Differences in survival and cause-specific mortality in a culturally diverse Greek population, 1999–2008

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ABSTRACT

Background Modern urban populations exhibit considerable internal heterogeneity. Several social groups, such as ethnic minorities or immigrants, constitute individual clusters with different demographic and epidemiological characteristics.

Methods Death records were collected from the Municipality Registry between 1999 and 2008. Kaplan–Meier survival analysis was conducted for (i) natively born Greeks, (ii) former USSR-repatriated Greeks and (iii) Roma. Further evaluation was conducted by log-rank (Mantel–Cox) test. Relative mortality rates were assessed by means of cross-tabulation (Pearson’s $\chi^2$).

Results Statistically significant differences in median survival were observed among the three social groups ($P < 0.001$). The relative mortality from infectious diseases was higher in the Roma population compared with natively born Greeks, odds ratio (OR) = 8.31 [confidence interval (CI) 95% 3.19–21.61]. More than 70% of these deaths were attributed to respiratory tract infections and were associated with children under the age of 5. Excess mortality due to external causes, injuries and substance abuse was observed in repatriated males compared with their natively born counterparts, OR = 2.27 (CI 95% 1.35–3.81).

Conclusions Specific public health interventions are required, to improve the survival of different cultural groups. For example, improvement of immunization status and increase in overall hygiene awareness can ameliorate high infant/childhood mortality in Roma population, while social integration can help reduce acculturation-related mortality among repatriated Greeks.

Keywords acculturation, ethnicity, relative mortality, survival analysis

Introduction

Modern urban populations may exhibit significant social heterogeneity. The existence of subgroups that differ both socio-economically and culturally creates inherent inequalities that reflect into the demographic and epidemiological characteristics of the whole. The elucidation of these patterns is of paramount importance in the understanding of disease patterns that prevail in the urban environment (e.g. infectious disease mortality, impact of chronic diseases, etc.). Survival analysis can reveal these discrepancies, thus making interventions alleviating social exclusions feasible and may further support the process of social integration.

In Greece, there are established Roma minorities inhabiting regional and metropolitan centers. Despite the important progress that has been achieved over the past few years, certain pockets of underdevelopment and socioeconomic backwardness still prevail. The living standards for many Roma remain extremely low, with significant levels of illiteracy and high rates of infant mortality. Several epidemiological studies have focused over time on Roma populations, documenting higher incidence of birth defects, infectious diseases, injuries from external causes and psychiatric disorders.

After the collapse of the Soviet Union, a significant amount of USSR citizens of Greek ethnicity and their
descendants, who historically inhabited the Black Sea region, have been repatriated. The communal installation of the repatriated people was quite successful. However, not without problems, as regards several aspects of social acceptance, education and employment opportunities. This was widely depicted in many sociological studies, reporting elevated rates of juvenile delinquency, violent behavior and substance abuse.

The Municipality of Alexandroupolis in North Eastern Greece is a multicultural environment, with diverse social and demographic characteristics. This type of social diversity is inherent in many European populations, although it is often overlooked in gross national and/or local statistics. Median survival time is a practical index for evaluating the overall health status of populations and also a mode to explain how mortality impacts upon life expectancy. The present study aimed at explaining the differences in survival among three social groups, namely natively born Greeks, repatriated Greeks from the former USSR and Roma of Muslim religion. Effort was taken to investigate the potential risk factors and define the necessary interventions that reduce health and social disparities.

Methods

Mortality data were collected from the Municipality of Alexandroupolis Registry for the period 1999–2008. These data included \( n = 3879 \) records of death, of which 2114 (54.5%) corresponded to male and 1765 (45.5%) to female cases. Gender, date, place of birth, address of residence of the deceased and cause of death, using the World Health Organization ICD-10 system, were recorded. The records were separated into three groups: (i) natively born Greeks (based on first and last name of Hellenic origin); (ii) Roma (based on the combination of an Islamic name and an address of residence in particular parts of the city, inhabited exclusively by Roma); (iii) repatriates from the former Soviet Union (based on place of birth located in former USSR). The survival analysis was performed by the Kaplan–Meier method and evaluated by means of log-rank (Mantel–Cox) test.

To characterize individual risk factors, cause of death was classified into five groups: (i) circulatory diseases (I00-I99), (ii) neoplasms (C00-D48), (iii) respiratory diseases (J00-J99), (iv) infectious diseases (A00-B99) and (v) external causes and injuries (V01-Y98). The proportional mortality ratio (PMR) was calculated according to the formula:

\[
PMR = \frac{m_i}{m_x} \times 100,
\]

where \( m_i \) the grouped \((i-v)\) cause of death and \( m \) the total mortality. Comparisons between social groups (odds ratio, confidence interval 95%) were performed by the Pearson’s \( \chi^2 \) method. A Bonferroni correction was applied where required, and a value of \( P < 0.05 \) was considered to be statistically significant.

To assess the impact of the causes of death in the survival of each social group, the method of cause elimination was applied. In brief, the median survival time was recalculated after removing the specific cause from the original data set. All statistical analyses were conducted in the statistical package SPSS v15.

Results

The majority of the records referred to natively born Greeks \( [n = 3365 (84.5%)] \), while only 264 (6.6%) and 250 (6.3%) referred to Roma and repatriates from the former Soviet Union, respectively. The survival probability of the examined cultural groups is shown in Fig. 1. The median survival time was higher in the natively born population, compared with the Roma and the repatriates, for both males and females, as well as in total population (Table 1). Differences in median
survival between natives and Roma as well as natives and repatriates were statistically significant for both sexes (males and females), as indicated by the log-rank (Mantel–Cox) test ($P < 0.001$). However, there was no difference in survival between Roma and repatriates in male and female subgroups (Table 2).

These data clearly indicate a discrepancy of Roma and repatriated Greeks compared with the natively born population, as regards median survival. The survival curve of the Roma shows a rapid decline in early stages, apparently reflecting high infant mortality rates (Fig. 1). As regards the repatriates from the former USSR, there is a clear attenuation of male survival at ages 25–65 that is not present in the female population. In particular, the survival of repatriated males in the 40–60 age group is inferior to both natives and Roma.

Differences in median survival of social groups were further evaluated by an extensive analysis of the individual causes of death. The PMR for external causes and injuries (V01-Y98) was significantly higher in repatriates, and this divergence was statistically significant ($\chi^2 = 9.871, P = 0.002$). Differences were even more pronounced in the male population ($\chi^2 = 10.045, P = 0.002$). In contrast, there were no statistically significant differences between natively born and repatriated females (Table 3). Main individual causes included traffic-related deaths, substance abuse, occupational accidents and self-harm (suicide). Moreover, the elimination of this cause would add $\sim$2 years in the median survival of this particular social group (data not shown).

In the Roma cluster, PMR from infectious diseases was significantly higher, compared with natives (Table 4), while for repatriates this rate was 0.4%. The difference in mortality from infectious diseases between Roma and natives was very statistically significant ($\chi^2 = 26.803, P < 0.001$). The majority (>70%) of these deaths were associated with children under the age of 5 and principally concerned respiratory tract infections (J00-99, ICD-10). A secondary survival analysis that was run after the elimination of this cause of death has shown an increase in the median survival of this social group by $\sim$2 years (data not shown).

## Discussion

### Main finding of this study

A survival analysis of social groups in the culturally diverse urban environment of Alexandroupolis, NE Greece, has revealed significant differences among natively born Greeks, Roma and repatriated Greeks from the Former Soviet Union. During the decadal study period (1999–2008), the median survival of the Roma lagged that of the natives by 7 years (9 years for males and 6 years for females). The corresponding deviations for the repatriated Greeks were 4 years (6 years for males and 3 years for females). Further investigation of the causes of death highlighted the potential risk factors responsible for these disparities.

More specifically, for decreased survival probabilities in repatriated Greeks can be attributed to external causes and injuries (V01-Y98, ICD-10). Most of these deaths were associated with male gender and were more prevalent in the 25–65 age group. Individual causes included traffic-related deaths, substance abuse, occupational accidents and self-harm (suicide). As already mentioned, elimination of these causes would add $\sim$2 years in the median survival of this particular social group.

On the other hand, high mortality from infectious diseases is deteriorating the survival of the Roma. The majority of these deaths refers to children under the age of 5 and was

### Table 2 Log-rank (Mantel–Cox) across-group survival comparisons

<table>
<thead>
<tr>
<th></th>
<th>Natives</th>
<th>Roma</th>
<th>USSR repatriates</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Both sexes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natives</td>
<td>—</td>
<td>$&lt;0.001$</td>
<td>$&lt;0.001$</td>
</tr>
<tr>
<td>Roma</td>
<td>$&lt;0.001$</td>
<td>—</td>
<td>0.655</td>
</tr>
<tr>
<td>USSR repatriates</td>
<td>$&lt;0.001$</td>
<td>0.655</td>
<td>—</td>
</tr>
<tr>
<td><strong>Males</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natives</td>
<td>$&lt;0.001$</td>
<td>$&lt;0.001$</td>
<td>$&lt;0.001$</td>
</tr>
<tr>
<td>Roma</td>
<td>$&lt;0.001$</td>
<td>—</td>
<td>0.163</td>
</tr>
<tr>
<td>USSR repatriates</td>
<td>$&lt;0.001$</td>
<td>0.163</td>
<td>—</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natives</td>
<td>—</td>
<td>$&lt;0.001$</td>
<td>$&lt;0.001$</td>
</tr>
<tr>
<td>Roma</td>
<td>$&lt;0.001$</td>
<td>—</td>
<td>0.717</td>
</tr>
<tr>
<td>USSR repatriates</td>
<td>$&lt;0.001$</td>
<td>0.717</td>
<td>—</td>
</tr>
</tbody>
</table>

### Table 3 PMR for external causes and injuries (V01-Y98)

<table>
<thead>
<tr>
<th></th>
<th>USSR repatriates (%)</th>
<th>Natives (%)</th>
<th>OR (CI 95%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Both</strong></td>
<td>8.8</td>
<td>4.4</td>
<td>1.81 (1.13–2.91)</td>
<td>0.019</td>
</tr>
<tr>
<td><strong>Males</strong></td>
<td>12.8</td>
<td>6.1</td>
<td>2.27 (1.35–3.81)</td>
<td>0.002</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td>3</td>
<td>2.5</td>
<td>1.19 (0.36–3.91)</td>
<td>0.109</td>
</tr>
</tbody>
</table>

### Table 4 PMR for infectious diseases (A00-B99)

<table>
<thead>
<tr>
<th></th>
<th>Roma (%)</th>
<th>Natives (%)</th>
<th>OR (CI 95%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Both</strong></td>
<td>2.7</td>
<td>0.3</td>
<td>8.31 (3.19–21.61)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Males</strong></td>
<td>4</td>
<td>0.3</td>
<td>12.6 (4.00–39.44)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td>0.9</td>
<td>0.3</td>
<td>2.73 (0.32–23.61)</td>
<td>0.172</td>
</tr>
</tbody>
</table>

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 principales attributed to respiratory tract infections (J00-99, ICD-10). Notably, this type of morbidity/mortality can be prevented with appropriate medical interventions (e.g. immunization and chemoprophylaxis) and should, thus, be considered completely avoidable.15–18 The elimination of this cause of death alone would add ~2 years in the median survival of this social group.

**What is already known on this topic**

Socioecological factors, such as poor hygiene and sanitation, low-income criteria and stoical attitude toward disease are some of the major factors driving health disparities in marginalized populations.19 Several studies have reported high prevalence of infectious causes among Roma people, which often act as foci of epidemic outbreaks, including hepatitis A, measles and meningitis.3,20,21 On the other hand, problems of integration in the broader social environment, as well as racism and social exclusion phenomena constitute psychosocial factors that tend to increase morbidity and mortality.22–24 Collectively, these factors are inherent in the acculturation process.25,26 The burden may be more pronounced in males, due to the more intimate contact with the social environment (e.g. higher gender employment rates).

Diaspora migration from the former Soviet Union to Western Europe has been shown to significantly affect health indicators.27 The ‘East–West’ mortality gap and post migration factors may lead to higher morbidity and mortality rates, including suicidal behavior and drug-related deaths.28–30 This phenomenon has been well described in epidemiology and is evident in many time-series analyses across Europe.31–34 People who migrate carry both the risk factors of past exposure, as well as face new challenges in the host environment, which makes them particularly vulnerable to increased morbidity and mortality.36,35,36

**What this study adds**

Survival analysis of individual population groups can reveal significant differences that are otherwise masked in the ‘big picture’ of epidemiological and demographic statistics. The survival patterns of certain social groups may affect epidemiological indicators and life expectancy, and should thus be taken into account.19,37,38 Ethnic minority groups often exhibit poorer health indicators, as opposed to the general population. Immigrants, in particular, may face acculturation issues that are translated into epidemiological disparities.

Given these data, it is imperative to take all the necessary actions to eliminate social exclusion and accelerate the process of social integration for marginalized minorities. Identifying risk factors in socially deprived populations can help mitigate health burdens and improve overall survival. Emphasis should be given on increasing the accessibility of health and education services. Health promotion should focus on primary prevention, and especially avoidable mortality causes, such as infectious diseases and external causes.

**Limitations of this study**

This study faces certain limitations that are principally associated with lack of detailed demographic data for the Roma and USSR-repatriated Greeks. Once the structure of the population is not known, any effort of standardization is practically impossible. This can lead to systematic errors, particularly when crude mortality rates are considered. For example, higher fertility and mortality rates have been observed among Roma, which suggests a younger population structure.4,17 Equally, the structure of the repatriated Greek population may alter overall survival rates, especially when dealing with chronic disease, where age is a critical factor.

The unavailability of demographic data for individual social groups is a well-documented problem in the scientific literature.37 The ethnicity parameter is missing from population censuses, although there is increasing advocacy for incorporating this information in national and international statistics. As migration flaws rise and modern populations become increasingly diverse, it is inevitable to observe epidemiological discrepancies that arise from heterogeneities that are intrinsic in a community (socioeconomic, cultural, etc.).

**Conclusions**

Overall, these data present a hypothesis concerning the potential reasons for survival disparities among different social groups. PMRs gave an indication on the propensity of each group to a particular cause of death (or rather grouped causes of death). Only infectious diseases and external causes were addressed in this occasion, as they are more resilient to structural differences. The main causes that show absolute age dependence (circulatory disease, neoplasms and respiratory) were excluded. Results presented here need to be further evaluated, to provide final and conclusive evidence. This can only be attained if census data incorporate the ethnicity parameter in the registration process.

**References**


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