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European Journal of Public Health, Vol. 23, No. 2, 274–279

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doi:10.1093/eurpub/cks101 Advance Access published on 31 July 2012

Excess mortality in women of reproductive age from low-income countries: a Swedish national register study

Annika Esscher, Bengt Haglund, Ulf Högberg, Birgitta Essén

Department of Women's and Children's Health, International Maternal and Child Health (IMCH), Uppsala University, Uppsala, Sweden

Correspondence: Annika Esscher, Department of Women's and Children's Health, International Maternal and Child Health (IMCH), University Hospital, SE-751 85 Uppsala, Sweden, tel: +46 (0) 70 510 91 28, fax: +46 (0) 18 50 80 13, e-mail: annika.esscher@kbh.uu.se

Background: Cause-of-death statistics is widely used to monitor the health of a population. African immigrants have, in several European studies, shown to be at an increased risk of maternal death, but few studies have investigated cause-specific mortality rates in female immigrants. **Methods:** In this national study, based on the Swedish Cause of Death Register, we studied 27 957 women of reproductive age (aged 15–49 years) who died between 1988 and 2007. Age-standardized mortality rates per 100 000 person years and relative risks for death and underlying causes of death, grouped according to the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, were calculated and compared between women born in Sweden and in low-, middle- and high-income countries. **Results:** The total age-standardized mortality rate per 100 000 person years was significantly higher for women born in low-income (84.4) and high-income countries (83.7), but lower for women born in middle-income countries (57.5), as compared with Swedish-born women (68.1). The relative risk of dying from infectious disease was 15.0 (95% confidence interval 10.8–20.7) and diseases related to pregnancy was 6.6 (95% confidence interval 2.6–16.5) for women born in low-income countries, as compared to Swedish-born women. **Conclusions:** Women born in low-income countries are at the highest risk of dying during reproductive age in Sweden, with the largest discrepancy in mortality rates seen for infectious diseases and diseases related to pregnancy, a cause of death pattern similar to the one in their countries of birth. The World Bank classification of economies may be a useful tool in migration research.

Introduction

Substantial inequalities in mortality between ethnic groups have been found in several countries.^{1–3} The mortality risk of immigrant populations may be higher or lower than the native population and can vary greatly by cause of death, cause of migration, origin, sex and age.^{4–8} Few studies have investigated cause-specific mortality rates in female immigrants.^{4–6,8} To reduce excess mortality, one needs to understand the factors causing the differences in risks. Cause-of-death statistics are widely used to monitor the health of the general population or specific groups of the population. Therefore, studies on causes of death are important for health planning and setting priorities to disease prevention.

Women of reproductive age are exposed to the risk of pregnancy complications, which globally account for 14% of deaths in this age group.⁹ Studies from the UK, France and The Netherlands indicate that maternal mortality rates have tended to increase, whereby immigrants, especially Africans, have been shown to have a higher risk of maternal mortality.^{10–12} However, it has not always been possible to establish a causal link by adjusting for obstetric or well-known social risk factors.

Sweden today is a multi-ethnic society, having a higher proportion of foreign-born inhabitants than Great Britain or the USA.¹³ In 2007, 17% of all women of reproductive age in Sweden were foreign born.¹⁴ After the culmination of the labour immigration of the 1950s and 1960s, new waves of refugees from conflict

zones in non-European countries began to arrive.^{4,13} As do all people, migrants carry with them 'footprints' of the socio-economic environments of their countries of origin. As Gross National Income (GNI) has been shown to be a major socio-economic determinant of population health,^{15,16} we hypothesized that women from poor countries would continue to be the most vulnerable group with regard to mortality after migration. The aim of this study was to analyse the causes of death in women of reproductive age to seek a correlation between the underlying cause of death and the economic situation of the individual's country of birth—something that, to the best of our knowledge, has not been investigated before.

Methods

This is a national register study based on 27 957 deaths of women of reproductive age (defined by the World Health Organization as 15–49 years old) between 1988 and 2007. These individuals were identified through the Swedish Cause of Death Register (CDR), a record maintained by the Swedish National Board of Health and Welfare that includes all residents, whether or not the person in question was a citizen or was present in Sweden at the time of death. However, undocumented migrants and those who died while seeking asylum or visiting Sweden are not included. The register is based on death certificates issued by an attending physician or a physician conducting an autopsy. Variables obtained from the register included age, year of death, underlying cause of death and country of birth.

The underlying cause of death is defined as the disease or injury that initiated the pathological chain resulting in death or the circumstances surrounding the accident or act of violence that caused a lethal injury. Underlying and contributory causes of death are coded according to the International Statistical Classification of Diseases and Related Health Problems, 10th Revision¹⁷ (ICD-10) in the CDR. ICD-10 has been in use since 1997, preceded from 1987 to 1996 by ICD-9. In our study, we only considered the underlying cause of death (not contributory causes of death). The main chapters of the ICD-10 classification were used for grouping cases. Less common underlying causes of death were consolidated as 'other diseases' (ICD-10 chapters III, IV, VI–VIII, X–XIV, XVI–XVIII, XXI and XXII). When a death is due to injury, poisoning or other external factors (chapter XIX), the underlying cause of death is always the external cause (chapter XX). Suicide is classified as an external cause of death. Use of psychoactive substances, however, is classified as a mental and behavioural disorder, although some deaths from substance abuse could be classified as alcohol poisoning or drug overdose and thus within the chapter of external causes of death. Most changes in classification from ICD-9 to ICD-10 are not relevant to this study, with two exceptions: (i) ICD-10 reclassified human immunodeficiency virus (HIV)/acquired immune deficiency syndrome (AIDS) from 'other metabolic disorders and immunity disorders' to 'certain infectious and parasitic diseases'. Thus, cases with an HIV/AIDS diagnosis in ICD-9 ($n = 70$) were moved to the group for infectious diseases. (ii) Cases of viral pneumonia in ICD-9 ($n = 4$) were also moved from 'respiratory diseases' in ICD-9 to the group for infectious diseases.

In contrast to studies from the UK and USA, in which self-selected ethnic group or race is commonly used for defining the population, we used the definition of an immigrant as a person who was born in one country and has moved to Sweden, irrespective of age, year or cause of migration. The countries of birth are linked to the CDR from the Swedish population register by means of each resident's personal identification number. The deceased women were grouped by country of birth according to the World Bank country classification of 2007 (table 1). This classification is based on the GNI and revised every year.¹⁸ GNI is defined as the total value produced within a country (i.e. its gross domestic product) plus income received from other countries (interest and dividends), less similar

Table 1 Countries of birth of women of reproductive age who died in Sweden 1988–2007, grouped according to the World Bank classification of economies for 2007¹⁸

Low-income countries	Libya
Afghanistan	Lithuania
Bangladesh	Macedonia, Former Yugoslav Republic
Burkina Faso	Malaysia
Burundi	Mauritius
Cambodia	Mexico
Congo, Democratic Republic	Moldova
Cote d'Ivoire	Morocco
Eritrea	Paraguay
Ethiopia	Peru
The Gambia	Philippines
Ghana	Poland
Kenya	Romania
Lao, People's Democratic Republic	Russian Federation
Liberia	Serbia and Montenegro
Madagascar	Soviet Union ^a
Mozambique	South Africa
Nepal	Sri Lanka
Nigeria	Sudan
Pakistan	Swaziland
Papua New Guinea	Syrian Arab Republic
Sierra Leone	Thailand
Somalia	Trinidad and Tobago
Tanzania	Tunisia
Uganda	Turkey
Uzbekistan	Turkmenistan
Vietnam	Ukraine
Yemen, Republic	Uruguay
Zambia	Venezuela, Bolivarian Republic
Middle-income countries	West Bank and Gaza
Algeria	Yugoslavia ^a
Angola	High-income countries
Argentina	Australia
Azerbaijan	Austria
Barbados	Belgium
Bolivia	Canada
Bosnia and Herzegovina	Denmark
Botswana	Finland
Brazil	France
Bulgaria	Germany
Cameroon	Greece
Cape Verde	Hong Kong, China
Chile	Hungary
China	Iceland
Colombia	Ireland
Congo, Republic	Israel
Costa Rica	Italy
Croatia	Japan
Cuba	Korea, Republic
Czech Republic	Kuwait
Ecuador	Luxembourg
Egypt, Arab Republic	Macao, China
El Salvador	The Netherlands
Estonia	New Zealand
Georgia	Norway
Guyana	Portugal
Honduras	Singapore
India	Spain
Indonesia	Sweden
Iran, Islamic Republic	Switzerland
Iraq	UK
Jamaica	USA
Jordan	
Kazakhstan	
Latvia	
Lebanon	

(continued)

a: Yugoslavia and Soviet Union were classified as middle-income countries.

payments made to other countries. In 2007, low-income countries were defined as having a GNI per capita of <936 USD, middle-income countries (often divided into lower and upper middle income) 936–11 455 USD and high-income countries

>11 455 USD. Our study population included 27 952 women born between 1939 and 1992 (excluding five women because of unknown countries of birth).

For calculating the population at risk, we obtained data from the national repository of population records, Statistics Sweden. The estimated mid-year population of women 15–49 years old was calculated as the mean of the population on 31 December of a given year and the preceding year during the study period, divided into 5-years age groups and by countries of birth. Mortality risks per 100 000 person years were calculated using denominator data from the mid-year population. Age-standardized mortality rates were calculated with the Swedish-born women as a standard, as well as relative risks (RR) with 95% confidence intervals (CIs), in comparison with the Swedish-born group using Poisson regression. The analysis was performed with SAS version 9.2 and SAS Enterprise Guide 4.2 software package (SAS Institute, Cary, NC, USA).

Results

Among the 27 952 deceased women surveyed, 23 773 (85%) had been born in Sweden, 300 (1%) in low-income countries, 1 698 (6%) in middle-income countries and 2 181 (8%) in high-income countries other than Sweden. Women from the Nordic countries constituted 44% of the deceased immigrants (81% of those born in high-income countries), followed by women from the former Yugoslavia (10%), Poland (7%), Turkey (3%) and Iran (3%). In the group of women born in low-income countries, a majority (76%) came from African countries.

The proportion of foreign-born women in the total Swedish population increased during the study period, as shown in figure 1. The most common high-income countries of birth among the immigrants were Finland, Norway, Denmark, Germany and South Korea. The former Yugoslavia, Poland, Iran, Iraq and Turkey were the most common middle-income countries, and Ethiopia, Somalia, Vietnam, Afghanistan and Pakistan were the most common low-income countries of birth in the background population.

During the study period, total mortality decreased in all groups (figure 2). However, mortality for this period was significantly *higher* among women born in low- and high-income countries (standardized mortality rate = 84.4/100 000 and 83.7/100 000 person years, respectively) and *lower* in women born in

middle-income countries (57.5/100 000), as compared with Swedish-born women (68.1/100 000) (table 2). The most frequent cause of death in all groups was neoplasm, followed by external causes. Among those external causes, suicide was the most common precipitating factor (47%), followed by traffic accidents (21%).

The largest difference in mortality rates was seen among women who died of infectious diseases. HIV/AIDS was the most common of these as a cause of death among women from low-income countries (65%; RR: 39.2, 95% CI 24.8–61.9), but the risk was also high for other infectious diseases (RR: 7.1, 95% CI 4.2–12.0). Total mortality was still significantly higher among women born in low-income countries (RR: 1.4, 95% CI 1.2–1.5), but remained unchanged in other groups when HIV/AIDS was excluded from the data set. The risk of dying from diseases or complications related to pregnancy and childbirth for women born in low-income countries also increased (RR: 6.6 [2.6–16.5]). Those women born in low-income countries were also at higher risk of dying from malignant neoplasm (RR: 1.3, 95% CI 1.1–1.6). Death from mental and behavioural disorders (mainly drug misuse) was significantly more common in women born in high-income countries (RR: 2.4, 95% CI 1.9–3.0) and less common in women born in middle-income countries (RR: 0.3, 95% CI 0.2–0.6). The same pattern was seen in diseases of the circulatory system: women born in high-income countries were at higher risk (RR: 1.2, 95% CI 1.0–1.3), whereas women from middle-income countries were at lower risk (RR: 0.7, 95% CI 0.6–0.9). Women born in high-income countries also had an increased risk of dying from accidents (RR: 1.3, 95% CI 1.1–1.5) and suicides (RR: 1.6, 95% CI 1.4–1.8) as compared with Swedish-born women. All immigrant groups were at a higher risk of dying from ‘other external cause’, including assaults, events of undetermined intent, complications of medical and surgical care and sequelae of external causes. The group of ‘other diseases’ was so diverse that no leading cause of death could be distinguished. However, women born in low- or high-income countries were at greater risk of dying from ‘other diseases’ (RR: 1.4, 95% CI 1.1–1.9 and RR: 1.2, 95% CI 1.1–1.3, respectively) than women born in middle-income countries (RR: 0.7, 95% CI 0.6–0.9).

Discussion

Our findings indicate that women born in low-income countries are at highest risk of dying during reproductive age in Sweden. They

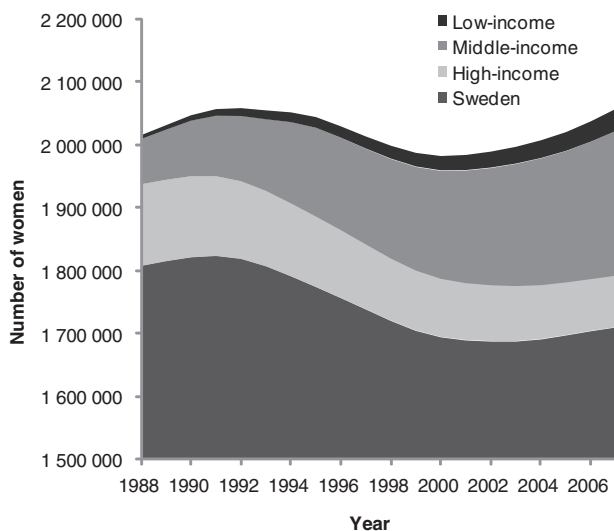


Figure 1 Composition of Swedish female population of reproductive age, 1988–2007, by country of birth (please, note that the y-axis begins at 1 500 000)

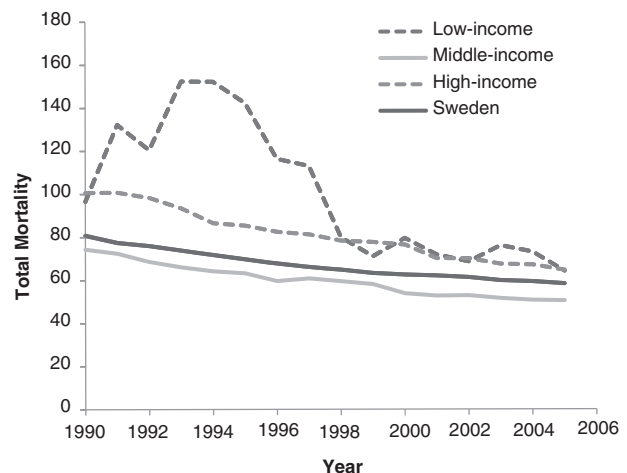


Figure 2 Total age-standardized mortality per 100 000 person years during the study period (1988–2007), sliding mean values shown (5 years) for women born in low-, middle- and high-income countries and Sweden

Table 2 Mortality rates and RR for women of reproductive age born in low-, middle- and high-income countries and Sweden, grouped by underlying cause of death

Cause of Death	Sweden	Low income	Middle income	High income	Total
All causes					
Number of deaths	23 773	300	1698	2181	27 952
Mortality rate	68.1	84.4	57.5	83.7	69.1
RR (95% CI)	1 ^a	1.5 (1.3–1.7)	0.9 (0.8–0.9)	1.2 (1.2–1.3)	
Infectious/parasitic diseases					
Number of deaths	297	43	37	30	407
Mortality rate	0.9	11.0	1.2	1.4	1.0
RR (95% CI)	1 ^a	15.0 (10.8–20.7)	1.5 (1.1–2.1)	1.4 (1.0–2.0)	
HIV					
Number of deaths	65	28	16	13	122
Mortality rate	0.2	6.3	0.5	0.5	
RR (95% CI)	1 ^a	39.2 (24.8–61.9)	2.7 (1.6–4.7)	2.7 (1.5–4.9)	
Infectious, excluding HIV					
Number of deaths	232	15	21	17	285
Mortality rate	0.7	4.7	0.7	0.9	
RR (95% CI)	1 ^a	7.1 (4.2–12.0)	1.1 (0.7–1.7)	1.0 (0.6–1.7)	
Neoplasms					
Number of deaths	9767	96	778	801	11 442
Mortality rate	28.0	31.9	26.6	28.5	28.3
RR (95% CI)	1 ^a	1.3 (1.1–1.6)	1.0 (0.9–1.1)	1.0 (0.9–1.1)	
Mental and behavioural disorders					
Number of deaths	495	1	13	92	601
Mortality rate	1.4	0.3	0.4	3.5	1.5
RR (95% CI)	1 ^a	0.2 (0.0–1.8)	0.3 (0.2–0.6)	2.4 (1.9–3.0)	
Diseases of the circulatory system					
Number of deaths	2844	30	163	266	3303
Mortality rate	8.1	9.6	5.6	9.6	8.2
RR (95% CI)	1 ^a	1.4 (1.0–2.0)	0.7 (0.6–0.9)	1.2 (1.0–1.3)	
Pregnancy and childbirth					
Number of deaths	61	5	6	3	75
Mortality rate	0.2	1.2	0.2	0.1	0.2
RR (95% CI)	1 ^a	6.6 (2.6–16.5)	1.1 (0.5–2.6)	0.8 (0.2–2.5)	
Other diseases^b					
Number of deaths	3876	49	211	340	4476
Mortality rate	11.1	12.4	7.1	12.9	11.1
RR (95% CI)	1 ^a	1.4 (1.1–1.9)	0.7 (0.6–0.8)	1.2 (1.1–1.3)	
Accidents					
Number of deaths	2303	20	135	176	2634
Mortality rate	6.6	4.8	4.6	7.5	6.5
RR (95% CI)	1 ^a	0.8 (0.5–1.3)	0.7 (0.6–0.9)	1.3 (1.1–1.5)	
Suicides					
Number of deaths	2989	34	221	319	3563
Mortality rate	8.6	8.2	7.4	14.0	8.8
RR (95% CI)	1 ^a	1.1 (0.8–1.6)	0.9 (0.8–1.0)	1.6 (1.4–1.8)	
Other external causes					
Number of deaths	1141	22	134	154	1451
Mortality rate	3.3	5.0	4.3	6.3	3.6
RR (95% CI)	1 ^a	2.1 (1.9–2.3)	1.5 (1.2–1.8)	1.9 (1.6–2.3)	

Mortality rate = age-standardized mortality rate per 100 000 person years

a: Comparison group.

b: Other diseases include ICD-10 chapters III, IV, VI–VIII, X–XIV, XVI–XVIII, XXI and XXII.

seem to bring with them a pattern from their countries of birth, where death from infectious diseases and maternal deaths are common.⁹ The high HIV/AIDS mortality in women born in low-income countries may not be surprising, as a majority migrated from countries with a high HIV prevalence and died during the first half of the study period, that is, before the introduction of highly effective antiviral therapy in the mid-1990s. Inadequacies in offering HIV testing may have increased the risk of dying from AIDS for such immigrants in Sweden.¹⁹ A higher risk for maternal death among women born in low-income countries has also been observed in other European countries. Besides well-known obstetric risk factors, studies have shown that substandard care, including that caused by communication problems, are more common among immigrants than native-born

European women.^{11,20,21} Moreover, maternal deaths are known to be underreported in low- and high-income countries.^{22–24} There is reason to believe that additional cases may be concealed under other diagnoses. The slight (although significant) increase in risk of dying from cancer for women from low-income countries that we found contrasts with other Swedish studies showing an equal or lower incidences of cancer for immigrant women from Africa and Asia, as compared with women born in Sweden.^{25,26}

An increased risk of death in women of reproductive age was also seen in women born in high-income countries. A vast majority of these women come from the Nordic countries, a group that in several Swedish studies have shown high death rates.^{7,27} Women from high-income countries are at a higher risk for death due to suicides, accidents, alcohol and drug abuse and circulatory diseases than other groups, in parallel with earlier studies of immigrants from the Nordic countries.^{4,5}

The lower mortality risk among women born in middle-income countries may account for the 'healthy migrant effect', i.e. people who migrate are healthier than average,^{1,28} and the 'unhealthy re-migrant' hypothesis, i.e. immigrants with low mortality risk are continually selected for remaining in the host country.²⁹ It is likely that ill-health was a main barrier for labour immigration to Sweden from middle-income countries during the 1950s and 1960s.⁴ However, in later years, a majority of immigrants arrived as refugees from war-ravaged areas in low- and middle-income countries and may be suspected of being less healthy than labour and social immigrants.³⁰ Immigrants from middle-income countries constitute a heterogeneous group of both labour immigrants and refugees, in contrast to women from low-income countries who mainly come from war-torn areas as refugees. Therefore, there is reason to believe that both the 'healthy migrant effect' and the 'unhealthy re-migrant' hypothesis might have a stronger impact on women from middle-income countries than women from low-income countries, which is reflected in our results. The 'healthy migrant effect' could be also true for women from the low-income countries, when compared with women in their countries of birth who do not migrate, but this would not be detectable in this study. There are studies suggesting a negative selection among the Finnish immigrants that moved to Sweden, i.e. that the socio-economically disadvantaged might have migrated.^{4,31} This effect might contribute to the increased mortality seen in the group of women born in high-income countries.

The World Bank classification of economies is an alternative tool for characterizing the background of immigrants in terms of socio-economic standards and public health, to using geographical divisions. GNI per capita is strongly associated with most health indicators and has been a better predictor of good health in earlier studies than alternative instruments like the Gini index of national income inequalities, or the more complex human development index, which is less commonly used in health research and available for fewer countries.^{15,16} The economic and health situation of two neighbouring countries like Afghanistan and Iran, for example, shows great contrasts, whereas both GNI and health indicators between Afghanistan and countries in sub-Saharan Africa such as Somalia and Ethiopia are comparable. No major changes have been seen in the classification of the most common countries of birth for immigrants that moved to Sweden from 1988 to 2007. Although our hypothesis suggesting that women from poor countries would continue to be the most vulnerable group with regard to mortality after migration seems to be true, there seem to be more complex associations between country of birth and death in women of reproductive age from middle- and high-income countries.

A limitation of this study is that no information was available on the reasons for migration, the number of years spent in Sweden or the socio-economic situation of neither the deceased women nor the population used as denominator in the calculations. Refugees are more likely to have experienced violence, food shortages, lack of

public health services, discrimination and psychological stress than people who have been able to plan their migration.³⁰ Unfortunately, Sweden has no record of causes of death among asylum seekers (36 207 individuals in 2007). Approximately 17 000 international adoptee girls between the ages of 0 and 10 years arrived in Sweden before 1993 and were, therefore, of reproductive age during the period of our study. Hence, the study population includes an unknown, but probably small, number of international adoptees, the majority of who are born in South Korea, Colombia, India and Sri Lanka.³² These women today are probably in most respects like Swedish-born women. Although the CDR has been known for maintaining high international standards of accuracy,^{33,34} a well-known problem in mortality studies concerning immigrants is deficiencies in national registration. A considerable number of immigrants do not notify registration authorities in Sweden when they re-migrate, leading to an overestimation of the population and, thereby, an underestimation of mortality.²⁷ There is no evidence of systematic flaws in the coding or registration of causes of death of immigrants in CDR.

The main finding of our study is that the pattern of causes of death varies according to country of birth, and that women born in low-income countries are at the highest risk for death during reproductive age. The grave discrepancy in risk for maternal death and death from infectious diseases between Swedish-born and immigrant women from low-income countries is troublesome. Further research is needed to reveal whatever substandard factors may prevail in the medical services offered to immigrant women of reproductive age. Our results may provide the basis for future research on morbidity and mortality among such immigrant women. Increased awareness about associations between origins and mortality on the part of decision makers and clinicians whose daily practice includes foreign-born patients is necessary if we are to achieve equity in the provision of health care to an entire population.

Acknowledgements

Preliminary results of this study were presented (in Swedish) at the Swedish Society of Obstetrics and Gynecology (SFOG) meeting in Visby, Sweden, on 1 September 2010.

Ethical approval for this study was not needed according to Swedish laws on ethical review, as all subjects were deceased. The Regional Ethics Committee in Uppsala, Sweden, was consulted and confirmed that the study did not fall into the category of research requiring ethical clearance [2008/381, 2009-01-14].

Funding

This work was supported by a grant from the Swedish Council for Working Life and Social Research [FAS 2007–2026] and by the Medical Faculty, Uppsala University.

Conflicts of interest: None declared.

Key points

- Among women of reproductive age, immigrants born in low-income countries are at greatest risk of dying in Sweden.
- The greatest difference in mortality rates between Swedish-born women and immigrant women born in low-income countries was seen among women who died from infectious diseases and complications of pregnancy or childbirth.
- The World Bank classification of economies provides a simple but useful tool for describing the background of immigrant populations.

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European Journal of Public Health, Vol. 23, No. 2, 279–284

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doi:10.1093/eurpub/cks029 Advance Access published on 10 May 2012
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Gender distribution of suicide attempts among immigrant groups in European countries—an international perspective

Cendrine Bursztein Lipsicas¹, Ilkka Henrik Mäkinen², Danuta Wasserman¹, Alan Apter³, Ad Kerkhof⁴, Konrad Michel⁵, Ellinor Salander Renberg⁶, Kees van Heeringen⁷, Airi Värnik⁸, Armin Schmidtke⁹

1 National Prevention of Suicide and Mental Ill-Health (NASP), Karolinska Institute and Stockholm County Council’s Centre for Suicide Research and Prevention, WHO Lead Collaborating Centre of Mental Health Problems and Suicide across Europe, Sweden

2 Stockholm Centre on Health of Societies in Transition (SCOHOST), School of Social Sciences, Södertörn University, Sweden

3 Feinberg Child Study Center and the Department of Child and Adolescent Psychiatry, Schneider Children’s Medical Center, Petah-Tikva, Israel

4 Department of Clinical Psychology, Vrije Universiteit, Amsterdam, The Netherlands

5 University Psychiatric Services (UPD), Bern, Switzerland

6 Department of Clinical Sciences, Division of Psychiatry, Umeå University, Sweden

7 University Department of Psychiatry & Medical Psychology, Unit for Suicide Research, University Hospital, Ghent, Belgium

8 Estonian-Swedish Mental Health and Suicidology Institute, Tallinn, Estonia

9 Unit for Clinical Psychology, Department of Psychiatry and Psychotherapy, University of Wuerzburg, Germany

Correspondence: Cendrine Bursztein Lipsicas (PhD candidate), National Prevention of Suicide and Mental Ill-Health (NASP) at the Karolinska Institute and Stockholm County Council’s Centre for Suicide Research and Prevention, Sweden, tel: +972 4 6180138, fax: +972 4 6180138, e-mail: cendrinebursztein@gmail.com

Background: Studies report high rates of suicide attempts for female immigrants. This study assesses variations in the distribution of suicide attempts across gender in immigrant and non-immigrant groups in Europe. **Method:** Data on 64 native and immigrant groups, including 17 662 local and 3755 immigrant person-cases collected, between 1989 and 2003, in 24 million person-years were derived from the WHO/EURO Multicentre Study on Suicidal Behaviour. Female-to-male ratios of suicide attempt rates (SARs) were calculated for all groups. **Results:** The cases were combined into four major categories: hosts; European and other Western immigrants; non-European immigrants; and Russian immigrants. The non-European immigrants included higher female SARs than the Europeans, both hosts and immigrants. Unlike the other groups, the majority of suicide attempters among the Russian immigrants in Estonia and Estonian hosts were male. This was also true for immigrants from Curaçao, Iran, Libya and Sri Lanka. When the single groups with a male majority were excluded, the correlation between female and male SARs was relatively high among the European immigrants ($r=0.74$, $P<0.0005$) and lower among the non-European immigrants ($r=0.55$, $P<0.03$). Generalized estimating equation analysis yielded a highly significant difference ($P<0.0005$) in gender ratios of suicide attempts between hosts (ratio 1.52) and both non-European immigrants (ratio 2.32) and Russian immigrants (0.68), but not the European immigrants. **Conclusions:** The higher suicide attempt rates in non-European immigrant females compared with males may be indicative of difficulties in the acculturation processes in Europe. Further understanding of factors underlying suicidal behaviour in immigrant and minority groups is necessary for planning effective prevention strategies.

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