A replication of the curvilinear relationship between population growth and elderly suicide rates in a cross-national study

A curvilinear (U-shaped) relationship between population growth rates and elderly suicide rates fitting the quadratic equation \( y = a + bx + cx^2 \) (where \( y \) is the elderly suicide rate, \( x \) is the population growth rate and \( a, b \) and \( c \) are constants) has been reported (Shah, 2009a). A theoretical model with three sequential stages incorporating population growth, elderly population size, the proportion of elderly in the general population, life expectancy and birth rates has been proposed to explain the findings (Shah, 2009a).

An identical curvilinear relationship was also observed between “predicted” future population growth rates and elderly suicides (Shah, 2009b). As “predicted” future population growth, which has not yet occurred, cannot directly explain an increase in suicide rates, the accuracy of the curvilinear relationship between population growth and elderly suicide rates has been questioned (Shah, 2009b). The “predicted” future population growth rate may

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References


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be a proxy measure for other correlates of elderly suicides or other variables may predict both elderly suicide rates and the future population growth rates (Shah, 2009b). An additional source of bias in the previous study was that only one-year cross-sectional data on elderly suicide rates were used because suicide rates can randomly fluctuate year on year (Shah and Coupe, 2009). Therefore, a study designed to replicate the curvilinear relationship between population growth and elderly suicide rates was undertaken: (i) using a one-year average of five years of data on suicide rates; and (ii) using more recent data on both elderly suicide rates and population growth than used in the previous study.

Data on elderly suicide rates for males and females in the age-bands 65–74 years and 75+ years were ascertained from the World Health Organization (WHO) website (http://www.who.int/whosis/database/mort/table1.cfm). For a small number of countries only the raw figures for the number of suicides were available from the WHO website. Suicide rates for these countries were calculated by dividing the number of reported suicides by the population size in the relevant age-band and sex group available on the same website. Data were ascertained for the latest five consecutive years. The one-year average suicide rate was calculated by dividing the sum of suicide rates for the latest five consecutive years by five. The median (range) for the latest year for the suicide rate data was 2005 (1983–2007). Data on the average annual population growth were also ascertained from the WHO website (http://www.who.int/countries/afg/en/) and were for the year 2005 (1983–2007). The one-year average suicide rate was calculated by dividing the sum of suicide rates for the latest five consecutive years by five. The median (range) for the latest year for the suicide rate data was 2005 (1983–2007). Data on the average annual population growth were also ascertained from the WHO website (http://www.who.int/countries/afg/en/) and were for the year 2005 (1983–2007).

Curve estimation regression models were used to examine the curvilinear relationship between elderly suicide rates and the average annual population growth fitting the quadratic equation $y = a + bx + cx^2$ (as defined above).

A full dataset for elderly suicide rates and all the other measured variables was available for 85 countries. Table 1 illustrates the curve estimation regression models, whereby the relationship between suicide rates in both sexes in both the elderly age-bands and the average annual population growth rates was curvilinear (U-shaped curve) and fitted the quadratic equation $y = a + bx + cx^2$.

The significant curvilinear (U-shaped curve) relationship between suicide rates and average annual population growth rates in both sexes in both elderly age-bands, using the one-year average of five years of data on suicide rates and the latest available data set (different from the earlier study), confirmed the findings of the earlier study using only one-year cross-sectional data on suicide rates. This suggests that this relationship is robust and accurate.

### References


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**Table 1. Curve estimation regression models for the relationship between elderly suicide rates and the average annual population growth rate**

<table>
<thead>
<tr>
<th></th>
<th>R²</th>
<th>Degrees of Freedom</th>
<th>F</th>
<th>Significance Value</th>
<th>Regression Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males 65–74 years</td>
<td>0.37</td>
<td>82</td>
<td>24.37</td>
<td>p &lt; 0.0001</td>
<td>$y = 38.01 - 23.20x + 3.97x^2$</td>
</tr>
<tr>
<td>Males 75+ years</td>
<td>0.26</td>
<td>82</td>
<td>14.46</td>
<td>p &lt; 0.0001</td>
<td>$y = 52.36 - 22.53x + 1.07x^2$</td>
</tr>
<tr>
<td>Females 65–74 years</td>
<td>0.32</td>
<td>82</td>
<td>19.51</td>
<td>p &lt; 0.0001</td>
<td>$y = 9.75 - 4.97x + 0.36x^2$</td>
</tr>
<tr>
<td>Females 75+ years</td>
<td>0.20</td>
<td>82</td>
<td>10.52</td>
<td>p &lt; 0.0001</td>
<td>$y = 13.99 - 7.42x + 0.78x^2$</td>
</tr>
</tbody>
</table>

$y =$ Suicide rates.

$x =$ Average annual population growth rate.