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Lung cancer in the heavily smoking society: the evidence from Russia

Key words: Russia, lung cancer, smoking patterns, cohort effect

Abstract

The article is devoted to the description, detailed analysis and explanation of the lung cancer mortality phenomenon in Russia. The lung cancer deaths rates have been steady declining in Russia since 1994 assuming the fall in smoking prevalence in the past. The shortage of reliable data about the smoking prevalence in the Soviet Union cannot support this effect. However there was indirect evidence that the level of smoking among men born within the period 1930-1960 was stable (about 85% ever-smokers) and for women the smoking prevalence was slightly increasing for both current and ever-smokers. Moreover the current researches show that since 1990 the active smoking started to be even more widespread. The prevalence of smoking for the adult male population increased from 45% in the early 1980s to 60–70% in 1996 (McKee et. al, 1998), to more than 60% in 2001 and according to GATS estimations this figure was still actual for Russia in 2009. The respective rise among women was from 10% to 15-16% (Roberts et al, 2012) or more than 20% (GATS, 2009). In this case the strong causal effect of smoking on the lung cancer mortality (Gandini et. al, 2007; Peto et. al, 2000) is likely to be less pronounced in Russia.

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Text

Lung cancer is considered to be an important marker of past levels of smoking in a population, and the main measurement for the burden from the smoking related diseases. The researchers devoted mainly to the Soviet period of time showed that tobacco makes an important contribution to overall mortality in the Russian Federation and lung cancer in particular (Cooper 1982[2], Peto et al 1994).

Russia could be considered as a heavily smoking country. According to the researcher until the last decade the picture was not changing too much becoming even worse if we do not take into account accurately the gender, education and cohort difference. For example, while male smoking prevalence, which stood at 61 percent in 1995, has declined recently to the figures from 50% to 60% (depending on the research GATS 2009; Quirmbach & Gerry 2016), female smoking has increased from around 9% , in 1995, to around 14 % in 2014 with the peak levels between 2000s and 2010s - up to 22% according to GATS, 2009. With such figures Russia is in the leading group of the smoking countries for males in 2012 (Ng et al 2014) and in the middle of the list for women consumption.

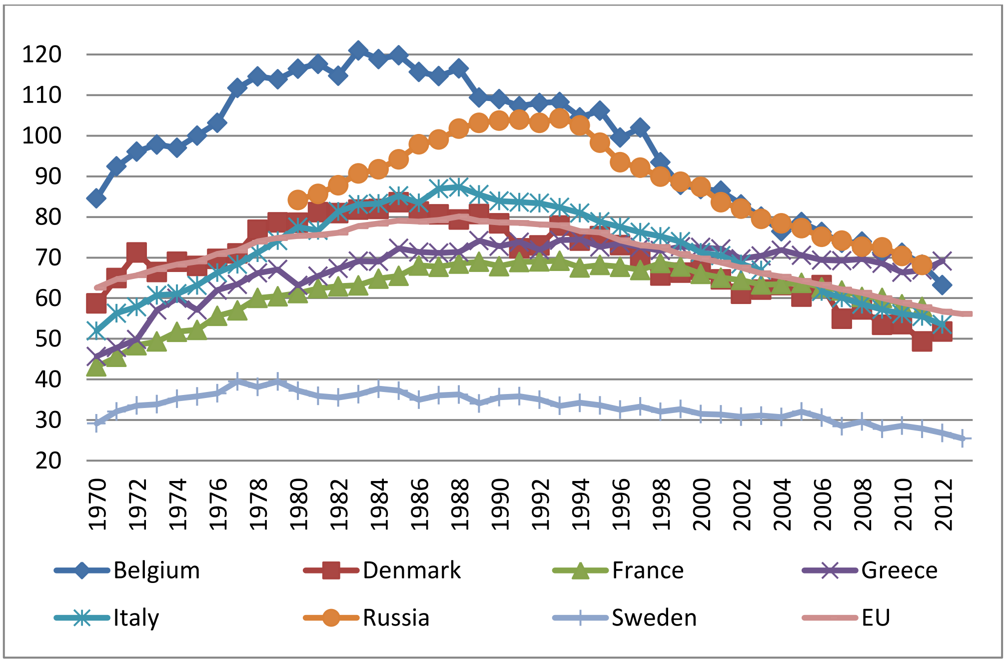
Moreover Russia was among the leading countries in the cigarette consumption and with a combination of the high prevalence and high consumption it was sent to the group with the greatest health risks with more than 20 cigarettes per daily smoker per day: the majority of male smokers (54.1 %) smoked 15–24 cigarettes per day while among women 35.0 % smoked 10–14 cigarettes per day, 33.9 % smoked 15–24 (Thun et el 2012, GATS 2009).

Regardless the current and historic smoking status and the fact that Russia is among European leaders in lung cancer risk rates by incidence (Ferlay et al 2006) and mortality, the lung cancer mortality rates in the country have been declining very fast since 1990s.

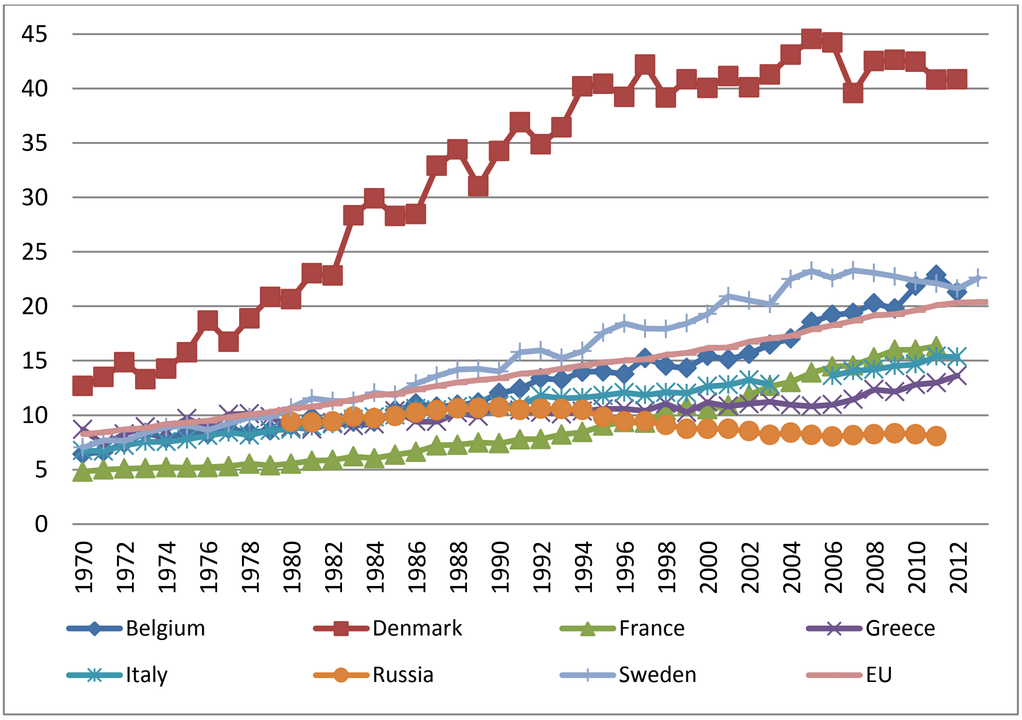
Graph 2 shows us that among women there is a decline despite of the fact that the female smoking prevalence was growing and far from potential saturation (at least a stabilization on the Eastern Europeans levels).

Graph 1. Trachea/bronchus/lung cancer standardized death rates per 100 000, males (European standard)

[2] This is a summary paper based on the different epidemiological researches from the Soviet period of time.



Graph 2. Trachea/bronchus/lung cancer standardized death rates per 100 000, females (European standard)

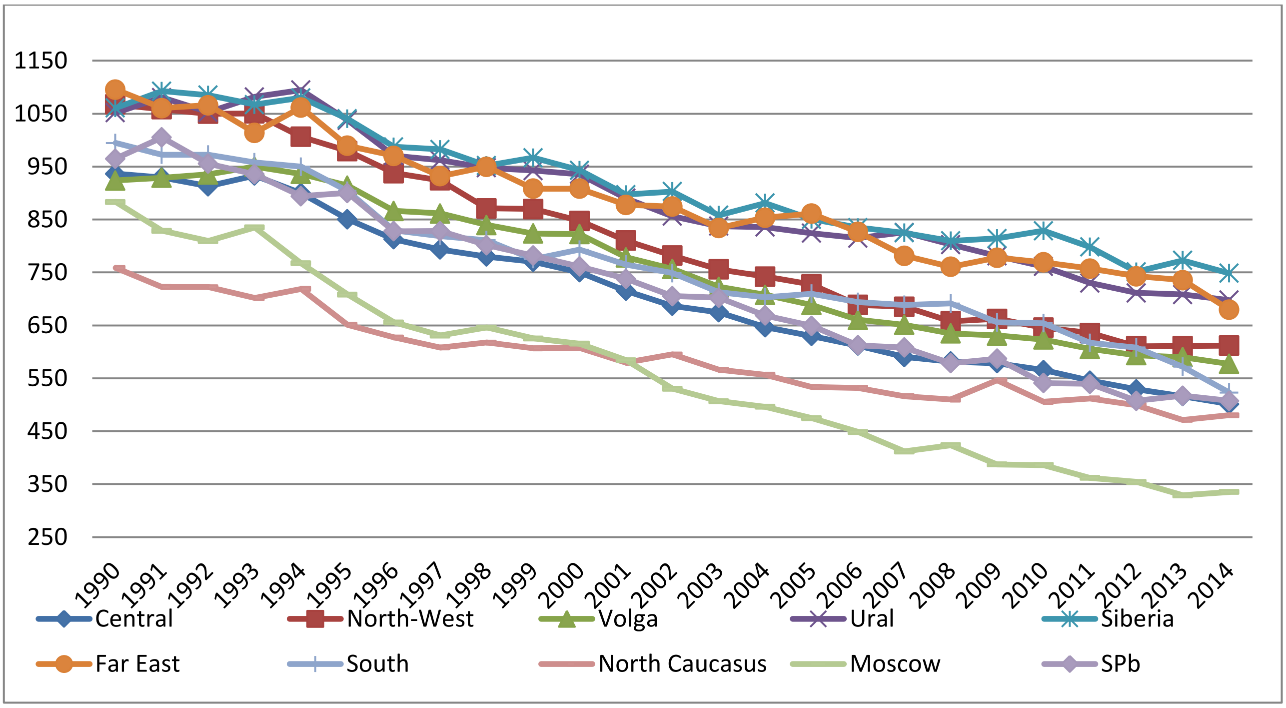


This effect is strong and visible for both rural and urban population and almost for all macroregions (Federal districts of Russia), while for the outliers there are differences in the base and dynamics.

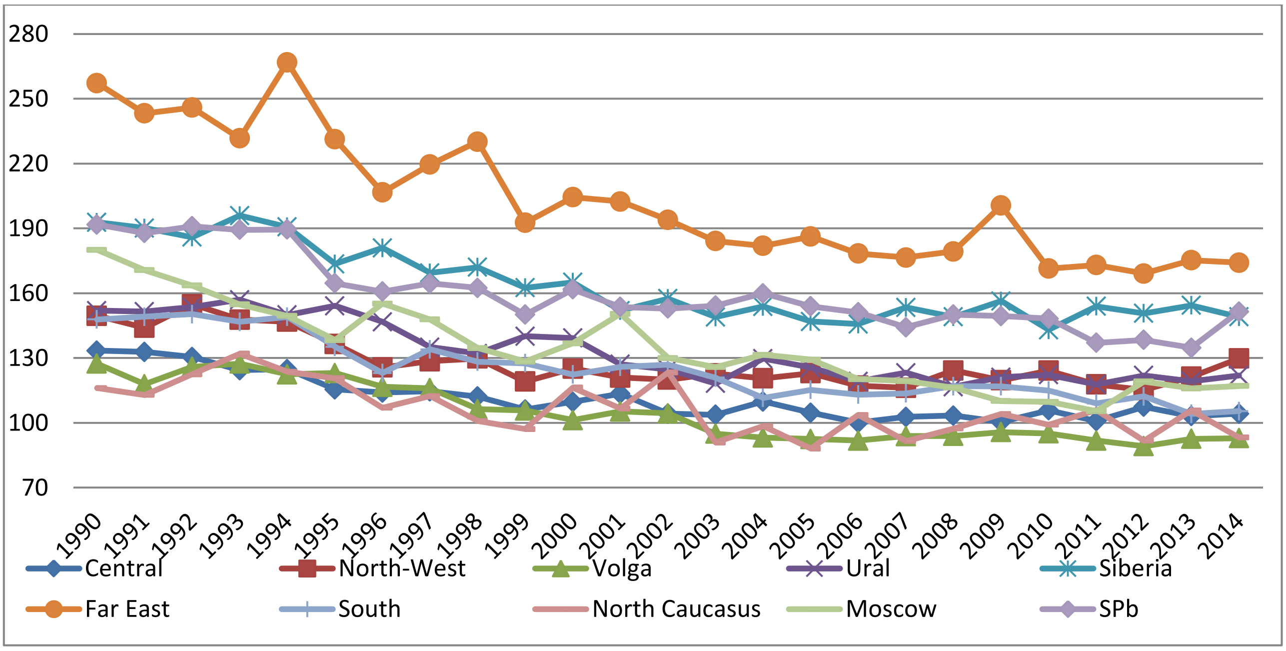
Graph 3. Trachea/bronchus/lung cancer standardized death rates per 1 000 000 (standard: Russian Census age structures)

A. Federal districts

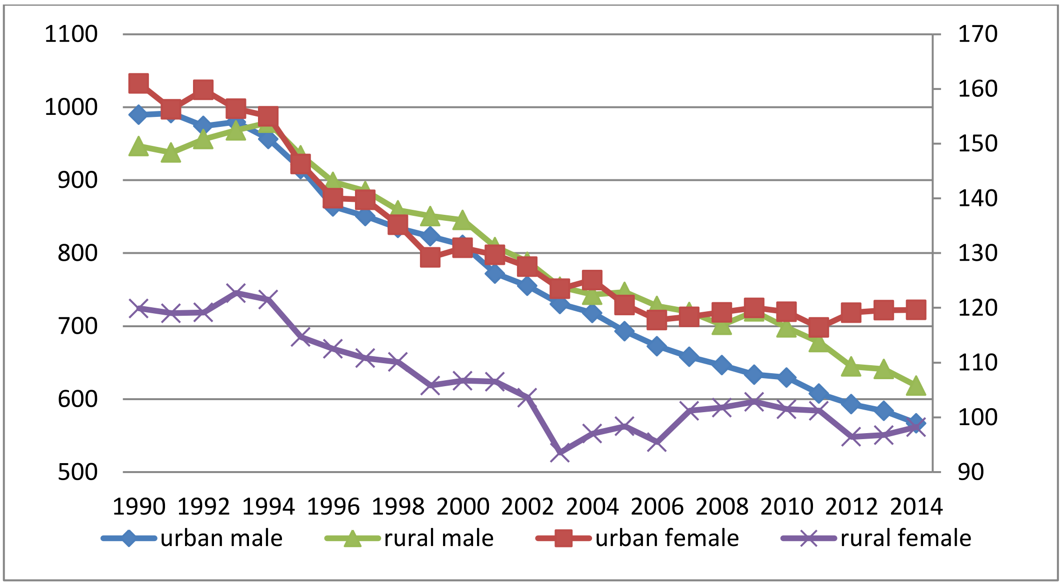
males



females



B. Rural and urban differences



If we address the classic model of cigarettes epidemics we will find that at the population level, peak smoking-attributable mortality generally lags behind peak smoking consumption by about 30 years (Lopez, Collishaw & Piha 1994). In this case the peak of smoking consumption should occur in Russia somewhere at the early 1960s. However there is a debatable question about the possible share of smokers within this peak if the smoking rate in Russia was already one of the highest in the world among men.

A full understanding of this situation is complicated because of the absence of reliable data on smoking rates during much of the Soviet period. In the early 1990s nationwide surveys found that the frequency of ever-smoking among Russian men was really high. For the men aged 65 and over in early 1990s the level was 71% compared with 83% in those aged 55-64 and 86% in those aged 45-54 (McKee et al 1998), while on the 2000s the figures were 69%, 77% and 80.5% (Quirmbach, Gerry 2016). The observed drift could be an indicator of the even higher smoking prevalence in the 1960s and 1970s in comparison with 1990s. However Perlman et al (2007) found that between 1992 and 2003 smoking prevalence has increased among men from 57.4% to 62.6%. The regional studies support the hypothesis, e.g. The Karelia research taken place within 1990s found the smoking rate 65% among men and 10% (or 21% if we adjust for the possible underreporting) among women (Laatikainen, Vartiainen & Puska 1999).

The existing researches (Quirmbach & Gerry 2016) about the dynamics of the indicator found that the male smoking prevalence in Russia has remained at very high levels which were not changed significantly since the mid-20th century and in this case the chance that the smoking prevelance rates were higher in 1950s in comparison with 1960s and 1970s is relatively low. Lillard & Dorofeeva (2015) found that generally all but the two youngest cohorts of men smoked at approximately the same rate. However according to Cooper (1982) the heaviest consumption was in the decade of the 1940s – the evidence that can support our hypothesis about the decline in smoking that happened in Russia in the 1960s. To the late 1970s smoking rates among men ranged from 44% to 69% depending on the region. According to Hurt (1995) the groups norms to smoking were close to the drinking patterns encouraging the heavily smoking as the normative pattern of male working-class lifestyles, so in this case almost 80% of adult males in industrial areas smoke. However the antismoking campaign started in the USSR at the late 1970s and the observed rates of smoking could be the result of the decrease.

If we look at the current cohorts we will find that the female smoking started increasing towards the end of the 1960s, and accelerated incrementally through in to the 1990s. The figure doubled among women from 6.9% to 14.8% (Perlman et al 2007). However the previous researchers found that in 1970s about 10% of women were found to smoke (Cooper 1982), it could be an u slight indicator of the higher smoking rates for the older cohort women, e.g. those who somehow participated in the WWII.

Concluding the remarks above we should say that the situation looks a bit paradoxically. However the attempt to investigate the Russian lung cancer phenomenon could be found in the article by Shkolnikov et. al (1999). The results show clear cohort effects for males which are maximum for those born in the few years between 1926 and 1934 and between 1938 and 1943. The authors expected that the decline in lung cancer mortality would be changed rising to a peak about 2003 because o this period the second peak reached the age of 65. However this prediction did not came into reality and the downturning trend remained stable.

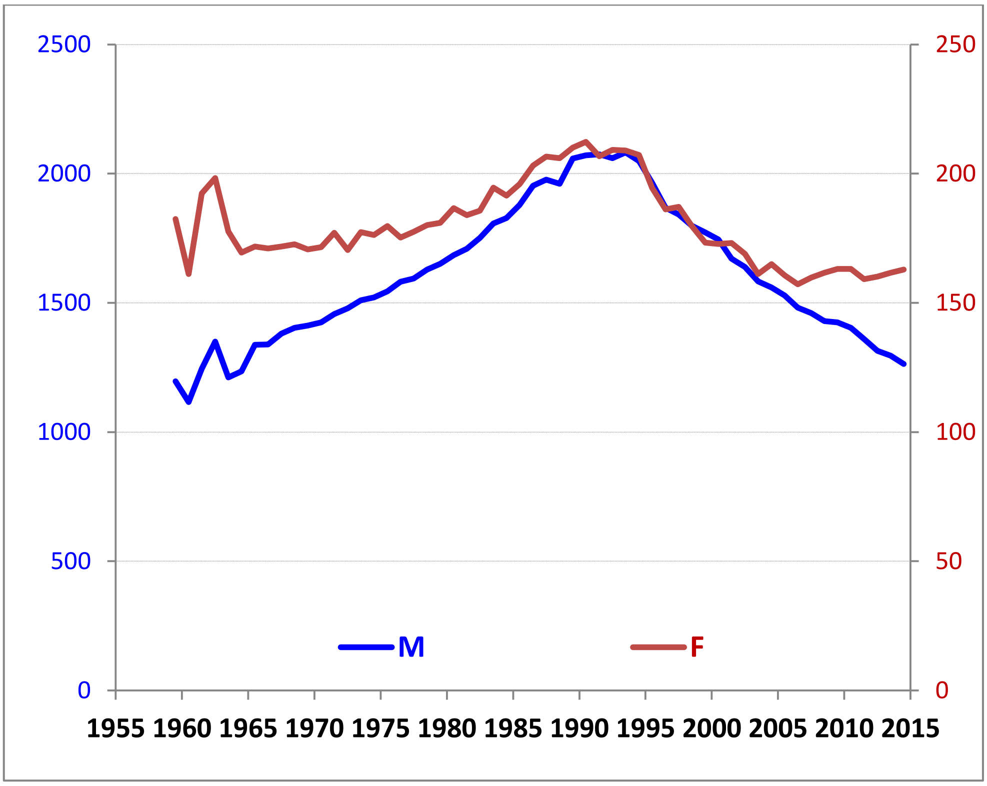
We should say that the overall contribution of the lung cancer decline among males into the life expectancy growth within the period 2003-2012 is nevertheless neglectable - 0,1 years (Shkolnikov et. al, 2014). However the only categories in which mortality was lower in Russia than in the UK were breast and lung cancers among women, but while in the UK we see the plateau in Russian graph we can see the decline.

Demographic analysis of the lung cancer

Univariate Analyses

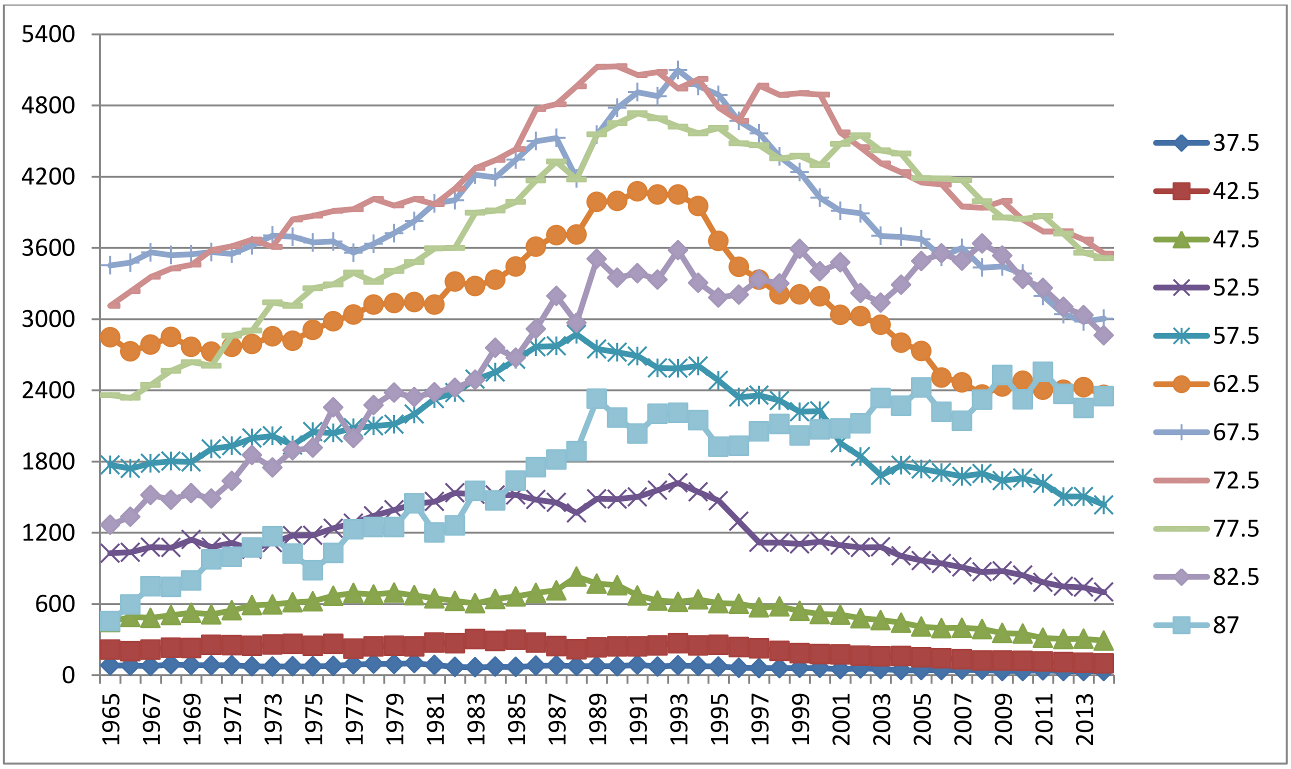
By lung cancer mortality we mean the deaths caused by malignant neoplasms of trachea, bronchus and lung, (C33-C34 by ICD-10). Data source for our analysis is The Russian Fertility and Mortality database (RusFMD). We have 5-year age groups for mortality rates since 1959. However because of the serious fluctuation we include in the further analysis data from the most reliable period (1965).

Graph 4. Trachea/bronchus/lung cancer standardized death rates per 100 000, Russia (European standard)



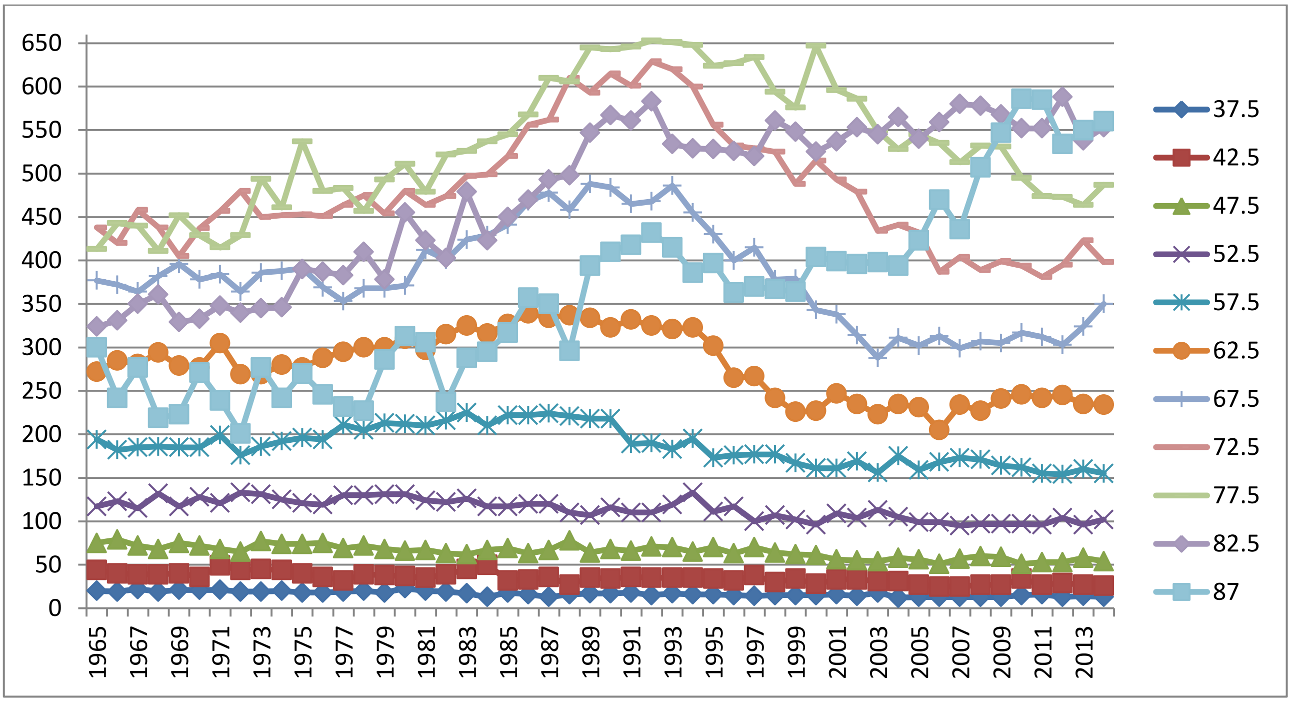
If we look at the period-specific death rates by age for males we will find a decline of the rates for all ages apart from the group 60-64 (the stagnation since 2005) and 85+ (growing trend).

Graph 5. Period-specific rates by age (male), per 1 000 000 (the mid of the interval on the scale)



For females we see the growing trend for the 85+ age, recent increase for 65-69 and the stabilization for most of the age groups.

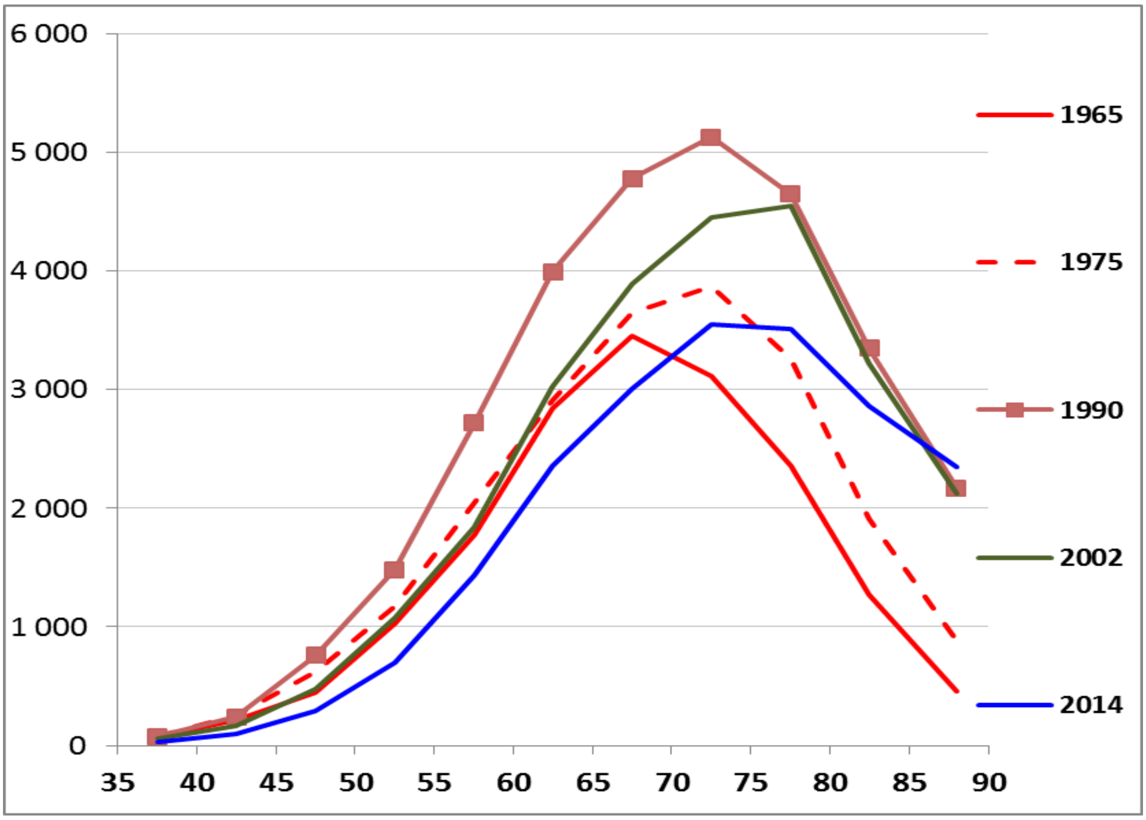
Graph 6. Period-specific rates by age (female), per 1 000 000 (the mid of the interval on the scale)



If we analyze the age profiles of the lung cancer mortality we will find the strong tendency to the ageing (this one could be interpreted in the definitions of the demographic transition as a delayed cause of death stage) of the phenomenon after the peak in 1990s for both males and females.

Graph 7. Age profiles of the lung cancer mortality, per 1 000 000 by selected years

Male


6 000
5 000
4 000
3 000
2 000
1 000
0
35
40
45
50
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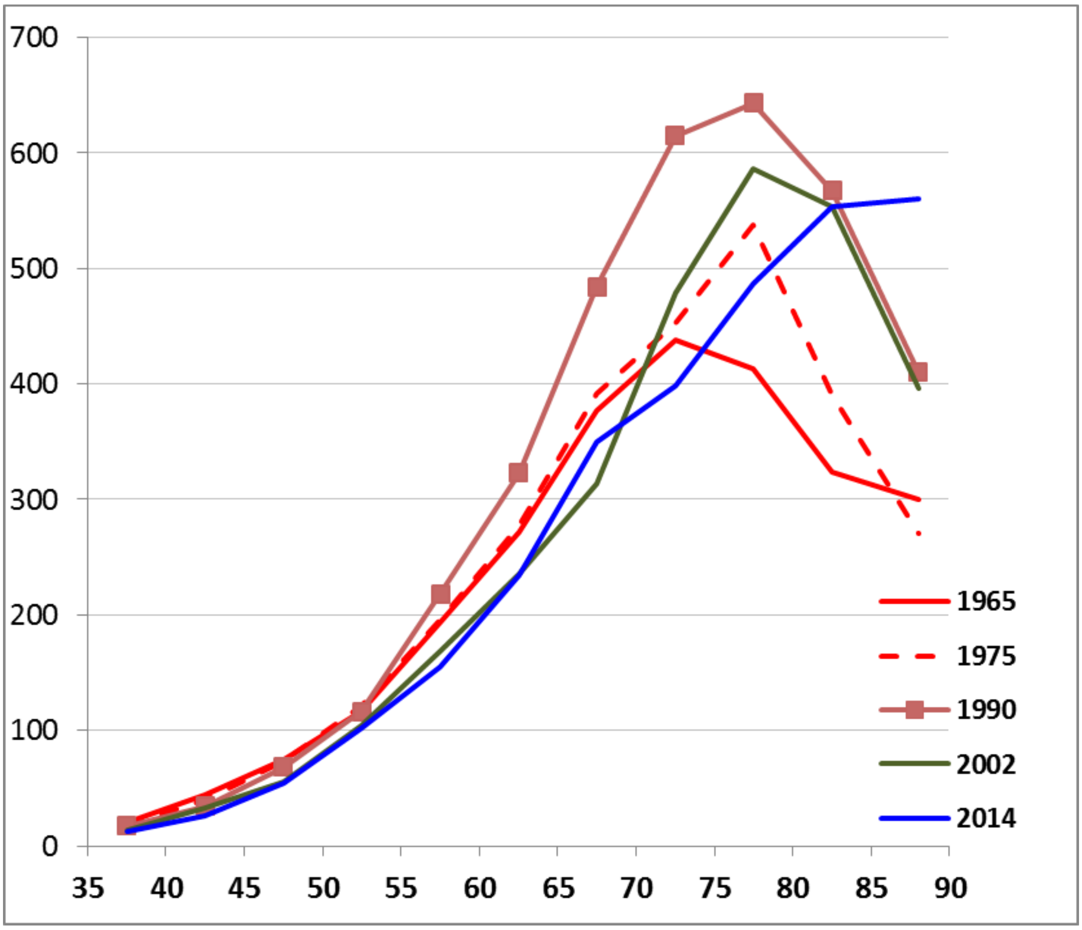
60
65
70
75
80
85
90
1965
1975
1990
2002
2014

Female


700
600
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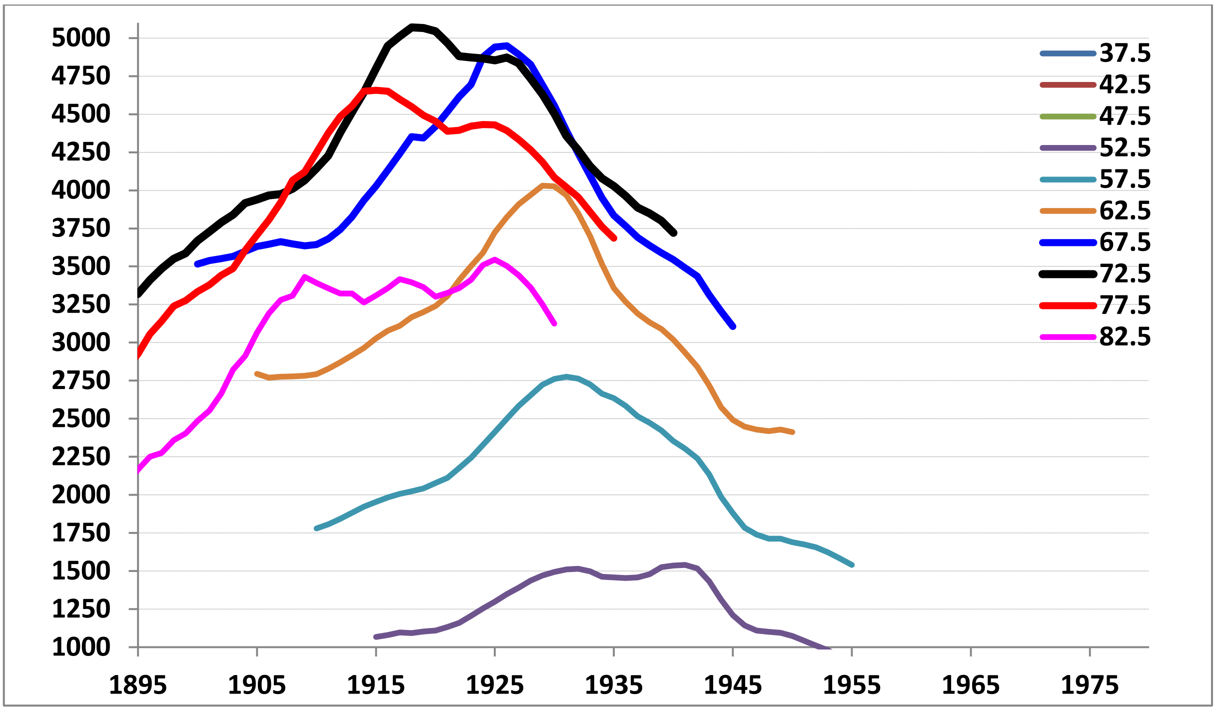
60
65
70
75
80
85
90
1965
1975
1990
2002
2014

Graph 7 illustrates additionally our statement about the lung cancer delay that was made after the analysis of Graph 8. Further we should understand if it could be explained by the cohort effect.

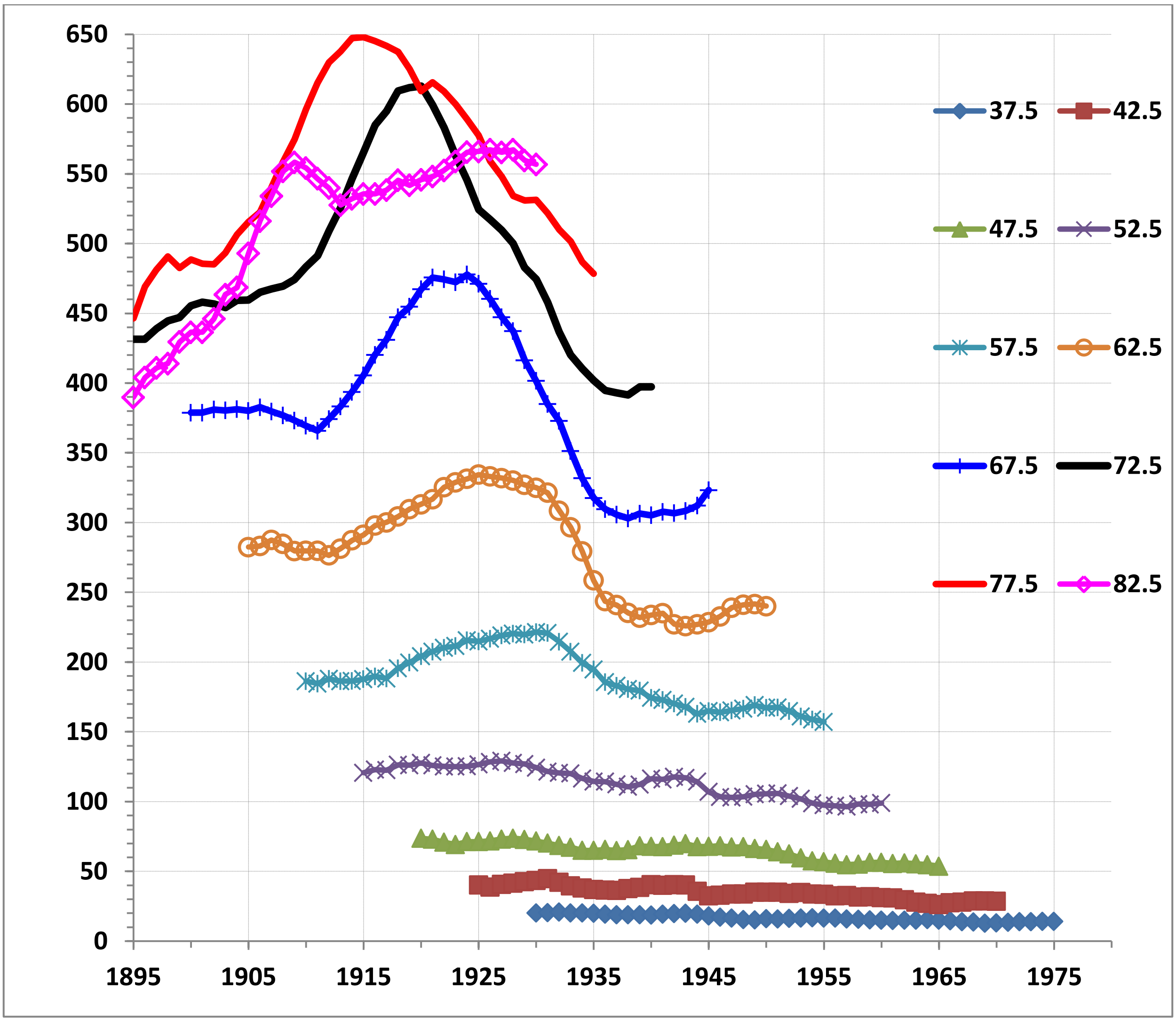
There are some visual peaks for the cohorts born. For males these are identified by Shkolnikov (1999) persons born in late 1920s early 1930s, for female the persons born approximately at the period from 1910-1930

Graph 8. Age specific death rates by birth cohorts, per 1 000 000

Males



Females



APC analysis

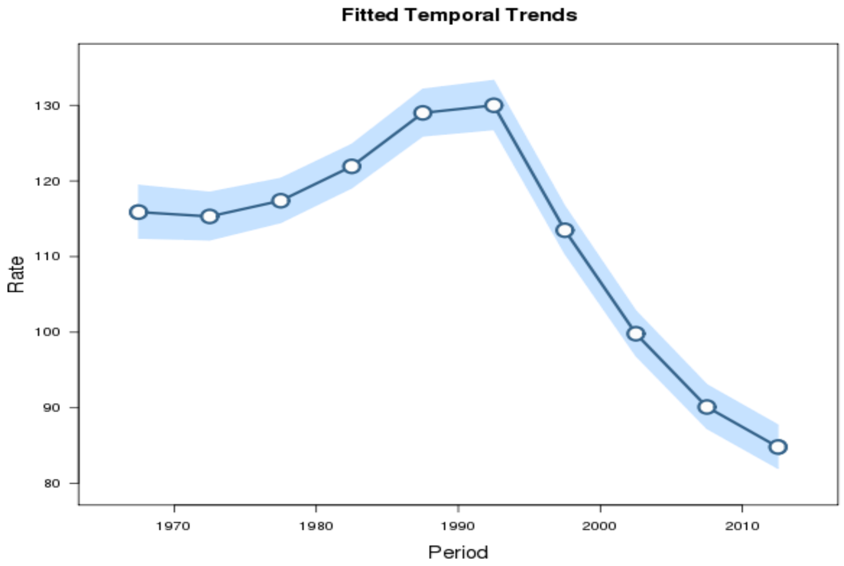
For the APC analysis we used a special web tool for cancer incidence and mortality rates (Rosenberg, Check, Anderson 2014) and also the Epipackage in R (Carstensen 2005)

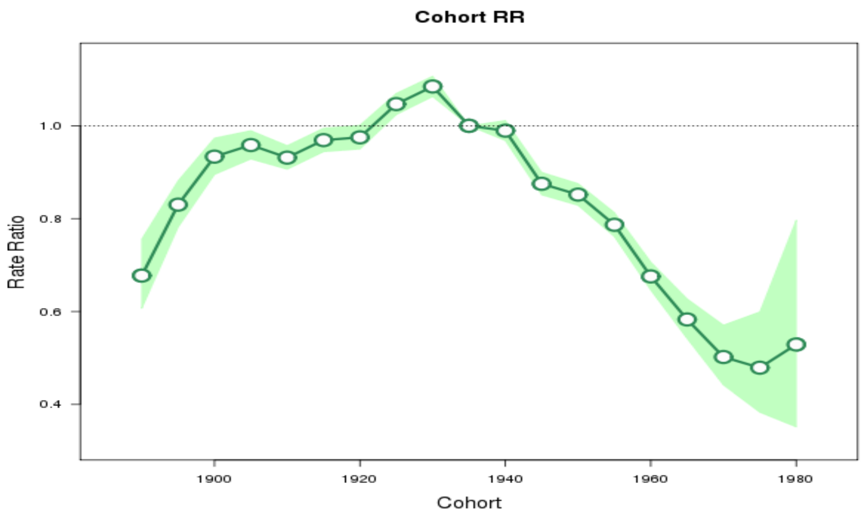
We do not have registers in our analysis that is why we have to take ecological data (the same that was used for the previous analysis on graphs 3-8).

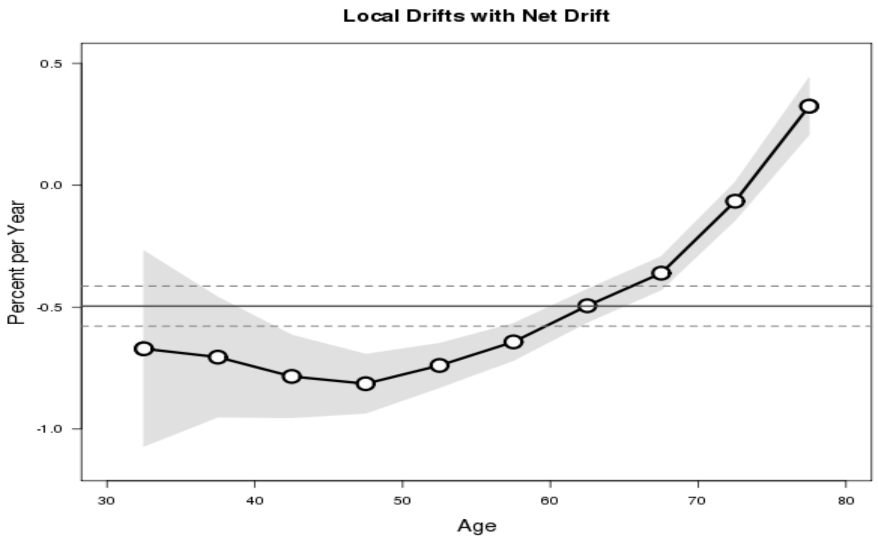
We do not also have the mortality data by 1-year age groups. In this case we are dealing with the following Lexis cells (age*period) Lexis 5x1 (rectangular) and for the robustness check Lexis 5x5 (square). Squares are not overlapping - 1st 5x5 square = 1965-1969 … 2010-2014 (the data is starting from 1965) also we are taking into account only 5-year groups within the age 30-80. So the results for the oldest age group will be truncated.

For the male population we see on the Graph 9 the downturning trend of the Fitted Temporal trends (rates in reference age group adjusted for cohort deviations)

Graph 9. Results of the APC (male) using web tool





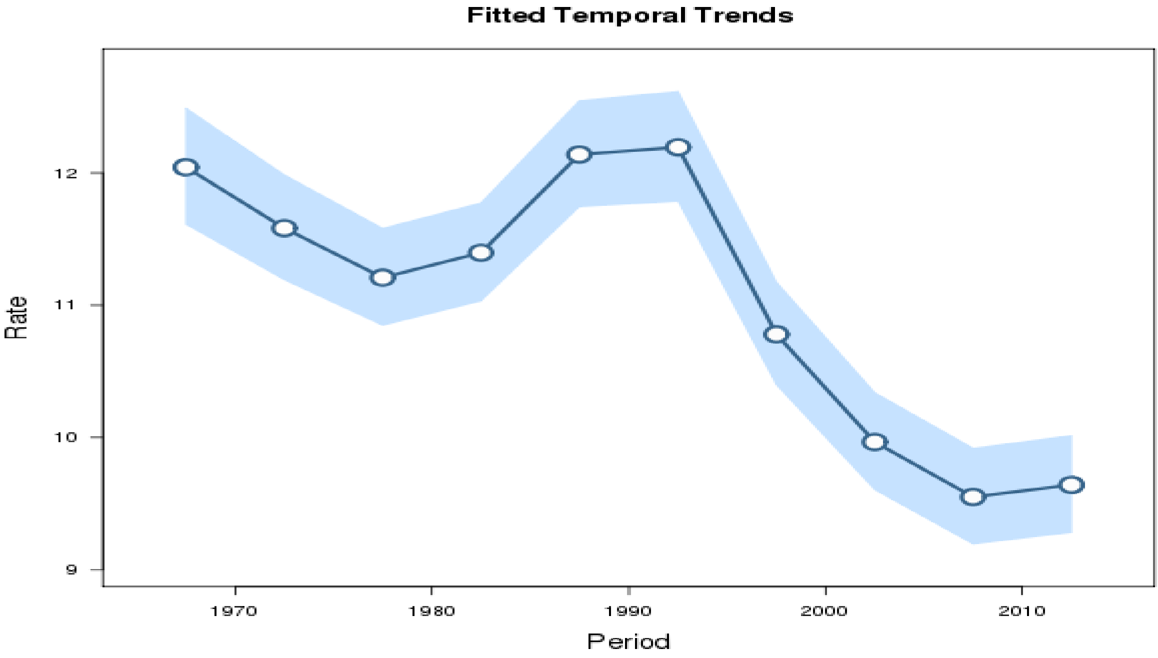


Ratio of age-specific rates in cohort relative to reference cohort shows us the high effect for the 1925-44 generations and the really strong decline in the youngest cohorts.

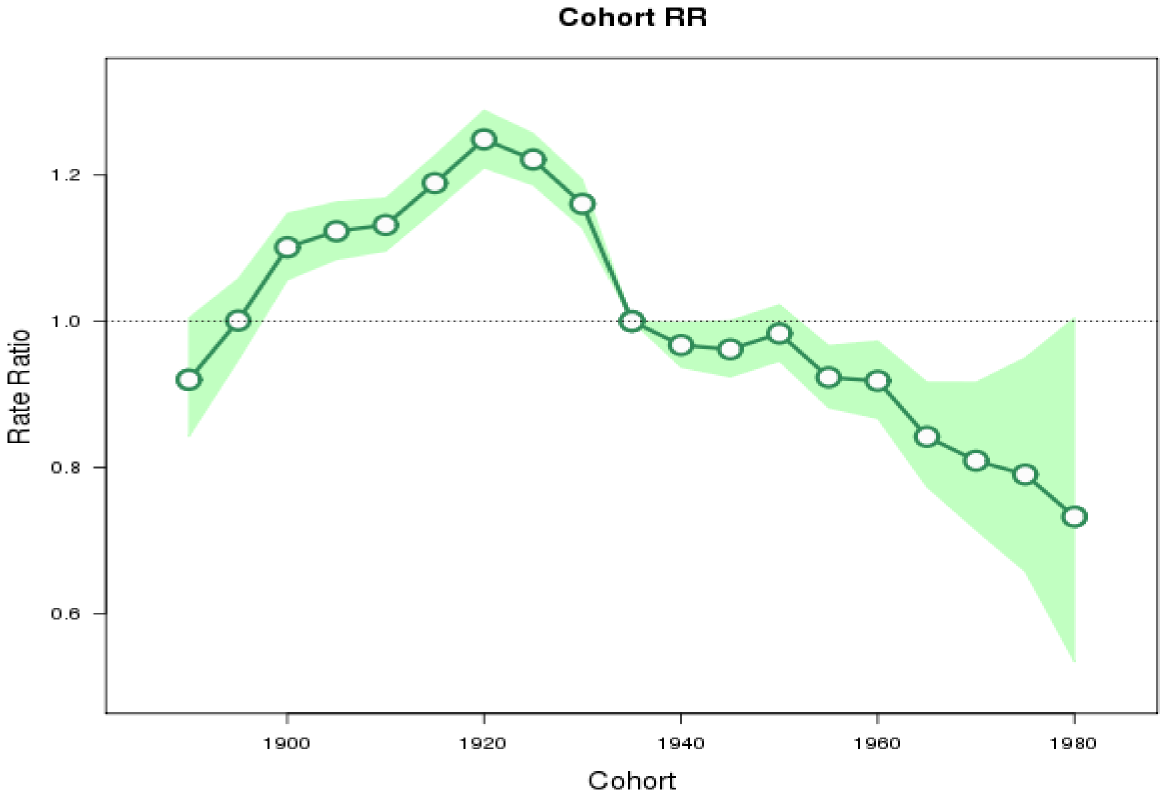
Local Drifts estimated as annual percentage change over time specific to age group is showing the strong redistribution to the older ages and in this case may be the most vulnerable cohorts are still affecting the current lung cancer mortality rates and afterwards the trend could go down even sharper. Net Drift - APC analogue of the estimated annual percentage change (EAPC) in the age-standardized rate (ASR) shows a decline for male population -0.671% (95% CI -0.585, -0.757)

For the female population (graph 10) we see the downturning trend of the "Fitted Temporal Trends" which has just started to grow – it could be the result of the higher smoking rates in the current population. However these rates are still the lowest for the whole period of observation.

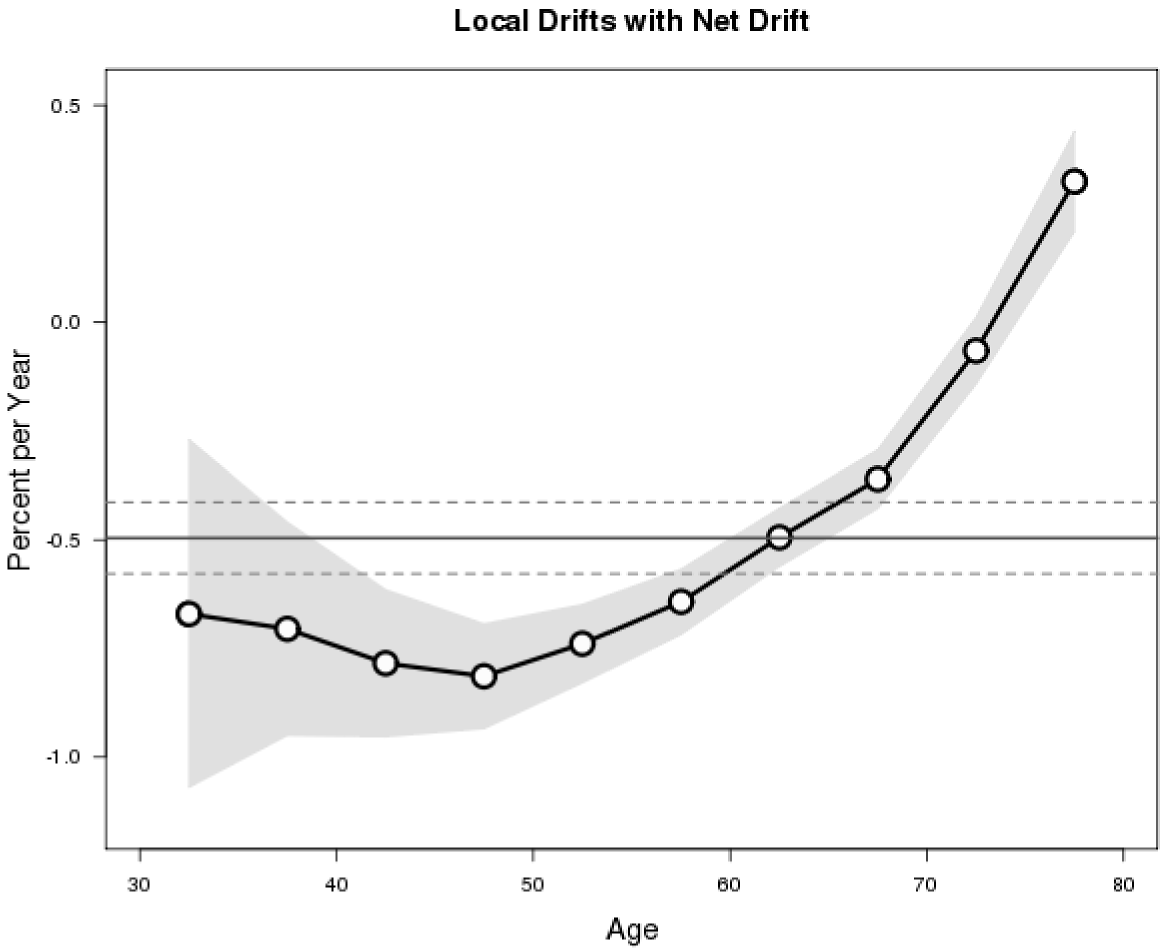
Graph 10. Results of the APC (female)



Ratio of age-specific rates in cohort relative to reference cohort shows us the high effect for the cohorts 1900-40 (especially for 1915-1930) and the steep decline in the youngest cohorts even regarding the higher smoking prevalence.



This effect could be explained by the participation of the women in WWII (not only directly in the military forces, but in the infrastructure like hospitals, plants and so on) and the more masculine life style after the WWII. The current results based on the US data shows that the prevalence of current smoking among adults (men and women) who reported ever serving on active duty in the United States Armed Forces is much higher and similar to that of the US adult population during the late 1960s/early 1970s (Brown 2009). However this effect is not so visible for male population, where the effect of the higher smoking prevalence is more pronounced for the persons who were initiated after the WWII. The age of initiation for both sexes who were born before war but did not participate was luckily lower for different reasons (the lack of the parents control, masculine environment, and harsh living conditions). Also the effect could be not so easily identified because of the oldest age truncation.



Local Drifts is showing the redistribution to the older ages, but the most vulnerable cohort could already die out within the previous decades due to the higher ASDR for the younger age-groups.

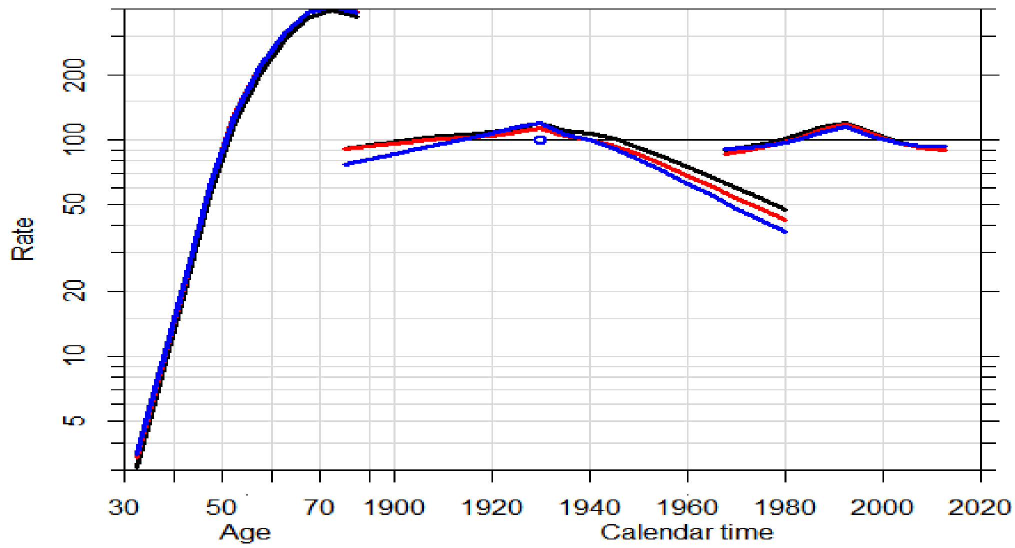
Net Drift - shows a decline for females but not so high as for the male population -0.496 (95% CI -0.413, -0.578)

However the new wave of smoking that seems to stop now could affect negatively on the cancer rates in the near future.

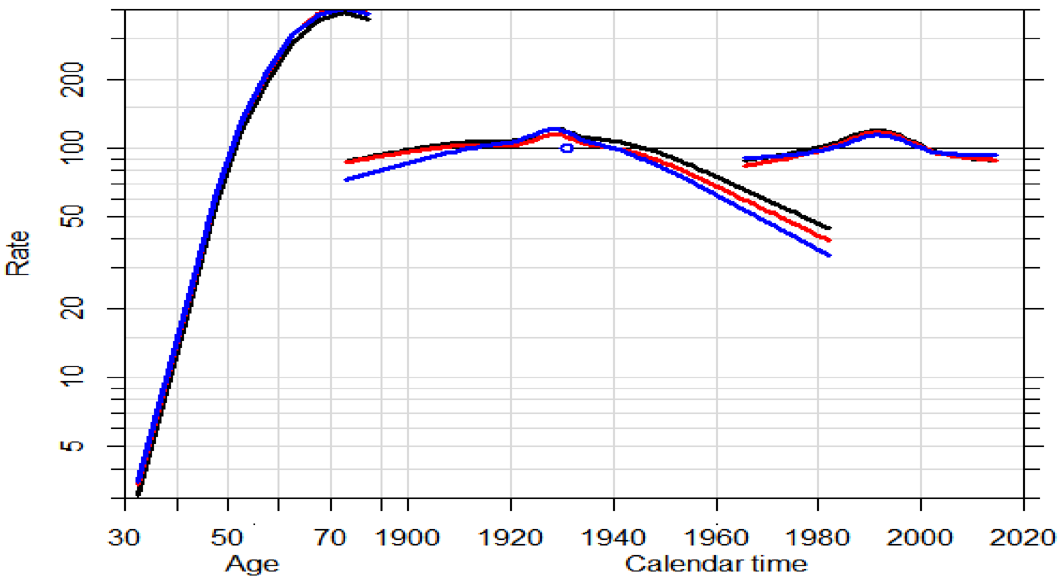
For robustness checks we used the Epi package in R. And we can see that the results based on the other software package were the similar. In this case we can maintain that the cohort results are robust and drive to the interpretation.

Graph 11. Robustness checks in R

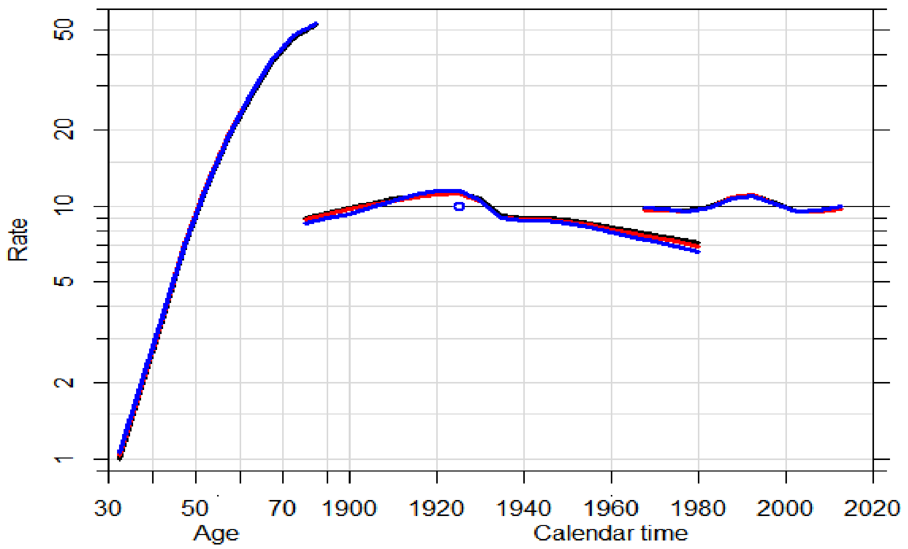
Male for 5*5.



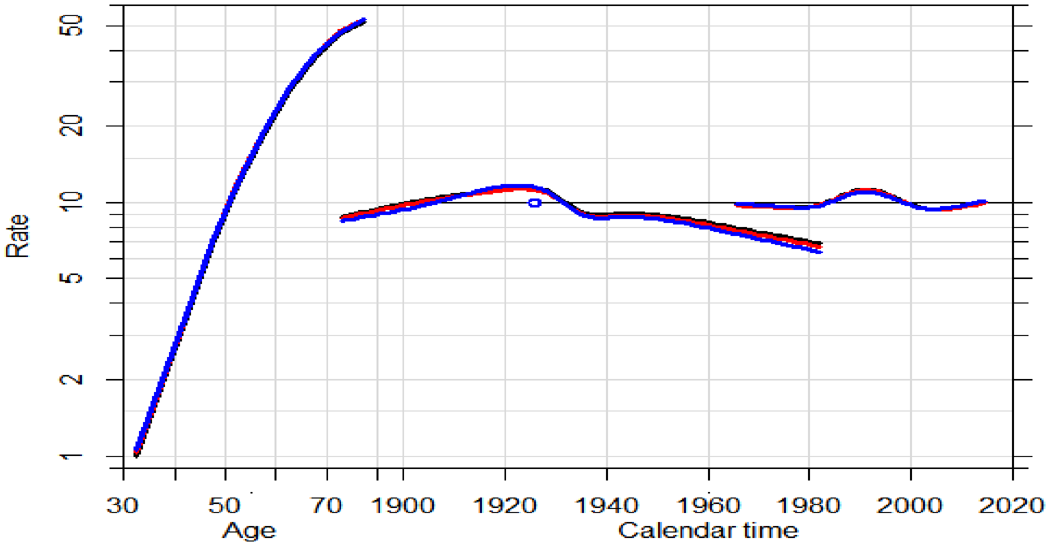
Male for 5*1



Female for 5*5



Female for 5*1



To sum up we could see that the lung cancer mortality is going down from cohort to cohort and the age patterns are migrating to the older periods. In this case we can conclude that the mortality is going down even in heavily smoking society.

Cohort smoking differences (the previous researches)

Quirmbach & Gerry (2016) analyzed the smoking patterns among Russian population since persons born in 1940s. They found that among males, smoking prevalence has remained at very high levels across cohorts, and with nearly identical life-course trajectories, peaking at around

75 percent for those entering their 20s (i.e. around the age of compulsory military service, see Brown 2007). However the authors claim that peak prevalence rates have been falling slightly over time, starting in the 1970 cohort. According to the researches the smoking reduces the life expectancy and in this case the selectivity could reduce the smoking prevalence if we look at the older cohorts. After mortality adjustment Quirmbach & Gerry (2016) found that the true smoking prevalence among males born in 1940s was higher (up to 80% within the peak period) which is consistent with our cohort lung cancer mortality observations. It might be that for the younger 1950's cohorts the smoking rates were even higher, on the one hand it is hard to imagine such a wide spread of the smoking habit, while on the other hand Cooper (1982) claimed that in 1940s the prevalence rate was the highest.

In contrast, for females, smoking prevalence has increased in each successive cohort since 1940s, with the steepest increases occurring among women born in the 1970s. Unfortunetelly we cannot observe properly in the Russian surveys the women belonging to the war cohorts there, but we can see that regardless the prevalence the lung cancer mortality is going down for female cohorts born in 1940 and later (it could be the effect of the net age drift, but vice versa age drift could be the result of the lower smoking prevalence of younger women)

Explanation of the cohort differences

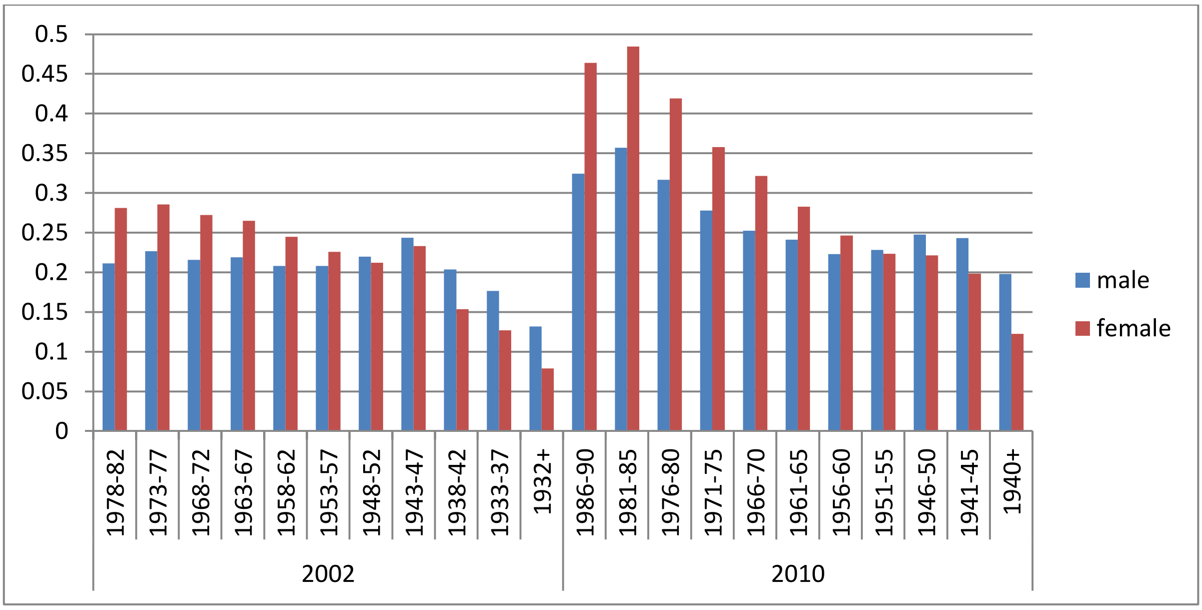
Education

One of the evidences towards the lower rate of the smoking could be the effect of the education. The education level was growing from cohort to cohort since 1956 till end of 1970s (however there was a decline for those born in 1980s), but the authors did not find the strong differences among 1940s cohort in smoking prevalence by the education status (the differences were pronounced for 1950 and later cohorts). In this case the growing education level for males cannot be a barrier on the smoking rates until recent years.

However for females in current cohorts we see the marginalization of the smoking to the uneducated groups of persons especially for the young ones. So we could drive a hypothesis that the growing education of women could be the barrier for the smoking spread. Also we could be optimistic predicting the trend and the lung cancer prevalence among women, because the share of uneducated in Russia is going down and concentrated in special vulnerable groups.

However the retrospective data because of selectivity could be incomplete and inaccurate. For example according to Cooper (1982) smoking rates were also different in 1970s among different educational groups: 37,2% among those with a higher education, 59,7% with a secondary education, and 64,8% with a primary education.

Graph 12. Share of persons with higher education (included incompleted higher) by Russian Census 2002 and 2010



The effect of cessation.

For the recent RLMS (2001-2010) waves more than the half of the ever-smokers quit at the age of 65+ (1936-1945 most vulnerable cohorts), more than a quarter to the age 55-64. 21,5% of the whole ever-smoking female population quit. How could this phenomenon effect the lung cancer epidemiology?

Based on the cohort studies in the UK we can find that the lifelong smokers die 10 years earlier than non-smokers (Doll et al. 2004). By 1990 cessation had almost halved the number of lung cancers that would have been expected if the former smokers had continued. For men who stopped at ages 60, 50, 40, and 30 the cumulative risks of lung cancer by age 75 were 10%, 6%, 3%, and 2% in comparison with 16% for the smokers (Peto et al 2000).

In Russia we might have the different effect from smoking quitting. The cumulative risk of death from lung cancer by the age of 75 years among current male smokers was 14.6% in Russia that is a bit lower in comparison with some other European countries (the same as in Romania), but still quite significant. The risk is proportional to the number of cigarettes and really neglectable – that is not unique for Russia – and insignificant for women – that is a Russian peculiarity (Brennan et al 2006).

The more likely explanation for the observed decrease of lung cancer mortality is a change in a combination of cigarette smoking prevalence, consumption of low tar and nicotine cigarettes, and an increased use of filter cigarettes by the recent birth cohort. The same picture was observed in the developed countries like USA (Zheng et al 1994). In this case we can talk about the part cessation when the person is not quit smoking, but change the smoking pattern. So we can claim that in Russia we observed not the perfect cessation but a substitution of the harmful substances to the less harmful ones.

The effect of this substitution is widely observed in literature. Garfinkel & Silverberg (1991) showed that persons smoking cigarettes with relatively low tar and nicotine had a reduction in lung cancer risk of about 25% compared with those smoking high tar/nicotine cigarette. The researches based on the Western European data within the period of filter cigarettes replacement of the non-filter ones showed that smoking only filter brands as well as a reducing the number of cigarettes smoked a day was also associated with a lowered risk (although changing from a non-filter to a filter cigarette had only a relatively small impact on risk of developing lung cancer), but was not as effective a preventive measure as giving up completely (Lubin et al 1984). B'chir (2007) explained the difference in pattern change of lung adenocarcinoma in Tunisia by the delayed introduction of filter cigarettes which became popular in Tunisia only in the 1970s whereas these cigarettes have been introduced in USA 20 years before. In Russia the cigarettes with filter usage decreased the number of tobacco consumed (Arzhenovsky 2005).

The situation with the quality of the tobacco products were improving in the late USSR. For example the share of cigaretteres with filters in the total amount of the cigarettes and papyrosas increased from 1.3% in 1965 to 20.7% in 1980 (Cooper 1982).

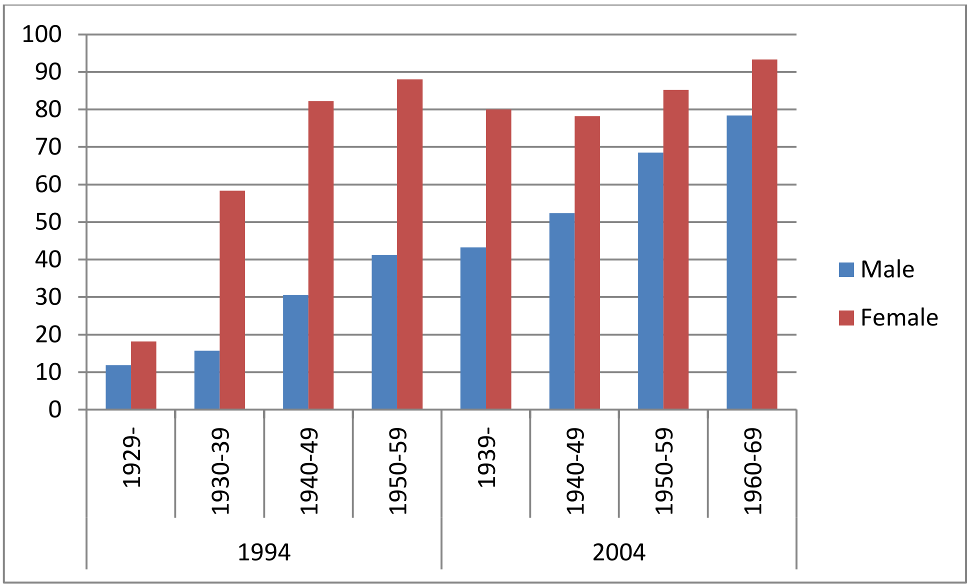
In the 1990s the share of smokers who preferred cigarettes with filters and without filters to the more harmful hand-rolled cigarettes and papirosy (the number of pipe-smokers was neglectible in Russia) was about 85% (among women more than 90%).

Demyanova (2005) found that the cigarettes with filters are more popular among smokers within the 1990s – more than half of the population used them especially among higher social class.

Zasimova & Lukinyh (2009) showed the tremendous decline of the tobacco production apart from the ones with filters consumption: it dropped from 50% in 1994 to 15% in 2006 and the average number of the cigarettes smoked by an individual has started to decline since 2003. These changing patterns could play a role of cessation for the Russian population and decreased the cancer levels. The cigarettes without filters and papyrosas are almost not produced in Russia (in 2010 the share in sales was about 5%, in 2013 based on RLMS the consumption was less than 7% for men and 1,5 % for women).

Tar level was decreased from 35 mg in 1989 to 19 mg, and in 1995 the new standard was 15 mg for the imported cigarettes, than is dropped to 12 mg now.

Graph 13. Share of cigarettes with filters in the total consumption by wave of RLMS and cohort, %



Other factors influencing cancer epidemiology

Miscoding

One of the explanation could be the difference into the coding system, when the malignant neoplasms could be confused with the other diseases by accident or for the purpose of showing the better performance of the healthcare system (since 2004 malignant neoplasms were included into the social harmful disease). In this case we could expect the violation of the indicators from region to region. However the paper by Danilova (2016) did not find any strange variation in the lung cancers among regions. The same conclusion could be done after the analysis of the regional spread of malignant neoplasms (first of all trachea, bronchus and lungs) variation from the paper by Timonin (2013).

Better healthcare

This is the mostly unlike situation. Even in the developed European countries the situation (diagnosis, staging and treatment) with the lung cancer has changed little and for the period 1960-1990s survival remains by 12% in Europe (Sant, Allemani & Santaquilani 2009). In this case we can say that the even hypothetic healthcare improvement in Russia could not change practice and we can say that the mortality from lung cancer reflects the behavior patterns of the previous decades.

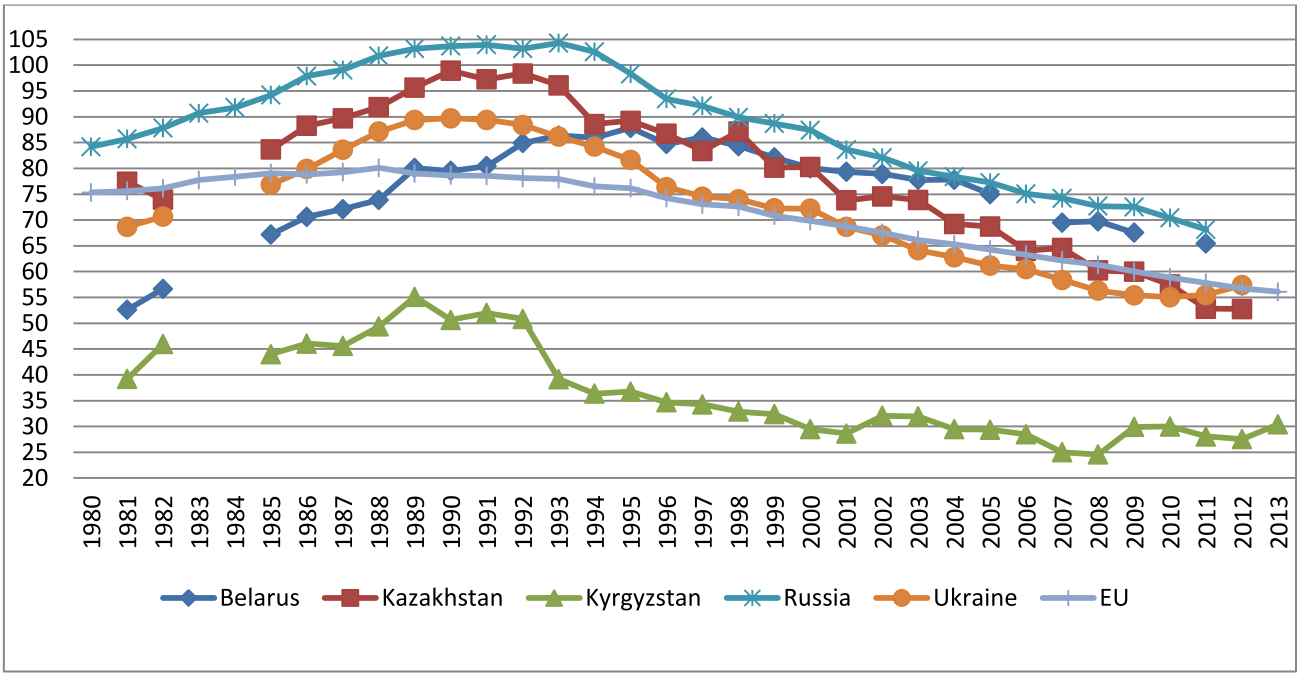
Lower air pollution

Another possible explanatory factor could be the level of air pollution which dropped down with the economic crisis of 1990s. Pope et al (1994) showed the relation of particular and sulphur-oxide related pollution with the lung cancer in the USA (each 10-mg/m3 elevation of air pollution increased risk of cancer mortality on 8%. However the same problem was observed for the heart diseases although the risk was lower (6%) and the heart diseases caused mortality in Russia sky-rocketed within the observed period.

If Russian case is unique. Lung cancer mortality in the other countries compared with Russia

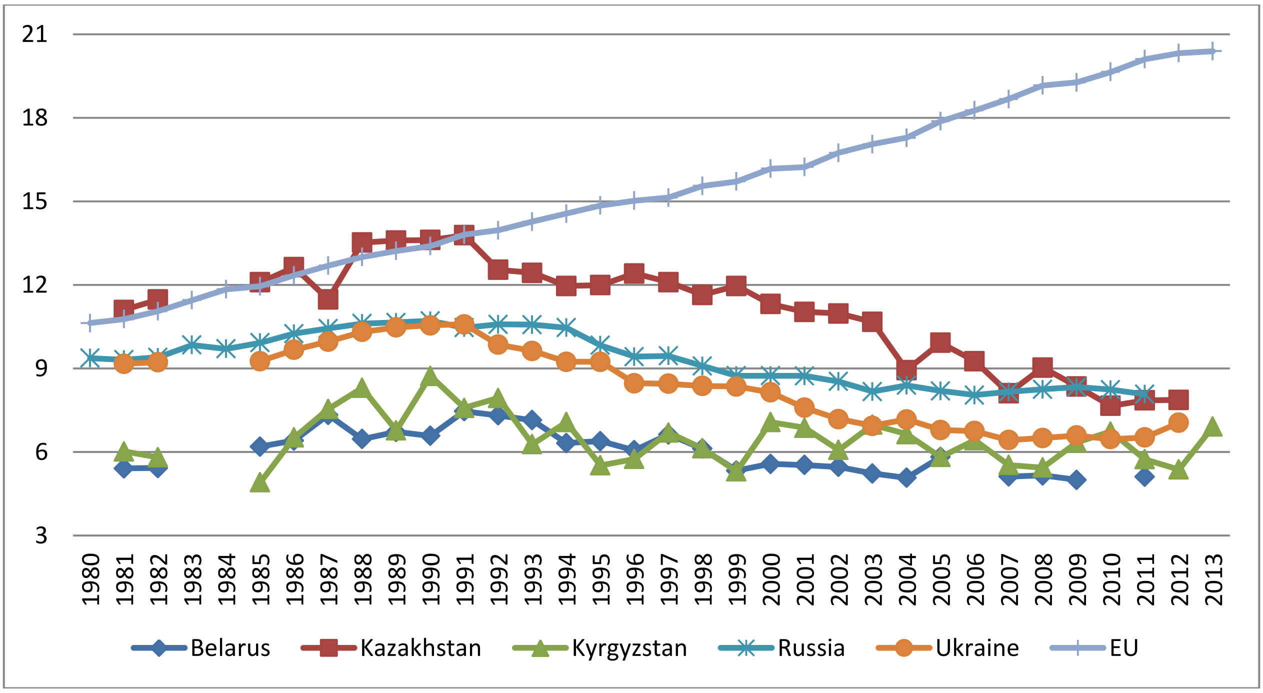
Graph 14. Trachea/bronchus/lung cancer standardized death rates per 100 000, Post-Soviet countries (European standard)

Males



The observed trend could be estimated as a Soviet legacy, because we should observe it in the whole Post-Soviet territory. If in the territory of Kazakhstan and Kyrgyzstan it could be explained by the migration of the non-Muslim population[3], the situation in Ukraine and Belarus could be close to Russian due to the similar smoking patterns in these countries.

Females



Gilmore et al (2001) found the very high levels of smoking in the Ukraine, particularly in men under 60 and the rapidly increasing level of smoking among young women. GATS 2010 showed that 50% of male (without pronounced regional differences) and 11% of female population smoked in Ukraine (with the majority in the South-East). The mean number of cigarettes smoked

[3] See Cooper (1982) for the differences in smoking patterns and lung cancers among European populations and Muslims of the Central Asian. On the other hand Cockerham (2004) did not support the results showing that smoking pattern are widespread among title nations and even Muslim population in case of Kazakhstan.

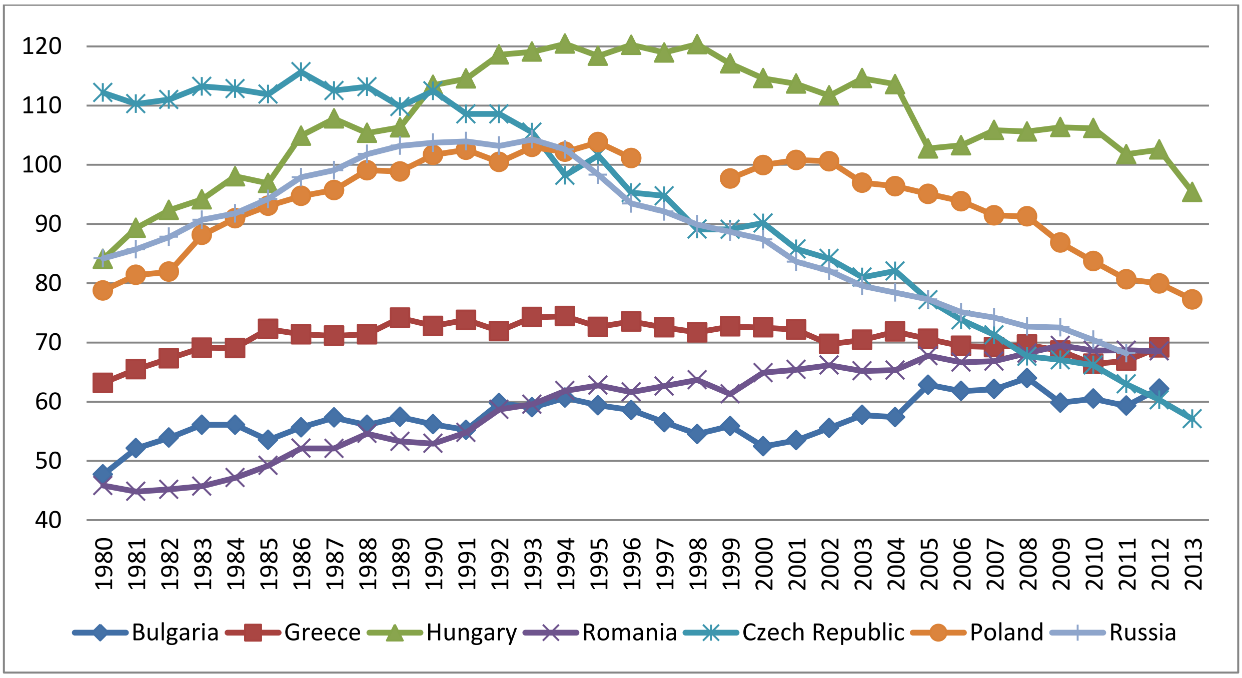
daily is 16.9 (for men is 18.2 and for women 11.8), that is a bit lower than in Russia. More than 90% of the population smoked with the regular of slim filter. Lillard and Dobrodeeva (2015) found the same patterns for both countries, but more Russian women took up smoking than did Ukrainian women.

Gilmore et al (2001) showed that in Belarus the patterns of smoking are close to Russia and Ukraine: in the late 1990s 41% of the population have ever smoked, 29% are current smokers and 12% are ex-smokers. These proportions vary by age and sex group with 53% of men and 9% of women currently smoking. Ever smoking is highest in 50-59 years old men, amongst whom 80% have smoked and in 18- 29 years old women amongst whom 28% are ever smokers. In both sexes, current smoking is most common in those aged 30-39 years.

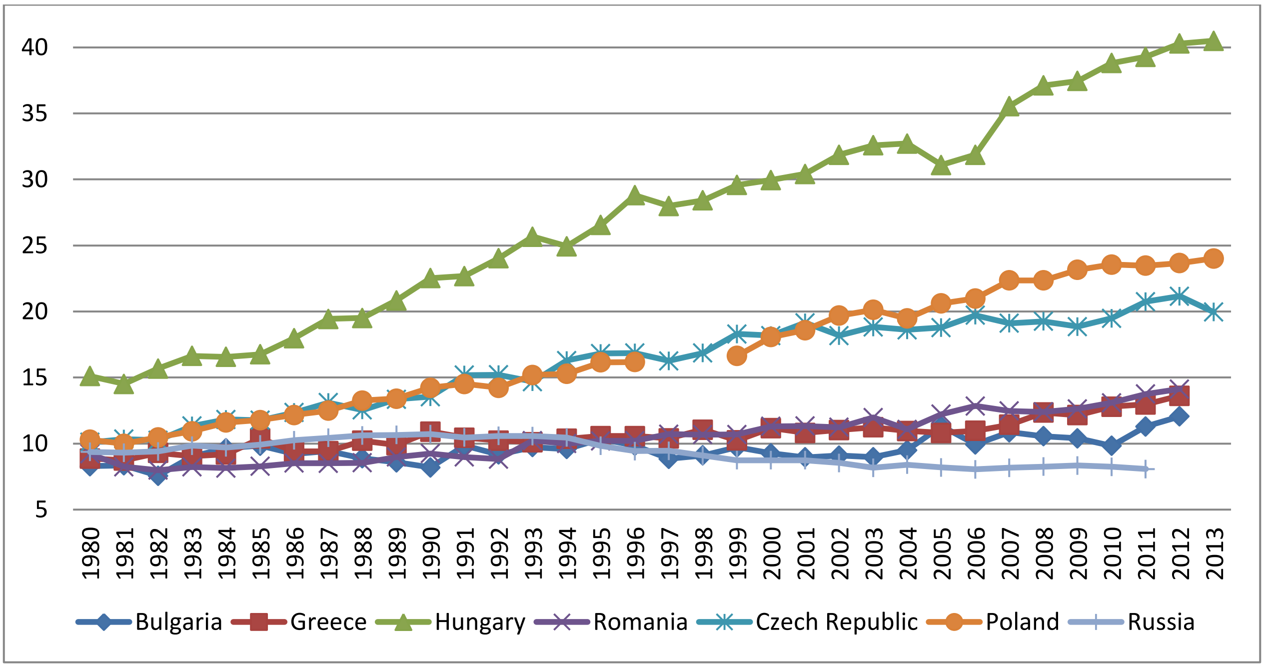
On the other hand the decreasing level of male lung cancer observed in Ukraine and Belarus was also similar in Czech Republic. Simultaneously in the other post-communist countries there was the growth (Bulgaria and Romania), that changed to the decline in 2000s (Poland and Hungary). For women all the mentioned post-communist countries demonstrated a growth.

Graph 15. Trachea/bronchus/lung cancer standardized death rates per 100 000, Eastern Europe (European standard)

Males



Females



We could say that Spilková, Dzúrová &Pikhart (2011) described the situation in Czech Republic and the cessation seems to start earlier than the end of 1980s. However the significant decrease in smoking prevalence was reported for Czech males between 1985 and 1997—49–37%among 35–64 years old men based on WHO MONICA results (Skodova´ et al.,2000). The prevalence remained almost the same for Czech females (1985–1997 change from 28% to 26%). Later reports by the Czech National Institute of Public Health (Sovinova´ et al., 2008, 2010) summarizing the smoking prevalence between 1997 and 2007, showed virtually constant prevalence of approximately 30% in the age group 15–64 years. So the lung cancer epidemic for Czech women is far from being controlled.

The time lag between smoking patterns and lung cancer was observed in developing countries as well. For example in Tunisia, the incidence of lung adenocarcinoma was relatively low in 1990 when compared to western countries and was shown to continue to increase. A lag-time period of 10 years is observed between Tunisia and Europe for this increased incidence in smokers and about 20 years between USA and Tunisia (B'chir 2007).
Greece also could be an interesting case showing the low levels of cancer mortality with a high smoking prevalence (Vardavas, Kafatos 2006; Ng et al 2014), may be the reasons for it are close to the Russian ones.
In this case we should say that the situation in Russia and other Post-Soviet countries is interesting and need the further explanation.

Additional explanation. Other causes of death replacement

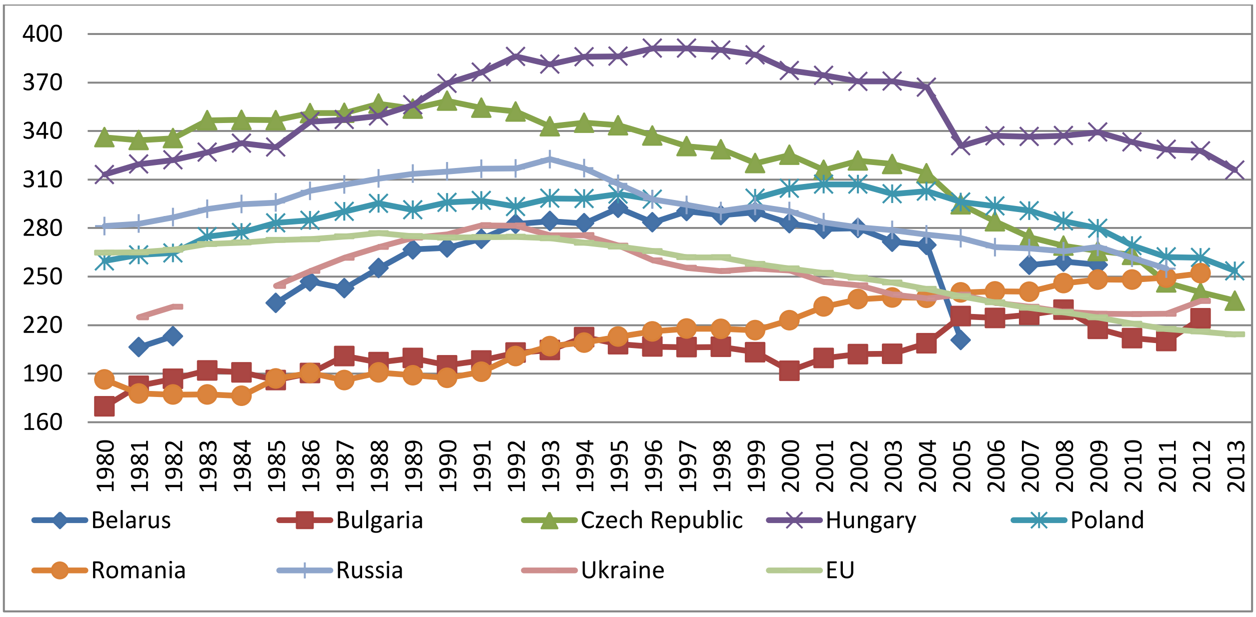
According to the classical model the main indicator for the smoking caused diseases are lung cancers, because the heart and respiratory diseases has different other risk factors and it is impossible to mix them.
However Preston, Glei &Wilmoth (2010) found in their alternative models that a 50% reduction is assumed in smokers' excess risk of death from causes other than lung cancer.
The meta-analysis performed by Gandini et al. (2008) found that the risk of respiratory cancers were much stronger for the smokers in comparison with the non-smokers. The pooled risk ratios were the following: laryngeal (RR 5 6.98; 95% CI: 3.14–15.52) and pharyngeal (RR 5 6.76; 95% CI: 2.86–15.98) cancers presented the highest relative risks (RRs) for current smokers,

followed by upper digestive tract (RR 5 3.57; 95% CI: 2.63–4.84) and oral (RR 5 3.43; 95% CI: 2.37–4.94) cancers.

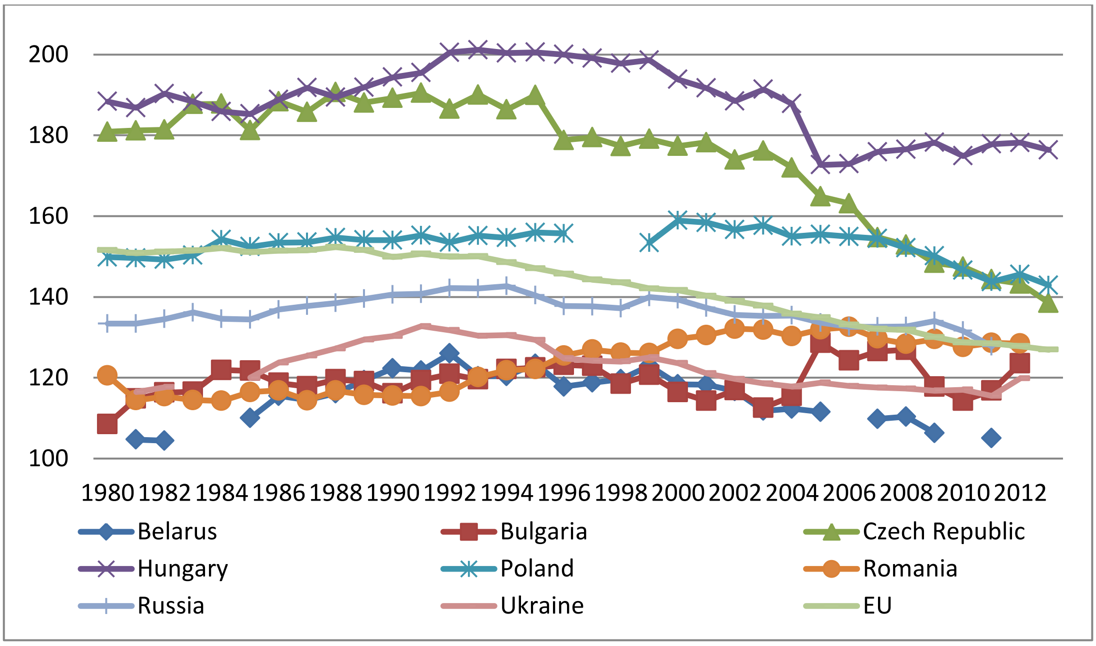
The whole malignant neoplasms mortality in Russia is also going down although not so fast as the lung cancer in this case the completion between cancers is unlikely play a significant role. In the most of the post-communist countries the cancer mortality profile is also explained mainly by the lung cancer mostly, especially for men.

Graph 16. Malignant neoplasms standardized death rates per 100 000, Eastern Europe (European standard)

Males



Females



We should say that the lung cancer itself could be different and smoking is a cause only by limited forms of it.

Kreyberg (1955, 1962) found that 2 types of lung cancer have different etiologic profiles:
Only Kreyberg I (including squamous, large, small, oat, spindle, clear, and large cell undifferentiated carcinomas) was considered to be strongly associated with cigarette smoking. This effect was visible on American data by Wynder (1987) and Zheng at al (1995). We can see what is happening with the different types of the cancer using the cancer register data. However now we have not access for them to check our hypothesis.

The other diseases could be also play a great deal in moving down the cancer. Russia within the period of active lung cancer decline had problems with the high circulatory system caused mortality. In this case smokers spured also by the other risk factors could die out from their cohort mainly due to the higher probability to die from heart and circulatory diseases.
Among all Leistikow (2009) found the suggestive qualitative relationships between higher smoke loads and higher heart disease mortality levels across education levels, times, genders, and studies.

Huxley & Woodward (2011) based on the more than 2 mln. sample found the stronger effect of smoking on the heart diseases and more over women who smoke have a 25% greater RR of coronary heart disease than do male smokers, independent of other cardiovascular risk factors.

Yusuf, Hawken & Ounpuu (2004) found that smoking is one of the most significant factors contributing to the risk of MI and IHD

If we use previous researches about Russia we will see that all the other main substitutes could play their role. Leon et al (2007) found that lower levels of education and smoking were both associated with increased volume of ethanol consumed, non-beverage alcohol drinking, and markers of problem drinking. Denisova (2010) highlighted that the detrimental role of smoking to health is found to be comparable with the role of excess alcohol consumption, which is novel in the Russian context where the influence of smoking is typically downplayed in comparison with alcoholism.
Also we observed in Russia the high risk of respiratory diseases especially among the young working-age population at the period of 1990s. (Semenova, 2005). The high external mortality risk observed in Russia since 1960s could also play a role in the depletion of the cohort for the potential lung cancer mortalities.
Shkolnikov et al (1999b) found that in the very beginning of the trend competitive risks from cardiovascular diseases and external causes could be responsible for the cancer (all) mortality rates in the middle ages reduction. The current situation could be observed and explained more in details.

Projections

Regardless to the decline across cohorts we could expect the possible growth of the lung cancer death rates for women when the cohorts born in 1970-80s will came into the age of intensive death while for men we could expect the decline, but not so steep or even stabilization because of the shrink of the other competitive causes of death (although the smoking prevalence is going down).

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