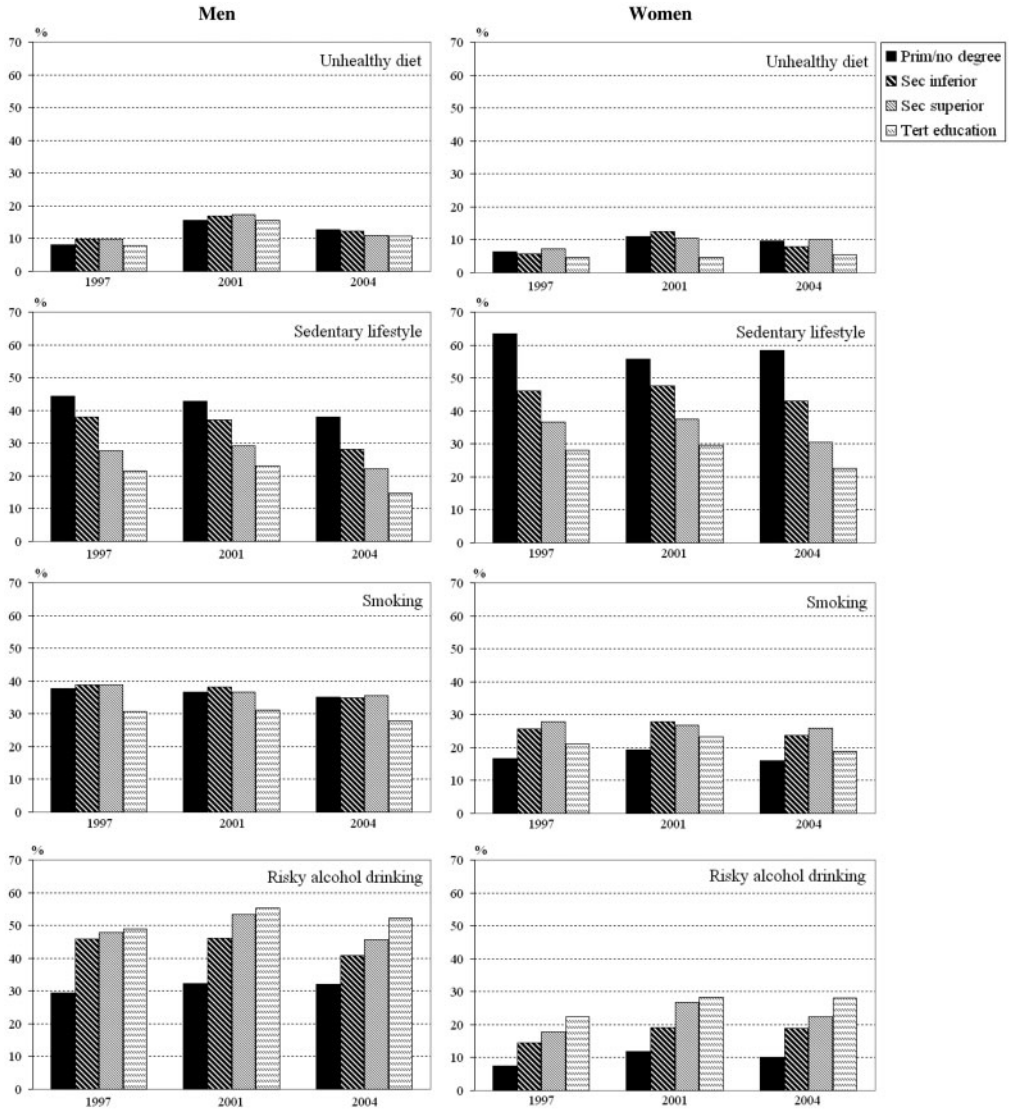

Figure 1 Distribution of the unhealthy behaviours by educational attainment and gender, population 15 years and older, HIS Belgium 1997, 2001 and 2004

educational attainment, gender and year. Unhealthy diet is the less prevalent behaviour, both for men (around 12%) and women (around 8%) and over the years no gradient in educational inequalities nor a clear time trend can be observed.

The most prevalent unhealthy behaviour among women is sedentaryness, fluctuating around 38%. Moreover, the prevalence of sedentaryness decreases with higher educational attainment: women with the lowest educational attainment are 2.3 times more frequently inactive during leisure time than women with the highest attainment. The same kind of gradient is observed among men. The prevalence of sedentaryness decreases over time in all educational levels, both for men and for women.

Men more often tend to smoke (around 35%); there are fewer smokers among the highest educated group only, the percentages for the three other educational groups are similar. Among women, these percentages are higher in the two intermediate educational groups. So no clear gradient is found for both sexes. Also smoking has a decreasing prevalence in time in all educational levels.

In contrast to the other unhealthy behaviours, risky alcohol drinking is the most prevalent for men with the highest educational attainment (among 46%) and only starts to decrease from 2001. In this case, a clear reverse gradient in educational inequalities is determined, except for 1997. The scenario for women is almost the same, except that the prevalences are lower, while the education-related inequalities are more pronounced and the reverse gradient also exists in 1997.

Overall for men, a decrease in prevalence of the four behaviours is assessed in each educational level between 2001 and 2004, but this decrease is the smallest in the lowest level. For women, no generalization can be made of the four behaviours.

Table 1 presents the age-adjusted prevalence of multiple risk behaviour by educational attainment and gender for the three survey years. Among men, the overall age-adjusted prevalence of multiple risk behaviour significantly declines from 10.1% in 2001 to 7.7% in 2004. Men with a tertiary education have the lowest age-adjusted prevalence for multiple risk behaviour in comparison with the other levels. The differences compared with primary level are significant in the three survey years ($P_{1997} < 0.003$; $P_{2001} = 0.014$; $P_{2004} < 0.003$). No significant evolution over time is observed, except for men with a secondary education for the period 2001–2004.

Among women, the overall age-adjusted prevalence of multiple risk behaviour significantly increases from 3.4% in 1997 to 4.7% in 2001. There are no socio-economic

Table 1 Age-adjusted[a] prevalence (and 95% CI) of multiple risk behaviour by educational attainment and gender, population aged ≥15 years, HIS Belgium 1997, 2001 and 2004

Educational attainment	1997		2001		2004		*P*-value 2001/1997	*P*-value 2004/2001
	Adj. % (95% CI)	Unweighted number	Adj. % (95% CI)	Unweighted number	Adj. % (95% CI)	Unweighted number		
Men								
Primary or no degree	10.4 (7.3–14.7)	562	11.3 (8.2–15.2)	590	16.4 (11.4–23.2)	465	0.726	0.121
Secondary inferior	14.8 (11.3–19.1)	645	13.7 (10.8–17.3)	731	8.8 (6.3–12.2)	585	0.667	*0.032*
Secondary superior	7.6 (5.7–10.2)	1135	11.4 (9.2–13.9)	1193	7.9 (6.1–10.1)	1096	*0.026*	*0.027*
Tertiary education	5.6 (4.0–7.8)	1238	6.8 (5.2–8.8)	1418	4.6 (3.4–6.2)	1376	0.368	0.055
Total	8.7 (7.7–10.1)	3580	10.1 (9.0–11.4)	3932	7.7 (6.6–8.9)	3522	0.105	*0.005*
Women								
Primary or no degree	2.9 (1.7–4.8)	662	6.9 (4.6–10.1)	690	6.3 (3.7–10.3)	654	*0.009*	0.779
Secondary inferior	3.8 (2.4–6.0)	689	5.4 (3.7–7.6)	801	5.5 (3.5–8.6)	706	0.238	0.952
Secondary superior	3.2 (2.2–4.5)	1203	4.3 (3.2–5.9)	1263	3.0 (2.1–4.3)	1137	0.219	0.134
Tertiary education	2.5 (1.7–3.6)	1297	3.7 (2.6–5.2)	1456	2.9 (1.9–4.4)	1440	0.134	0.379
Total	3.4 (2.7–4.1)	3851	4.7 (4.0–5.6)	4210	4.0 (3.2–4.8)	3937	*0.018*	0.230

a: Reference: Belgian population 2004

Table 2 Inequalities in multiple risk behaviour by educational level and gender, summary measures, population aged ≥15 years, HIS Belgium 1997, 2001 and 2004

Summary measures	1997	2001	2004	Relative change 2001/1997	*P*-value 2001/1997	Relative change 2004/2001	*P*-value 2004/2001
Men							
Prevalence difference (%), lowest minus highest educational level	4.9	4.5	11.8	0.9		2.6	
Population attributable risk (%)	36.2	33.3	40.4	0.9		1.2	
Odds ratio (95% CI), lowest vs. highest educational level	1.8 (1.2–2.9)	1.6 (1.1–2.5)	3.4 (2.0–5.6)	0.9	0.704	2.1	*0.025*
Relative Index of Inequality (95% CI)	1.2 (0.6–1.7)	0.9 (0.4–1.3)	1.4 (0.8–2.1)	0.8	0.472	1.6	0.254
Women							
Prevalence difference (%), lowest minus highest educational level	0.4	3.2	3.4	8		1.1	
Population attributable risk (%)	25.7	20.9	27.3	0.8		1.3	
Odds Ratio (95% CI), lowest vs. highest educational level	1.1 (0.6–2.1)	1.8 (1.1–3.1)	2.1 (1.1–4.1)	1.6	0.234	1.2	0.719
Relative Index of Inequality (95% CI)	0.4 (0.0–1.1)	0.7 (0.0–1.4)	1.0 (0.1–2.0)	1.8	0.535	1.4	0.726

inequalities for multiple risk behaviour in 1997: the age-adjusted prevalence fluctuates around 3%. Socio-economic inequalities between the lowest and highest educational levels are observed in 2001 ($P = 0.018$) and 2004 ($P = 0.021$): 7% in the lowest level compared with ∼3% in the highest. Furthermore, the prevalence of multiple risk behaviour in the different educational levels barely change over time; only a significant increase is observed between 1997 and 2001 for those with a primary or no degree.

Table 2 gives an overview of summary measures for socio-economic inequalities in multiple risk behaviour. Among men, the prevalence difference between the lowest and the highest educational level remains almost the same in 2001 as in 1997, but then rises from 4.5% to 11.8% in 2004, resulting in a relative change of 2.6. The PAR in 1997 can be interpreted as a 36% reduction in the overall prevalence of multiple risk behaviour if the whole Belgian population experiences the same prevalence of the highest educational level. This reduction increases from 33% in 2001 to 40% in 2004, resulting in a relative change of 1.2. The OR is doubled from 1.6 in 2001 to 3.4 in 2004; this increase is significant. The final measure of inequality is the RII and it shows no significant differences over the years for multiple risk behaviour.

Among women, the prevalence difference between the lowest versus highest educational level is only 0.4% in 1997, but increases to 3.2% in 2001 and 3.4% in 2004. Compared to men, a lower PAR is assessed and this PAR fluctuates ∼25%. The OR nearly doubles from 1997 to 2004, but this increase is not significant. The RII is lower than 1 in 1997 and 2001, but this index increases, although not significantly, to 1.0 in 2004.

Discussion

One of the WHO Regional Health for All Targets is that 'by the year 2020, the health gap between socio-economic groups within countries should be reduced by at least one-fourth in all Member States, by substantially improving the health of disadvantaged groups'.[26] Four different summary measures are evaluated in this study to assess socio-economic inequalities in lifestyle. Simple measures such as the prevalence difference, the PAR and the OR, can easily be calculated and interpreted, but the problem is that they ignore parts of available information (e.g. the in-between social groups). On the contrary, the more sophisticated measure RII does take more of the available information into account (e.g. the population size of groups), but has a more complex

interpretation. The advantage is that this index facilitates the comparison over time. In this article, both approaches are used since they are complementary and can be checked against one another.[13,23]

Among men, the prevalence difference and the OR especially increased from 2001 to 2004, clearly indicating a polarization between the lowest and the highest educational level of multiple risk behaviour. As the RII is almost equal to 1 and does not change over time, we cannot speak of a gradient between the different educational levels. This corresponds with the findings of the age-adjusted prevalence. The widening between the lowest and highest educational level can be attributed to the fact that multiple risk behaviour in the lowest level is worsening and in the highest level is improving between 2001 and 2004. From our figures, it is difficult to say which specific behaviour is responsible, but the prevalence of poor diet and risky alcohol drinking among the lowest educated increased from 1997 to 2001 and barely decreased afterwards. Contrary to men, the prevalence difference and the OR among women increase, although not significantly, from 1997 to 2001. So there is a tendency to polarization between the lowest and the highest educational level. The fact that the RII shows no gradient between the educational levels can be attributed to the non-linear relation between the age-adjusted prevalence of multiple risk behaviour and educational attainment. Besides, this RII almost does not change over time. Nevertheless, based on these summary measures, together with the outcome of the age-adjusted prevalence, the following conclusion can be drawn: the prevalence of multiple risk behaviour among lower educated women is worsening, but the socio-economic differences are less pronounced than among men. If one behaviour is responsible for this increase in prevalence of multiple risk behaviour, then it would probably be poor diet.

The overall conclusion of this article is that cumulating several unhealthy behaviours is not uncommon in the adult Belgian population. Multiple risk behaviour is more frequent in men and in lower educational groups. This is similar to the findings in other countries.[2,7,11,27] Our analyses also show a significant increasing polarization from 2001 to 2004 for multiple risk behaviour among men, widening the socio-economic gap. A study conducted in the USA in the period 1990–2004 also found that the relative socio-economic inequalities worsened in some states.[28] Finally, it needs to be mentioned that the RII was not very contributive in this study, probably because the data did not fit well.

This article has several strengths. The National Health Interview Survey is an appropriate tool to study multiple risk behaviour[29] in relation to the socio-economic status because of the horizontal approach of the data collection: several types of information (health status, health determinants, personal characteristics, etc.) are collected at the same time for the same person. The survey method did not change over time and includes a large sample of the general population.[11] Unfortunately there are also some limitations. Sensitive variables, such as smoking, alcohol consumption and physical activity may be reported with less accuracy which can result in an underestimation of multiple risk behaviour.[3,30] Also the definition of poor diet can contribute to this underestimation. This definition was the most difficult, because the subject of nutritional behaviour is extensive. We only focused on the frequency of fruit and vegetable consumption, because it is a good indication of healthy eating habits. Maybe this 'large' definition (no details on daily consumption and no precisions on portion size) has led to the fact that no gradient in socio-economic inequalities could be shown. Moreover, it is not impossible that the small socio-economic inequalities in multiple risk behaviour are a result of a dilution effect caused by the inversed gradient in socio-economic inequalities[28] for risky alcohol drinking in comparison to sedentary lifestyle. Probably smoking has to be taken into account too for this dilution effect because there is no clear gradient in socio-economic inequalities and this, contrary to what the literature usually shows.[31] Furthermore, studies indicate that people with a lower socio-economic status are less likely to participate in health surveys.[32,33] Lorant *et al.*[34] have hypothesized that people with a low socio-economic status are more at risk for unhealthy behaviours, but because of the fear for stigmatization, they refuse to participate. Another shortcoming of this study is the mix of different lifestyle behaviours and more particularly the cut-off points for defining the unhealthy behaviours to create the lifestyle index, as no single instrument or procedure is optimal.[1] Dichotomization of the lifestyle index represents a major simplification,[8,20] but it makes interpretation of such a complex matter easier.

Health behaviour is not only a matter of personal choice but is also linked to educational attainment.[4] Consequently, it may be beneficial to develop prevention and promotion programmes which focus on the lower socio-economic groups.[9,11,35] Targeting risk behaviours simultaneously or sequentially, because of the cluster effect, is a surplus value of these intervention programmes.[8,20,36] Keep on tackling the socio-economic inequalities needs to be the message. Because this study is only based on a relatively short-term time period (8 years), long-term studies are needed to follow-up this problem in the future.

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Conflicts of interest: None declared.

Key points

- Studying the socio-economic variation in multiple risk behaviour to target the population groups at risk.
- Monitoring the trend of socio-economic inequalities in multiple risk behaviour over time.
- Tackling the socio-economic inequalities in multiple risk behaviour is still necessary, especially among men.
- Targeting risk behaviours simultaneously is a surplus value of prevention and health promotion programmes.

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