

Patterns of cigarette smoking and trends in lung cancer mortality in Italy

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SUMMARY Cigarette consumption has increased steadily throughout this century in Italy. There were marked increases in three periods: in the 1920s, in the 1950s possibly due to the spread of smoking among young men, and in the 1970s in part due to smoking among women. The average number of cigarettes per adult per day sold legally in 1980 was 6.9 but, taking smuggling into account, the actual average number of cigarettes smoked per day is likely to range between eight and nine. Data from a national sample-based survey conducted in 1980 showed that smoking prevalence in men was broadly similar within age groups, geographical area, education, and socioeconomic groups. Smoking in women, on the other hand, was concentrated in younger and more educated women living in larger towns and in richer areas of the country. This pattern is typical of a recent rapid spread of smoking among women. The average tar yield of Italian cigarettes in 1983–4 was about 17 mg. Tar yield was strongly and negatively correlated with price ($r = -0.55$). This abnormality should be urgently reversed by government intervention. No material increase in lung cancer mortality in young women was evident up to the late 1970s. Lung cancer death rates in men correlated closely with the observed changes in cigarette consumption. The highest mortality rates (about 7, 20, and 50/100 000 respectively in the age groups 35–39, 40–44, and 45–49) were reached by the generation born around 1927–30, and the rates have remained fairly constant around these maximum levels for those born up to 1940. As a consequence, Italian lung cancer death rates in middle-aged men (45 to 54) are currently the highest registered in developed countries, and large upward trends are currently detectable in older men.

Over the last few years, there has been an extremely rapid rise in lung cancer mortality in young men in Italy, producing, in the age groups 35–44 and 45–54, death rates among the highest currently registered in developed countries.¹

In the present paper, trends in total tobacco and manufactured cigarettes sales over the last century and current patterns of cigarette smoking in Italy are described, and the tar, nicotine, and carbon monoxide yields of commonly available Italian cigarettes are reported. Further, lung cancer mortality trends in young and middle-aged men are considered and related to patterns of past and current cigarette smoking.

Materials and methods

TRENDS IN TOBACCO CONSUMPTION AND PREVALENCE OF CIGARETTE SMOKING

Data of mean daily sales of total tobacco and

manufactured cigarettes per person from 1900 to 1980 (fig 1) are derived from an official Department of Health publication² and corrected for decennial census data³ to estimate sales per adult.

Estimates of prevalence of cigarette smoking (tables 1–3) are based on a survey conducted by the Central Institute of Statistics (ISTAT) in 1980⁴ on a sample of 25 018 households (corresponding to 1.34% of the total number of households) randomly chosen within strata of geographical area and size of the place of residence to be representative of the general population. Failure to trace or refusal of interview excluded 1 400 households, thus giving an overall participation rate of 94.4%. A detailed description of the sampling methods and statistical techniques used, together with the computation of the standard errors of the rates, is given in the original publication.⁴

Over the period 1950–78 four surveys were commissioned by the Italian State Monopoly (in

Table 1 *Estimated prevalence (%) of cigarette smoking in Italy according to selected variables. Data from a sample-based survey conducted in 1980 by the Central Institute of Statistics**

Variables	Males			Females		
	Smoker	Exsmoker	Nonsmoker	Smoker	Exsmoker	Nonsmoker
Age (years)						
14-29	44.8	1.5	53.7	22.6	1.0	76.4
30-39	64.9	5.0	30.2	26.0	1.7	72.3
40-49	61.7	8.6	29.6	17.7	1.5	80.9
50-59	61.7	13.6	24.6	12.9	1.3	85.8
60-70	52.0	23.1	24.9	7.1	1.9	91.1
> 70	38.6	28.1	33.2	2.7	1.8	95.6
Geographical area						
North	50.8	10.9	38.4	18.8	2.1	79.1
Centre	53.1	10.5	36.4	19.9	1.4	78.7
South	59.8	8.4	31.8	11.8	0.6	87.6
Place of residence						
Rural area	53.2	9.8	37.0	12.6	0.9	86.5
Town	57.7	9.4	32.9	17.4	1.4	81.1
population < 100 000	51.0	12.5	36.4	21.7	2.4	75.9
population 100 000-500 000	54.9	9.3	35.9	23.7	2.2	74.9
population > 500 000						
Education (years)						
≤ 5	57.3	13.3	29.3	10.5	1.1	88.4
6-8	48.9	5.5	45.7	22.1	1.6	76.4
≥ 9	54.2	7.8	38.0	34.5	2.7	62.9
Total	54.3	9.9	35.7	16.7	1.4	81.9

Table 2 *Estimated distribution (%) of smokers according to age at starting smoking, current age, and sex. Data from a sample-based survey conducted in 1980 by the Central Institute of Statistics***

Age (years)	Age at starting smoking							
	Males				Females			
	< 18	18-21	22-29	≥ 30	< 18	18-21	22-29	≥ 30
14-29	56.8	38.7	4.5	—	41.6	46.4	12.0	—
30-39	34.1	45.7	17.5	2.8	13.9	35.2	41.7	9.1
40-49	24.2	39.9	27.5	8.4	6.5	17.5	32.8	43.3
50-59	22.2	34.9	25.4	17.5	5.1	12.2	28.3	54.4
60-70	18.3	34.0	23.4	24.3	6.1	15.9	19.2	58.9
> 70	17.1	24.7	26.5	29.0	9.1	6.1	13.6	71.2
Total	32.7	38.5	18.9	9.9	21.3	31.8	25.7	21.2

*Estimated mean age at starting smoking (years): males 20.9; females 24.1; total 21.7.

Table 3 *Estimated distribution (%) of cigarette smokers according to number of cigarettes smoked, age, and sex. Data from a sample-based survey conducted in 1980 by the Central Institute of Statistics***

Age (years)	Number of cigarettes smoked per day									
	Males					Females				
	≤ 5	6-10	11-20	21-30	≥ 31	≤ 5	6-10	11-20	21-30	≥ 31
14-19	21.1	42.8	34.1	1.8	0.2	35.8	48.5	15.1	0.4	0.2
20-29	7.1	27.1	54.7	9.1	2.0	24.1	45.2	28.9	1.4	0.4
30-39	6.7	15.7	58.9	14.2	4.6	22.4	41.6	33.3	2.1	0.6
40-49	5.7	15.3	57.3	15.1	6.6	29.7	35.9	30.1	3.4	1.0
50-59	6.6	18.8	56.4	12.2	6.0	26.4	35.9	33.4	2.7	1.6
60-70	7.4	25.4	53.2	9.7	4.3	22.8	37.8	35.0	2.5	1.8
> 70	15.2	34.7	39.8	7.4	2.8	37.4	46.2	16.2	—	0.2
Total	7.8	21.9	54.4	11.5	4.4	25.8	41.3	30.0	2.1	0.8

**Estimated mean number of cigarettes smoked per day: males 17.2; females 10.9; total 15.6.

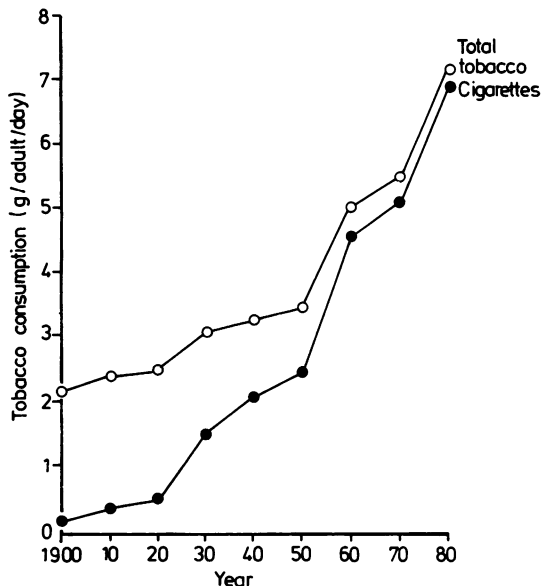


Fig 1 Mean daily sales of total tobacco and manufactured cigarettes per Italian adult over 20 years of age, 1900–80.

1957, curiously, with the financial support of the American Agriculture Department) to a private marketing research institute (table 4).^{5–8} They were based on samples of 4 000–6 000 subjects, randomly chosen within strata of covariates in the last three surveys. The questions asked chiefly concerned marketing aspects, for example, preference in brands of cigarettes, etc.

ANALYSIS OF YIELD AND MARKET SHARE OF VARIOUS CIGARETTE BRANDS

Packets of 18 commonly available Italian cigarette brands were purchased from different shopping centres in Milan and Rome in 1983 and 1984. All the cigarettes had been recently manufactured. The nicotine, tar, and carbon monoxide yields were determined by the British Laboratory of the Government Chemist using the same standard smoking procedure and analytical techniques as in the production of the tar and nicotine tables issued by the British Health Departments.

The market share of each brand of Italian cigarette was published by the States Monopoly up to 1979.^{9 10} Estimates reported in table 5 are weighted averages for the years 1977–9. No official information is, to our knowledge, available for more recent years.

LUNG CANCER MORTALITY TRENDS

Death certifications from cancers of the “trachea, bronchus, and lung” have been published annually from 1955 onwards by the Central Institute of Statistics stratified for sex and age in five-year groups.¹¹ Data before 1955 are also available from the review volume by the Central Institute of Statistics summarising the major causes of death from 1887 to 1955.¹² Those data, however, are likely to be severely biased by underdiagnosis and are therefore not considered in the present work. Estimates of the resident population have been published by the Department of Demography of the University of Rome for the period 1952–72¹³ and officially by the Central Institute of Statistics from 1972 onwards.¹⁴ These estimates are based on decennial censuses (1951–1961–1971), corrected for census undercount, and on official numbers of births, deaths, immigrations, and emigrations per year (immigrations and emigrations being averaged over ten-year periods for each age group). We checked these estimates with other (unpublished) estimates commonly used for sociological studies by the Institute of Statistics of the Catholic University of Milan and with linear interpolations from decennial censuses (corrected for census undercount); no difference of material importance was evident between these various estimates.

On the basis of these data, age-specific lung cancer death certification rates in men for the six five-year age ranges, 35–39, 40–44, etc., up to 60–64, were computed for the period 1955–78. Age-standardised rates (under age 65) were computed by the direct method, using the 1971 census population as standard. Figures 2, 3 and 4 are based on weighted averages of three calendar year death rates.

International comparisons reported in fig 5 are derived from World Health Statistics Annuals.^{15 16}

Results

Trends in legal sales of total tobacco and manufactured cigarettes in Italy from 1900 to 1980 are shown in fig 1. Cigarette consumption has been increasing steadily throughout the current century. The upward trend, however, showed marked increases in three periods: in the 1920s and 1950s (following the two world wars) and in the 1970s. The first two rises may reasonably be attributed to the spread of cigarette smoking among young men during and after the first and, to a greater extent, the second world war. The last marked increase, observed in the 1970s, may be at least partly related to the recent spread of smoking among women, although in the 1970s there was also a considerable drop in cigarette price at real values,¹⁷ which, of

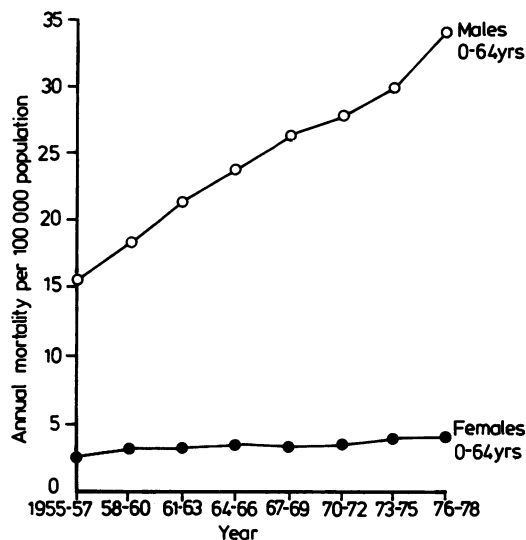


Fig 2 Trends in age-standardised (under 65 years) death certification rates from lung cancer, Italy, 1955-78.

course, may have caused a generalised rise in consumption.

Tobacco manufacture and distribution is a state monopoly in Italy, so cigarette advertising is banned. Legal sales, however, are known not to account for the total number of cigarettes smoked in Italy. We asked the Department of Finance for an estimate of the "market share" covered by smuggling: in the years 1981-2 confiscated smuggling tobacco represented about 3% of the amount legally sold by the State Monopoly. The actual amount introduced and sold illegally must, of course, have been much larger (possibly up to an order of magnitude) but is subject to broad variations due, for example, to shifts in the exchange rate of the Italian lira. Considering the large uncertainties of illegal tobacco sales, the actual number of cigarettes per adult per day smoked in 1980 should be raised from 6.9 (fig 1) to somewhere between 8 and 9.

This estimate is considerably higher than the one derived from the questionnaire-based survey conducted by the Central Institute of Statistics⁴ which was 5.7 cigarettes per day per adult aged 20 or more. It is known that information on smoking habits based on questionnaires is subject to large errors in the sense of systematic and marked underreporting, however accurate the sampling methods and correct the statistical techniques adopted. Even admitting that the overall figure on smoking habits in Italy from tables 1-3 is seriously underestimated, analysis of specific subgroups contains interesting indications

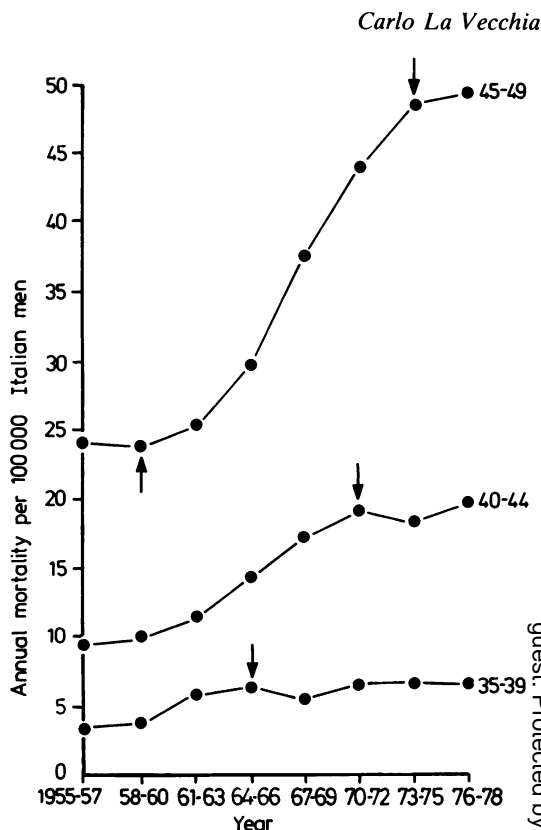


Fig 3 Trends in age-specific (35-49 years) male death certification rates from lung cancer, Italy, 1955-78. Upward arrows indicate the start of large rises; downward arrows flattening off in trends.

and warrants further consideration. Current prevalence of smoking in males, for instance, was not appreciably influenced by age up to age 70, geographical area, or size of the place of residence. Moreover, there was no negative association of smoking prevalence with education or other indicators of social class (not shown). Reported prevalence of smoking in females was higher in the younger age groups, in the richer areas of the country (north and centre), in middle-sized or large towns and in more educated subjects (table 1).

Age at starting smoking has shown a steady decline over subsequent generations, which was extremely rapid in females. More than 50% of women aged 50 or more who smoked in 1980 reportedly started smoking at age 30 or older (table 2). For the younger age groups (14 to 29), however, mean age at starting smoking was not materially different in males (17.2 years) and in females (18.0). Females reported a smaller number of cigarettes smoked per day,

Table 4 Main results of four sample-based surveys conducted by the "DOXA" Marketing Research Institute on behalf of the Italian State Monopoly and the American Agriculture Department (1957 survey only)⁵⁻⁸

Variables	Male			Female		
	Smoker	Exsmoker	Nonsmoker	Smoker	Exsmoker	Nonsmoker
1949 Survey^{5**}						
Estimated prevalence %	71.4	28.6		9.7	92.3	
Average number of cigarettes smoked per day	13.5	—	—	7.9	—	—
Average age at starting smoking (yr)	17.5	NA	—	20.3	NA	—
1957 Survey^{6‡}						
Estimated prevalence %	65.0	12.5	22.5	6.2	4.0	89.8
Average number of cigarettes smoked per day [‡]	13.3	—	—	7.0	—	—
Average age at starting smoking (yr) [‡]	18.0	NA	—	22.0	NA	—
1965 Survey^{7‡}						
Estimated prevalence %	60.3	16.3	23.4	7.7	3.2	89.1
Average number of cigarettes smoked per day [‡]	13.3	—	—	5.8	—	—
1975 Survey^{8**}						
Estimated prevalence %	53.2	46.8		16.3	83.7	

NA not available
 * Aged 18 or over
 ‡ Non random sampling
 † Aged 16 or over
 ** Aged 15 or over

Table 5 Tar, nicotine, and carbon monoxide (CO) yields, * market share[†] and prices[‡] of commonly available brands of Italian cigarettes

Brand name	Tar (mg)	Nicotine (mg)	CO (mg)	Market share (%)	Price
Futura	8	0.5	8	NA	0.60
Lido Blu Extra Mild	10	0.7	10	0.1	0.55
Gala Double Filter	12	0.5	15	0.6	0.55
MS Blu	12	0.9	13	2.3	0.55
Linda Plurifilter	14	1.2	14	0.6	0.55
Lido Double Filter	17	1.1	17	1.8	0.55
Zenit Triple Filter	17	1.2	19	0.5	0.70
MS	17	1.3	15	33.9	0.55
Super Filter	17	1.3	16	1.7	0.45
Stop King Size Filter	17	1.3	17	1.8	0.60
Pack King Size Filter	18	1.2	15	0.3	0.55
N80 Filter	19	1.0	17	1.6	0.35
Nazionali Filter	19	1.0	18	2.8	0.35
Esportazione Filter	19	1.1	16	1.4	0.35
Presidente Double Filter	19	1.2	18	0.4	0.65
Bis King Size Filter	19	1.3	17	0.8	0.50
Alfa	22	1.4	15	1.8	0.30
Esportazione	24	1.2	15	1.3	0.35
12 other Italian brands	—	—	—	13.0**	—
All foreign brands sold legally	—	—	—	33.3	—

* 1983-4 (see Methods)
 † 1977-9 (see Methods)
 ‡ 1984 expressed in Pounds Sterling
 NA not available in 1977-9
 ** In 1977-9 about 6% of the market was covered by the brand 'Nazionali' (plan), with about 32mg of tar. This brand is no longer commonly available. In 1983 the market share of the brand 'MS' should be increased to about 43%, and that of 'Other Italian brand' to less than 5% (unofficial data from the State Monopoly).
 Correlation coefficients: Tar/Price r = -0.55, p < 0.02; Nicotine/Price r = -0.18, ns; CO/Price r = -0.09, ns.

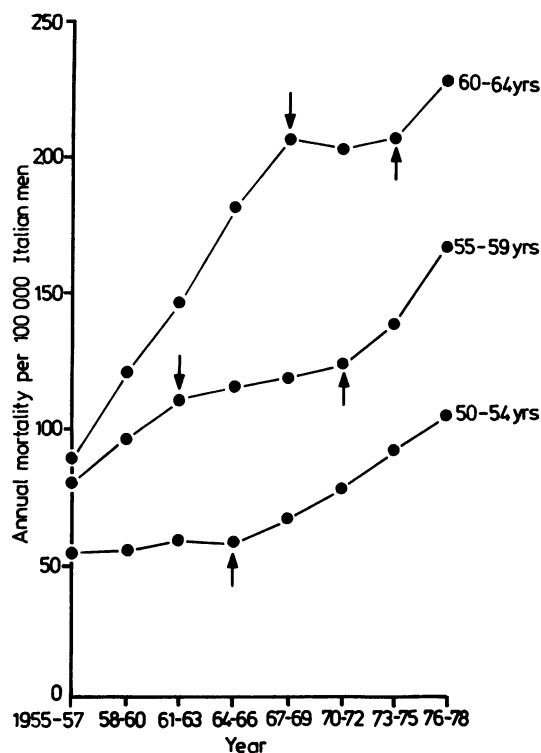


Fig 4 Trends in age-specific (50-64 years) male death certification rates from lung cancer, Italy, 1955-78. Upward arrows indicate the start of large rises; downward arrows flattening off in trends.

estimated mean being 17.2 per male and 10.9 per female smoker. This difference was apparent in all the age groups considered (table 3).

The marketing survey data reported in table 4 are hardly comparable with the most recent health orientated survey and may be criticised as they were based on non-random sampling. Nonetheless, they confirm the striking increase in female consumption and show a possible slight decrease in prevalence of male current smokers, though the estimated number of cigarettes smoked per day is less than in the 1980 ISTAT survey.⁴

Tar, nicotine, and carbon monoxide yields, market shares, and prices of commonly available Italian cigarettes are listed in table 5. The sale-weighted average tar yield in 1983-4 ranged between 17 mg, based on unofficial estimates given by the Director of the State Monopoly, and 17.5 mg, based on data in table 5. Both these estimates are higher than current average tar content in cigarettes sold in Britain, the United States, or other developed countries.^{18 19}

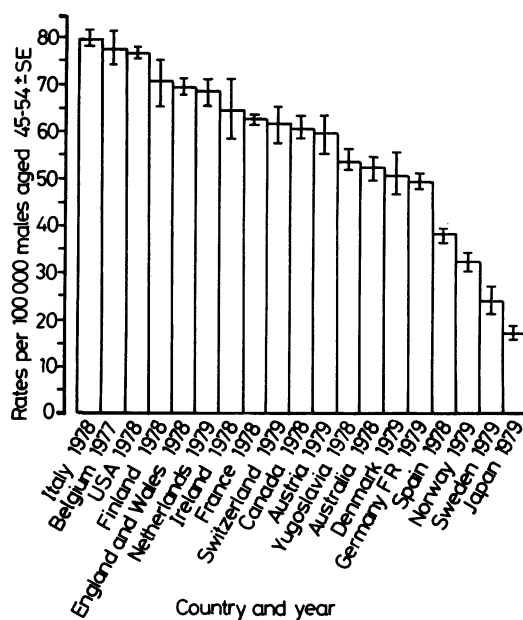


Fig 5 International comparison of lung cancer death certification rates in middle-aged men in selected developed countries. Data from WHO.^{15 16}

More important, older high-tar cigarettes are cheaper in Italy (correlation coefficient tar/price -0.55 , $p < 0.02$). The official explanation is that these cigarette brands are an item in the cost-of-living index. Tar contents or tar groups are not written on Italian cigarette packs, nor on foreign brands legally sold in Italy. Furthermore, the average price of cigarettes has dropped 47% in real terms over the period 1971-81.¹⁷

Trends in age-standardised lung cancer death certification rates under age 65 in males and females are shown in fig 1. Lung cancer mortality in females up to age 44 did not show any appreciable increase over the period 1955-78. There was a moderate upward trend in the age groups 45-54 and 55-64 and, consequently, in the age-standardised rate. This is not surprising, as smoking has become widespread among women only in the last one or two decades (tables 2 and 4).

Age-specific trends in lung cancer mortality in young and middle-aged men from 1955 to 1978 are shown in figs 3 and 4. In the age group 35-39 mortality rates approximately doubled (from 3.4 to 6.8/100 000) between 1955 and 1965 and have remained fairly constant thereafter (downward arrow in fig 3). This upward trend can reasonably be related to increased cigarette consumption since the

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second world war. Corresponding upward trends were observed in the age groups 40–44 (up to 1970–2, reaching a level of 21·7/100 000, downward arrow) and 45–49 (starting from the late 1950s, upward arrow), ie, in the generation born around 1912, and apparently flattening off (downward arrow) in the mid-1970s, in the generation born around 1927.

Upward trends in male lung cancer death rates attributable to the post-war increase in cigarette consumption were similarly evident in older age groups (fig 4) with approximately five-year lags: in the age group 50–54 starting from the mid 1960s, in the age group 55–59 starting from the early 1970s, and in the age group 60–64 starting from the mid 1970s (see upward arrows in fig 3). In the oldest age groups considered (50–59 and 60–64), the previous upward trend attributable to increased cigarette consumption after the first world war is clearly evident, with subsequent flattening off for the generation born around 1905 (downward arrows in fig 3), who became adult between the two wars. Age-specific lung cancer death rates are currently showing marked increases in these latter middle-aged men. Further, over the same calendar period (1955–78), lung cancer mortality increased almost five-fold in men, and roughly doubled in women over age 65. Inferences based on these data, however, are more doubtful, as death certification is known to be less reliable at older ages.

In conclusion, the highest lung cancer death rates in Italian men have been reached by the generation born around 1927–30, and the rates are apparently remaining fairly constant around these maximum levels (about 7, 20, and 50/100 000 respectively in the age groups 35–39, 40–44, and 45–49) for generations born up to 1940. As a consequence, lung cancer death rates in young and middle-aged men in Italy in the late 1970s were the highest registered in developed countries (see fig 5 comparing age-specific lung cancer death rates in the age group 45–54 in selected developed countries; a similar figure for the age group 35–44 has been published previously.¹)

Discussion

The evidence presented in this paper suggests that the highest level in lung cancer death rates in early middle aged Italian men was reached by the generation born around 1927–30. These rates in young middle-aged men were slightly lower (about 20–25%) than those observed in the worst affected British generation (men born around 1910–11) and comparable to that of the worst affected American generation (born around 1927–8).²⁰ However, whereas British and

American lung cancer mortality has considerably declined in young men of subsequent generations,²⁰ no such downward trend is as yet evident in Italy. Thus, the generation born around 1940 appears to maintain the highest levels. The patterns described in age-specific mortality trends are consistent with the data presented on trends in cigarette consumption over the current century, showing large increases after the two world wars, and on prevalence of cigarette smoking in the early 1980s when no negative relation was evident in men between smoking and education or other indicators of social class. Prevalence of cigarette smoking notoriously starts to decline in more educated people. The persistently high mortality from lung cancer in young and middle-aged men, moreover, can also be attributed, at least partly, to the relatively high average tar yield of Italian cigarettes together with the strong negative correlation between tar yields and price, though there has been a tendency towards reduction in average tar yields over recent years. This abnormal negative correlation between price and tar level should, of course, be urgently reversed by government intervention.

As a consequence of these various factors, Italian lung cancer death rates in young and middle-aged men in the late 1970s were the highest observed in developed countries. Though the absolute numbers of deaths in early middle age were, of course, relatively limited, and the overall age standardised mortality rate from lung cancer in Italy (67·1/100 000 males in 1978)¹⁶ was not among the highest currently reported, this pattern of trends appears particularly worrying since current cancer rates in early middle-aged men are of crucial importance in determining trends to be expected among older men in future decades, in the absence of important changes in the pattern of exposure to risk factors.²⁰ It is known that the effects of smoking in a population become evident only a few decades after its diffusion: lung cancer incidence, in fact, increases with a power (probably ranging from the fourth to the fifth) of duration of smoking,²¹ and is therefore strongly related to age at starting smoking. Consequently, smoking habits in early adult life are strong determinants of the risk in subsequent life.²⁰ Therefore, a massive epidemic of lung cancer in the first two decades of the 21st century can be expected in Italy, just when lung cancer death rates are expected to be falling in British and American men. In the absence of a decreasing frequency of cigarette smoking in the future, this epidemic is likely to be particularly long-lasting, as the present rate of lung cancer deaths in the young shows no sign of falling.

Finally, though no clear upward trend of lung cancer mortality among young women is yet evident,

the pattern of current cigarette smoking in women emerging from the data presented in this paper is typical of a recent and massive spread of the habit; cigarette smoking was much more common in younger, more educated women living in large towns and in richer areas of the country. These indications suggest that the epidemic of cigarette-associated diseases in Italian women is likely to be delayed but not avoided.

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