Educational inequalities in quantity, duration and type of tobacco consumption among lung cancer patients in Asturias: Epidemiological analyses

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Socioeconomic inequalities cause different tobacco consumption patterns. The purpose of this study was to examine the relationship between educational level and smoking behaviour, including type of tobacco consumption, in lung cancer patients. To this end, epidemiological analyses of 801 lung cancer patients recruited for a case-control study in four public hospitals in Asturias, Spain, between October 2000 and April 2006 were carried out. Smoking behaviour and educational level data were obtained through personal interview. Analyses indicated that the probability of heavy smoking among low educational-level patients was approximately twice as high as for high educational-level patients (RRR>31.2packs/years = 2.04; CI 95%= 1.15-3.62; RRR>52packs/years= 2.14; CI 95%= 0.98-4.64). Low-educated patients were more than three times as likely to be long-time smokers (RRR>40years= 3.30; CI 95%= 1.43-7.62). The probability of smoking exclusively black tobacco was almost four times greater in low educational-level patients (RRRblack only= 3.72; CI 95%= 1.23-11.19). The results show that there are broad educational inequalities with regard to the quantity, duration and type of tobacco consumption among lung cancer patients in Northern Spain.

Desigualdades educativas según la cantidad, duración y tipo de tabaco consumido en pacientes con cáncer de pulmón en Asturias: análisis epidemiológicos. Las desigualdades socioeconómicas causan diferentes patrones de consumo tabáquico. El objetivo de este estudio fue examinar la relación entre el nivel educativo y el hábito tabáquico en pacientes con cáncer de pulmón. Para ello se llevaron a cabo análisis epidemiológicos en 801 casos de cáncer de pulmón reclutados en un estudio caso-control de Asturias, entre octubre de 2000 y abril de 2006. Los datos relativos al hábito tabáquico y al nivel educativo fueron obtenidos mediante entrevista personal. La probabilidad de ser gran fumador entre pacientes de bajo nivel educativo es aproximadamente dos veces mayor que en pacientes con nivel educativo alto (RRR>31,2paquetes-año = 2,04; IC95% = 1,15-3,62; RRR>52paquetes-año= 2,14; IC95%= 0.98-4.64). Los pacientes con bajo nivel educativo fumaban durante más tiempo (RRR>40años= 3,30; IC95%= 1,43-7,62) y tenían cuatro veces más probabilidades de fumar exclusivamente tabaco negro (RRRsolo tabaco negro= 3,72; IC95%= 1,23-11,19). Los resultados indican que existen grandes desigualdades educativas en relación a la cantidad, duración y tipo de tabaco consumido entre los pacientes de cáncer de pulmón en Asturias.

Smoking and smoking-related diseases are crucial determinants of socioeconomic inequalities in health (Cavelaars et al., 2000; Huisman, Kunst, & Mackenbach, 2005a; Mackenbach et al., 2004). Among men in Western Europe specifically, lung cancer was found to be the second largest contributor to educational inequalities in mortality (Huisman et al., 2005). The patterns of the tobacco smoking epidemic and the consequent rise of socioeconomic inequalities in lung cancer mortality in developed countries world-wide have been well-characterised (López, Collishaw, & Piha, 1994; Peto, López, Boreham, Thun, & Heath, 1994). The tobacco epidemic is classically presented as a habit that initially diffuses through the most educated groups of society before progressively migrating and becoming established amidst the less educated population. However, while the general patterns of the smoking epidemic occur globally, specific smoking behaviours and their effect on societal health inequalities tend to develop uniquely in different national settings (Giskes et al., 2005; Kunst, Groenhof, Mackenbach, & Health, 1998). For this reason, public interventions meant to prevent the growth of socioeconomic disparities in lung cancer mortality should reflect the specific timing and nature of smoking behaviour within the population in question.

Spain and its Southern European neighbours provide compelling national settings in which to actively anticipate the rise of such

health inequalities. In Spain, as in Italy, Portugal and Greece, the smoking epidemic has been shown to be less advanced than in other Western European countries (Giskes et al., 2005; Huisman, Kunst, & Mackenbach, 2005a). Recent studies specifically locate Spain within the 3rd stage of the classically-described smoking epidemic (Cavelaars et al., 2000; Graham, 1996; Schiaffino et al., 2003), a stage during which smoking prevalence in the male population generally decreases disproportionately among those of higher socioeconomic status, whereas women of all socioeconomic levels of society reach their peak prevalence rate of smoking before a decrease in prevalence occurs exclusively among higher educated women. These trends typically precede the progressive transformation of smoking into a habit of the lower educated groups of society, a transformation which can only serve to amplify socioeconomic health inequalities within the society in question. Currently, however, while overall lung cancer mortality is rising in Spain, recent investigation suggests that less educated men and women are still generally benefiting from lower lung cancer mortality rates (Mackenbach et al., 2004). It is thus an opportune moment to analyse specific smoking tendencies in relation to educational level within this population vulnerable to an impending shift and growth of socioeconomic inequalities in mortality.

A number of international, national and regional studies have described educational gradients in smoking tendencies —largely smoking initiation and cessation— among the general population in Spain in recent years. These investigations suggest that there are educational inequalities in the prevalence and duration of tobacco consumption in this population

In Spain, there is an additional variable in smoking behaviour that must be considered. There are two types of tobacco used in manufactured cigarettes in European countries: black and blond. Blond tobacco is usually either air-cured or flue-cured and is not typically fermented, whereas black tobacco —grown mainly in Central and South America, Cuba, Spain and France— undergoes a necessary process of air-curing and fermentation before resulting in a tobacco adequate for consumption («Physicians for a Smoke-Free Canada», 2009). Higher socioeconomic status has been linked to greater blond tobacco consumption as opposed to black tobacco in Spain (Shafey et al., 2004); blond tobacco is similarly the type of tobacco historically favoured by Spanish women (Shafey et al., 2004), although much more investigation of this smoking variable is needed to reinforce the socioeconomic and gender-based links to consumption of specific tobacco type.

The purpose of this study, therefore, was to evaluate in a geographically-based sample of lung cancer patients the association between educational level and quantity, duration and type of tobacco consumption.

Method

Participants

The subjects for this epidemiological study were recruited for the *Cáncer de Pulmón en Asturias* (CAPUA) study, a hospital-based case-control study conducted in the «*Unidad de Epidemiología Molecular del Cáncer, Instituto Universitario de Oncología*» of the University of Oviedo. The detailed methods of recruiting participants for this study have been described elsewhere (Fernández-Rubio et al., 2008; González-Arriaga et

al., 2008; López-Cima et al., 2007; Marín et al., 2004). Briefly, a total of 801 cases were recruited in four main hospitals of Asturias, Spain following an identical protocol from October 2000 to April 2006. Eligible cases were incident cases of histological confirmed lung cancer between 30 and 85 years of age and residents in the geographical area of each participating hospital for at least six months before diagnosis. Patients with primary cancer other than lung cancer occurring in the previous five years were excluded. The hospitals' ethical committees approved the study and written consent was obtained from each participant.

Procedure

Data collection

Information on participants' smoking behaviour and education was collected personally by trained interviewers using computer-assisted questionnaires during the first hospital admission for lung cancer diagnosis. A total of 976 eligible cases consented to study participation. Of these cases, 91.4% of the participants (892 cases) were interviewed, so 84 individuals without interview were excluded from analyses. Ninety-one cases with missing information in the questionnaires were also excluded from analyses. Thus, the final study population available for this investigation included 801 cases.

Tobacco smoking behaviour

Participants were defined as never smokers if they had not smoked more than 100 cigarettes in their lifetime and were defined as ever smokers otherwise. Ever smokers were further classified as current smokers if they had smoked at least one cigarette per day for the previous six months or longer. Individuals who had smoked regularly but had stopped smoking at least one year before the interview were defined as former smokers; those who had stopped smoking less than one year before the interview were defined as current smokers. Ever smokers were asked the duration in years that they had smoked at least one cigarette daily and how many cigarettes they normally consumed daily. Smoking intensity was further characterized in pack-years (PY), defined as the number of packs of cigarettes smoked per day multiplied by the number of years smoking. Subjects were categorized as light (<31.2 PY) or heavy (≥31.2 PY) smokers, based on median cumulative tobacco consumption in the control group. Subjects were also categorized in four categories of smoking quantity based on quartiles of the quantity of smoking in the control group. Duration of smoking was categorized according to scientific literature (Samanic et al., 2006) in order to compare our findings with the results in other studies. The type of tobacco consumed by subjects was ascertained by asking ever smokers which type of tobacco they normally smoked, with response options being «black tobacco», «blond tobacco» or «both».

Educational level

Education was chosen as an indicator of socioeconomic status because educational level appears to be more closely related to smoking habits than income in most European countries, and specifically in Spain (Huisman, Kunst, & Mackenbach, 2005b). Three educational levels were formed according to national

classification schemes and using guidelines from the International Standard Classification of Education (UNESCO, 1997): (1) early primary education (first six years of compulsory education) or less; (2) completion of primary and lower secondary education; and (3) completion of upper secondary and tertiary education, which included all vocational and university education. These categories were respectively designated as «low», «medium» and «high» educational groups for the purpose of our analyses. This variable was used as response variable.

Data analysis

To assess the independence of two categorical variables the chi-square test was applied. Multinomial logistic regression (Hosmer & Lemeshow, 2009) with adjustment for age (continuous) and gender (male/female) was performed to evaluate the association between tobacco and educational level. Adjusted Relative Risk Ratios (RRRs) («Stata Services», 2009) and their 95% confidence intervals (95% CI) were calculated for the variables of interest. P-value for trend was also calculated for each risk factor. P-values less than 0.05 were considered statistically significant. All statistical analyses were performed with STATA/SE version 8.2 software.

Results

Subject characteristics

The analysis included 801 lung cancer cases from the population of Asturias in Northern Spain. Table 1 presents the distributions of gender, age, educational level, family cancer history, smoking status, and specific smoking behaviour data for study subjects.

Educational level and smoking tendencies

There were various significant differences in tobacco consumption trends in relation to the educational level of our subjects.

Table 2 presents the association between smoking characteristics and educational level. Using the high-educated subjects as the comparison group and adjusting for age and gender, the probability of being a heavy smoker, defined in this study as >31.2 pack-year or >52 pack-year smoking history, was approximately two times higher for low educational level subjects than for subjects in the high education group (adjusted $RRR_{>31.2pack-years}$: 2.04; CI 95% 1.15-3.62 and adjusted $RRR_{>52pack-years}$: 2.14; CI 95% 0.98-4.64 (P-trend<0.05), respectively). Similarly, low educational level subjects were twice as likely to smoke any quantity of cigarettes/day (adjusted $RRR_{11-20cig/day}$: 2.11; CI 95% 1.06-4.22, adjusted $RRR_{21-30cig/day}$: 1.72; CI 95% 0.77-3.82, and adjusted $RRR_{>30cig/day}$: 1.99; CI 95% 0.96-4.15) and more than three times as likely to be long-time smokers (>40 years smoking history) than subjects in the high educational group (adjusted $RRR_{>40years}$: 3.30; CI 95% 1.43-7.62, P-trend<0.05). This trend was also observed in the analysis of men alone (table 3).

Our data showed a clear association between educational level and type of tobacco smoked by our study subjects. Low-educated patients smoke fundamentally black tobacco only (82%). 16% of high-educated patients smoke blond tobacco only. Low-educated patients were almost 4 times more likely to smoke exclusively black

tobacco than their high-educated counterparts (adjusted $RRR_{black\ only}$: 3.72; 95% CI 1.23-11.19, P-trend<0.05). When stratifying these results by gender, this educational gradient in black tobacco consumption was observed in both men and women, although these results did not reach statistical significance (adjusted $RRR_{black\ only\ (Men)}$: 4.03; 95% CI 0.89-18.31; adjusted $RRR_{black\ only\ (Women)}$: 5.35; 95% CI 0.55-52.41).

The adjusted relative risk ratio (RRR) was slightly lower for ever smoking vs. never smoking than for current smoking vs. never smoking when using the high education group as the

Table 1 Characteristics of lung cancer cases		
	Cases (n= 801)	
	N	**%**
Gender		
Male	719	89.76
Female	82	10.24
Age (Median, p25; p75)	68	58; 74
Educational level		
Low	238	30.05
Medium	367	46.34
High	185	23.36
Family history of cancer		
No	446	60.68
Yes	289	39.32
Ever smokers		
Never	51	6.38
Ever	749	93.63
Tobacco status		
Never	51	6.46
Former	341	43.16
Currrent	398	50.38
Smoking quantity (cig/day) (Median, p25; p75)	25	20; 40
Smoking quantity (cig/day)		
Never	51	6.46
1-10	59	7.48
11-20	305	38.66
21-30	133	16.86
>30	241	30.54
Smoking duration (years) (Median, p25; p75)	43	36; 53
Pack-year (Median, p25; p75)	54	39; 82
Pack-year		
Non-smoker	51	6.53
≤31.2	118	15.11
>31.2	612	78.36
Type of cigarette tobacco smoked		
Non-smoker	51	6.42
Black only	565	71.16
Blond only	72	9.07
Both	106	13.35

reference in comparison to the low education group (adjusted RRR: 2.41; 95% CI 0.82-7.07 and adjusted RRR: 2.56; 95% CI 0.85-7.68, respectively), suggesting that high-educated lung cancer patients in our study have a higher rate of quitting smoking than their low-educated counterparts. This trend was maintained when stratifying for gender but was no longer statistically significant (Men: adjusted RRR: 3.06; 95% CI 0.67-13.93 and adjusted RRR: 3.23; 95% CI 0.70-15.03; Women: adjusted RRR: 3.87; 95% CI 0.55-27.22 and adjusted RRR: 5.27; 95% CI 0.61-45.64).

Discussion and conclusion

Summary of findings

Our results reflect prominent educational inequalities with respect to the quantity, duration and specific type of tobacco consumption among lung cancer patients in Asturias, Spain. Subjects of low educational level smoked more, longer and more often exclusively black tobacco than their high-educated counterparts. All of these associations were statistically significant.

Table 2
Association between smoking and educational level

| | Educational level | | | | | | RRR[b] [95%CI] | |
	Low (n =238)		Medium (n = 367)		High (n = 185)		p-value[a]	Low	Medium
	N	%	N	%	N	%			
Smoker									
Never	16	6.72	24	6.54	10	5.43	0.845	1.00	1.00
Ever	222	93.28	343	93.46	174	94.57		2.41 [0.82-7.07]	1.14 [0.47-2.76]
Tobacco status									
Never	16	6.75	24	6.65	10	5.52		1.00	1.00
Former	116	48.95	160	44.32	63	34.81	**<0.05**	2.42 [0.80-7.28]	1.28 [0.51-3.20]
Current	105	44.30	177	49.03	108	59.67		2.56 [0.85-7.68]	1.02 [0.41-2.51]
								p-trend 0.281	*p-trend* 0.427
Pack-year (2 categories)									
Never or ≤31.2 PY	44	18.72	78	21.91	45	24.86	0.316	1.00	1.00
>31.2 PY	191	81.28	278	78.09	136	75.14		**2.04 [1.15-3.62]**	1.29 [0.81-2.04]
Pack-year (4 categories)									
Never or ≤15 PY	30	12.76	37	10.39	20	11.05		1.00	1.00
15-31.2 PY	14	5.96	41	11.52	25	13.81	**<0.05**	0.94 [0.35-2.49]	1.33 [0.61-2.93]
31.2-52 PY	52	22.13	118	33.15	52	28.73		1.72 [0.75-3.93]	1.78 [0.88-3.60]
>52 PY	139	59.15	160	44.94	84	46.41		2.14 [0.98-4.64]	1.36 [0.69-2.67]
								p-trend **<0.05**	*p-trend* 0.623
Smoking quantity (Cig/Day)									
Never or ≤10 cig/day	37	15.61	47	13.05	25	13.73		1.00	1.00
11-20	97	40.93	145	40.28	59	32.42	0.305	**2.11 [1.06-4.22]**	1.66 [0.90-3.05]
21-30	36	15.19	56	15.56	40	21.98		1.72 [0.77-3.82]	1.10 [0.56-2.22]
>30	67	28.27	112	31.11	58	31.87		1.99 [0.96-4.15]	1.45 [0.77-2.77]
								p-trend 0.341	*p-trend* 0.814
Smoking duration (Years)									
Never or ≤20 years	22	9.32	36	10.03	21	11.60		1.00	1.00
21-40	42	17.80	142	39.55	88	48.62	**<0.05**	1.58 [0.66-3.77]	1.30 [0.67-2.54]
>40	172	72.88	181	50.42	72	39.78		**3.30 [1.43-7.62]**	1.51 [0.77-2.97]
								p-trend **<0.05**	*p-trend* 0.231
Type of cigarette tobacco smoked									
Non-smoker	16	6.72	24	6.61	10	5.50		1.00	1.00
Black only	196	82.36	257	70.80	106	58.24	**<0.05**	**3.72 [1.23-11.19]**	1.52 [0.62-3.75]
Blond only	13	5.46	27	7.44	30	16.48		1.24 [0.37-4.19]	0.61 [0.23-1.65]
Both	13	5.46	55	15.15	36	19.78		0.90 [0.26-3.15]	0.99 [0.38-2.60]
								p-trend **<0.05**	*p-trend* **<0.05**

[a] Two -sided Chi-squared
[b] Relative Risk Ratio adjusted by age and gender (High= comparison group)

The marked educational inequalities in smoking tendencies were found in similar measure in the male and female population when stratifying results by gender. Comparison of the adjusted relative risk ratios for ever smoking vs. never smoking and current smoking vs. never smoking between the high and low educational groups additionally suggests that subjects of low educational level quit smoking less than high-educated subjects.

Several studies have described educational gradients in smoking tendencies —largely smoking initiation and cessation— among the general population in Spain in recent years. These investigations suggest that there are educational inequalities in the prevalence and duration of tobacco consumption in this population, according to our results. It has been observed that tobacco consumption is declining less among low educated smokers compared to their more educated counterparts (Fernández et al., 2001; Fernández, Schiaffino, García, & Borras, 2001; Giskes et al., 2005; Schiaffino et al., 2007) and that smoking initiation rates are now higher among less educated men and women (Schiaffino et al., 2003). In accordance with classically-observed patterns of the smoking epidemic, the relationship between low education level and increased tobacco consumption was first noted among male smokers and is subsequently being observed among the female

Table 3
Association between smoking and educational level in male subjects

	Educational level						p-value[a]	RRR[b] [95%CI]	
	Low (n =215)		Medium (n = 328)		High (n = 166)			Low	Medium
	N	%	N	%	N	%			
Smoker									
Never	3	1.40	5	1.52	5	3.03	0.424	1.00	1.00
Ever	212	98.60	323	98.48	160	93.97		3.06 [0.67-13.93]	2.23 [0.63-7.93]
Tobacco status									
Never	3	1.40	5	1.55	5	3.09		1.00	1.00
Former	114	53.27	153	47.52	62	38.27	0.053	3.10 [0.67-14.35]	2.45 [0.68-8.85]
Current	97	45.33	164	50.93	95	58.64		3.23 [0.70-15.03]	2.03 [0.56-7.30]
								p-trend 0.430	*p-trend 0.767*
Pack-year (2 categories)									
Never or ≤31.2 PY	25	11.79	48	15.14	34	20.99	**0.050**	1.00	1.00
>31.2 PY	187	88.21	269	84.86	128	79.01		**2.32 [1.27-4.25]**	1.50 [0.92-2.46]
Pack-year (4 categories)									
Never or ≤15 PY	13	6.13	17	5.36	14	8.64		1.00	1.00
15-31.2 PY	12	5.66	31	9.78	20	12.35	**<0.05**	1.01 [0.33-3.08]	1.59 [0.63-4.01]
31.2-52 PY	50	23.59	111	35.02	47	29.01		2.04 [0.83-5.06]	**2.36 [1.06-5.28]**
>52 PY	137	64.62	158	49.84	81	50.00		**2.52 [1.08-5.87]**	1.80 [0.84-3.87]
								p-trend <0.05	*p-trend 0.326*
Smoking quantity (Cig/Day)									
Never or ≤10 cig/day	20	9.34	27	8.41	20	12.27		1.00	1.00
11-20	93	43.46	132	41.12	51	31.29	0.186	**2.71 [1.28-5.73]**	**2.16 [1.10-4.23]**
21-30	34	15.89	53	16.51	37	22.70		1.96 [0.85-4.54]	1.35 [0.65-2.84]
>30	67	31.31	109	33.96	55	33.74		**2.50 [1.15-5.40]**	1.82 [0.92-3.62]
								p-trend 0.254	*p-trend 0.647*
Smoking duration (Years)									
Never or ≤20 years	8	3.76	16	5.00	14	8.64		1.00	1.00
21-40	36	16.90	125	39.06	77	47.53	**<0.05**	1.54 [0.55-4.31]	1.60 [0.73-3.52]
>40	169	79.34	179	55.94	71	43.83		**3.48 [1.33-9.13]**	1.98 [0.91-4.34]
								p-trend <0.05	*p-trend 0.089*
Type of cigarette tobacco smoked									
Non-smoker	3	1.39	5	1.54	5	3.07		1.00	1.00
Black only	191	88.84	247	76.24	101	61.96	**<0.05**	4.03 [0.89-18.31]	2.62 [0.73-9.34]
Blond only	8	3.72	20	6.17	26	15.95		0.94 [0.17-5.25]	0.92 [0.23-3.66]
Both	13	6.05	52	16.05	31	19.02		1.09 [0.21-5.62]	1.86 [0.49-7.02]
								p-trend <0.05	*p-trend 0.104*

[a] Two -sided Chi-squared
[b] Relative Risk Ratio adjusted by age and gender (High= comparison group)

population of smokers in Spain (Fernández et al., 2001; Fernández, Schiaffino, García, & Borrás, 2001; Schiaffino et al., 2003; Schiaffino et al., 2007). One recent international study additionally cites strong cross-sectional evidence that lower educated smokers consume larger quantities of cigarettes than their more educated counterparts (Giskes et al., 2005). Less educated people carry out mainly manual jobs so, similarly, several studies have reported the same differential cigarette smoking patterns related to occupation: blue-collar workers (mainly manual workers and therefore less educated) were more likely to report current and daily smoking compared with white-collar workers (higher educated) (Hrubá et al., 2009; Lawrence, Fagan, Backinger, Gibson, & Hartman, 2007; Sorensen, Barbeau, Hunt, & Emmons, 2004). In relation to association found for type of tobacco smoked, it is remarkable that black tobacco is cheaper than blond tobacco, being therefore more accessible for less educated persons.

In the case of our study, the described greater quantity and longer duration of tobacco consumption, the lower rates of smoking cessation and, perhaps most characteristically, the preferential use of black tobacco are all factors which may potentiate the connection between lower educational level and negative health trends in Northern Spain and similar populations. The causative relationship between increased tobacco consumption —as well as decreased tobacco cessation— and lung cancer mortality is well established (IARC, 1986). Furthermore, while there is not yet a consistent body of evidence describing the association of lung cancer risk with smoking black tobacco specifically, various international studies have linked the consumption of black vs. blond manufactured tobacco to elevated lung cancer risk (Armadans-Gil, Vaque-Rafart, Rossello, Olona, & Alseda, 1999; De Stefani et al., 2004). Therefore, the characteristic smoking tendencies exhibited in our study have the potential to escalate the magnitude of socioeconomic inequalities in lung cancer mortality if uncontrolled amidst the foretold progression of the smoking epidemic in this population, and should likewise be addressed as such.

Study limitations

The use of self-reported data on smoking could potentially lead to underestimation of smoking status and could particularly bias our results if underreporting were to occur more frequently in a specific educational group of the population. However, analysis of the validity of self-reported smoking data has found self-reporting to be an accurate method of obtaining information about tobacco in the case of interviewer-administered questionnaires (Patrick et al., 1994). Additionally, two U.S.-based studies reported only inconsistent associations between underreporting of smoking and socioeconomic status (Wagenknecht, Burke, Perkins, Haley, & Friedman, 1992; Wewers et al., 1995), whereas a past European study found no effect of socioeconomic status on underreporting of tobacco use (Suadicani, Hein, & Gyntelberg, 1994). While the possibility of such an association cannot be dismissed, it is unlikely to account for the pronounced educational gradients observed in relation to smoking tendencies among our study subjects.

Over reporting of former smokers is also a potential problem related to the fact that smokers who quit immediately prior to the interview may subsequently resume smoking. To prevent this type of bias from affecting our results, we considered former smokers only those who had quit smoking at least one year before the interview.

Conclusion

The educational inequalities in smoking tendencies among Northern Spanish lung cancer patients, as reflected in these analyses, highlight behavioural patterns which merit further investigation and which may serve as potential and novel targets for population-specific interventions to address socioeconomic inequalities in a population health. Previous research has underscored the notion that improving health disparities is a nationally- and culturally-specific task, dependent upon recognition of the circumstances and mechanisms that reinforce the link between low educational level and poor health (Kunst, Groenhof, Mackenbach, & Health, 1998) in a given population. Tobacco control policies employed in Northern Spain, and within populations of similar cultural and regional circumstances, may benefit from addressing these specific high-risk health behaviours associated with lower educational level for men and women. Further research is justified to reinforce the link between low educational level and the exclusive consumption of black tobacco, as well as to examine the design and effect of future policy interventions in this context.

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