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Mortality Differentials by Religious Denomination in Vienna 1981-2002

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Abstract

Using statistical record linkage of anonymized population census data 1981, 1991 and 2001 with deaths during twelve months from census day, we computed standardized mortality ratios for nine religious groups (including groups with no religion and religion not stated) in the city of Vienna. Relative mortality risk is above average for Roman Catholics (1.01), but below average for Protestants (0.98) and people with no religion (0.97). Very low mortality risks are found for Muslims and Orthodox Christians, which is partly due to the low mortality of foreign immigrants. The lower mortality risk of Protestants compared to Roman Catholics is restricted to males and essentially due to different educational distributions. Despite their low overall mortality level, people with no religion face excess suicide mortality.

Keywords

Vienna, mortality, standardized mortality ratio, life expectancy, religion, suicide.

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Introduction

It is generally agreed that a population's mortality risk is an important measure of public health and standard of living. A prominent example is the Life Expectancy Index as one of the three indices of the United Nations' Human Development Index (United Nations Development Programme 2014). Mortality risk summarizes a population's nutrition, hygiene, access to medical care, socio-economic position, and risk of accidents, among others. Compared to other social indicators, a major advantage of mortality risk is that it is insensitive to definitions, since death is obviously a 'hard fact'.

The past years have witnessed increasing interest in differential mortality on a sub-national level, besides the traditional breakdowns of mortality risk by sex and age. Eurostat, the statistical agency of the European Union, and the OECD, the Organisation for Economic Co-operation and Development, have started regular collection of mortality risk by educational level (Corsini 2010, OECD 2013: pp. 26-27). Also, analyses of mortality by occupation-based social class, race/ethnicity, or marital status have been carried out (Marmot et al. 1991, Hummer et al. 1999, Martikainen et al. 2005). This paper contributes to that research by investigating mortality differentials by religious denomination.

Religion-specific mortality is important both from a demographic and a social point of view. From a demographic point of view, it influences the religious distribution of a population as well as the age distribution within a religious group. Religion-specific mortality is also a necessary input for unbiased religion-specific population projections. From a social point of view, mortality risk may be used as an indicator of the socio-economic position of religious groups. This is because mortality is highly correlated with education, income level, and occupational class (Vallin et al. 2001). Mortality risk is also a summary of a population's predominant lifestyle. Special insight into behavioural variation may be gained by cause-specific mortality analysis. Indeed, Émile Durkheim's 1897 analysis of suicide rates by religion is sometimes considered to be the 'birth of sociology'. To give a modern example, significant disparities in cause-specific mortality rates have been found—in face of identical health care system—between French and German cantons of Switzerland, largely attributable to variation in cultural risk factors (Faeh et al. 2009).

The population analysed in this paper is the city of Vienna, a 1.8 million population[1] place with a highly diversified and rapidly changing religious landscape. In 1961 Roman Catholics still accounted for about 80 percent of the Viennese population, whereas today their share is only about 40 percent (Goujon and Bauer 2013). The two

[1] The current (2014) population count of Vienna is almost 1.8 million; however in the periods analyzed in this paper the value was closer to 1.5 million.

major reasons for the declining share of Roman Catholics have been leaving the church and foreign immigration. Leaving the church has also affected the smaller traditional Christian churches in Austria (Lutheran and Reformed Protestants, Old Catholics) and resulted in an increasing share of people with no religious denomination. Foreign immigration has resulted in an increasing share of Orthodox Christians and Muslims,[2] a development reinforced by their disproportionately high fertility rates.

Data and Methods

Data

Our analysis is based on linked longitudinal data (as opposed to unlinked cross-sectional data, Jasilionis et al. 2012). Individual census records of the censuses 1981, 1991 and 2001[3] were statistically matched with deaths in twelve-month follow-up periods, so essentially for every person counted in a census one can tell whether this person has died or survived the twelve months thereafter. About 90 percent of all deaths in the follow-up periods could be linked to census records. Details on linkage can be found elsewhere (Klotz 2007).

In this paper we apply the available-case method, i.e. we assume that the 10 percent non-linkable deaths are missing at random conditional on age, sex and follow-up period. Besides, deaths occurring outside of Austria (e.g., during holidays abroad) are not included in the Austrian death records.

The major advantages of our data are as follows. Firstly, the entire population of Vienna is covered in the census, so our results are not biased by selective inclusion. Then, because of individual linkage, the information on religious denomination is identical in the census data and death certificates, meaning that our data are not subject to a numerator-denominator-bias (Jasilionis et al. 2012). Finally, the population figures and death counts are sufficiently large for statistical reliability.

In each census all persons were asked for his or her religious denomination. The legally recognized religious societies, which are also the largest religious groups, were given as tick boxes. Smaller groups could be indicated by a summary tick box in 1981 and 1991 and by text field in 2001.[4] A tick box was also provided for the undenominational.

Table 1 gives the religious distribution of census populations and matched deaths in follow-up periods. One clearly sees the declining shares of Roman Catholics and Protestants, in sharp contrast to rising shares of Muslims, other religion and no religion. In 2001, the Jewish, the Muslims and the other religions were predominantly (> 50 percent) made up of foreign immigrants.

[2] Large-scale foreign immigration to Austria started in the 1960s and was until the 1990s essentially driven by labor immigration from former Yugoslavia and Turkey.
[3] The Austrian most recent 2011 census does not provide information on religious denomination.
[4] In 2001, the 'other religion' category was distributed as follows: 79 percent Orthodox (Eastern) Christians, 12 percent other Christians, 9 percent other non-Christians.

Table 1: Distribution of census populations and follow-up deaths in Vienna

	Census population			Matched deaths in follow-up period		
	1981	1991	2001	1981	1991	2001
Total	**1,531,346**	**1,539,848**	**1,550,123**	**21,378**	**17,720**	**16,022**
Roman Catholic	1,094,775	889,985	762,089	15,027	10,877	9,088
Protestant (Lutheran)	96,238	74,742	64,085	1,293	833	807
Protestant (Reformed)	9,175	7,672	7,524	133	89	102
Old Catholic	14,697	9,918	7,134	368	185	119
Jewish	6,527	6,554	6,988	148	97	76
Muslim	28,099	62,305	121,149	24	81	130
Other religion	49,841	83,437	117,853	226	247	316
No religion	207,292	304,562	397,596	3,769	3,994	4,416
Not stated	24,702	100,673	65,705	390	1,317	968

Source: Authors' own calculations based on data provided by Statistics Austria

Contrary to other census variables, missing values on religious denomination were not imputed by the census department, but coded as a separate category ('not stated'). The underlying assumption was that not indicating one's denomination is for itself a religious statement (Ladstätter 2003). The frequency of missing values was only 1.6 percent in 1981; it was then much higher, 6.5 percent in 1991; and finally, 4.2 percent in 2001, questioning the comparability of this group over time. The particularly high frequency of missing values in 1991 is believed to be a legacy of an anti-census movement in West Germany.[5] For 2001, a disproportionately high frequency of missing values was observed for people living in institutionalized households, the elderly in general, and foreigners.

Religious denomination is not the same as religiosity. For example, our data do not indicate to what extent people believe in God, pray, or attend worship services. We interpret religious denomination as a component of religiosity which for our purposes has the major advantage that it is available in the census data. One may assume some correlation between religious denomination and other components of religiosity, for instance among the undenominational.[6]

Methods

Mortality risk is analysed from a relative perspective, using standardized mortality ratios (SMRs). The SMR denotes the ratio of an observed number of deaths in a religious group to the corresponding 'expected' number of deaths. An SMR greater than 1 means higher than average mortality risk.

[5] This assumption is supported by the regional variation in the frequency of missing values in the 1991 census. It was highest in Western Austrian cities Salzburg, Innsbruck and Linz, there 8-10 percent, whereas in many rural districts of Eastern and Southern Austria it was less than 2 percent.

[6] A recent master thesis on leaving the Christian churches in Vienna used qualitative methods and found that low religiosity is the key reason to leave. Other factors such as child sex abuse scandals are mostly triggers (Krivanek 2013).

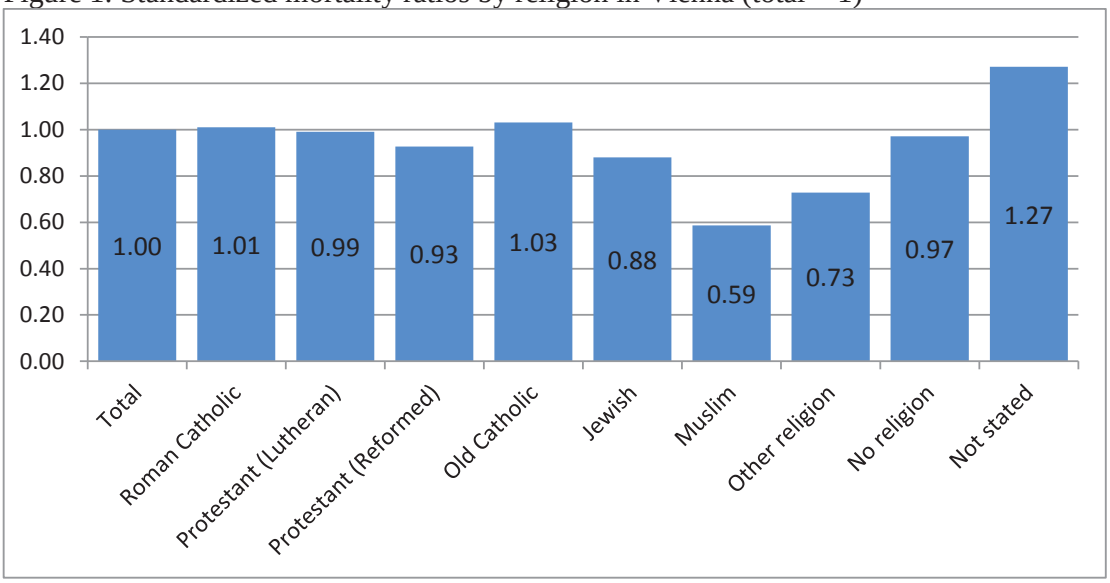
Expected deaths were calculated by applying the overall relative frequencies of dying, broken down by five-year age groups, to the population of the religious group. Expected deaths were first calculated separately for each follow-up period for men and women, to account for general mortality differentials over time and between the sexes. To minimize random variation in the SMRs, expected deaths were then pooled over the three follow-up periods and the two sexes.

Finally, we estimated life expectancies for men and women by selected religious denominations in Vienna in 2013. For that purpose we applied age-specific SMRs (from age groups 5-9 to 85-89 years) to the average single-year conditional probabilities of dying (q_x-values) from the Vienna 2013 life tables (Statistics Austria 2014).

Results

Figure 1 gives the SMRs by religious denomination. Mortality risk is slightly above average for Roman Catholics (SMR = 1.01). In contrast, the overall SMR of Protestants is 0.98, with a higher risk for Lutheran (0.99) than for Reformed Protestants (0.93). Old Catholics are found to be above average (1.03), whereas the non-religious are below average (0.97). A particularly high SMR of 1.27 is found for those with missing values on religious denomination, which may be the result of selective nonresponse. Very low SMRs appear for the Jewish (0.88), the Muslims (0.59), and the 'other religion' group (0.73).

Figure 1: Standardized mortality ratios by religion in Vienna (total = 1)



Source: Authors' own calculations based on data provided by Statistics Austria.

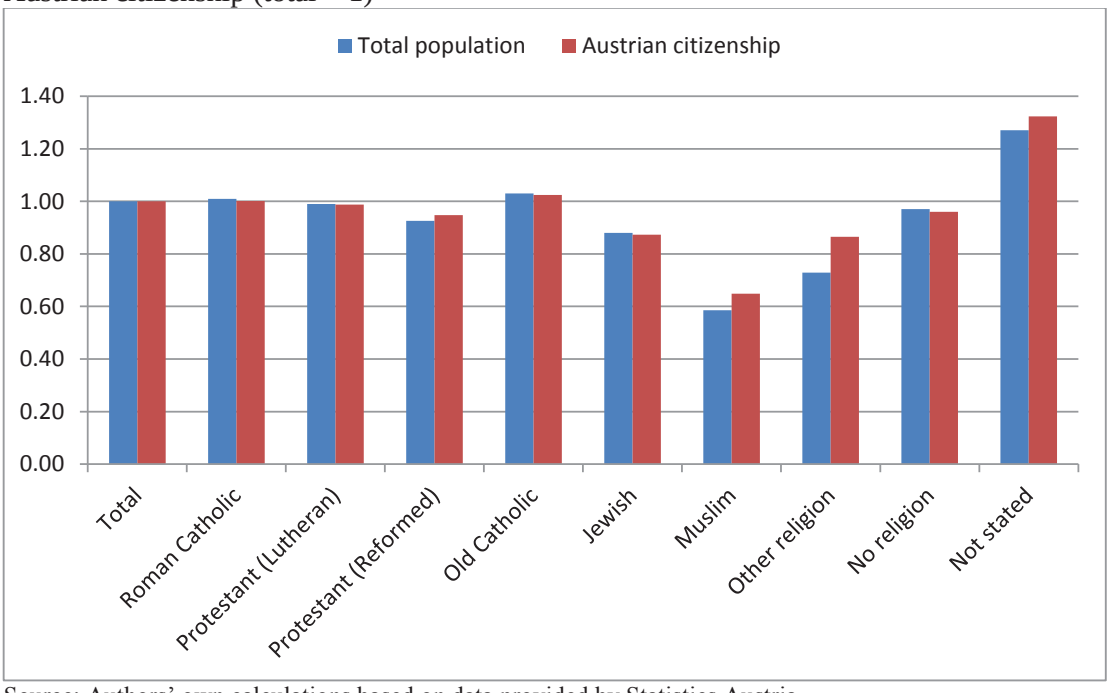
In the following we discuss possible explanations for the variation in mortality risk by religion in Vienna. We investigate selection effects, socio-economic disparities, and cultural and lifestyle differences.

Selection Effects

Several instances of differential mortality are known to be caused by selection effects. A famous example is the low mortality of foreign immigrants in many countries, which is attributed to a 'healthy migrant effect' and/or a 'salmon bias effect'[7] (Razum 2006). Since Vienna has a high fraction of foreign-born population (24 percent in 2001, see Table 1) and because the immigrants' religious makeup differs essentially from the natives', there is reason to believe that our findings may be subject to such selection effects.

The 1981 and 1991 censuses did not survey the country of birth; however, we are able to disaggregate the mortality risk by citizenship. Figure 2 compares the SMRs for the total Vienna population (the same as in Figure 1) with the values restricted to Austrian citizens. We see a slight decrease in mortality risk among Roman Catholics, Lutheran Protestants, and the non-religious, all of which have lower shares of foreign-born population than the Vienna average. This contrasts with an increase among Reformed Protestants, Muslims, and the 'other religion' group. This picture indicates that mortality differentials are partly explainable by selection effects; however, the quantitative difference for Muslims is surprisingly small, and no substantial difference exists for the Jewish.

Figure 2: Standardized mortality ratios by religion in Vienna, for total population and Austrian citizenship (total = 1)



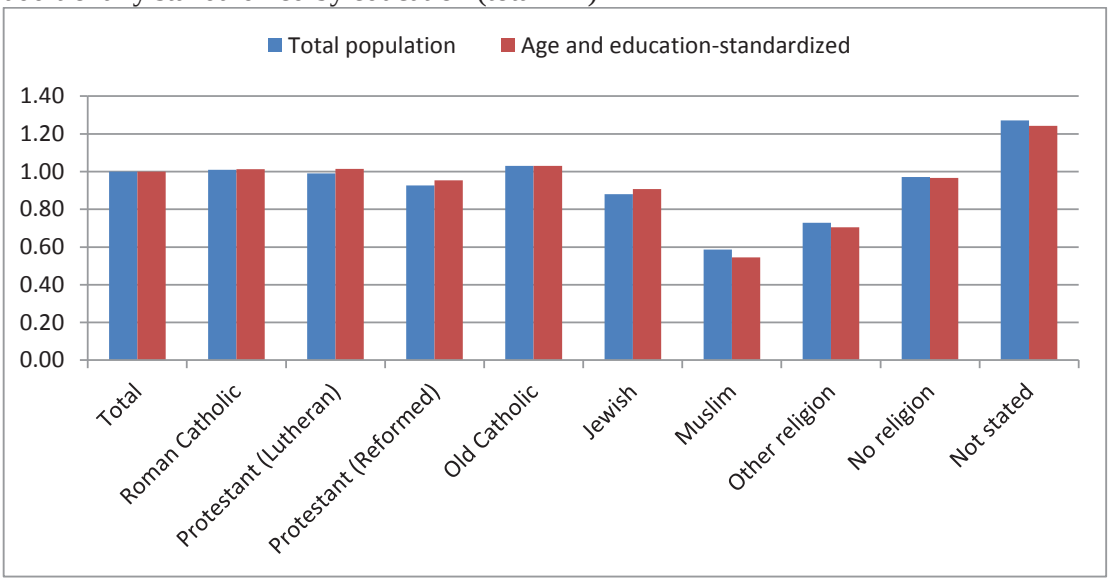
Source: Authors' own calculations based on data provided by Statistics Austria.

[7] The 'healthy migrant effect' means that foreign immigrants are at the time of immigration statistically healthier than the native population of the same age, due to selective participation in international migration. The 'salmon bias effect' means that deterioration of health status increases the likelihood of re-migration from host countries to home countries. Both effects statistically result in low mortality rates of immigrants in their host countries.

Socio-Economic Disparities

It is a well-known fact that mortality has a socio-economic gradient. Those with higher education, better jobs and higher incomes live longer on average (Vallin et al. 2001). Religious denomination is often found to be correlated with socio-economic position,[8] which may statistically explain the religious variation in mortality risk. For that purpose a comparison is drawn in Figure 3 between the ordinary SMRs (the same as in Figure 1) with values additionally standardized by highest educational level (three groups, national classification).

Figure 3: Standardized mortality ratios by religion in Vienna, for total population and additionally standardized by education (total = 1)



Source: Authors' own calculations based on data provided by Statistics Austria.

It turns out that the mortality advantage of Protestants compared to Roman Catholics virtually disappears when their higher educational distribution is accounted for. Also, the SMR of the Jewish is higher after standardization by education, though still below average. On the other hand, mortality risks for the Muslims and those with 'other religion' are even lower when standardized by age and education.

A very small decline in mortality risk after education-standardization is also found for the undenominational. This may be surprising, as in many countries the non-religious are better off in socio-economic terms.[9] In Vienna however, being non-religious is for historical reasons particularly widespread among the native-born working class. For the 23

[8] In Austria in 2001, 7 percent of all Roman Catholics aged 15 and over had academic education, compared to 11 percent among Protestants and 19 percent among Jews. For the United States in 2014, the Pew Research Center estimates that the share of population with annual total family income of $100,000 or more ranged from 4 percent among Jehovah's Witnesses to 44 percent among Jews (Pew Research Center 2015, p. 58).

[9] For example, in the United States 'Atheists' and 'Agnostics' have a much better than average income distribution (Pew Research Center 2015, p. 58).

districts of Vienna, the ecological Pearson correlation coefficient between the percentage undenominational and the percentage of manual workers among the labour force was +0.75 in 2001 (restricted to the population born in Austria; own calculation based on data provided by Statistics Austria).

Cultural and Lifestyle Differences

A good deal of differential mortality is often found to result from lifestyle factors such as smoking, obesity, alcohol abuse, distress, or openness to risk. For example, the excess mortality of males over females is often largely attributable to smoking (Luy and Wegner-Siegmundt 2013). With regard to religion, one may think of low alcohol consumption among Muslims. Unfortunately, lifestyle disparities by religion are not directly observable because in Austria, surveys on such factors do not ask for religious denomination. Instead, some indication of lifestyle differences can be obtained by cause-specific mortality risks. Such an analysis is however subject to small death counts. So in Table 2 we present SMRs for selected causes of death for Roman Catholics, Protestants (Lutheran and Reformed combined), the undenominational, and the total of the three religious groups mostly made up of foreign immigrants (Jewish, Muslim, and the 'other' group). The smallest expected number of deaths underlying these figures is 26.

Table 2: Standardized mortality ratios for selected causes of death and selected religions

Cause of death	ICD code		Percent of all deaths	Standardized mortality ratio			
	Rev. 9	Rev. 10		Roman Catholic	Protestant (Lutheran, Reformed)	No religion	Jewish, Muslim, 'Other religion'
Colon cancer	153	C18	2.4	1.01	0.94	0.98	0.68
Lung cancer	162	C33-C34	4.3	0.97	1.04	1.10	0.76
Diabetes	250	E10-E14	1.6	1.01	0.84	1.03	0.83
Myocardial infarction	410	I21-I22	13.2	1.00	0.96	1.02	0.73
Stroke	430-438	I60-I69	11.9	1.01	0.99	0.91	0.96
Liver cirrhosis	571	K70, K73-K74	2.3	1.08	1.05	0.93	0.28
Accident	E800-E949	V01-X59	2.7	1.02	0.98	0.98	0.77
Suicide	E950-E958	X60-X84	1.6	1.00	0.89	1.15	0.50
All causes of death			100.0	1.01	0.98	0.97	0.73

Source: Authors' own calculations based on data provided by Statistics Austria.

Little variation in SMR by cause of death can generally be observed for Roman Catholics. Both Roman Catholics and Protestants face a disproportionate risk of dying from liver cirrhosis. Regarding the undenominational, high values can be found for lung cancer, and in particular suicide mortality. The latter conforms to a finding for Switzerland (Lerch et al. 2010). Together, the three religious groups which are predominantly made up of foreign immigrants face a less than average mortality risk for all selected causes of

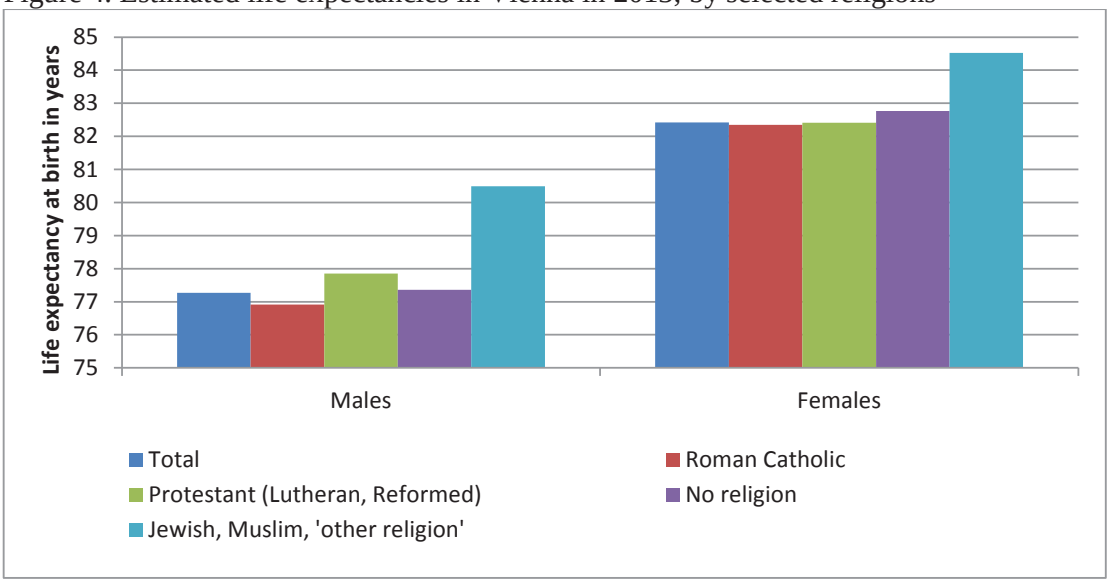
death. This is particularly so for liver cirrhosis and suicide, whereas stroke mortality is close to the Vienna average.

Sex-Specific Analysis

Finally, we investigated whether the SMRs by religious group differ between men and women. We computed sex-specific SMRs and then tested the null hypothesis of equal SMRs by z-tests (significance level 0.05, Bonferroni-adjusted), assuming the observed deaths to be Poisson distributed (Winkelmann 2010). The null hypothesis was rejected for those with religion not stated, and moreover for Roman Catholics (sex-specific SMR 1.030 among males, 0.998 among females).

Figure 4 gives the estimated life expectancy at birth in Vienna in 2013, for four selected religious groups; this is based on observed age- and sex-specific relative mortality risks in our data and the general Vienna 2013 life tables for men and women. Interestingly, the mortality advantage of Protestants over Roman Catholics is clearly visible among men (one-year difference), but non-existent among women. This sex-specific finding is supported by a comparative ecological analysis of European countries. Besides Switzerland, male life expectancy was highest in 2005/2010 in traditionally Protestant Iceland and Sweden, whereas female life expectancy was highest in traditionally Roman Catholic Spain and France (United Nations 2013).

Figure 4. Estimated life expectancies in Vienna in 2013, by selected religions



Source: Authors' own calculations based on data provided by Statistics Austria.
Note: The vertical axis has a minimum of 75.0, in order to visualize the disparities.

The undenominational have a slightly higher life expectancy than Roman Catholics; the excess is about half a year among both males and females. Particularly high life expectancies are estimated for the combined group of 'immigrant' religions. Their estimated advantage over the general Vienna life expectancy is more than three years

among males and two years among females. It should be repeated that the Austrian death records do not contain deaths occurring outside of Austria. Since such abroad deaths are probably more common among members of 'immigrant' religions, their true life expectancy advantage might be somewhat smaller (see also Bauer and Kytir 2010).

Discussion and Conclusions

This paper presents results on mortality by religious denomination in the city of Vienna, a place with a highly diversified and rapidly changing religious landscape. To the best of the authors' knowledge, this is the first Austrian study on the subject, using high-quality data from individual linkage of census records with death certificates. Also, the death counts are sufficiently large.

In this paper we analysed mortality from a relative perspective, applying standardized mortality ratios (SMRs) which account for different age distributions of religious groups. SMRs allow for reliable estimates of overall mortality levels. Unfortunately, any breakdown of our analysis by age groups or causes of death comes with the problem of small death counts, so we are limited in making statements not just on overall but on patterns of mortality.

Data from three twelve-month periods (1981/82, 1991/92, 2001/2002) were pooled to make results more reliable. Such a procedure may be problematic when religion-specific mortality differs from period to period. To guard against such distortions, we calculated period-specific SMRs (data not shown), revealing that pooling is by and large adequate. The only group with substantial variation in SMR between the periods is the one with religion not stated, which we assume to reflect the different reasons for item nonresponse in the three censuses, as mentioned in the data and methods section.

A disadvantage of our data is however that it is somewhat outdated. Given the fundamental changes in the Viennese population structure since the 1980s, it is debatable to what extent our findings can be generalized to the contemporary Viennese population or are merely historical. Unfortunately, the latest 2011 Austrian census does not provide information on religious denomination.

In our data the population of Vienna is broken down by religious denomination, as indicated by the respondents in the census questionnaires. One should not confuse religious denomination with religiosity, which is typically understood as a broader and multi-dimensional concept. Nevertheless, there is reason to assume that religious denomination is correlated with religiosity.

Religious denomination is often found to be correlated with socio-economic position, one of the drivers of mortality.[10] In this paper highest educational level completed was used as an indicator of socio-economic position, because it is available for the entire

[10] To what extent there is a causal relationship between religion and socio-economic status is subject to discussion beyond our work. One may think of Max Weber's famous work in the field of sociology of religion.

population, census information on it can be assumed to be sufficiently valid, and since it is usually completed at young adult ages endogeneity bias by feedback from mortality risk can essentially be ruled out (e.g., a worsening health status may reduce a person's income, but does not reduce his or her educational level). Admittedly, because of the educational expansion that occurred in Austria since the 1970s it is questionable to what extent educational levels are comparable between generations.

Besides the caveats mentioned, several conclusions can be drawn from our findings. First, substantial mortality differentials by religious denomination exist in the city of Vienna. Lower than average mortality is found for religious groups which are predominantly made up of foreign immigrants, which is partly explainable by selection effects associated with international migration. Another explanation for mortality differentials, relevant for the risk difference between Roman Catholics and Protestants, is socio-economic disparities between religious groups. Also, cultural and lifestyle disparities matter, as indicated by the very low liver cirrhosis mortality among 'immigrant' religions as well as the disproportionately high suicide mortality among the undenominational. Finally, a specific analysis for men and women reveals that gender is an effect modifier of the mortality difference between Roman Catholics and Protestants, resembling the mortality ranking of Western European countries.

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