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RESEARCH PAPER

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Background: Changes in smoking, particularly an increase in women, were predicted to follow the aggressive campaigns of multinational tobacco companies in transitional Russia. However, such changes have not yet been demonstrated unequivocally.
Objective: To examine smoking trends by gender, education and area of residence.
Methods: Data from 10 rounds of the Russia Longitudinal Monitoring Survey (1992–2003), consisting of more than 3000 men and 4000 women in each round, were used. The mean reported ages of first smoking in current smokers were compared between 10-year birth cohorts.
Results: Between 1992 and 2003, smoking prevalence doubled among women from 6.9% (95% CI 6.3% to 7.6%) to 14.8% (13.9% to 15.7%) and increased among men from 57.4% (95% CI 56.0% to 58.8%) to 62.6% (61.1% to 64.1%). In both sexes, the rise was significantly greater in the least educated, markedly so in women (a doubling vs a 1.5-fold rise in the most educated). Although prevalence of smoking among women was considerably higher in Moscow and St Petersburg than in rural areas, the dramatic threefold increase in prevalence in rural women was significantly greater than in the main cities (36%, $p<0.001$). The mean age of first smoking was significantly lower in women born after 1960, but in men it was stable between cohorts.
Conclusions: For the first time, it has been shown unequivocally that smoking among women increased markedly during the transition to a market economy in Russia. The already high prevalence of smoking among men has continued to rise. These changes are likely to reflect the activity of the tobacco industry and provide further evidence of the harms of privatisation. Effective tobacco control policies are urgently needed.

The collapse of the Soviet Union led to massive changes in the region's cigarette industry; state-owned tobacco monopolies were privatised, and the transnational tobacco companies (TTCs) invested heavily.[1] This led to a massive surge in advertising and a change in distribution strategies, which were shown by tobacco industry documents to be targeted particularly at women, young people and those living in cities, and which were accompanied by a weakening in tobacco control legislation as a result of aggressive lobbying by the industry.[2–5] Cigarette consumption across the region increased almost exponentially.[6]

In Russia alone, the TTCs invested approximately US$1.7 billion between 1992 and 2000, gaining a collective market share of over 60% and increasing by fourfold the production capacity in their newly acquired factories.[1] Various numbers of new brands were introduced; Japan Tobacco International, for example, introduced eight new brands in 1999 alone.[7] Advertising, which had been non-existent in Soviet times, escalated massively to promote such brands as an indispensable part of the ''western lifestyle''.[8 9] By the mid 1990s, it was estimated that up to 50% of all billboards in Moscow and 75% of plastic bags in Russia carried tobacco advertising;[10] tobacco soon became the product most heavily advertised outdoors, with three major transnationals ranked as the first, second and third heaviest advertisers.[11] After the initial targeting of urban areas, industry documents state that the focus was on expanding marketing efforts to other regions of Russia.[12 13] Since the transition, tobacco control policies in Russia have largely been dictated by the tobacco industry. In 1995, for example, a new law on advertising was implemented, based on the industry's voluntary code of conduct,[14 15] and changes to the federal bill on Limitation of Tobacco Consumption, signed in 2001, were described by the *St Petersburg Times* as ''a textbook demonstration of the lobbyist's art''.[16]

Although the tobacco epidemic in men in Russia, as in the rest of the former Soviet Union (FSU), is well established,[17] and smoking rates among men have been high for decades, rates have failed to decline, as models of the tobacco epidemic would predict.[18 19] In women, the tobacco epidemic is at an earlier stage. Survey data show far higher rates of smoking among young than among older women, particularly in countries targeted by the TTCs, which, combined with comparisons with historical data, suggest an increase in smoking rates among women. However, such an increase is yet to be established unequivocally, as previous efforts to examine these and other trends in the tobacco epidemic have been limited by the lack of truly comparable data and the small sample size of repeated surveys.[19 20]

In addition to the marked changes in the region's tobacco industry, the need to address these research gaps is underlined by the fact that the accumulated burden of tobacco-related disease among men <75 years of age in the FSU is the highest in the world.[21] More than half of Russian men smoke,[19 20] and estimates indicate that smoking presently accounts for nearly half of male deaths and just <4% of female deaths.[22] This work will also further efforts to understand the impacts of privatisation of the tobacco industry, which continues to be promoted by the International Monetary Fund.[4 18]

In this paper, we used data from the Russia Longitudinal Monitoring Survey (RLMS), a large panel study comprising data collected in 10 rounds between 1992 and 2003, to study trends in smoking and to explore in detail the impact of the entry of TTCs on smoking habits. We hypothesised, based largely on the actions of the privatised tobacco companies now

Abbreviations: FSU, former Soviet Union; PSU, primary sampling unit; RLMS, Russia Longitudinal Monitoring Survey; SSU, secondary sampling unit; TTCs, transnational tobacco companies

Table 1 Distribution of the study sample by age, sex, education, area of residence and calendar year

	1992	1993	1994	1995	1996	1998	2000	2001	2002	2003
Males										
Number (%)	4468 (42.1)	4187 (41.6)	3610 (43.3)	3398 (43.0)	3337 (42.7)	3441 (42.9)	3534 (42.4)	3902 (41.9)	4074 (42.2)	4137 (42.1)
Mean age, years (SD)	43.9 (15.7)	44.5 (15.7)	43.2 (15.9)	43.3 (16.0)	43.3 (16.1)	43.1 (16.2)	43.0 (16.5)	42.9 (16.6)	42.9 (16.6)	42.4 (16.5)
Females										
Number (%)	6139 (57.9)	5868 (58.4)	4732 (56.7)	4506 (57.0)	4476 (57.3)	4579 (57.1)	4801 (57.6)	5416 (58.1)	5571 (57.8)	5679 (57.9)
Mean age, years (SD)	47.5 (17.4)	48.2 (17.5)	46.8 (18.0)	47.3 (18.3)	47.2 (18.3)	47.1 (18.3)	46.8 (18.5)	46.6 (18.5)	46.7 (18.6)	46.5 (18.6)
Area of residence										
Moscow or St Petersburg	NA	NA	885 (10.4)	734 (9.0)	656 (7.6)	742 (6.4)	533 (4.1)	1409 (9.7)	1489 (10.9)	1420 (9.7)
Other urban	NA	NA	5533 (65.1)	5315 (65.0)	5668 (65.6)	7621 (66.0)	8483 (65.4)	8731 (60.4)	8230 (60.1)	8834 (60.6)
Rural	NA	NA	2080 (24.5)	2124 (26.0)	2322 (26.9)	3186 (27.6)	3954 (30.5)	4327 (29.9)	3984 (29.1)	4316 (29.6)
Education										
Primary or incomplete secondary	NA	NA	2931 (33.1)	2594 (33.0)	2536 (32.6)	2506 (31.3)	2465 (29.6)	2510 (27.0)	2581 (26.8)	2615 (26.7)
Complete secondary (with or without technical)	NA	NA	2573 (29.1)	2484 (31.6)	2462 (31.7)	2571 (32.2)	2752 (33.0)	3225 (34.7)	3257 (33.9)	3337 (34.0)
Higher	NA	NA	3340 (37.8)	2775 (35.3)	2771 (35.7)	2919 (36.5)	3116 (37.4)	3553 (38.3)	3783 (39.3)	3853 (39.3)

NA, data not available (phase 1).

active in Russia, that smoking among women would increase, the age of smoking uptake would fall, and that rates of smoking among women in rural areas would tend to increase towards those already observed in urban areas. In men, we predicted little change in smoking rates, but an increase in educational inequalities in smoking.

METHODS

Study design and subjects

The data were taken from the RLMS, a panel study of households and the individuals within them. These data have been used in numerous earlier publications, and the survey methods are described in detail on the RLMS website (http://www.cpc.unc.edu/rlms).

The main data source for this study was phase 2 of the study, collected over eight rounds between 1994 and 2003. Participants were randomly selected from 38 population centres across the Russian Federation as follows. St Petersburg and Moscow were included automatically, and the remaining 36 districts, or primary sampling units (PSUs), were selected using the probability proportional to size method, after stratifying districts by socioeconomic criteria. Within the selected PSUs, urban and rural secondary sampling units (SSUs), i.e. census enumeration districts and villages, respectively, were selected. From each SSU, 10 households were selected from housing lists developed by the investigators. The first dwelling was chosen randomly, and the remainder at regular intervals thereafter. In subsequent rounds, the same households were interviewed, with newly recruited households used to replace those that had left. Individuals therefore entered the study in different years. The overall response rate in the first round of phase 2 (1994) in the regions outside the main cities was between 84% and 93%, somewhat higher than in St Petersburg (67%) and in Moscow (57%). The analyses were restricted to respondents aged >18 years. The distribution of household size in the sample compared well with the figures in the 1989 census, as did the distribution of the sample by sex, age and urban–rural residence.

We also used the data from two rounds of the earlier phase 1: round 2 (1992) and round 4 (1993), where the selection methods differed slightly. We omitted data from rounds 1 and 3 of the first phase, owing to difficulty in combining demographic and smoking data within these rounds. In phase 1, a total of 2335 official regions were stratified according to 10 quality of life measures, and by the percentage of the region that was urban. Probability proportional to size was used to select PSUs, and Moscow and St Petersburg were included automatically. SSUs were selected from a list of voting districts within each PSU, ordered according to size and, in the case of urban districts, proximity to the city centre. From the final list of 200 SSUs, households were selected at regular intervals from a list compiled by the investigators, using a random starting point. In all, 7200 households were selected (response rate 88%). The age and sex distribution of participants compared favourably with 1989 census data.

Measurements

Smoking

Respondents were asked "do you smoke?" (except in 1992, when respondents were asked "have you ever smoked?", and those who did were asked "do you smoke now ?").

Age of first smoking

Current smokers were asked "Remember, please, at what age did you start smoking? How old were you then?"

Education

Participants were classified into three categories of education: complete higher; complete secondary (technical, general or combined); and incomplete secondary or primary.

Area of residence

Respondents were defined as coming from an urban area or a rural area. We further divided urban areas into Moscow and St Petersburg, or other urban areas, using data obtained from the investigators.

Data analysis

We estimated the prevalence and 95% CIs of current smoking in different years by 10-year age band, separately for men and women. We then compared the prevalence of smoking by education and area of residence (Moscow or St Petersburg, other urban district or rural area) in each year of the study,

Table 2 Prevalence (%) of current smoking in the whole sample (standardised for age) and by 10-year age band

		Age group in years					
	Total (all ages)	18–24	25–34	35–44	45–54	55–64	⩾65
Male							
1992	57.4 (56.0 to 58.8)	61.6 (57.4 to 65.9)	69.0 (66.0 to 72.0)	66.0 (63.1 to 68.8)	55.0 (51.3 to 58.7)	46.2 (42.6 to 49.8)	34.7 (30.6 to 38.9)
1993	60.8 (59.3 to 62.4)	60.2 (55.6 to 64.9)	71.6 (68.3 to 74.8)	71.7 (68.9 to 74.6)	58.6 (54.7 to 62.6)	51.3 (47.4 to 55.2)	38.3 (33.8 to 42.8)
1994	59.0 (57.5 to 60.5)	63.1 (58.8 to 67.5)	70.8 (67.6 to 74.0)	66.2 (62.9 to 69.4)	59.3 (55.2 to 63.5)	49.9 (45.9 to 54.0)	33.5 (28.9 to 38.1)
1995	61.3 (59.7 to 62.9)	62.2 (57.7 to 66.6)	74.3 (71.1 to 77.6)	67.0 (63.7 to 70.3)	63.8 (59.7 to 67.9)	53.3 (48.9 to 57.6)	35.0 (30.4 to 39.5)
1996	61.9 (60.3 to 63.5)	64.3 (59.9 to 68.8)	73.7 (70.4 to 77.0)	67.7 (64.4 to 71.0)	66.6 (62.3 to 70.9)	51.9 (47.5 to 56.2)	35.7 (31.1 to 40.2)
1998	61.0 (59.4 to 62.6)	61.0 (56.7 to 65.3)	70.0 (66.5 to 73.5)	67.4 (64.1 to 70.6)	68.2 (64.3 to 72.2)	54.0 (49.6 to 58.5)	34.2 (29.7 to 38.6)
2000	61.3 (59.7 to 62.8)	62.6 (58.5 to 66.7)	68.1 (64.7 to 71.6)	69.6 (66.4 to 72.8)	68.2 (64.6 to 71.9)	55.1 (50.3 to 59.9)	32.2 (27.9 to 36.5)
2001	62.2 (60.7 to 63.7)	62.1 (58.1 to 66.1)	71.4 (68.3 to 74.5)	70.9 (67.8 to 74.0)	68.0 (64.6 to 71.5)	54.8 (50.1 to 59.4)	32.8 (28.8 to 36.9)
2002	63.0 (61.5 to 64.5)	63.8 (60.0 to 67.6)	71.2 (68.2 to 74.3)	71.9 (68.8 to 74.9)	68.7 (65.3 to 72.1)	55.2 (50.4 to 59.9)	34.5 (30.2 to 38.8)
2003	62.6 (61.1 to 64.1)	63.8 (60.0 to 67.6)	70.4 (67.5 to 73.3)	71.6 (68.5 to 74.7)	65.4 (62.1 to 68.8)	57.4 (52.7 to 62.1)	34.9 (30.9 to 38.8)
p Value for linear trend	0.003*	0.68	0.45	0.01	<0.001	<0.001	0.07
Female							
1992	6.9 (6.3 to 7.6)	10.1 (7.6 to 12.5)	11.8 (9.9 to 13.7)	10.2 (8.5 to 11.9)	5.9 (4.4 to 7.5)	2.5 (1.5 to 3.4)	2.3 (1.5 to 3.2)
1993	7.7 (6.9 to 8.5)	12.3 (9.3 to 15.4)	12.9 (10.6 to 15.2)	11.1 (9.2 to 13.1)	7.1 (5.1 to 9.0)	2.1 (1.1 to 3.1)	2.6 (1.6 to 3.5)
1994	9.0 (8.3 to 9.8)	20.9 (17.5 to 24.2)	17.1 (14.6 to 19.6)	11.4 (9.3 to 13.4)	6.7 (4.7 to 8.6)	2.3 (1.2 to 3.3)	1.2 (0.5 to 1.8)
1995	9.1 (8.3 to 9.9)	18.1 (14.8 to 21.4)	18.0 (15.2 to 20.8)	10.6 (8.6 to 12.6)	9.0 (6.7 to 11.3)	2.2 (1.1 to 3.2)	1.3 (0.5 to 2.0)
1996	9.8 (9.0 to 10.7)	18.1 (15.0 to 21.3)	20.3 (17.4 to 23.2)	11.9 (9.8 to 14.0)	9.6 (7.2 to 11.9)	2.1 (1.0 to 3.1)	1.3 (0.5 to 2.0)
1998	10.5 (9.6 to 11.4)	18.9 (15.7 to 22.1)	21.8 (18.8 to 24.8)	12.6 (10.4 to 14.8)	10.4 (8.1 to 12.6)	1.8 (0.8 to 2.8)	1.8 (0.9 to 2.6)
2000	11.5 (10.7 to 12.4)	18.1 (15.2 to 21.0)	24.4 (21.4 to 27.3)	14.6 (12.3 to 16.9)	13.4 (11.1 to 15.7)	1.6 (0.6 to 2.6)	1.4 (0.7 to 2.1)
2001	13.9 (13.0 to 14.7)	22.3 (19.3 to 25.2)	26.3 (23.4 to 29.1)	17.8 (15.4 to 20.3)	16.0 (13.7 to 18.4)	3.9 (2.5 to 5.4)	2.0 (1.1 to 2.8)
2002	13.8 (12.9 to 14.7)	21.4 (18.4 to 24.3)	27.9 (25.0 to 30.7)	17.5 (15.0 to 20.0)	15.0 (12.6 to 17.3)	5.7 (3.7 to 7.6)	0.7 (0.2 to 1.3)
2003	14.8 (13.9 to 15.7)	23.1 (20.2 to 26.0)	28.1 (25.4 to 30.8)	20.6 (17.9 to 23.2)	14.2 (12.1 to 16.4)	5.9 (4.1 to 7.7)	1.5 (0.8 to 2.2)
p Value for linear trend	<0.001*	<0.001	<0.001	<0.001	<0.001	<0.001	0.1

Values in parentheses are 95% CI.

indirectly standardising the results by 10-year age band against the 1995 study population. Data for education and area of residence were used only from 1994 onwards, since the measures used in phase 1 were not comparable with those of the later rounds.

We estimated the statistical significance of the linear trend in smoking by calendar year in each age band, educational group and area of residence; we did this by including calendar year as a continuous variable in a logistic regression model. We also tested for interactions between calendar year and education and residence, to assess whether the gradients over time differed by education and area of residence. In addition, we estimated the mean age of smoking uptake in men and women by 10-year birth cohorts: 1920–9; 1930–9; 1940–9; 1950–9; 1960–9; and 1970–9, based on data from the 1994 round. To assess whether age at participation (and thus recall bias) influenced the results, we compared data from the 1994 and 2003 rounds.

RESULTS

Description of the sample

Slightly more than half of the respondents were female, and, on average, the women were slightly older than the men. Nearly 40% of respondents had had a university education, just under one-third had a complete secondary education and the remainder had had more limited formal education (table 1). About one-quarter of the subjects lived in rural areas, the remainder were urban dwellers. The proportion of residents of Moscow and St Petersburg fluctuated between years (table 1), perhaps because these individuals were more likely to leave the study and there were delays before more households were recruited to replace them.

Trends in prevalence of smoking

The prevalence of smoking was much higher in men than in women. During the study period, the age-adjusted prevalence of current smoking in men increased slowly but steadily from 57.4% (56.0% to 58.8%) in 1992 to 62.6% (61.1% to 64.1%) in 2003, p for trend 0.003 (table 2). Age-specific data indicated significant increases among men aged between 35–44 years ($p<0.01$) and 45–64 years ($p<0.001$), but little change in prevalence among younger and older adult males. In women, the increase in smoking over the same period was considerably more marked, with the age-adjusted prevalence more than doubling from 6.9% (6.3% to 7.6%) to 14.8% (13.9% to 15.7%), p for trend <0.001 (table 2). This increase was significant in all but the oldest (⩾65 years) age group.

An urban–rural gradient in prevalence of smoking in men was observed, with men in rural areas generally more likely to smoke (table 3, fig 1). The upward trend in male smoking in rural areas during the study period was significant ($p<0.02$), unlike the weaker increase in urban areas. The significant inverse relationship between education and smoking in men increased non-significantly over time, owing to an increase in the two lowest educational groups, with the trend in the intermediate group differing significantly from that in the most educated group (table 3, fig 1).

Smoking among women was significantly more common in Moscow and St Petersburg than in other areas in each round. Smoking was also more common in women in other urban areas than in rural ones; thus, the urban–rural gradient in women was the reverse of that seen in men, and was considerably steeper (table 3, fig 1). Although smoking increased significantly in all three types of settlement (all p values <0.001), the eventual scale of this upswing was significantly greater in rural areas (a threefold rise, compared with a 36% rise in the main cities, $p<0.001$), mainly because it continued throughout the study period, whereas the rise in urban areas stabilised from around 2001 onwards (fig 1). While in 1994 the prevalence in Moscow and St Petersburg was 6.3 times that of rural areas, by 2003 this ratio had fallen to 2.6.

Smoking prevalence increased among women in all educational groups ($p<0.001$), but the increase was far more marked in the least educated (table 3, fig 1), in whom smoking prevalence more than doubled from 9% to 20%, compared with those with a higher education, in whom the prevalence

Table 3 Prevalence of smoking in men and women by area of residence and education (standardised for age)

	Residence			Education		
	Rural	Other urban	Moscow or St Petersburg	Primary/incomplete secondary (lowest)	Complete secondary	Higher
Male						
1994	63.5 (60.5 to 66.6)	57.9 (56.0 to 59.8)	54.0 (49.2 to 58.8)	67.4 (64.7 to 70.0)	62.5 (59.2 to 65.8)	49.2 (46.4 to 51.9)
1995	63.6 (60.4 to 66.7)	60.4 (58.5 to 62.4)	60.8 (55.3 to 66.3)	70.6 (67.9 to 73.4)	63.1 (60.0 to 66.3)	50.4 (47.4 to 53.5)
1996	63.3 (60.1 to 66.5)	61.6 (59.6 to 63.6)	61.3 (55.2 to 67.3)	68.7 (65.8 to 71.6)	64.6 (61.4 to 67.9)	51.4 (48.3 to 54.6)
1998	63.5 (60.4 to 66.6)	60.1 (58.1 to 62.1)	59.8 (53.5 to 66.0)	69.0 (66.1 to 72.0)	64.8 (61.7 to 67.9)	49.9 (46.9 to 53.0)
2000	65.9 (63.0 to 68.8)	59.3 (57.3 to 61.3)	56.7 (49.0 to 64.5)	72.8 (70.1 to 75.6)	62.9 (59.7 to 66.0)	48.7 (45.6 to 51.7)
2001	66.5 (63.6 to 69.4)	60.9 (58.9 to 62.8)	57.5 (53.0 to 62.0)	71.2 (68.4 to 74.0)	66.2 (63.4 to 69.0)	49.0 (46.1 to 51.8)
2002	67.7 (64.9 to 70.6)	61.4 (59.4 to 63.4)	60.9 (56.7 to 65.1)	70.7 (67.9 to 73.6)	66.8 (64.0 to 69.5)	51.6 (48.8 to 54.4)
2003	67.2 (64.4 to 69.9)	61.0 (59.1 to 63.0)	60.5 (56.3 to 64.8)	71.3 (68.6 to 74.1)	66.3 (63.8 to 68.9)	49.8 (47.1 to 52.6)
p Value for linear trend (age-adjusted)	0.02	0.70	0.69	0.18	0.24	0.41
p Value for heterogeneity		0.06 (vs rural)	0.09 (vs rural) 0.61 (vs urban)		0.40 (vs lowest)	0.11 (vs lowest) 0.01 (vs intermediate)
Female						
1994	3.4 (2.3 to 4.5)	8.5 (7.6 to 9.5)	21.7 (18.4 to 25.0)	9.3 (7.2 to 11.5)	10.6 (9.0 to 12.3)	8.5 (7.3 to 9.6)
1995	4.7 (3.3 to 6.0)	8.6 (7.7 to 9.6)	21.2 (17.4 to 24.9)	10.4 (8.0 to 12.8)	10.1 (8.7 to 11.5)	8.1 (6.8 to 9.3)
1996	5.0 (3.7 to 6.4)	9.8 (8.8 to 10.9)	23.0 (18.9 to 27.0)	11.1 (8.7 to 13.5)	10.6 (8.8 to 12.3)	9.1 (7.8 to 10.3)
1998	6.4 (5.0 to 7.9)	10.1 (9.1 to 11.1)	23.0 (18.5 to 27.5)	16.3 (13.5 to 19.1)	11.4 (9.6 to 13.1)	8.5 (7.3 to 9.7)
2000	7.6 (6.2 to 9.0)	11.7 (10.6 to 12.7)	24.2 (18.8 to 29.6)	14.1 (11.6 to 16.7)	13.4 (11.6 to 15.2)	10.0 (8.8 to 11.2)
2001	8.4 (7.0 to 9.8)	12.5 (11.4 to 13.6)	27.3 (24.0 to 30.6)	17.6 (14.9 to 20.2)	16.7 (14.9 to 18.6)	11.9 (10.6 to 13.1)
2002	9.0 (7.5 to 10.5)	11.7 (10.6 to 12.8)	29.7 (26.4 to 33.0)	18.7 (15.9 to 21.5)	16.4 (14.7 to 18.2)	11.5 (10.3 to 12.8)
2003	11.2 (9.5 to 12.8)	13.1 (12.0 to 14.2)	29.6 (26.4 to 32.9)	20.7 (17.9 to 23.4)	16.0 (14.4 to 17.5)	12.4 (11.1 to 13.6)
p Value for linear trend (age-adjusted)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
p Value for heterogeneity		<0.001 (vs rural)	<0.001 (vs rural) 0.93 (vs urban)		0.005 (vs lowest)	0.004 (vs lowest) 0.96 (vs intermediate)

Values in parentheses are 95% CI.

increased from 8.5% to 12.4%. Differences in this trend were significant ($p = 0.004$). There was no educational gradient in smoking in women in 1994, but by 2003, a pronounced gradient had developed (table 3, fig 1).

According to the 1994 data, the mean age of smoking uptake in men was similar in each cohort, at between 15 and 18 years of age (table 4). Although the age of uptake in the youngest male cohort differed significantly from that in some older cohorts, overall there was no clear trend. Among women, in contrast, the age of first smoking seemed to decrease in successive cohorts (table 4). In those born in or after 1960 (ie, aged $\leqslant$30 years in 1990), the mean age of first smoking was $\leqslant$20 years, significantly lower than in women born earlier, other than in the oldest cohort, where numbers were too small to make an accurate assessment. Moreover, in the youngest female cohort, born in or after 1970 (aged $\leqslant$20 years in 1990), the mean age of uptake was 16.8 years, significantly lower than even that in the previous cohort (born between 1960 and 1969). The mean ages of smoking uptake reported in 1994 were slightly different (usually lower) from those for the same cohorts reported in 2004, but the differences were small and the patterns of the temporal changes were similar.

DISCUSSION

Summary of findings

This large nationally representative study in Russia yielded four major findings. First, we have demonstrated unequivocally for the first time a marked increase in smoking during the transition to a market economy, particularly among women, in whom rates more than doubled between 1992 and 2003. Alarmingly, we also identified a further increase in the already very high rates of smoking in men. Second, the rise in smoking prevalence in both sexes was most pronounced among the least educated, resulting in growing inequalities during the study period. In women, this disparity was seen to emerge for the first time. Third, smoking prevalence among women is higher in urban than in rural areas, but the rate of increase over time was considerably more marked in rural areas. Finally, the age of first smoking was lower in the younger female cohorts, but among men there was no significant variation.

Limitations

This study has several limitations. First, there may have been some selection bias. RLMS is a large nationwide survey designed to be representative of the whole country. However, people who left the study were less educated, wealthier and living in urban areas; and those who died were more likely to be less educated, to smoke and to consume alcohol frequently. It is possible that people who remained in the study had a more favourable health-behaviour profile than the national population. The observed rates and trends in smoking may, therefore, underestimate the gravity of the smoking epidemic.

Second, we used data from two separate phases of RLMS, which were based on different study populations and varied slightly in methodology and sampling sites. The question on smoking was worded differently in the 1992 round. However, in the majority of subgroups, the results were consistent with the overall trends in smoking during the rest of the 1990s, when the data were consistent across successive rounds, suggesting that the low rates in the earliest rounds in women are likely to have been genuine.

Third, there may have been some bias in reporting the prevalence of smoking. A previous study shows that men, and particularly women, in Russia under-report smoking.[23] If such under-reporting reflects the cultural acceptability of smoking, which may have altered during the study period, it is possible that some of the trends observed reflect changes in reporting bias. In the absence of objective markers, such as cotinine, this

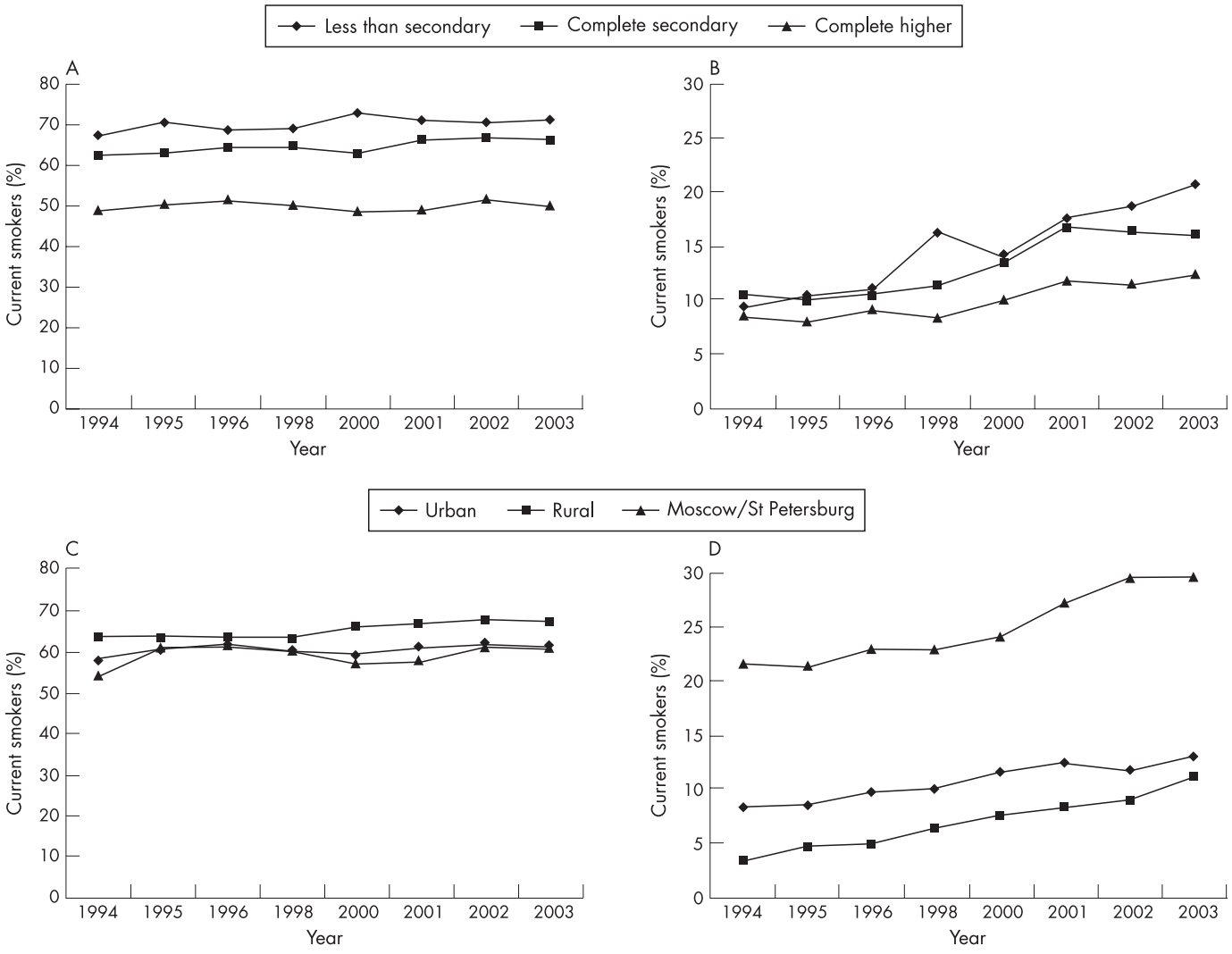

Figure 1 Smoking prevalence by education in men (A) and women (B) and area of residence in men (C) and women (D) in 1994–2003 (Russia Longitudinal Monitoring Survey).

potential bias is difficult to assess. However, this limitation is common to most population studies of smoking, and our results are consistent with those observed elsewhere, although the larger sample size now makes it possible to detect trends with greater confidence.[19 20] Fourth, smoking was not differentiated by frequency (eg, daily, weekly or less often), although the close similarities in findings here to studies of prevalence in daily smokers[9 11 12] suggest that those claiming to smoke do so daily.

Fifth, the mean age of smoking uptake was recorded only in current smokers, and not in ex-smokers, which could have biased the results. The mean age of uptake could also have been biased by differences in recall, although the relatively small

Table 4 Mean reported age of first smoking by sex and 10-year birth cohort among current smokers (reported in 1994 and 2004 study rounds)

		Male—mean age of starting smoking		Female—mean age of starting smoking	
Year of birth		**2003 data**	**1994 data**	**2003 data**	**1994 data**
1970–9	Mean	15.4 (14.8 to 16.0)	15.7 (15.4 to 16.0)	16.2 (15.9 to 16.6)	16.8 (16.4 to 17.3)
	Number of smokers	49	304	134	118
1960–9	Mean	16.7 (15.9 to 17.6)	16.3 (16.0 to 16.6)	18.1 (17.5 to 18.6)	19.4 (18.8 to 20.0)
	Number of smokers	87	551	146	148
1950–9	Mean	17.4 (16.5 to 18.4)	16.9 (16.5 to 17.2)	19.5 (18.5 to 20.4)	22.9 (21.5 to 24.3)
	Number of smokers	100	531	81	102
1940–9	Mean	16.6 (15.8 to 17.4)	17.8 (17.1 to 18.5)	20.5 (19.4 to 21.7)	26.4 (23.5 to 29.4)
	Number of smokers	118	315	61	42
1930–9	Mean	16.3 (15.0 to 17.6)	16.7 (15.9 to 17.5)	24.3 (20.1 to 28.5)	23.8 (20.5 to 27.0)
	Number of smokers	100	287	23	18
1920–9	Mean	15.5 (14.6 to 16.4)	17.1 (15.8 to 18.4)	27.0 (21.8 to 32.2)	28.6 (15.2 to 42.0)
	Number of smokers	116	118	10	8

Values in parentheses are 95% CI.

differences between the means in 1994 and 2004 for the same cohorts suggest that this was not a major problem.

The major strength of this study overall, however, is that it provides data collected repeatedly in a large sample during the key years of the transition.

Interpretation of findings

The high prevalence of smoking in men is very similar to that observed in other recent surveys in Russia.[17 19 20] Analyses of trends over time have hitherto been limited by the lack of truly comparative data over such a long time period, and, although the main picture has been one of long-standing high rates of male smoking, there is some evidence of an increase between the 1970s and mid-1990s. Prevalence of male smoking in two Moscow-based surveys during the 1970s was 45%.[24] Similar rates were seen in the Moscow samples of the MONItoring CArdiovascular disease study in the 1980s and early 1990s,[25 26] but by 1996 the percentage of male smokers in Moscow was 64%.[20 27] Importantly, we observed a small but significant increase in smoking prevalence among men between 1992 and 2003. This is especially remarkable, given the very high baseline level and the expectation, from the classical model of the tobacco epidemic, that this would now be falling.[18] The largest increase was among men aged between 35 and 55 years, which is consistent with the fact that middle-aged men were particularly badly affected by the impacts of transition, which in turn may have influenced their health behaviours, including their ability to quit smoking.[28]

The prevalence of smoking in women is still far lower than in men, but the increase over time was more marked. The rates obtained here are similar to those obtained in other recent national surveys,[19 20] although the prevalence observed in 1996 (10%) differs somewhat from the figure of 14% observed in another study undertaken at that time.[20] To our knowledge, this is the first definitive published evidence of a marked increase in the prevalence of smoking among women in Russia, as previous analyses using comparable data sets were based on far smaller samples.[20] It is nevertheless consistent with trends observed between non-comparable surveys,[27] increases that have failed to reach significance and have been limited to subnational samples,[29] and age-specific data showing far higher rates of smoking in young than in older women.[19 30] The increases in smoking prevalence in both sexes are also consistent with the almost exponential increase in cigarette consumption observed throughout the FSU during this period.[6]

The marked urban predominance of female smoking has been a key finding of all recent surveys in Russia and the rest of the FSU.[19 20 30–32] However, the dramatic increase in smoking among women in rural areas, increasing from a very low level to one that is almost the same as in cities (except Moscow and St Petersburg), is a new and important finding, confirming what has, to our knowledge, only been observed once previously.[20] It is consistent with the strategy pursued by the TTCs; the British American Tobacco company documents, for example, indicate that marketing was to be focused initially on Moscow and then expanded to other key cities, and the regions[12 13] as distribution systems, at first focused on the Moscow/St Petersburg corridor, were developed.[33]

The changing pattern of smoking in relation to education, again particularly marked in women, is another key finding. It is attributable to the increase in smoking among the least educated rather than a fall in those with higher education, among whom smoking also increased in women. This is broadly consistent with previously observed trends[20] and with the predicted course of the tobacco epidemic.

Sociodemographic variations in smoking rates among men in the FSU are well established through previous surveys.[17 19 20 24] However, the relationships between education (and other socioeconomic factors) and smoking reported for women in previous studies have been inconsistent.[17 19 20 30] This study clarifies this issue by showing that, while there was little difference by education in the mid-1990s, a large gap subsequently opened up, consistent with the predicted progress of the epidemic. Although a previous study suggested that rates were increasing among the better educated and least deprived, while falling among the least educated and most deprived,[20] those findings were at best of only borderline significance,[20] and, given the sample size of the RLMS, the present findings are likely to be more reliable.

Although these data support the predicted progress of the tobacco epidemic in a number of key aspects described above, there are also some important differences from the pattern observed in the West.[18] Most notably, rates of smoking among men have been very high for decades, and, rather than declining, as the model would predict, are increasing. This can be attributed to the scale of activity of the TTCs in recent years and the long-standing failure of the government to take adequate tobacco control measures. The increase in smoking rates among women observed here also occurred far later than the model would predict, and we believe it is directly attributable to the entry of the TTCs and their targeting of women. Indeed, the increase in smoking rates among women, their urban predominance and subsequent increase in rural areas are entirely consistent with the TTC's marketing and distribution strategies in the region.[2 4]

Although this study only relates to the situation in Russia, we believe that such alarming trends are likely to be seen in all countries in the region where private tobacco companies are active. This belief is based on our previous work, which identified changes in smoking habits and in sales that were common to all countries where the TTCs had invested, not only in Russia.[6 19] We have also firmly established the extent to which the TTCs will go to oppose and undermine effective tobacco-control measures throughout the region.[4 5 27 34] There is no reason, therefore, for assuming that Russia would be unique in that region. On the basis of these combined findings, we believe that had the previously state-owned tobacco monopolies never been privatised, thereby preventing the TTCs from investing, the tobacco epidemic would have taken a less aggressive course in the FSU. The International Monetary Fund and World Bank, who promoted tobacco industry privatisation across the region, must learn from this before making the same mistakes elsewhere. They should be encouraged to reconsider their response to the supply of tobacco products, in particular ensuring that, if privatisation is to be supported, it be accompanied by strong measures to offset its deleterious health consequences.[5]

What this paper adds

- Russia has high rates of smoking-related mortality, very high smoking rates among men, and lower, but possibly increasing, rates of smoking among women. Transnational tobacco companies (TTCs) have pursued aggressive marketing strategies in post-transition Russia.
- This paper demonstrates, for the first time, significant increases in smoking during the transition in women, greatest in the least educated and rural dwellers, changes which were hypothesised from the marketing strategies of the TTCs.

The continued rise in smoking in Russia will inevitably lead to a further increase in the already high burden of associated disease. There is an urgent need to take action that will reduce the prevalence of smoking. If the Russian government is serious about the demographic crisis affecting its population, as one of the few countries which have not yet signed or ratified the Framework Convention on Tobacco Control, it must wake up to this public health disaster. This means taking active steps to counter the powerful influence of the TTCs, which have now effectively set the tobacco control agenda in Russia.

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