A replication of the relationship between elderly suicides rates and elderly dependency ratios: cross-national study

Ajit Shah a, *

a International School for Communities, Rights and Inclusion, University of Central Lancashire, Preston and Consultant Psychiatrist, West London Mental Health NHS Trust, London, United Kingdom.

Abstract:

Background: A positive correlation between elderly dependency ratios and elderly suicide rates has been observed using one-year cross-sectional data on elderly suicide rates.

Methods: A cross-national study designed to replicate this positive correlation between elderly dependency ratios and elderly suicide rates was undertaken by: (i) using one-year average of five years data on suicide rates; and (ii) using more recent data on both elderly suicide rates and elderly dependency ratios. Data on elderly suicide rates, and the total number of elderly and young people was ascertained from the World Health Organization website.

Results: The main findings were of significant positive correlations between elderly dependency ratios and suicide rates in both sexes in both the elderly age-bands (65-74 years and 75+ years).

Conclusions: The replication of the positive correlations between elderly dependency ratios and elderly suicide rates by using one-year average of five years data on suicide rates suggests that this relationship is robust and accurate.

© 2010 KUMS, All right reserved

*Corresponding Author at:
Professor Ajit Shah, West London Mental Health NHS Trust, Uxbridge Road, Southall, Middlesex, UB1 3EU, United Kingdom. Telephone: 44 208 354 8140, Fax: 44 208 354 8307, E-mail: ajit.shah@wlmht.nhs.uk (A. Shah).

© 2010 KUMS, All right reserved

Introduction

Suicide rates among non-white Americans, 1 Indians, 2, 3, 4 Arabs in Jordan, 5 men in Kuwait, 6 Malayans in Singapore, 7 Indian immigrants to the United Kingdom, 8,9 and in some east European countries 10 decline with increasing age.

Traditionally, in these societies the elderly are respected, held in high esteem and live in closely knit families, and this offers protection against loneliness and despair, which otherwise may lead to suicide. 11 These factors may also explain the low elderly suicide rates in Thailand, 12 and among Malayans in Singapore. 13 A similar hypothesis may also explain high suicide rates among the elderly in Japan, 14,15 Hong Kong, 16 China 17,18 and Taiwan 19 because they have lost their traditional role in the family. Additional evidence supporting this, from Hong Kong and China, includes: mismatch between the traditional dependence of elderly on their children for emotional and financial support and their children’s ability to provide this; 17,18,20 the greater effect on the elderly of their children’s negative attitudes; 20 and, the migration of children to urban areas or to other countries. 16,17 Lower elderly suicide rates are associated with reduction in the number of caregivers, 13,20,22 larger household size, 13,23 greater proportion of extended family
households and lower proportion of single family households.

A recent cross-national study reported a positive correlation between elderly suicide rates and elderly dependency ratios (the ratio of people over the age of 65 years to people under the age of 65 years). This finding was primarily explained by speculating that presence of greater number of younger people being available to care for older people ultimately leading to reduction in elderly suicide rates based on the cultural explanations described above.

However, this study used only one-year cross-sectional data on elderly suicide rates and suicide rates can randomly fluctuate year on year. Therefore, in order to replicate the findings of this earlier study, the relationship between elderly suicide rates and elderly dependency ratios was examined: (i) by using a one-year average of five years data on elderly suicide rates; and (ii) using the latest available (and, therefore, a more recent) data set on elderly suicide rates.

### Methods

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 Organisation (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).

The definition of elderly dependency ratio used in this study was the ratio of those over the age of 60 years to those under the age of 60 years. The age of 60 years was used as a cut-off age because the WHO provides figures for the proportion of the population over the age of 60 years. Data on the proportion of people over the age of 60 years and the total general population size was ascertained from the WHO website for the year 2006 (http://www.who.int/ countries/). From this the absolute numbers of people over the age of 60 years and under the age of 60 years in the general population was calculated. The elderly dependency ratio was calculated by dividing the number of people over the age of 60 years by the number of people under the age of 60 years. Child mortality rates (i.e. for those under the age of 5 years) were also ascertained from the same WHO website to enable examination of the findings in the context of social development of countries as child mortality rates can be considered to be proxy for social development.

The relationship between elderly suicide rates, in both sexes in both the age-bands, and the elderly dependency ratios was examined by using Spearman’s correlation coefficient.

### Results

Full data set was available for 85 countries from the WHO website. A list of these 85 countries is provided in Table 1 along with their suicide rates, elderly dependency ratios and child mortality rates. The median (range) for suicide rates and elderly dependency ratios across the countries is provided in Table 2.

There were significant positive correlations between elderly dependency ratios and suicide rates in males aged 65-74 years (Rho=+0.60, P<0.0001), males aged 75+ years (Rho=+0.57, P<0.0001), females aged 65-74 years (Rho=+0.66, P<0.0001) and females aged 75+ years (Rho=+0.57, P<0.0001).

### Discussion

Some methodological issues need consideration. Cross-national data on suicide rates should be viewed cautiously because: data were not available from all countries; the validity of this data was unclear; the legal criteria for the proof of suicide vary between countries and in different regions within a country; some countries have poor death registration facilities; and, cultural and religious factors and stigma attached to suicide may lead to under-reporting of suicide. 

| Table 1: Median and range of suicide rates and elderly dependency ratios |
|-----------------------------|--------|--------|
| **Suicide rates males aged 65-74 years** | 19.6  | 0-93.98 |
| **Suicide rates males aged 75+ years** | 28.3  | 0-161.42 |
| **Suicide rate females aged 65-74 years** | 4.6   | 0-32.54 |
| **Suicide rate females aged 75+ years** | 5.06  | 0-71.36 |
| **Elderly dependency ratios** | 0.18  | 0.03-0.37 |
| **Suicide rates are per 100,000 of the relevant age and gender group** |
Several countries were from a different year, and these data from 1987 to 2007 and the elderly dependency ratios for suicides. The latest available data on suicide rates ranged from a one-year average of five-year data on suicide rates. The table below shows the characteristics of the studied countries.

### Table 2: Characteristics of the Studied Countries

| Country  | Male 65-74 Suicide Rate | Male +75 Suicide Rate | Female 65-74 Suicide Rate | Female +75 Suicide Rate | Male Child Mortality Rate | Female Child Mortality Rate | Elderly Dependency Ratio |
|----------|-------------------------|-----------------------|---------------------------|-------------------------|--------------------------|---------------------------|-------------------------|
| Albania  | 4.74                    | 6.9                   | 2.54                      | 5.94                    | 17                       | 16                        | 0.15                    |
| Argentina| 26.58                   | 42.6                  | 4.7                       | 5.68                    | 18                       | 15                        | 0.16                    |
| Armenia  | 7.34                    | 7.12                  | 1.76                      | 5.06                    | 26                       | 21                        | 0.16                    |
| Australia| 19.6                    | 25.58                 | 4.92                      | 4.56                    | 6                        | 5                         | 0.22                    |
| Austria  | 50.06                   | 87.98                 | 13.76                     | 19                      | 5                        | 4                         | 0.28                    |
| Azerbaijan| 0                      | 0                     | 2.62                      | 3.94                    | 93                       | 84                        | 0.10                    |
| Bahamas  | 0                       | 0                     | 3.52                      | 0                       | 16                       | 12                        | 0.11                    |
| Bahrain  | 1.72                    | 0                     | 0                         | 0                       | 10                       | 11                        | 0.05                    |
| Belarus  | 86.12                   | 76.4                  | 15.26                     | 20.4                    | 63                       | 75                        | 0.22                    |
| Belgium  | 39.62                   | 87.5                  | 13.58                     | 15.8                    | 77                       | 82                        | 0.28                    |
| Belize   | 33.18                   | 22.58                 | 0                         | 0                       | 65                       | 74                        | 0.06                    |
| Bosnia   | 27.02                   | 33.26                 | 8.52                      | 10.86                   | 17                       | 12                        | 0.23                    |
| Brazil   | 12.52                   | 14.6                  | 2.38                      | 2.28                    | 22                       | 18                        | 0.10                    |
| Brunei   | 0                       | 34.85                 | 0                         | 0                       | 10                       | 8                         | 0.05                    |
| Bulgaria | 38.78                   | 54.34                 | 15.56                     | 28.35                   | 13                       | 12                        | 0.3                     |
| Canada   | 17.48                   | 21.56                 | 4.66                      | 3.3                     | 6                        | 5                         | 0.22                    |
| Chile    | 27.62                   | 34.64                 | 2.42                      | 3.16                    | 10                       | 8                         | 0.14                    |
| Costa Rica| 48.70                  | 70.12                 | 10.7                      | 14.56                   | 76                       | 80                        | 0.09                    |
| Croatia  | 60.86                   | 99.70                 | 17.94                     | 24.64                   | 72                       | 79                        | 0.28                    |
| Cuba     | 44.46                   | 79.38                 | 15.5                      | 16.44                   | 76                       | 86                        | 0.19                    |
| Czech Rep| 31.74                   | 66.8                  | 8.31                      | 15.42                   | 5                        | 3                         | 0.25                    |
| Denmark  | 31.16                   | 56.14                 | 9.58                      | 16.78                   | 5                        | 4                         | 0.28                    |
| Dominica | 0                       | 0                     | 0                         | 16                      | 14                       | 14                        | 0.12                    |
| Ecuador  | 10.52                   | 12.52                 | 1.36                      | 1.98                    | 70                       | 76                        | 0.1                     |
| El Salvador| 15.44                  | 17.06                 | 0                         | 0                       | 28                       | 23                        | 0.09                    |
| Estonia  | 50.62                   | 67.93                 | 2.4                       | 4.44                    | 7                        | 4                         | 0.28                    |
| Finland  | 39.32                   | 43.14                 | 10.26                     | 8.2                     | 4                        | 3                         | 0.28                    |
| France   | 38.3                    | 73.56                 | 13.06                     | 15.58                   | 5                        | 4                         | 0.27                    |
| Georgia  | 14.34                   | 12.96                 | 3.20                      | 6.08                    | 33                       | 31                        | 0.22                    |
| Germany  | 28.72                   | 56.26                 | 10                        | 16.88                   | 5                        | 4                         | 0.33                    |
| Greece   | 7.88                    | 13.12                 | 1.78                      | 1.74                    | 4                        | 4                         | 0.3                     |
| Guatemala| 6.34                    | 6.08                  | 0.72                      | 0.9                     | 41                       | 41                        | 0.06                    |
| Guyana   | 52.6                    | 35.28                 | 7.56                      | 4.54                    | 68                       | 55                        | 0.1                     |
| Hungary  | 68.08                   | 121.36                | 18.66                     | 33.72                   | 8                        | 6                         | 0.27                    |
| Iceland  | 11.4                    | 8.93                  | 4.22                      | 2.27                    | 3                        | 2                         | 0.19                    |
| Ireland  | 14.16                   | 9.28                  | 4.22                      | 2.8                     | 5                        | 4                         | 0.18                    |
| Israel   | 15.28                   | 28.08                 | 4.74                      | 8.14                    | 6                        | 5                         | 0.15                    |
| Italy    | 18.5                    | 33.56                 | 5.5                       | 6.42                    | 4                        | 4                         | 0.35                    |
| Jamaica  | 0.88                    | 0                     | 0                         | 0.4                     | 33                       | 30                        | 0.11                    |
| Japan    | 42.4                    | 45.02                 | 18.62                     | 23.4                    | 4                        | 3                         | 0.37                    |
| Kazakhstan| 61.5                    | 60.88                 | 11.68                     | 20.94                   | 4                        | 3                         | 0.11                    |
| Kiribati | 0                       | 0                     | 0                         | 0                       | 65                       | 63                        | 0.06                    |
| Kuwait   | 0                       | 0                     | 0                         | 0                       | 12                       | 10                        | 0.03                    |
| Kyrgyzstan| 24.28                  | 25.34                 | 4.26                      | 7.62                    | 44                       | 38                        | 0.08                    |
| Latvia   | 62.02                   | 70.36                 | 12.56                     | 22.66                   | 10                       | 8                         | 0.28                    |
| Lithuania| 87.56                   | 84.38                 | 19.92                     | 25.56                   | 9                        | 8                         | 0.27                    |
| South Africa | 1.15                | 53.26                 | 6.66                      | 8.26                    | 72                       | 66                        | 0.08                    |

Methodological issues may have biased the findings. Also, using a one-year average of five-year data on suicide rates does the denominator for calculating suicide rates, and

**Journal homepage:** [http://www.jivresearch.org](http://www.jivresearch.org)
this may have biased the findings. However, data was gathered from the WHO data bank and was the latest and best available cross-national data set, and a one-year average of five years data on suicide rates was used.

The significant positive correlations between suicide rates, in both sexes in both the elderly age-bands, and elderly dependency ratios confirmed the findings of the earlier study using only one-year cross-sectional data on elderly suicide rates. The confirmation of earlier findings by using a more recent data set than the earlier study and one-year average of five years data on suicide rates suggests that the observed relationship between elderly suicide rates and elderly dependency ratios is accurate and robust. There may be several explanations for these findings. First, the findings may be an artifact of the methodological issues described above. Second, the findings were consistent with previous observations of positive correlations between elderly suicide rates and the proportion of elderly in the total population in large cross-national studies. This may reflect Durkheim’s hypothesis that the overall cohort size may influence suicide rates due to competition for scarce resources. Third, increased life expectancy was associated with increased suicide rates in the elderly in a cross-national study of 87 countries.

Increased life expectancy leads to an increase in the proportion of elderly in the population. This may also reflect Durkheim’s hypothesis stated above. Fourth, an alternative hypothesis pertaining to cultural factors may be important and is explored below.

The impact of elderly dependency ratios on elderly suicide rates may interact with and be modified and/or mediated through cultural factors. These cultural factors were described in detail in the Introduction and include: the degree of respect and esteem given by younger generations to the elderly, as well as the degree of social cohesion and connectedness within the community and family. These factors may influence the willingness of elderly individuals to engage in suicide, as well as the availability of support and assistance in times of distress.

The relationship between suicide rates and elderly dependency ratios may be complex and influenced by a variety of factors, including cultural, economic, and social factors. Further research is needed to better understand the mechanisms underlying these relationships and to develop interventions that can effectively reduce suicide rates among the elderly.
elderly; the traditional dependence of elderly on their children for emotional and financial support and their children’s ability to provide this; the traditional expectation of the elderly to live with their children or grand-children; the greater effect on the elderly of their children’s negative attitudes; migration of children to urban areas or to other countries; and, the number of available caregivers, household size and family size. Countries with lower elderly dependency ratios would potentially have a greater number of younger people potentially available to positively contribute to these cultural issues, and this may ultimately lead to reduction in elderly suicide rates.

This study merely examined the relationship between elderly suicide rates and elderly dependency ratios and cultural factors were not formally measured. Therefore, considerable caution should also be exercised in assuming that elderly dependency ratios act as a proxy measure for cultural factors.

Moreover, elderly dependency ratios may interact with, modify and mediate the effect of other factors on elderly suicide rates. An important factor in this context is the contribution of a greater number of younger people to the socio-economic status of countries because elderly suicide rates are also influenced by the socio-economic status of countries. The cross-sectional design of the study does not allow definitive conclusions about the aetiological relationship.

The contribution of cross-national differences in cultural factors on elderly suicide rates requires further study by formally measuring: (i) the cultural views and attitudes of young people towards the elderly; and (ii) the perception of the elderly on their traditional and changing role in society and their relationship with younger generations.

### Funding
This study was not funded externally.

### Competing interests
None declared.

### Ethical approval
Ethical approval was not needed.

### References

1. Seiden RH. Mellowing with age: factors affecting the nonwhite suicide rate. Int J Aging Hum Dev. 1981;13(4):265-84.
2. Woodbury MA, Manton KG, Blazer D. Trends in US suicide mortality rates 1968-1982: race and sex differences in age, period and cohort components. Int J Epidemiol. 1988 Jun;17(2):356-62.
3. Adityanjee DR. Suicide attempts and suicide in India: cross-cultural aspects. International Journal of Social Psychiatry. 1986; 32: 64-73.
4. Bhatia SC, Khan MH, Mediratta RP, Sharma A. High risk suicide factors across cultures. Int J Soc Psychiatry. 1987 Autumn;33(3):226-36.
5. Daradekh TK. Suicide in Jordan 1980-1985. Acta Psychiatr Scand. 1989 Mar;79(3):241-4.
6. Shah AK. The relationship between suicide rates and age: an analysis of multinational data from the World Health Organisation. Int Psychogeriatr. 2007 Dec;19(6):1141-52.
7. Ko SM, Kua EH. Ethnicity and elderly suicide rates in Singapore. Int Psychogeriatr. 1995 Summer;7(2):309-17.
8. Soni Raleigh V, Bulusu L, Balarajan R. Suicides among immigrants from the Indian subcontinent. Br J Psychiatry. 1990 Jan;156:46-50.
9. Neelam J, Mak V, Wessely S. Suicide by age, ethnic group, coroner’s verdicts and country of birth. A three-year survey in inner London. Br J Psychiatry. 1997 Nov;171:463-7.
10. Sartorious N. Recent changes in suicide rates in selected eastern European and other European countries. Int Psychogeriatr. 1995 Summer;7(2):301-8.
11. Shah AK, De T. Suicide and the elderly. Int J Psychiatry Clin Pract 1998; 2: 3–17. 19.
12. Lotrakul M. Suicide in Thailand during the period 1998-2003. Psychiatry Clin Neurosci. 2006 Feb;60(1):90-5.
13. Kua EH, Ko SM, Ng TP. Recent trends in elderly suicide rates in a multi-ethnic Asian city. Int J Geriatr Psychiatry. 2003 Jun;18(6):533-6.
14. Watanabe N, Hasegawa K, Yoshinaga Y. Suicide in later life in Japan: urban and rural differences. Int Psychogeriatr. 1995 Summer;7(2):253-61.
15. Shimizu M. Depression and suicide in late life. In: Psychogeriatrics: Biomedical and Social Advances (Eds. Hasegawa K, Homma A). Amesterdam: Excerpta Medica, 1990: 330-4.
16. Yip PS, Tan KC. Suicides in Hong Kong and Singapore: a tale of two cities. Int J Soc Psychiatry. 1998 Winter;44(4):267-79.
17. Yip PS, Callanan C, Yuen HP. Urban/rural and gender differentials in suicide rates: East & West. J Affect Disord. 2000 Jan-Mar;57(1-3):99-106.
18. Yip PS, Liu KY, Ku J, Song XM. Suicide rates in China during a decade of rapid social change. Soc Psychiatry Psychiatr Epidemiol 2005; 40: 792-8. 24.
19. Liu H, Wang H, Yang M. Factors associated with an unusual increase in elderly suicide rate in Taiwan. Int J Geriatr Psychiatry 2006; 21: 1219–21.
20. Yip PS. An epidemiological profile of suicides in Beijing, China. Suicide Life Threat Behav. 2001; 31(1): 62-70.
21. Yip PS, Chi I, Yu KK. An epidemiological profile of elderly suicides in Hong Kong. Int J Geriatr Psychiatry. 1998; 13: 631-7.
22. Shah AK, Padayatchi M, Das K. The relationship between elderly suicide rates and elderly dependency ratios: a cross-national study using data from the WHO data bank. Int Psychogeriatr. 2008 Jun;20(3):596-604.
23. Shah AK. The relationship between elderly suicide rates, household size and family structure: a cross-national study. International Journal of Psychiatry in Clinical Practice. 2009 (in press).

24. Shah A, Coupe J. A comparative study of elderly suicides in England and Wales, Scotland and Northern Ireland: trends over time and age-associated trends. Int Psychogeriatr. 2009 Jun; 21(3):581-7.

25. Mościcki EK. Epidemiology of suicide. Int Psychogeriatr. 1995 Summer;7(2):137-48.

26. Wasserman D, Cheng Q, Jiang G, Global suicide rates among young people aged 15-19. World Psychiatry. 2005 Jun;4(2):114-20.

27. Diekstra RF. Suicide and attempted suicide: an international perspective. Acta Psychiatr Scand Suppl. 1989; 354:1-24.

28. Shah AK, Ganesvaran T. Suicide in the elderly. In: Functional Psychiatric Disorders of the Elderly (Eds. Chiu E, Ames D). Cambridge: Cambridge University Press, 1994: 221-44.

29. Abrahams VJ, Abrahams S, Jacob KS. Suicide in the elderly in Kanyakumari block, Tamil Nadu, South India. International Journal of Geriatric Psychiatry. 2005; 20: 953-5.

30. Kiemo K. Towards a socio-economic and demographic theory of elderly suicides: a comparison of 49 countries at various stages of development. www.soc.ou.se/publications/fulltext/diss2003-3.pdf. 2004, accessed 2 February 2007.

31. Shah AK, Bhat R, MacKenzie S, Koen C. A cross-national study of the relationship between elderly suicide rates and life expectancy and markers of socio-economic status and healthcare. International Psychogeriatrics. 2008; 20: 347-3.