Where and why people die in Hungary

Introduction: Hungary has a mortality problem

Hungary has relatively high mortality and low life expectancy even compared to similar countries in its region, and countries with similar income levels around the world. This divergence is uneven across age groups, and was also changing over time. By the early-mid 1990s, mortality rates of men aged 45-64 were higher than the levels seen in the 1930s. Mortality has improved since then in Hungary, but also in most other countries too. This means that relative mortality, especially in the middle aged groups, is still significantly higher than even in other post-socialist countries (see Chart 1 and 2). Only post-Soviet countries perform worse in terms of late middle-aged (50-69) mortality, Hungary has higher mortality rate than Romania or Bulgaria in this age group. Also it is among the worst in terms of cancer mortality rates globally (see Chart 3).

In terms of mortality by age, the upturn in mortality as the individual's age progresses happens earlier in Hungary than in Western Europe. Relative mortality, compared to Western Europe, is very similar between ages 1 to about 30 (infant mortality, where effective health care may matter more than mortality of children, is about 60% higher). But after that age the upturn in overall mortality in Hungary comes 5-10 year earlier than in Western Europe (Chart 4).

Chart 1: Mortality rates have declined both in Hungary and elsewhere...

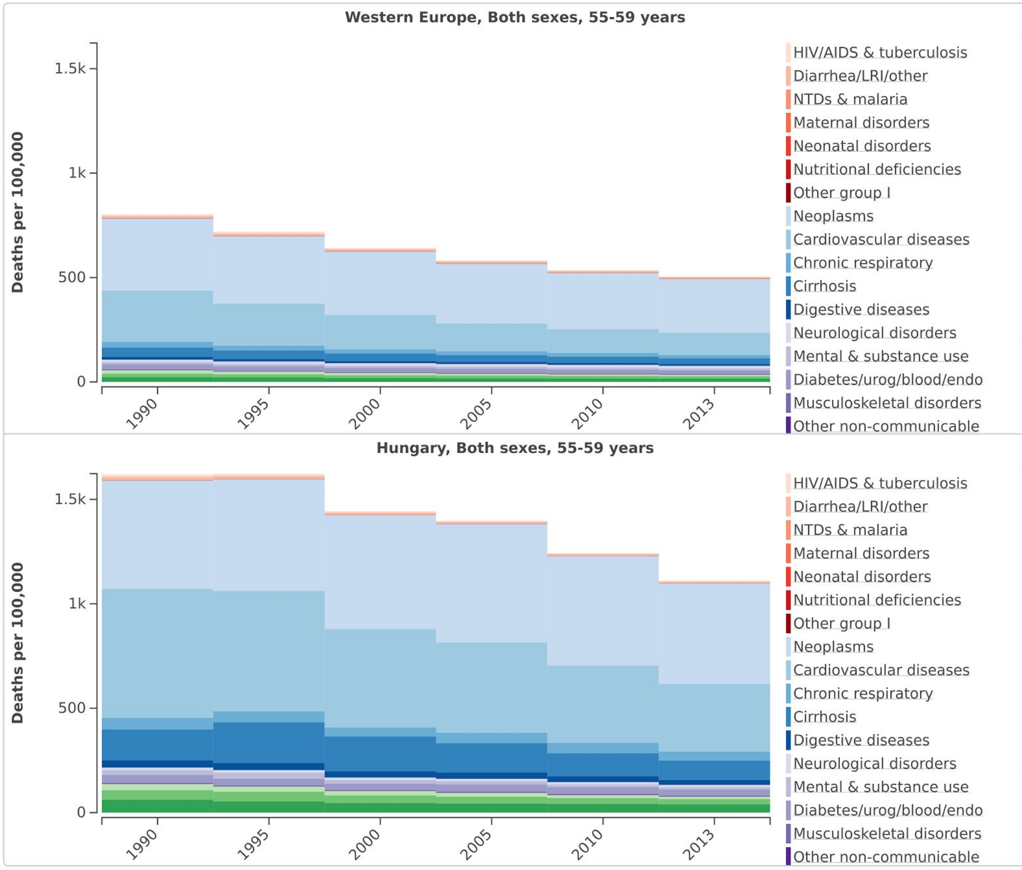


Chart 2...which means that relative mortality is still significantly higher

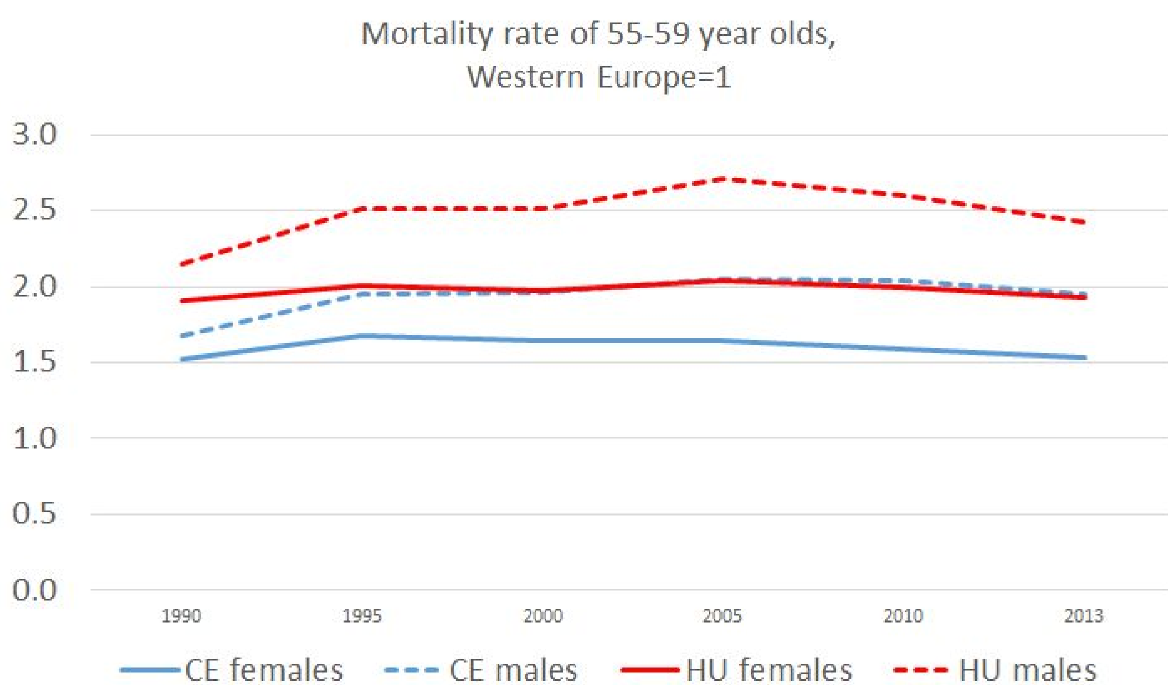


Chart 3: Hungarian middle-age mortality bad, cancer among the worst

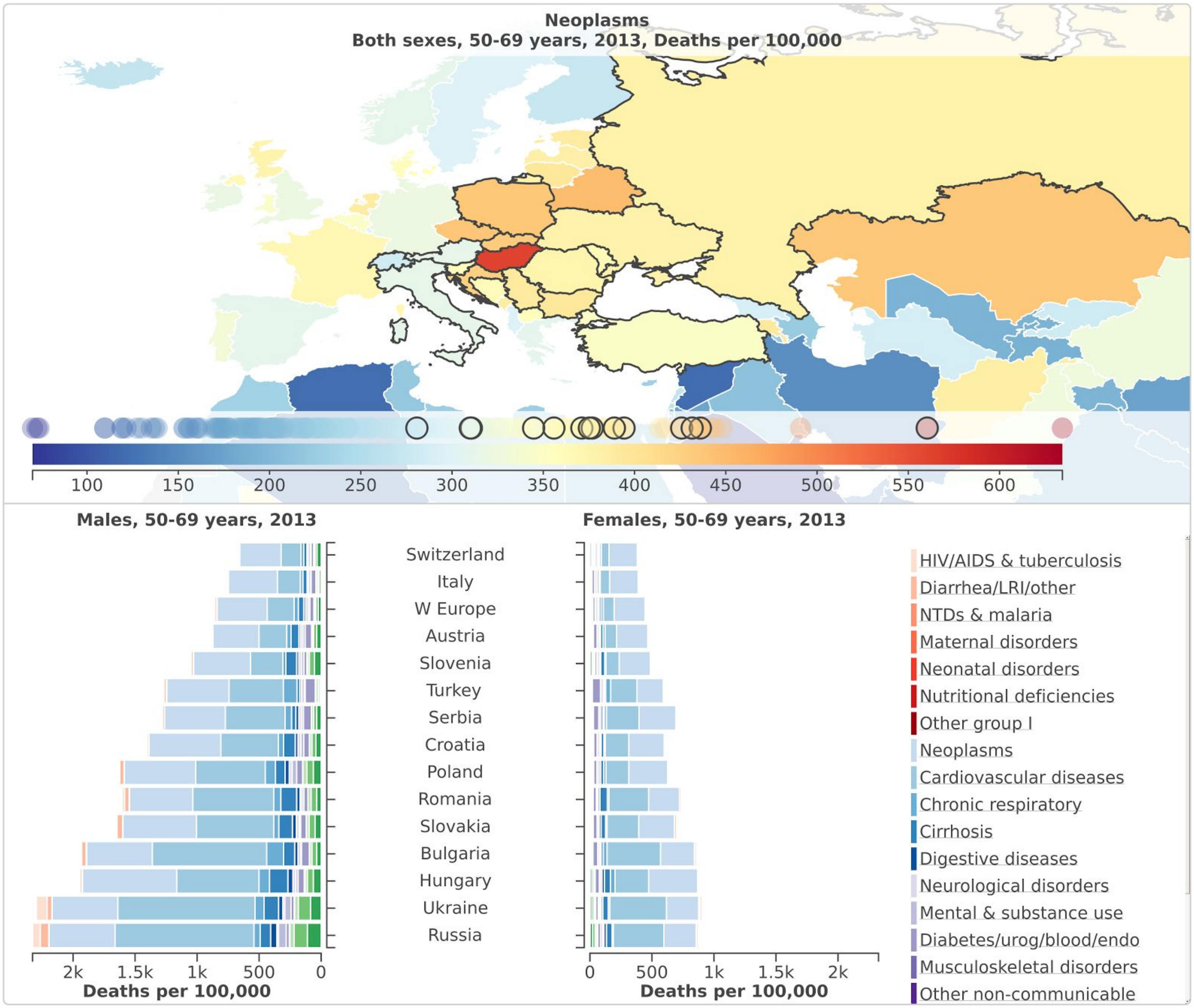
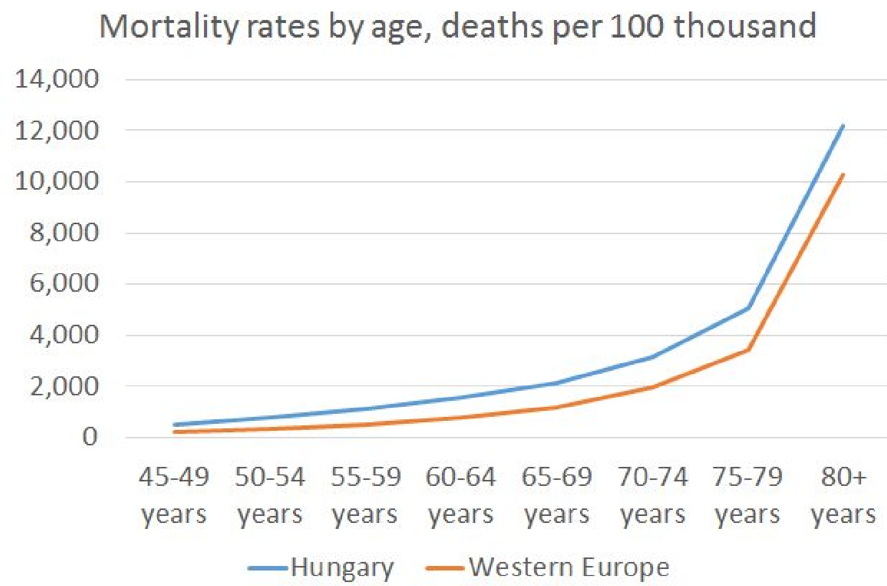


Chart 4: Mortality increases earlier in Hungary with age than in Western Europe



At the same time, a large spatial variance of mortality exists within Hungary. According to the Hungarian National Institute of Health Development, age standardized mortality rates are about 2.2 times higher in the worst counties of Hungary compared to the best (measured on an average for the 2009-13 period to account for noise in the data). Because of a different age standardization, the data is not exactly comparable, but this is the range between standardized mortality rates in the best Western European countries like France and in developing countries like Egypt on the Institute of Health Metrics and Evaluation dataset. For males, spatial differences are even higher in Hungary, the best and worst counties in Hungary have a 2.6 fold difference in mortality ratios. Also there are even larger differences in premature mortality ratios (the NIHD defines this as someone dying before age 65). I do not analyze life expectancy in this paper, but to put it in perspective, life expectancy even in the best counties (Budapest districts 2nd and 12th) only reaches Western European *average* for males, and they somewhat below that for females.

This paper looks at the spatial differences in age standardized mortality ratios within Hungary, and its correlates. The aim is to identify possible explanations of mortality differences and trends that may give clues to its future developments and ways to improve overall mortality rates. I will look at the following questions: What is mortality correlated with at the county ("járás") level? In what order should we select explanatory variables? What is amenable (avoidable) mortality correlated with? Is there a decline over time in mortality differences across counties? Is there any pattern to the “unexplained” component of the mortality in regressions? Is cancer mortality increasing in Hungary because other mortality is declining?

Data

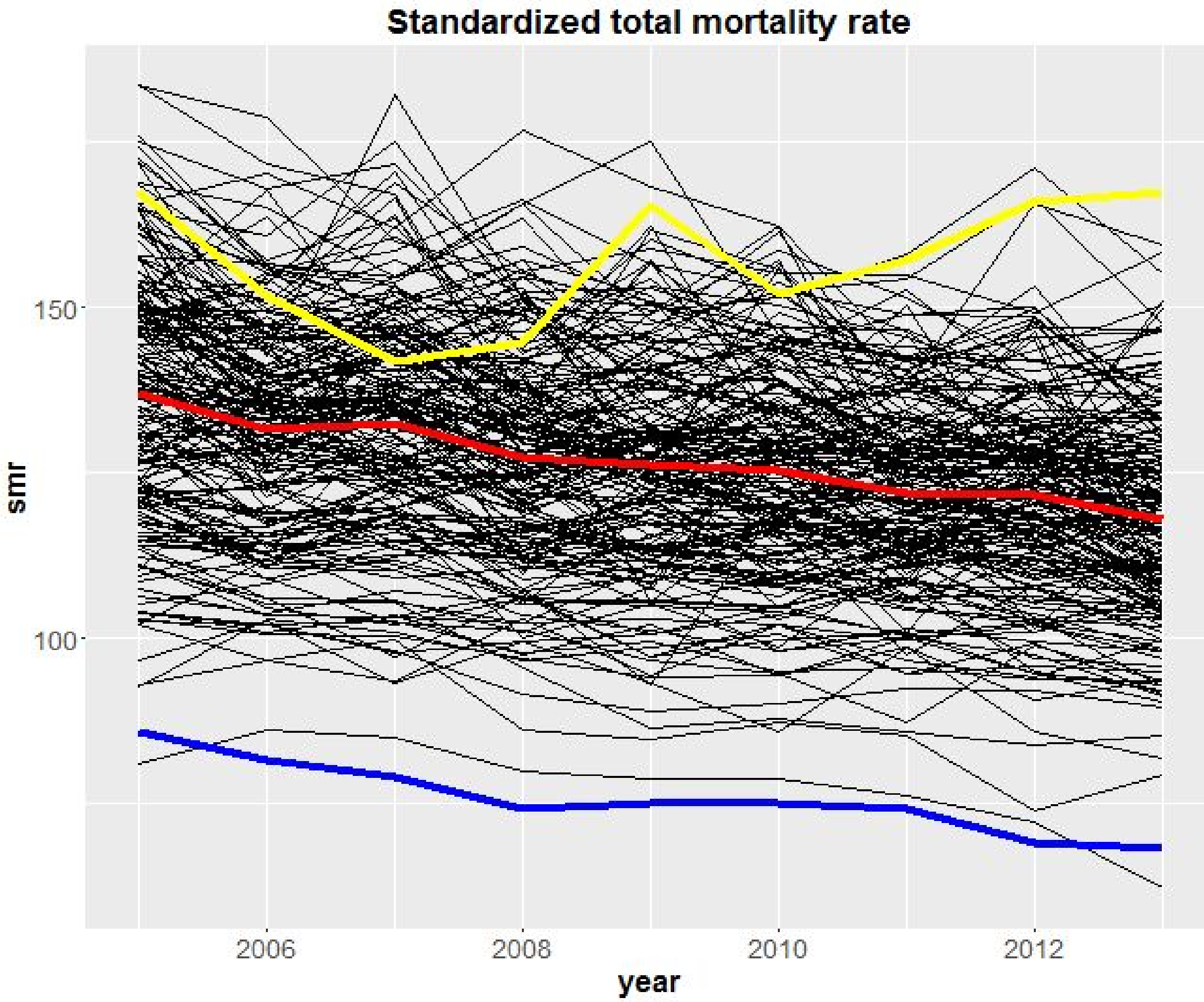
The Hungarian county level mortality data in this paper is coming from the “Nemzeti Egészségfejlesztési Intézet” or National Health Development Institute. The data is available from its old website: http://regi.oefi.hu/halalozas/. The data is not provided as a database, you can query data county by county for each of the 198 Hungarian counties (including Budapest districts) separately. This is why web scraping was necessary to collect the data (the Python script is attached to the paper).

I used the standardized mortality rates (denoted by “smr”) for all ages. This is separately age standardized for males, females and the total population and available for each year for the 2005-2013 period. The numbers refer to deaths per 10,000 population. Age standardization takes care of the problem that age distribution is different in different counties and the likelihood of death is different at different ages. Age standardized mortality rates provide a comparable measure of mortality by calculating the expected number of people dying if the age distribution was the same in every county. It is a similar measure to life expectancy, and the correlation is usually high between the two measures but not perfect: if overall standardized mortality is the same in two counties, one can have higher mortality at younger ages and lower mortality at older ages than the other, therefore have lower life expectancy.

Using mortality rates have the advantage that the causes of death can be separately examined. In the data there is total mortality and 27 separate (some overlapping) causes. I mainly concentrated on total mortality, cardiovascular mortality, cancer mortality (the latter two causes are far the most important subcomponents), amenable mortality and mortality attributable to smoking.

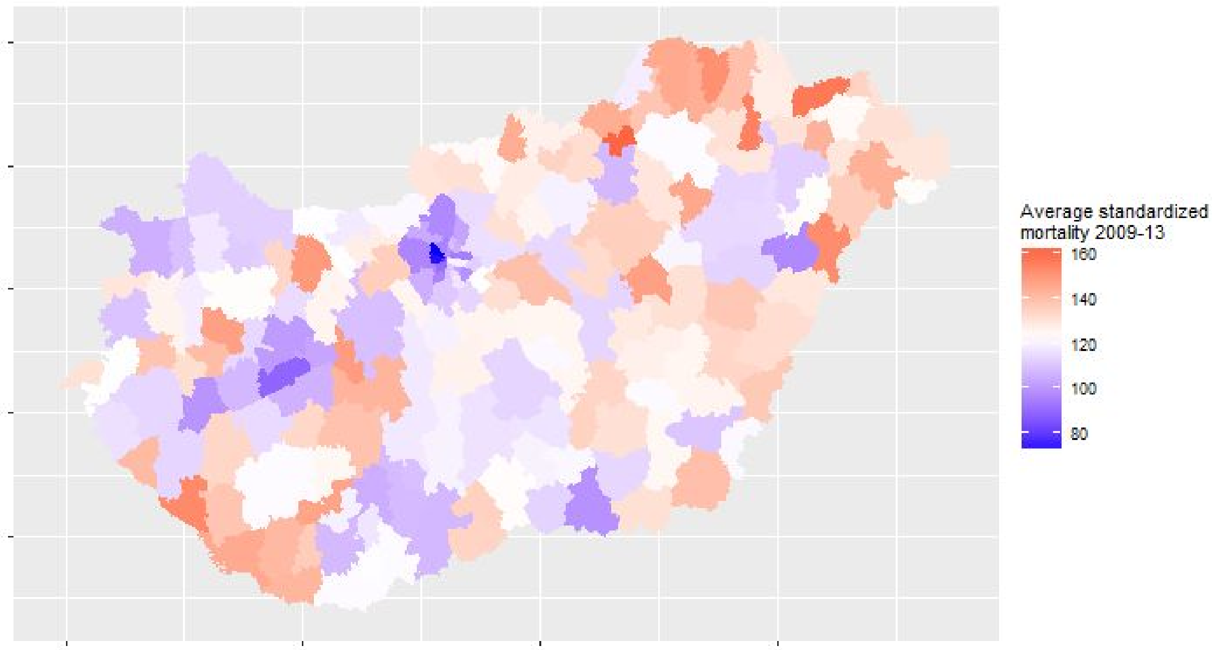
The county level data over time is very noisy even for total mortality as demonstrated on the chart below (depicting the total mortality rate for each of the counties and an average rate in red). For this reason I used the averages for 2005-2008 and for 2009-2013 to examine time trends to reduce the impact of randomly high or low death rates. In the analysis that follows, I concentrate on the 2009-2013 average mortality rate, if not otherwise indicated. Because of administrative changes, it is difficult to obtain other data in the same structure for the earlier period.

Chart 5a: Mortality data is noisy in the short run



There are huge differences in mortality rates across the 198 counties, the highest rate (for the 2009-13 period average) is in Belapátfalva county with 161.6 deaths per 10,000 people (highlighted by yellow above) and the lowest is in the 2nd district of Budapest with 72.4 deaths (highlighted by blue). Similar differences can be observed in the case of the sub-components of mortality.

Chart 5b: Large differences in average standardized mortality rates



As potential “explanatory” variables, I used Hungarian Central Statistical Office (KSH) data on counties from here: https://www.ksh.hu/docs/teruletiatlasz/jarasok.xls . For the list of variables and their definitions see the table below.

I also used education achievement data from the KSH from here:
http://www.ksh.hu/nepszamlalas/docs/tablak/nepesseg_iskolazottsaga/14_03_01.xls
This was available only for the population aged 7+ years, and not the total population, which introduced some distortion because the ratio of children varies from county to county. From the education dataset, I created a variable years of education (years_edu), where I assumed 4 years of education for those not finishing primary school, 8 years for those who has finished, 11 years for those who finished middle school without a bachelorette, 12 year for middle school with bachelorette and 16 years for those who have finished tertiary education.

Table 1: Description of variables

Variable name	Description	Mean	St. Dev.	Min	Max
smr	Standardized mortality rate, deaths per 10,000	122.6	15.6	72.4	161.6
pop_dens	Population density, people per sq km	824	3,028	29	30,989
pop	Population, people	50,292	41,370	8,710	249,563
pop_chg	Population change between 2001 and 2011, %	-4.5	8.1	-17.0	32.2
unempl	Unemployment in 2011, %	9.9	5.1	2.0	24.4
lt_unempl	Long term (12 m) unemployment rate	2.2	1.3	0.3	7.1
income	Taxable income per taxpayer	1605	442	1046	3525
houses	Number of dwellings	22014	18249	3827	105086
house_building	Average number of dwellings built, per 10000 people	22.4	18.9	1.0	125.0
pensioners	Number of pensioners per 1000 population	299.2	34.0	210.0	399.8
social_aid	Number of people receiving social aid, per 1000 population	6.3	4.2	0.6	24.1
cars	Number of cars per 1000 population	288	54	192	559
tert_edu	Ratio of people with tertiary education in 7+ years population	0.12	0.08	0.04	0.51
years_edu	Average years of education, as described in the text	10.0	0.9	8.4	13.1
house_pop	Number of dwellings per people	0.44	0.06	0.34	0.71
log_income	Log of income variable	7.35	0.24	6.95	8.17
log_cars	Log of cars variable	5.65	0.18	5.26	6.33
log_social_aid	Log of social aid variable	1.62	0.71	-0.51	3.18

The following table presents the mean of some of the above variables for the bottom decile (in terms of average mortality for 2009-13), the middle 80% and the top decile.

Table 2: Variable averages by best and worst mortality decile, middle 80%

Group	Best decile	Middle 80%	Worst decile
Smr (mortality)	93.5	123.0	148.6
pop_dens	3,014	644	57
pop	90,948	48,613	22,899
pop_chg	3.9	-4.8	-9.8
unempl	4.2	9.8	16.2
lt_unempl	1.0	2.2	3.5
income	2,439	1,542	1,269
houses	43,423	20,895	9,447
pensioners	284	301	297
social_aid	2.2	6.2	11.8
cars	370	284	238
tert_edu	0.29	0.11	0.07
years_edu	11.7	9.9	9.1
house_pop	0.49	0.43	0.42

These variables are mostly as you would expect them: in high mortality counties, population density is low, unemployment is high, population is declining, and the ratio of people getting social aid is high. In low mortality countries it is just the opposite. What is interesting is that average income and education levels are not that different between the middle 80% and the worst decile. But then again, mortality is not that different either between these two groups. Mortality is generally high, and there are a few bright spots, the best performing counties. But even within the best decile, differences are large: in fact, the difference between the worst and best counties *within* the best decile is higher than the difference between the average mortality of the middle 80% and the average mortality of the worst decile. The two top counties (Budapest 2nd and 12th districts) seem to be a world of their own *even within* the best decile.

Analysis

The following analysis was conducted in R, the script is provided as an appendix. The following charts demonstrate that mortality (as measured by the standard mortality rate) is highly correlated with both education and income. I provided charts both with county name labels and without labels. Mortality is also highly correlated with other variables, for example with car ownership (possibly a good proxy for income) or the ratio of population receiving social aid (these are not depicted).

Chart 6a: Strong correlation between mortality rates and income

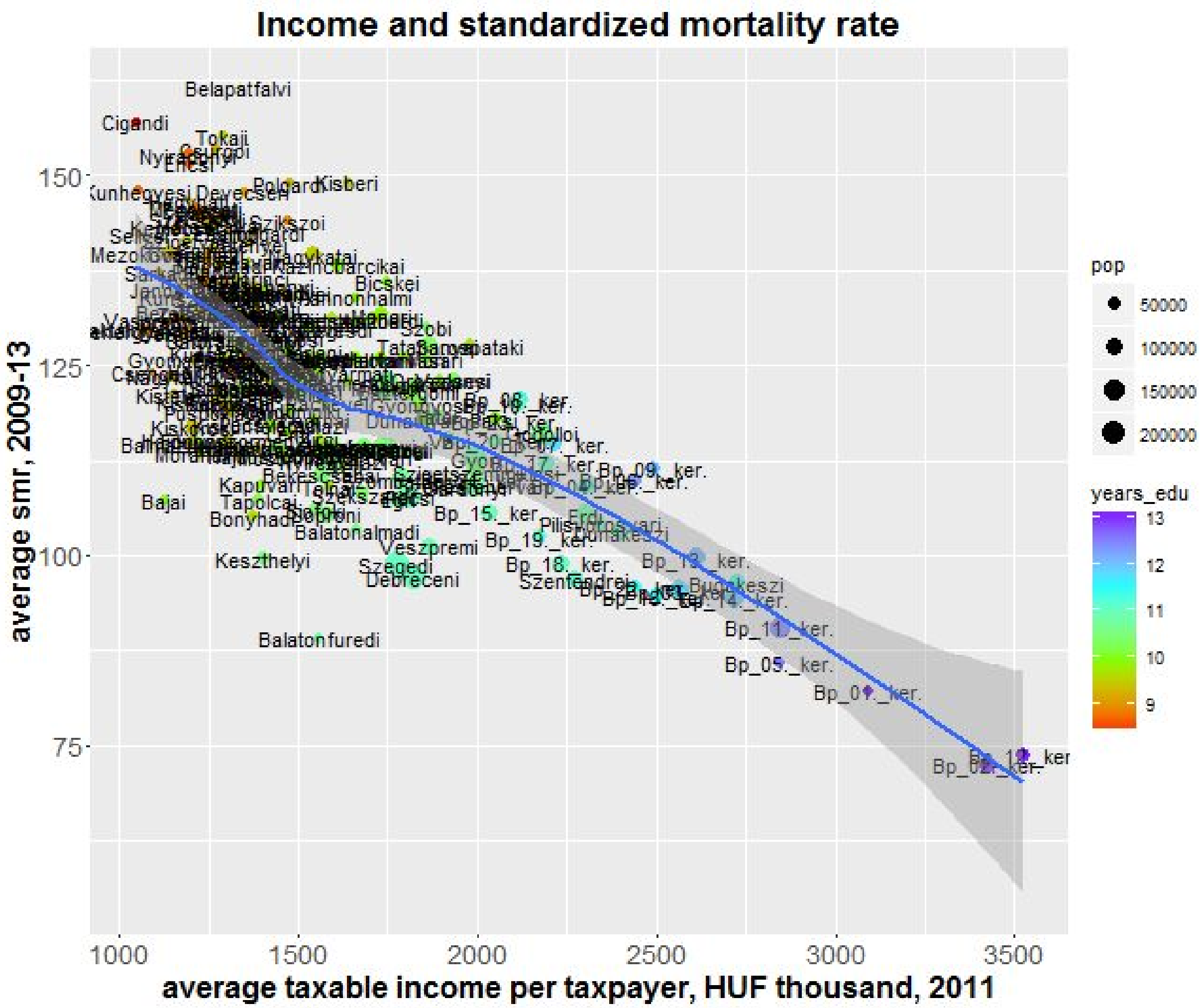


Chart 6b: Strong correlation between mortality rates and income

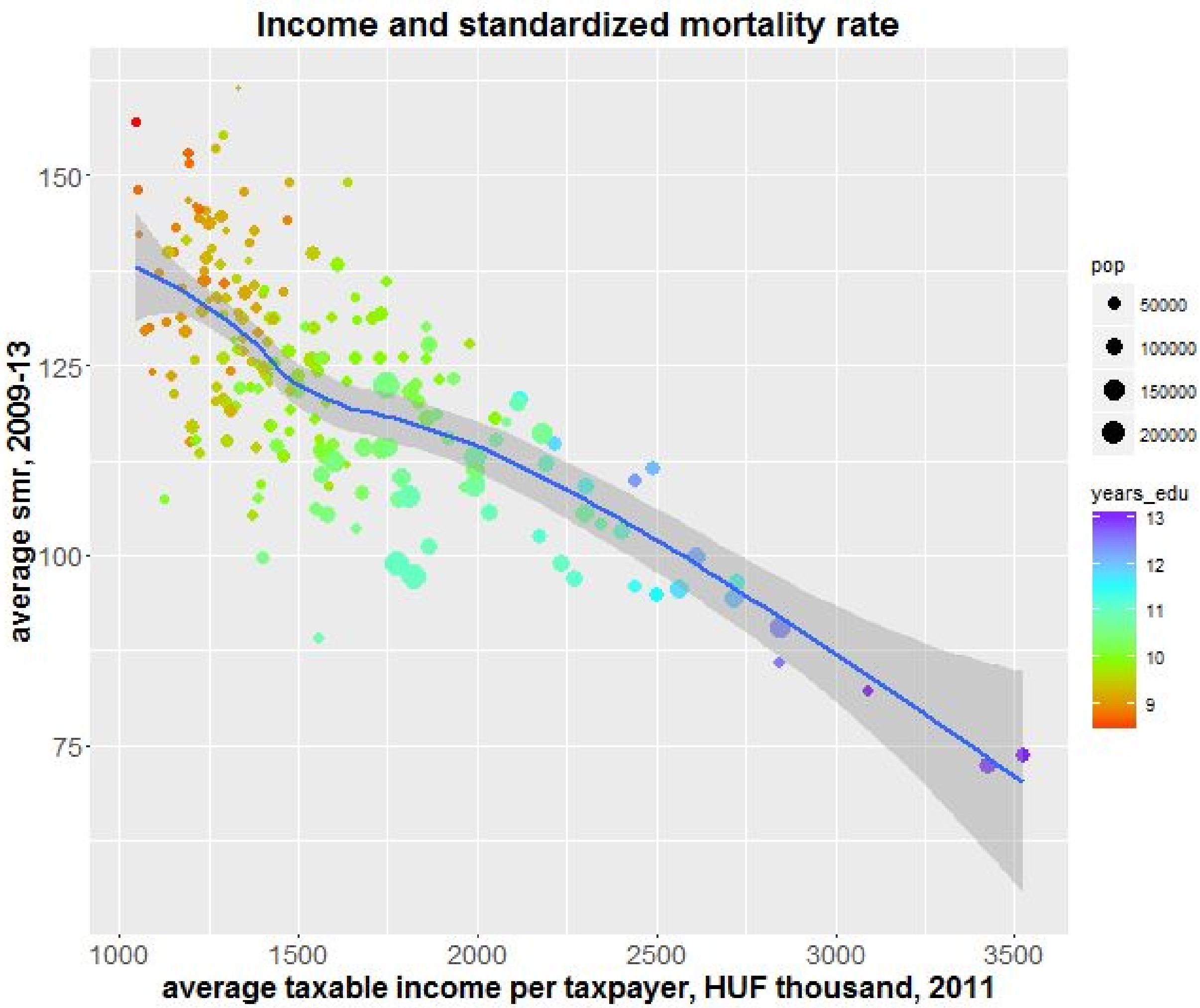


Chart 7a: Also a strong correlation between years of education and mortality

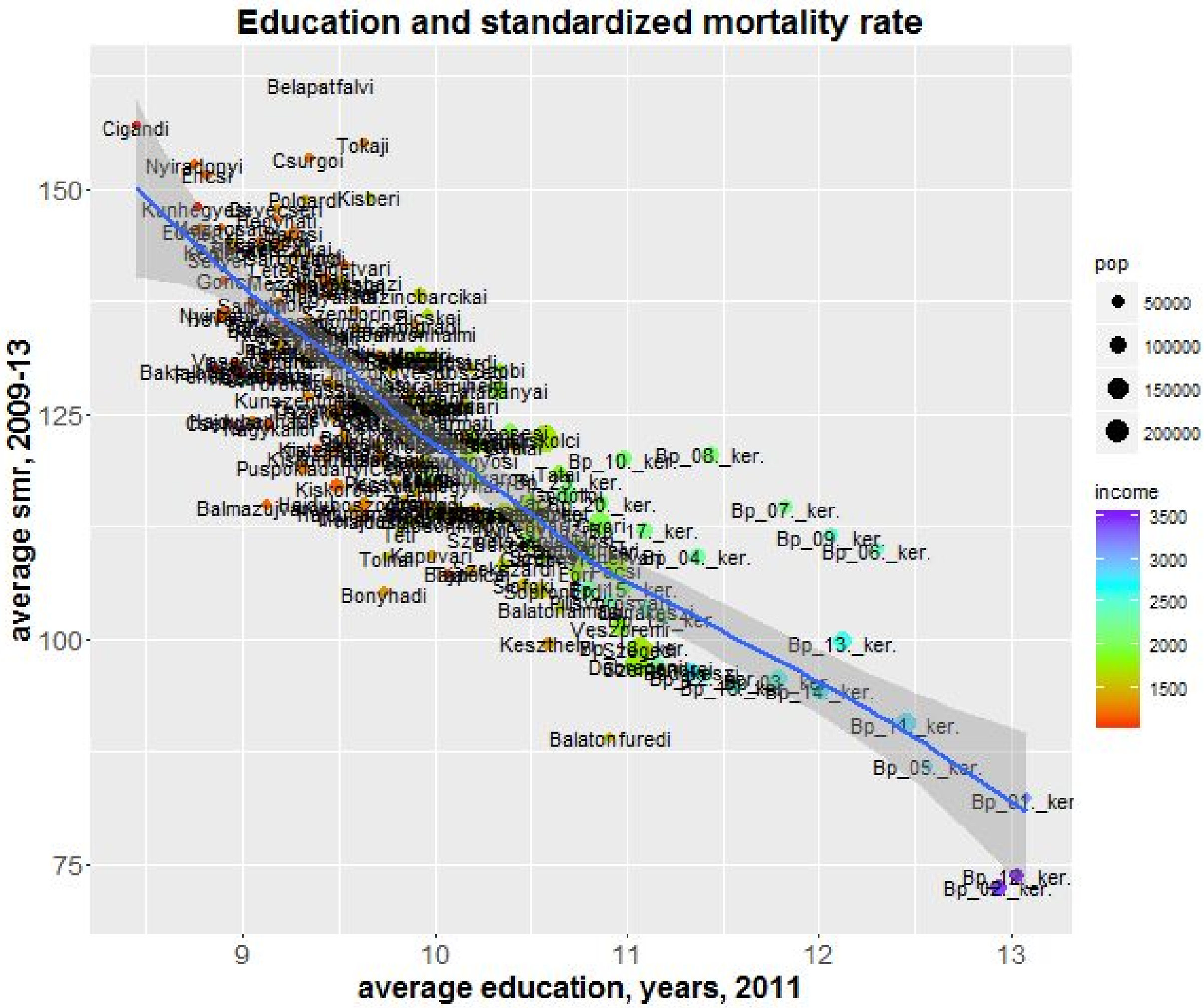


Chart 7b: Also a strong correlation between years of education and mortality

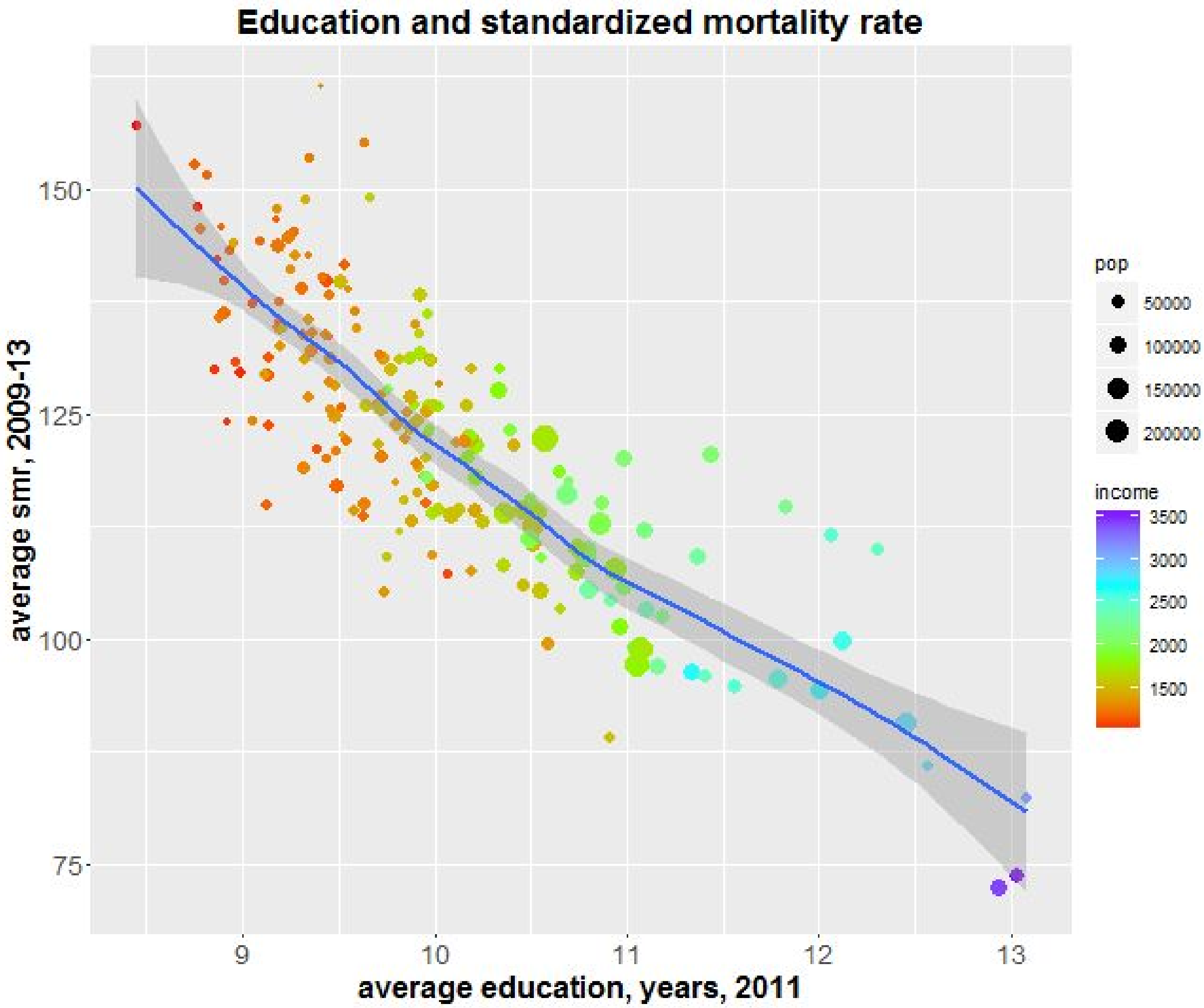
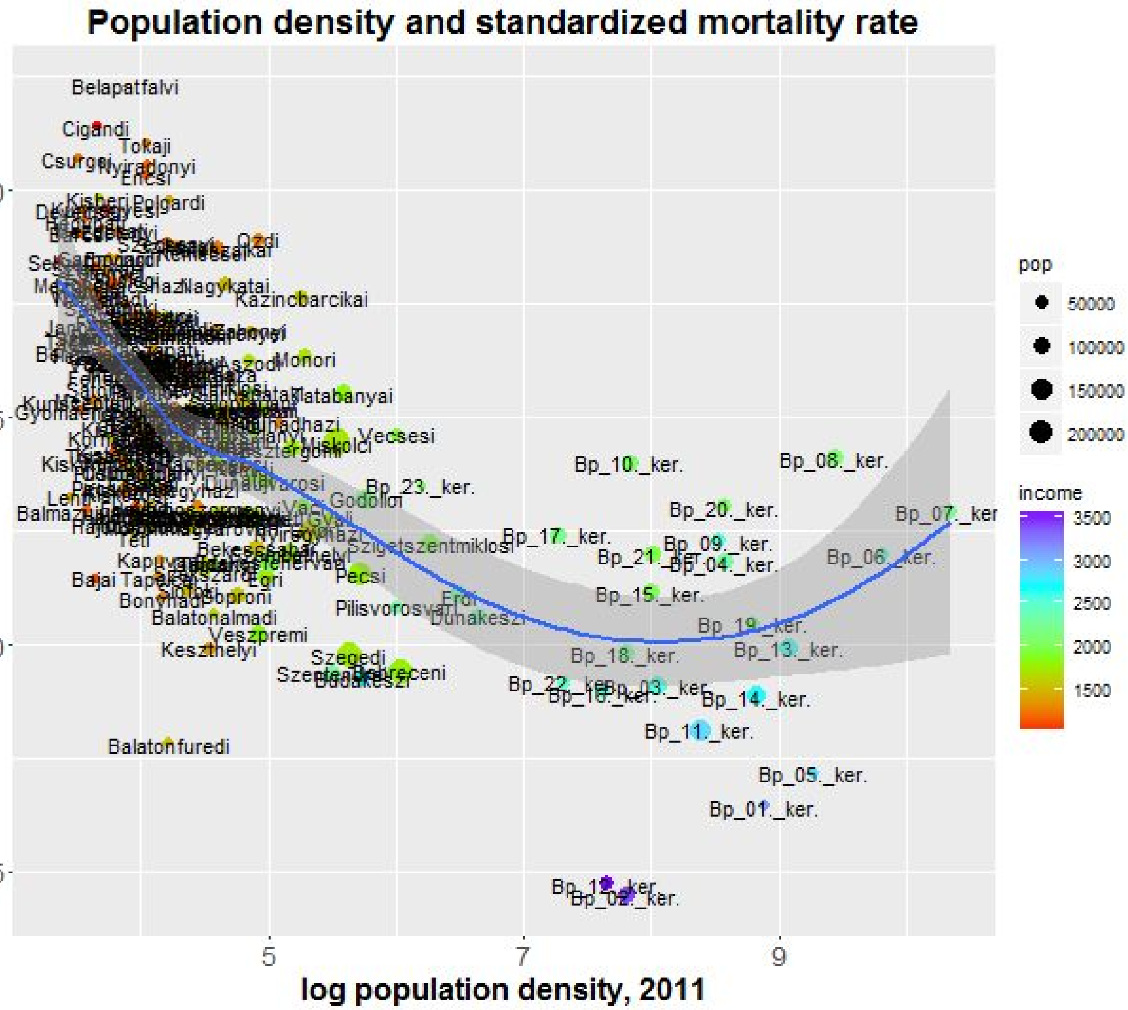
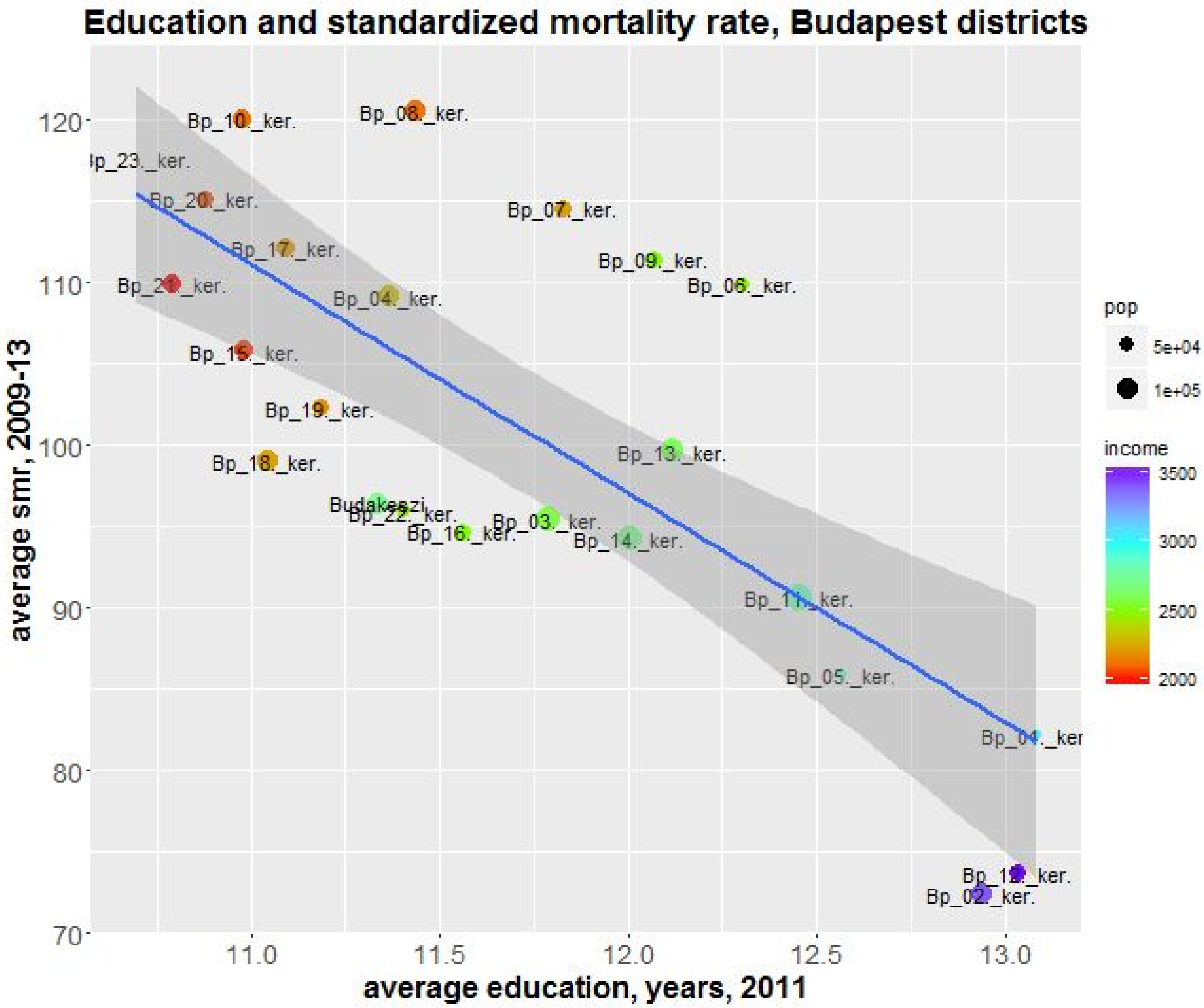


Chart 8: Population density and mortality negative correlation breaks down



Population density (a potential proxy for a more “urban” county) is negatively correlated with mortality up to a certain point, but the relationship breaks down in case of some of the districts of Budapest, where the most densely populated inner districts on the Pest side also have relatively high mortality ratios. These districts were outlier on the previous charts too. To highlight the interesting special status of these districts, the following chart is restricted to the Budapest districts only, and shows the relationship between total mortality and education.

Chart 9: Inner Pest districts are outliers in many relationships



Districts 6th,7th,8th and 9th have higher mortality rates than would follow from a simple relationship of education and mortality. To a lesser extent, the same is observable on the income/mortality plots as well (not depicted here). If we look at the disaggregated data, female cancer mortality stands out in these districts, and amenable and smoking related mortality rates are also relatively high for both males and females.

Lasso regression to select variables

Because of the collinearity problem (high correlation between the various characteristics of the counties), I ran Lasso regressions to determine which variables should be included in the regressions and in which order Lasso adds them. As the penalty for adding regressors decreases, Lasso pick variables in the following order: years or education, car ownership, social aid, population density and only then the log of the income variable. If we include all these in a regression, the coefficients are significant, but the sign of population density and the log of income is - somewhat surprisingly - , positive (i.e. higher population density is associated with higher mortality, controlling for education and car ownership).

Table 3: Mortality decreases with education and car ownership

	Age standardized mortality rate			
	(1)	(2)	(3)	(4)
Education (avg. years)	-11.978***	-19.007***	-11.842***	-19.064***
	(0.937)	(1.815)	(0.707)	(1.414)
Cars per '000 population	-0.067***	-0.039**	-0.075***	-0.058***
	(0.015)	(0.016)	(0.013)	(0.014)
Social aid recipients '000 population		0.572***		0.354*
		(0.197)		(0.193)
Population density		0.001***		0.001***
		(0.0002)		(0.0002)
Log of average income per taxpayer		24.008***		24.073***
		(5.882)		(4.996)
Constant	261.771***	143.285***	262.031***	150.004***
	(7.278)	(31.737)	(5.996)	(26.954)
Weights	equal	equal	population	population
Observations	198	198	198	198
R^2	0.706	0.749	0.772	0.815
Adjusted R^2	0.703	0.742	0.770	0.810
Residual Std. Error	8.486 (df = 195)	7.910 (df = 192)	1,594.440 (df = 195)	1,446.155 (df = 192)
F Statistic	234.658*** (df = 2; 195)	114.541*** (df = 5; 192)	330.092*** (df = 2; 195)	169.510*** (df = 5; 192)
Note:				*p<0.1; **p<0.05; ***p<0.01

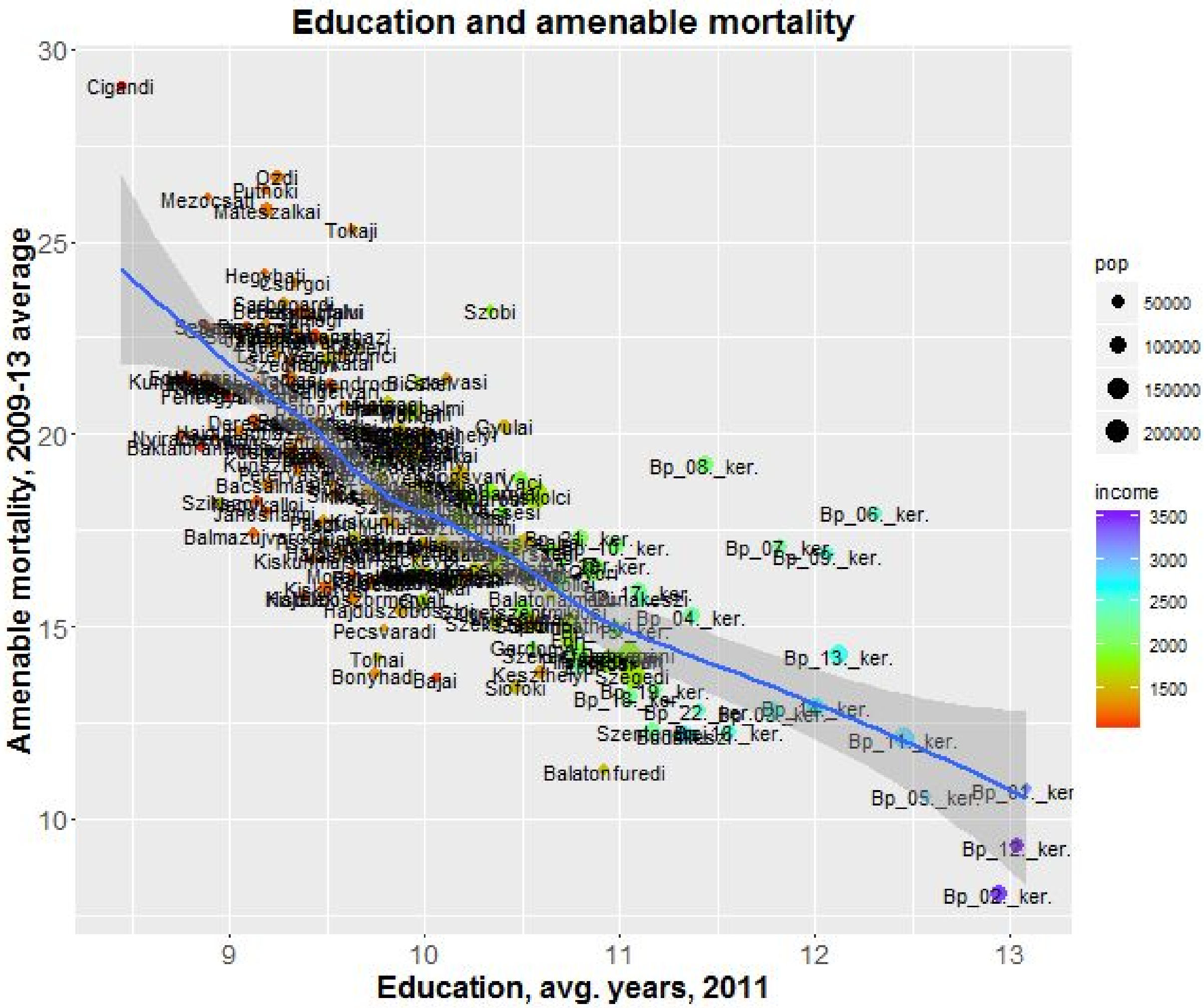
These regressions can account for a surprisingly large part of the variation in mortality (this does not necessarily imply causation of course). Looking at the residuals of the above regressions, two patterns seem to emerge. The inner Pest districts tend to have a positive residual (a higher mortality rate than predicted by the regressions), and some of the large cities like Szeged and Debrecen (but not Miskolc or Győr), as well as the 2nd and 12th districts in Budapest tend to have negative residuals.

Amenable deaths as a proxy for healthcare quality

Mortality differences are presumably mainly due to a combination of behavioral and environmental factors. The latter, importantly, includes the quality of healthcare. It is difficult to disentangle to what extent these factors are responsible to differences in mortality rates. But we can have a proxy for the quality of healthcare as the NIHD standardized mortality rate breakdown include statistics regarding “amenable death”. These are deaths that should not happen, given the present state of medical knowledge and equipment. This is not a perfect proxy, as with the same, bad quality healthcare, presumably more amenable deaths happen if behavioral factors such as smoking or obesity are higher. But at least this is an indication of health care quality that is outcome based. Amenable mortality rates are the highest or among the highest in Hungary within the OECD, depending on the definition used.

There are huge differences in amenable mortality rates within, the best counties have the level of about 30% of the worse ones. This may indicate a very different healthcare experience (but potentially also very different behavior). Amenable death rates are highly correlated with income and also even more strongly, with education (the inner Pest districts stand out on this measure as well). The interesting question is if even after controlling for income, amenable mortality is significant in regressions of other mortality on amenable mortality.

Chart 10: Amenable mortality correlated with education, inner Pest stands out



In the following, I will estimate regressions on a “narrow” mortality rate. This was calculated by deducting external factors (accidents etc) and estimated smoking effects from the total mortality rate, as well as amenable death rates. I will use the same regressors as in the above table, and examine if the amenable death rate added to these regressors is significant. The idea is that health care quality should impact the non-amenable death rate as well. Deducting mortality attributable to smoking should take care of some of the behavioral effects on the mortality rate.

Table 4: Amenable mortality significant in other mortality regressions

	Age standardized mortality rate			
	(1)	(2)	(3)	(4)
Education (avg. years)	-4.373***	-7.062***	-4.065***	-7.096***
	(0.644)	(1.262)	(0.532)	(1.045)
Cars per '000 population	0.023**	0.025**	0.016**	0.010
	(0.010)	(0.010)	(0.008)	(0.009)
Social aid recipients '000 population		0.087		-0.049
		(0.124)		(0.120)
Population density		0.0002		0.0002
		(0.0002)		(0.0001)
Log of average income per taxpayer		8.670**		9.120***
		(3.728)		(3.155)
Amenable mortality rate	1.485***	1.368***	1.434***	1.283***
	(0.172)	(0.178)	(0.164)	(0.171)
Constant	87.341***	51.628**	87.071***	55.018***
	(8.799)	(20.176)	(8.271)	(17.199)
Weights	equal	equal	population	population
Observations	198	198	198	198
R^2	0.693	0.704	0.765	0.778
Adjusted R^2	0.689	0.694	0.761	0.771
Residual Std. Error	4.958 (df = 194)	4.914 (df = 191)	909.434 (df = 194)	890.501 (df = 191)
F Statistic	146.224*** (df = 3; 194)	75.536*** (df = 6; 191)	210.560*** (df = 3; 194)	111.694*** (df = 6; 191)
Note:				*p<0.1; **p<0.05; ***p<0.01

The amenable mortality rate is significant in all regressions. This means that higher amenable mortality is associated with higher levels of *other* mortality (mortality here being defined as not smoking or external cause related deaths). To the extent that this relationship reflects different levels of healthcare, then the mortality differences due to health care differences are large across counties, a lot larger than what would be apparent from amenable mortality rates alone. In the regressions above, a one unit higher amenable (death per 10,000 people, age standardized) is associated with an additional 1.3-1.5 other deaths. If, in the extreme case, all of this is due to differences in effective health care provision, then health care provision differences would explain as much as two thirds of the difference in mortality rates between the top and bottom decile of counties. This number very likely overestimates the impact of health care provision as it neglects the interaction of behavioral factors and the health care system, but it points to the potentially huge impact the differences in effective health care provision may play in mortality rate differences. It also seems likely that effective health care access is driven more by education levels than income in itself. This may be because knowing how the healthcare system works and possibly having connections to the individuals in the system may matter more than having high income alone.

Changes in Hungarian mortality: mostly improving, except cancer

Overall age normalized mortality in Hungary as measured by the NIHD is declining in Hungary by about 1% per annum for females and 2% per annum for males (during the 2005-2013 period for which we have the NIDH data). At this rate it would take about 25 years to reach the *current* mortality rates of Austria (and 35 years to reach the current Swiss level). The improvement is uneven though. Cardiovascular mortality is declining relatively fast, by about 2% per annum for females and about 3% per annum for males. Chronic liver disease and cirrhosis is declining even faster, at about 7% and 6%, respectively. Mortality attributable to smoking has been declining by 0.3% per annum on average for females and 1.8% for males. Amenable death rates are declining by about 2.5% per annum. All these point to some combination of lifestyle and healthcare quality improvements.

On the other hand, cancer mortality is increasing by about 0.7% per annum for females and roughly stagnates for males (down by 0.2% per annum on average). This is important because cancer mortality is already very high in Hungary, as I noted in the introduction (the age standardized death rates for the total population was the second highest globally in 2013, according to the Institute of Health Metrics and Evaluation). Larynx and lung cancer mortality rates have been increasing by 3.7% for women, and colorectal cancer mortality rates by 1.3% for males, on average annually over 2005-2013. The high and even worsening cancer mortality is a puzzle because as previously mentioned, declining smoking, cirrhosis and cardiovascular mortality strongly point to improving behavioral factors.

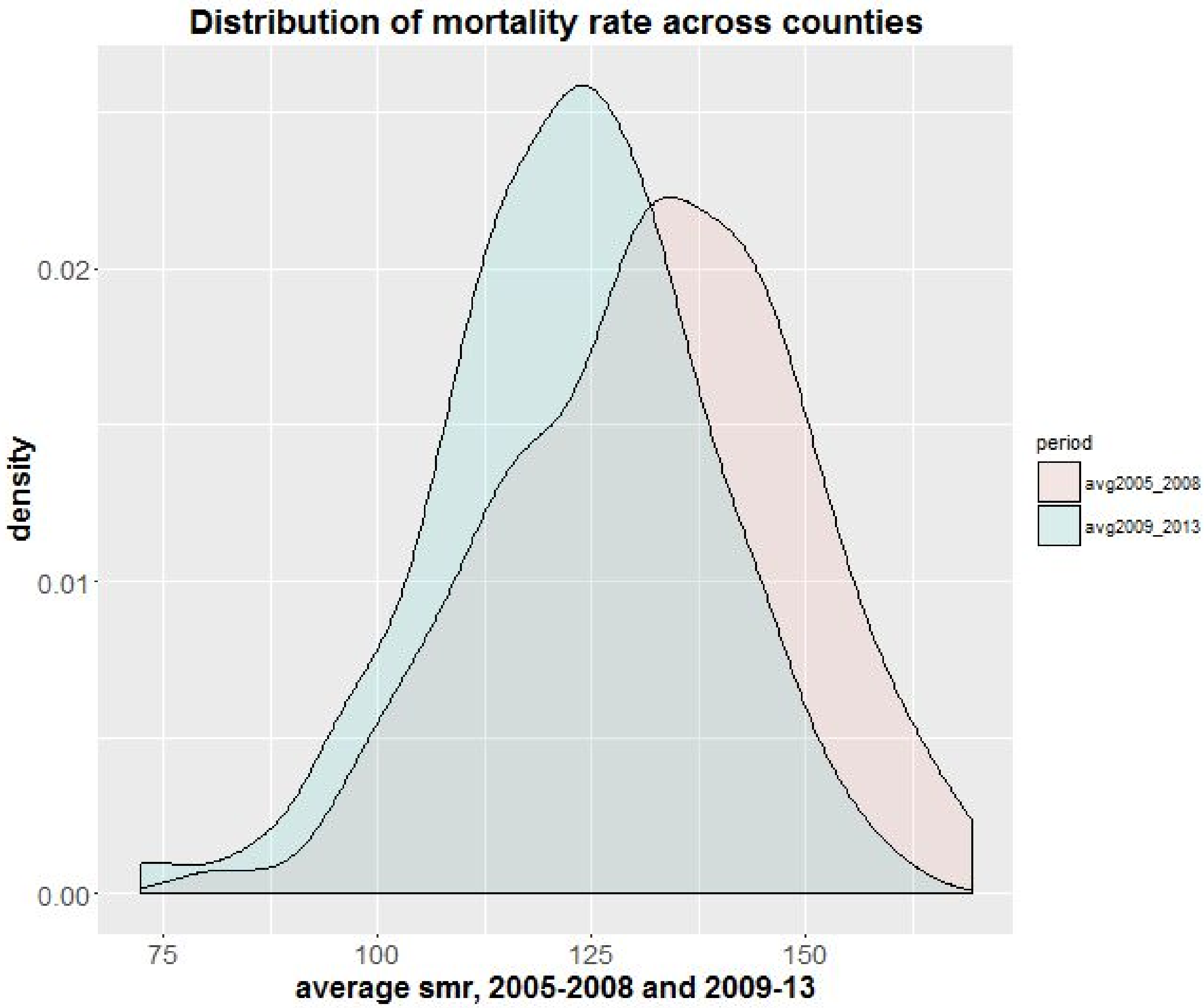
One reason why cancer mortality may not be declining is that an improvement in cardiovascular and other mortality leaves more people “available” for cancer mortality. Internationally as countries get richer and their health systems improve, cancer mortality tend to *increase*, as people do not die of other diseases (but overall mortality declines).

If this is the case, what we should probably observe is that the change in other mortality is negatively correlated with the change in cancer mortality across counties. I examined this hypothesis and this is not the case. The change in cancer mortality rate is not negatively related to the change in in other mortality rates across counties (and the regression has very low R squared). If anything, the relationship is positive between these two, therefore it seems unlikely that declining other mortality is the reason why cancer mortality rates are not following the general declining pattern. Stubbornly high cancer mortality rates remain a puzzle, and more research into the causes would be very useful.

Mortality differences are not declining quickly

What can we say about the change of cross sectional distribution of mortality? There is some sign of a slow convergence across counties, but this may just be a “regression to the mean”, as random shock in the first period fade out on the second. Also, counties with higher education tend to experience faster declines than counties with similar initial mortality rates but lower education levels. For example, the two lowest mortality counties (Budapest 2nd and 12th districts) which have the highest education levels, saw a mortality decline of 9.8% and 11.4%, which is significantly larger than the national average (-6.6%) between these two periods. The good performance of the two best districts means that the *range* of mortality rates across counties was almost exactly the same in 2005-8 and in 2009-11 (and the ratio of the highest and lowest mortality rate has even increased). It again seems that these two Budapest districts (2nd and 12th) are really a world of their own.

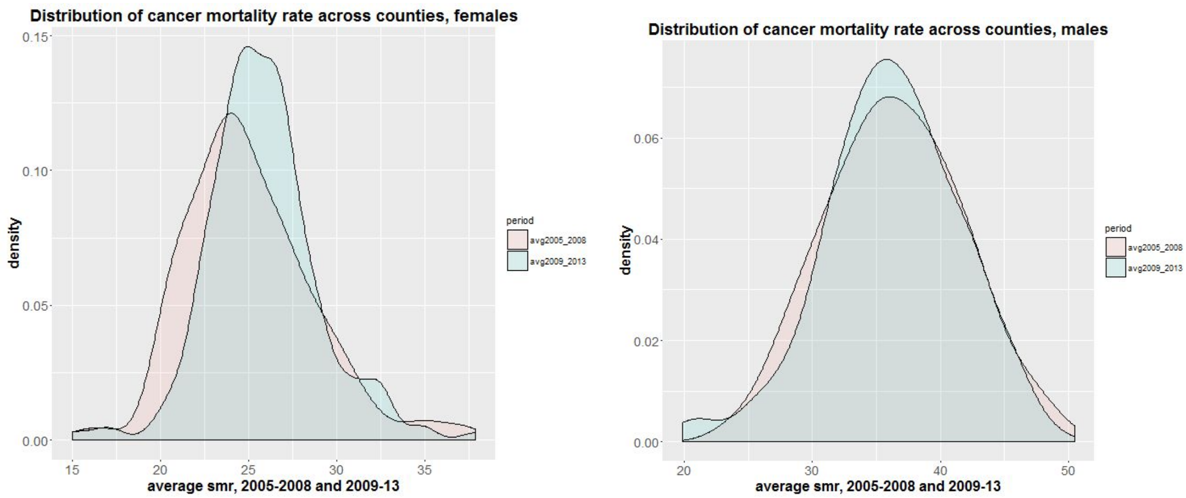
Chart 11: Overall mortality declining, but differences narrow only very slowly



The distribution of mortality across counties has got somewhat narrower between the 2005-08 and 2009-13 periods (standard deviation declining), but this narrowing is not large, as can be seen on the above chart - mortality differences declined only a little between the two periods. The shift to the left (lower mean mortality) is clear though.

In case of cancer mortality, there is practically no decline in the differences in mortality data across counties, and the standard deviations of the distributions are very similar too (not much sign of a convergence of cancer mortality). Here I will show the male and female distribution separately, as they are different. In case of females, the distribution has shifted to the right (higher mortality) over time, for males the distribution remain very similar between the two time periods. But the two overall top counties (Budapest 2nd and 12th districts) managed to buck the trend and showed declines of cancer mortality for both males and females - again pointing to a very different experience from the average.

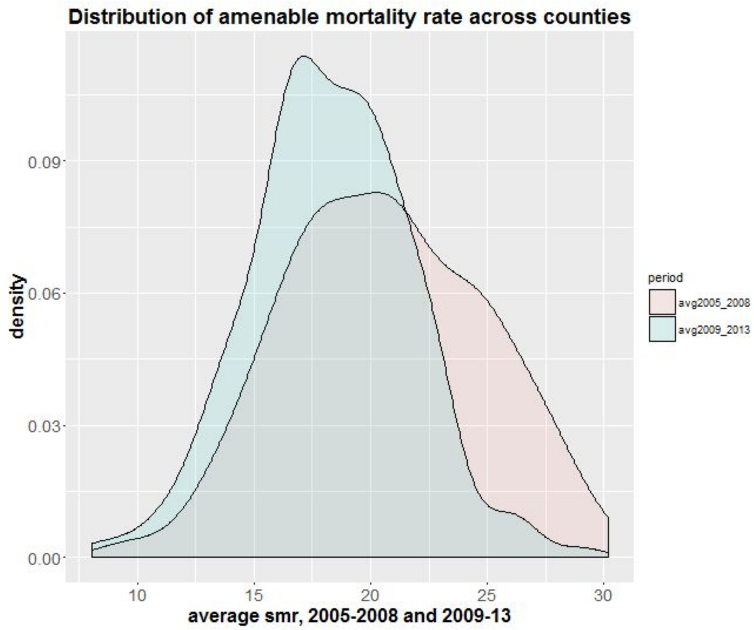
Chart 12: Cancer mortality or differences not improving, worsening for females



Amenable mortality: spatial behavior similar to overall mortality

In the following I will examine amenable mortality in greater detail, to see if the same factors can “explain” amenable mortality as overall mortality. Amenable mortality should not happen, and it is important to know where it happens. Amenable mortality is also important because as we saw earlier this might be the clue to other mortality differences too. As long as the differences represent differences in effective health care, the very bad outcomes may be relatively easy to improve. Eliminating ⅔ of the differences between amenable mortality rate in each county and the lowest one (while assuming other mortality is unchanged) would reduce overall mortality by more than 5% - a huge improvement. What is encouraging is that in case of amenable mortality, there already was an improvement over time, and the worst cases tended to improve more, reducing the standard deviation of the distribution (see chart below).

Chart 13: Amenable mortality improving, differences declining



If we run a series of lasso regressions for amenable deaths average for 2009-13, the regressions add the variables practically in the same order as the it does for overall mortality: years or education, car ownership, social aid, population density and only then the log of the income variable (and in this case house building at almost the same time). I will use the same regressions as in the case of overall mortality, and compare the slope coefficients to the slope coefficients of the overall mortality regressions. When comparing the coefficients, bear in mind that the mean value of overall mortality is about 6.7 times higher than amenable mortality

Table 5: Amenable mortality also decreases with education

	Age standardized amenable mortality rate	
	(1)	(2)
Education (avg. years)	-2.123***	-3.387***
	(0.176)	(0.368)
Cars per '000 population	-0.023***	-0.018***
	(0.003)	(0.004)
Social aid recepients '000 population		0.094*
		(0.050)
Population density		0.0002***
		(0.00005)
Log of average income per taxpayer		4.109***
		(1.299)
Constant	45.964***	26.389***
	(1.495)	(7.010)
Weights	population	population
Observations	198	198
R^2	0.701	0.737
Adjusted R^2	0.698	0.730
Residual Std. Error	397.495 (df = 195)	376.113 (df = 192)
F Statistic	229.009*** (df = 2; 195)	107.475*** (df = 5; 192)
Note:		*p<0.1; **p<0.05; ***p<0.01

If you compare the above table to regressions (3) and (4) in **Table 5**, you can see that the results are very similar, the signs are identical and the size of the coefficients are similar, if we take into account the 6.7 time difference between the two dependent variables. Regression residuals are well correlated too (correlation coefficients around 0.7.). Again, a surprisingly large part of the variance can be accounted for by just the average years of education variable.

Conclusions

Average years of education is better at “predicting” mortality rates across counties in Hungary than income is (it is picked up earlier in the lasso regressions and its sign is negative when entered together with income, which has a positive coefficient). This may be because income is badly measured and/or because the health care system in Hungary needs knowledge/connections to navigate and income alone is not enough. The rest of the variables add comparatively little to the explanatory power of regressions, average years of education alone “explains” about 70% of the variance in mortality rates. One more year in the average year of education in a county is associated with a mortality rate that is about 12-19 lower per 10,000. This is a very strong association, and certainly it would be interesting to see if it holds in a dynamic setup as well: how much (more) mortality declines if years of education increases by one year between two periods. Unfortunately the Statistical Office does not provide the education data in the same structure for an earlier period.

The residuals of the regressions exhibit a systematic pattern: the inner districts of Pest (6th, 7th, 8th, 9th) have usually positive residuals (higher mortality rates than would follow from the level of education and other variables), and Debrecen and Szeged (large cities) usually exhibit negative residuals, as well as the 2nd and 12th districts in Budapest.

I have examined the possibility that amenable mortality (mortality that should not happen, given the current level of medical knowledge) is a proxy for overall health care quality. There is some indication of this: the rest of mortality was positively associated with amenable mortality even after controlling for education etc. The amenable mortality variable remained significant when added to the regressions of other mortality on the same variables as in previous regressions. But amenable mortality is almost certainly an imperfect proxy of the quality of healthcare, even if it is available and is outcome based. In the extreme case, if all of the amenable mortality differences plus the associated other mortality differences were due to differences in effective health care provision, then **health care provision differences would explain as much as two thirds of the difference in mortality rates between the top and bottom decile of counties**. This is almost certanly an overestimate, but it indicates the potentially huge room for improvement in mortality rates due to an improved quality healthcare provision.

Only moving amenable mortality rates in every county closer to the best ones would have a noticeable impact on overall mortality rates. Eliminating ⅔ of the differences between amenable mortality rate in each county and the lowest one (while assuming other mortality is unchanged) would reduce overall mortality by more than 5% - a huge improvement.

When looking at the change of mortality rates between the periods of 2005-08 and 2009-13, there is only a limited indication of differences between counties narrowing over time (smaller standard deviation). The best two counties (2nd and 12th districts in Budapest) actually showed a larger than average percentage decline in overall mortality. Cancer mortality is stagnating for males and increasing for females, and there is no sign of the differences narrowing over time. But the two overall top counties (Budapest 2nd and 12th districts) managed to buck the trend here as well, and showed declines of cancer mortality for both males and females - again pointing to a very different experience from the average.

Cancer mortality in theory may not be declining because other mortality does, and leaves more people “available” for cancer. But this does not seem to be the case, as there is a weak positive correlation between the change in other mortality and cancer mortality. Cancer mortality seems to be a puzzle in Hungary: it is very high, and instead of declining, as mortality caused by most other factors does, it is increasing (or at best stagnating). The cause of this should be investigated further.

Finally, trying to predict amenable mortality based on county characteristics, we get the very similar regressions when trying to predict overall mortality. Again, the average years of education is the strongest explanatory variable, and the slope coefficients are similar too, if we take into account the differences in the mean values of the dependent variables.

The strong role of education in all of the regressions may stand in for some other characteristics. For example, people with more education in Hungary have lower obesity rates, especially among women, which similar to other countries. This could be also due not to healthy behavior alone, but at least partly to social status differences, as well documented in the successive Whitehall studies.

This document looked at county average data. This has serious drawbacks, as the data is an average for the people living in the given area, and is likely to contain a large range of different people with varying distributions in different counties. Studying individual histories would likely add to our understanding of the many remaining questions a great deal.

Other sources:

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