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Research report

Gender issues in suicide rates, trends and methods among youths aged 15–24 in 15 European countries

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Abstract

Background: No recent cross-country examinations for youth suicide trends and methods for Europe were found.
Aim: The aim of the study is to specify differences in suicide rates, trends and methods used among 15–24 years olds by gender across 15 European countries.
Method: Data for 14,738 suicide cases in the age group 15–24 in 2000–2004/5 were obtained and analysed.
Results: Suicide rates ranged 5.5–35.1 for males and 1.3–8.5 for females. Statistically significant decline since 2000 was observed in Germany, Scotland, Spain, and England for males and in Ireland for females. Hanging was most frequently used for both genders, followed by jumping and use of a moving object for males and jumping and poisoning by drugs for females. Male suicides had a higher risk than females of using firearms and hanging and lower risk of poisoning by drugs and jumping. There were large differences between single countries.
Limitations: The limitations of the study are the small numbers of specific suicide methods in some countries as well as the re-categorisation of ICD-9 codes into ICD-10 in England, Ireland and Portugal. Further, the use of suicides (X60–X84) without events of undetermined deaths (Y10–Y34) continues to be problematic considering the possibility of "hidden suicides".
Conclusions: The present study shows that suicide rates among young males are decreasing since 2000 in several European countries. Analysis of suicide methods confirms that there is a very high proportion of hanging in youths, which is extremely difficult to restrict. However, besides hanging there are also high rates of preventable suicide methods and reducing the availability of means should be one of the goals of suicide prevention.

Keywords: Suicide rates; Trends; Methods; Age 15–24; Europe; Country differences

1. Introduction

Suicide is the second leading cause of death among young people aged 15–29 in Europe following unintentional injuries (Blum and Nelson-Mmari, 2004). Worldwide, there are approximately 900,000 suicides each year, including as many as 200,000 adolescents and young adults (Greydanus and Calles, 2007). Suicide rates in 1965–1999 appeared to be rising faster for the youth (15–19) compared to all other age groups for both European and non-European countries (Blum and Nelson-Mmari, 2004; Wasserman et al., 2005; Mittendorfer-Rutz and Wasserman, 2004a). However, suicide rates have shown a decline in the age group 15–24 for both genders in Canada since 1991 (Steele and Doey, 2007) and in the US since the mid-1990s (Lubell et al., 2007). Further, a decline appeared in Australia since the late 1990s for males in the age group 20–24 (Morrell et al., 2007). One explanation of the recent decline might be the decreased availability of firearms (Steele and Doey, 2007; Lubell et al., 2007). Suicide rates by firearms among male have decreased in the age group 15–19 from 13.1 per 100,000 in 1994 to 6.5 per 100,000 in 2004 and in the age group 20–24 from 18.8 per 100,000 in 1994 to 11.1 per 100,000 in 2004 (Lubell et al., 2007).

In most regions of the world, suicide is more common for males than females in all age groups. Data from 90 countries showed that suicide rates in the age group 15–19 were higher in males (10.5) than in females (4.1) (Wasserman et al., 2005). Among the variety of psychological, biological, sociological and anthropological theories this is largely explained by the differences in methods of suicide used by males and females, which might differ by lethality, availability and cultural acceptability (Hawton, 2000; Värnik et al., 2008).

The European Commission funded project European Alliance Against Depression (EAAD), an international partnership of 17 European countries, established in 2004, aims to reduce suicide rates by implementing evidence evidence-based actions and creating recommendations for effective interventions (Hegerl et al., 2008). In response to the worrying situation among young people, the EAAD currently has a specific focus on interventions aimed at the prevention of suicidality among children, adolescents and young adults (www.eaad.net). The data on methods of suicide obtained during the course of this study provide provided the basis for an epidemiological overview and to contribute to the field of suicide research and prevention.

The objectives of the present study are: (1) to investigate differences in suicide rates and trends among youths aged 15–24 years by gender across 15 European countries participating in the European Alliance Against Depression (EAAD) study, (2) to compare the annual rates of the 15–24 age group with the 25–34 age group, and (3) to analyse the distribution of suicide methods used.

2. Materials and methods

2.1. Data collection

Data on suicide numbers, methods of suicide, and population by age groups were collected from 15 European countries participating in the European Commission funded project the "European Alliance Against Depression" (Värnik et al., 2008). The United Kingdom is represented in this project as two separate countries: England and Scotland. In Belgium, Estonia, Finland, France, Germany, Hungary, Luxembourg, Netherlands, Scotland, Slovenia, Spain, and Switzerland the method used in a suicide act was identified according to the codes X60–X84 by the 10th Revision of International Statistical Classification of Diseases and Related Health Problems (ICD-10; World Health Organisation, 1992). Suicide acts were identified by ICD-9 (World Health Organisation, 1978) codes E950–E959 for some or all of the study period in the following countries: England in 2000, Portugal in 2000/2001 and Ireland for the entire study period.

The compiled EAAD database contains suicide deaths for the following years: 2000–2005 in Estonia, Finland, Germany, Luxembourg, Netherlands, Scotland and Spain, 2000–2004 in Belgium (Flemish Region — 59% of entire population), England, France, Hungary, Ireland, Portugal, Slovenia and Switzerland. As data on method-specific suicide are not available through the WHO databank, the data were obtained from the respective statistics institutions of the EAAD countries. Specifically, the responsible institutions which provided the data are as follows: Belgium — Flemish Ministry of Health in cooperation with the National Institute of Statistics (Statistics Belgium), Estonia — Statistics Estonia (Statistikaamet) www.stat.ee, England — South East Public Health Observatory (SEPHO) www.sepho.nhs.uk, France — Epidemiological Center on Medical Causes of Death (Centre d'épidémiologie sur les causes médicales de décés) www.cepidc.vesinet.inserm.fr, Finland — Statistics Finland (Tilastokeskus) www.stat.fi, Germany — Information System of the Federal Health Monitoring (Gesundheitsberichterstattung des Bundes) www.gbe-bund.de, Hungary — Hungarian Central Statistical Office; Ireland — Central Statistics Office (CSO) Ireland www.cso.ie, Luxembourg — (Ministère de la Santé) www.ms.etat.lu, the Netherlands — Statistics Netherlands (Centraal Bureau voor de Statistiek) http://statline.cbs.nl/, Portugal — Statistics Institute (Instituto Nacional de Estatística) http://www.ine.pt/portal/, Scotland — General Register Office for Scotland www.groscotland.gov.uk-, Slovenia — Institute of Public Health and the Statistical Office of the Republic of Slovenia, Spain National Statistics Institute (Instituto Nacional de Estatistica) www.ine.es, Switzerland — Swiss Federal Statistical Office (Bundesamt für Statistik) www.bfs.admin.ch.

All suicide methods were classified into eight groups using the ICD-10 X-codes: poisoning by drugs (X60–X64), poisoning by other means (X65–X69), hanging (X70), drowning (X71), firearms (X72–X74), jumping from height (X80), moving object (X81) and other methods. The category 'other methods' includes methods that accounted for less than 3% of the overall number (all age groups) of suicides: explosive material (X75), fire (X76), hot vapors (X77), cutting/piercing with sharp object (X78), cutting/piercing with blunt object (X79), crashing of motor vehicle (X82), with other specified and classifiable means (X83), and other unspecified means (X84).

2.2. Statistical analysis

Suicide rates per 100,000 for males and females in the age group 15–24 and 25–34 were calculated for each country separately for 2000–2004/5 and for all 15 EAAD countries compiled for 2000–2004. Also, mean rates for the entire period were calculated. To compare youth suicide rates with the older age group rate ratios (mean rate of age 25–34/mean rate of age 15–24) were calculated. To estimate differences between the countries in suicide trends, chi-square tests for trend were calculated. Chi-square tests were further used to analyse differences in suicide methods. Male to female rate ratios (RR') with 95% confidence intervals (CI) were calculated in order to compare male and female suicide rates. To compare the distribution of male and female suicide methods in all countries included, relative risks (RR) with 95% CI were calculated separately and in total. The level of statistical significance was set at $\alpha = 0.05$. Statistical analysis was performed using SPSS 14.0 and StatsDirect 2.3.7.

3. Results

The present study includes 14,738 suicide cases in the age group 15–24 from 15 European countries during the years 2000–2004/5. Cases include 11,704 males (79%) and 3034 females (21%).

3.1. Suicide rates and trends

The average suicide rate for males in the age group 15–24 was 11.0 per 100,000 in 15 countries combined.

Table 1
Range of suicide numbers; rates in age groups 15–24 and 25–34 and suicide trends of 15–24 of EAAD countries by gender in 2000–2004/5

Gender	Country	Range of suicide no*	Mean rate per year		Rate ratio 25–34/15–24	Suicide rates per 100 000 in age 15–24						Chi^2 for trend	*p*-value
			Aged 15–24	Aged 25–34		2000	2001	2002	2003	2004	2005		
Males	Belgium	60–93	19.6	30.6	1.6	25.5	18.4	16.4	17.6	20.1	n/a	2.58	0.108
	England	205–255	6.6	15.3	2.3	7.6	6.8	6.5	6.2	6.1	n/a	6.67	**0.010**
	Estonia	27–36	30.2	44.5	1.5	29.6	35.1	32.8	29.5	29.1	25.2	0.95	0.329
	Finland	68–110	28.3	38.8	1.4	31.2	27.8	29.2	28.6	33.0	20.3	2.62	0.106
	France	434–495	12.0	25.3	2.1	12.1	11.1	11.9	12.5	12.2	n/a	0.77	0.381
	Germany	518–609	11.4	16.3	1.4	12.2	12.4	12.5	10.9	10.5	9.7	23.47	<**0.0001**
	Hungary	101–132	16.6	31.8	1.9	17.2	17.7	17.0	14.4	16.5	n/a	0.99	0.320
	Ireland	87–96	27.6	31.5	1.1	25.9	27.7	27.6	29.5	27.1	n/a	0.21	0.644
	Luxembourg	3–7	19.8	22.1	1.1	12.0	11.6	23.2	26.7	22.5	22.1	1.39	0.238
	Netherlands	68–90	7.8	13.9	1.8	9.4	7.3	8.2	6.9	7.3	7.9	1.40	0.236
	Portugal	28–50	5.5	11.5	2.1	3.8	5.7	7.1	5.6	5.5	n/a	1.64	0.200
	Scotland	50–91	19.1	29.9	1.6	28.9	22.0	17.3	15.2	17.2	14.9	17.78	<**0.0001**
	Slovenia	25–36	22.0	32.9	1.5	22.0	24.5	17.3	24.5	21.6	n/a	0.01	0.935
	Spain	175–229	6.9	11.1	1.6	8.2	7.0	7.0	6.9	6.3	5.9	11.17	**0.001**
	Switzerland	64–93	18.1	21.8	1.2	18.6	21.7	17.8	18.0	14.4	n/a	3.59	0.058
	total EAAD countries	2063–2301	11.0	18.6	1.7	11.9	11.3	11.3	10.8	10.6	**	17.76	<**0.0001**
Females	Belgium	17–25	5.6	7.9	1.4	5.4	6.0	4.6	7.1	4.9	n/a	0.00	0.997
	England	45–76	1.7	3.3	1.9	2.4	1.4	1.7	1.5	1.7	n/a	2.87	0.090
	Estonia	4–6	5.5	7.1	1.3	6.1	6.1	4.0	5.9	5.9	4.9	0.07	0.795
	Finland	22–33	8.5	9.6	1.1	8.1	6.9	7.2	8.5	9.7	10.3	2.39	0.122
	France	120–141	3.5	6.7	1.9	3.6	3.6	3.1	3.7	3.5	n/a	0.02	0.889
	Germany	120–155	2.9	4.0	1.4	3.0	2.7	3.0	3.3	2.7	2.5	1.11	0.292
	Hungary	21–31	3.7	5.4	1.4	3.9	4.3	3.6	3.4	3.2	n/a	1.01	0.316
	Ireland	9–22	4.9	5.2	1.1	6.8	5.1	4.7	5.0	2.9	n/a	4.07	**0.044**
	Luxembourg	0–1	2.7	6.0	2.3	4.1	4.0	4.0	4.0	0.0	0.0	***	
	Netherlands	18–33	2.9	4.8	1.7	1.9	3.4	2.8	3.1	2.6	3.4	1.33	0.249
	Portugal	7–11	1.3	2.7	2.1	1.0	1.1	1.5	1.6	1.2	n/a	0.59	0.441
	Scotland	18–27	7.1	7.6	1.1	5.8	6.4	8.2	8.2	5.9	8.3	0.83	0.361
	Slovenia	3–13	6.9	5.7	0.8	9.2	7.2	2.2	6.7	9.1	n/a	0.02	0.878
	Spain	37–56	1.7	2.8	1.6	1.6	1.5	1.7	2.1	2.1	1.4	0.24	0.623
	Switzerland	20–28	5.2	6.8	1.3	4.9	4.8	6.7	4.9	4.9	n/a	0.00	0.989
	total EAAD countries	531–595	3.0	4.6	1.5	3.1	2.9	2.9	3.2	2.9	**	0.01	0.916

*Minimum and maximum absolute suicide numbers during the study period.
**Data are not available for all countries.
***Not calculated due to very small numbers.
n/a not available.

The highest rates per 100,000 males in this age group were registered in Estonia (30.2), Finland (28.3), and Ireland (27.6) and the lowest in Portugal (5.5), England (6.6), and Spain (6.9). For females, the overall suicide rate per 100,000 in this age group was 3.0. The highest rates per 100,000 females were found in Finland (8.5), Scotland (7.1), and Slovenia (6.9) and the lowest in Portugal (1.3), England (1.7), and Spain (1.7) (Table 1).

A comparison of average suicide rates of the age group 15–24 with the age group 25–34 for years 2000–2004 showed that for all EAAD countries combined, higher suicide rates were observed in the age group 25–34 than in the age group 15–24: 1.7 times higher for males and 1.5 times for females (Table 1). While overall higher suicide rates were found for the age group 25–34, there was only one exception; young females in Slovenia had higher suicide rates compared to the older age group. England showed the largest differences between the two age groups for males and Luxembourg for females (Table 1).

Suicide rates for the age group 15–24 in all EAAD countries were 3.7 times higher for males compared to females (Fig. 1); the male to female rate ratio was lowest in Scotland (RR'=2.7; 95%CI=2.2–3.3) and in the Netherlands (RR'=2.7; 95%CI=2.3–3.3) and highest in Luxembourg (RR'=7.5; 95%CI=2.6–29.1), Ireland (RR'=5.6; 95%CI=4.4–7.2) and Estonia (RR'=5.5; 95% CI=3.4) (Fig. 1). In Luxembourg, the RR' is based on very small suicide numbers and therefore is not presented in the figure.

Most of the countries have shown a downward trend of male suicide rates in the age group 15–24 since 2000. However, for France and Ireland the trend was stable and in Portugal and Luxembourg a slightly upward trend was found. The decline of suicide rates among males in the age group 15–24 was statistically significant in Germany, Scotland, Spain and England (Table 1). For all EAAD countries combined, youth suicides showed a significant decrease for males in the years 2000–2004. Among females, suicide trends were more stable; only in Ireland, a significant increase in rates among young females during 2000–2004 was observed. For all other EAAD countries, youth suicides among females did not show significant changes.

3.2. Method-specific suicide rates and distribution of suicide methods

For both genders and across the countries combined, hanging was the most frequently used suicide method among youths aged 15–24 years and was 5 times more prevalent among males (5.5 per 100,000) than females (1.1 per 100,000). In 12 countries, hanging was the most common method for males ranging from 21.7% in Switzerland to 79.4% in Estonia, and in 14 countries for females ranging from 23.6% in Switzerland to 75% in Luxemburg (Table 2). For males, jumping from high place was the method in second place (this was highest for males in Luxembourg) followed by firearms (this was highest for males in Switzerland and Finland). For females, poisoning by drugs was second most frequent followed by jumping (this was highest for females in Spain).

Statistically significant regional differences in method method-specific suicide rates appeared, especially for males (Table 2). Suicide rates for hanging, which showed the biggest differences between the countries, were highest for both gender in Estonia (23.9 per 100,000 for males and 3.5 for females), Ireland (19.7 per 100,000 for males and 2.6 for females) and Scotland (13.3 per 100,000 for males and 3.6 for females). Further, between country comparisons revealed that suicide rates in firearms were highest in Finland (7.9 per 100,000) and Switzerland (7.9 per

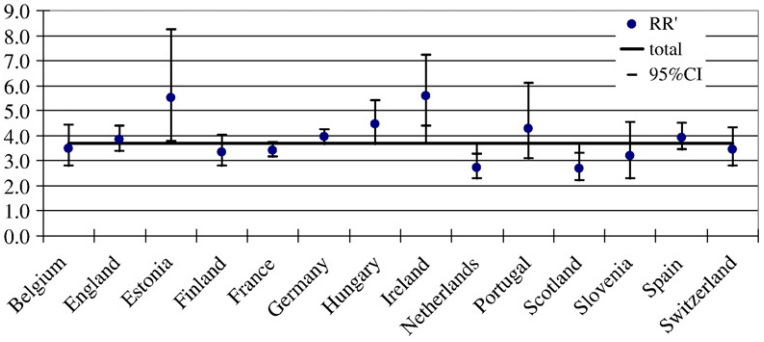

Fig. 1. Male to female rate ratio (with 95% CI) in EAAD countries in age group 15–24.

100,000) for males and in Finland for females (0.7 per 100,000). Suicide rates by poisoning by drugs were highest in Finland (2.6 per 100,000 for males and 2.3 for females) and in Scotland (2.1 per 100,000 for males and 2.8 for females). Poisoning by other means had the highest rates for both gender in Slovenia (2.8 per 100,000 for males and 0.7 for females). Suicide by drowning had the highest rates for both genders in Ireland (2.1 per 100,000 for males and 0.4 for females). Suicide by jumping from a height was highest in Luxembourg for males (7.0 per 100,000) and in Finland for females (1.1 per 100,000), and jumping in front of a moving object in Finland (3.6 per 100,000) and Belgium (3.1 per 100,000) for males and in Switzerland (1.2 per 100,000) and Finland (1.1 per 100,000) for females.

Comparing male and female suicides by the distribution of suicide methods has shown that combined for all EAAD countries males showed a statistically significant higher risk than female for suicides using firearms, hanging and poisoning by other means, and a lower risk of poisoning by drugs and jumping (Table 3). Males had higher risk of hanging than females in most of the EAAD countries except in Finland, Luxembourg, Switzerland and The Netherlands. Male suicides showed a lower risk of poisoning

Table 2
Suicide rates per 100,000 by 8 methods in EAAD countries by gender in age group 15–24 (calculated on the average suicide numbers and populations per year for the years 2000–2004/5)

Gender	Countries	Method-specific suicide rates per 100,000								
		Poisoning (drugs)	Poisoning (other)	Hanging	Drowning	Firearms	Jumping	Moving object	Other methods	Total
Males	Belgium	1.2	0.5	10.1	0.8	1.9	1.2	3.1	0.9	19.6
	England	0.5	0.5	4.3	0.0	0.2	0.3	0.6	0.2	6.6
	Estonia	1.0	0.3	23.9	0.0	2.6	1.4	0.3	0.6	30.2
	Finland	2.1	1.6	7.5	0.4	7.9	3.8	3.6	1.3	28.3
	France	0.7	0.2	5.9	0.1	2.3	1.3	0.5	0.9	12.0
	Germany	0.6	0.4	5.5	0.2	0.6	1.6	1.7	0.8	11.4
	Hungary	0.9	0.3	8.9	0.2	1.3	2.7	1.0	1.2	16.6
	Ireland	1.1	0.6	19.7	2.1	2.6	0.7	0.7	0.0	27.6
	Luxembourg	0.6	0.6	6.4	0.0	2.6	7.0	0.6	1.9	19.8
	Netherlands	0.4	0.1	3.3	0.2	0.2	1.1	2.0	0.5	7.8
	Portugal	0.2	0.5	2.0	0.2	1.0	0.8	0.1	0.7	5.5
	Scotland	2.6	0.6	13.3	0.2	0.4	1.1	0.6	0.4	19.1
	Slovenia	0.8	2.8	10.5	0.3	3.3	1.7	1.2	1.4	22.0
	Spain	0.1	0.2	3.1	0.1	0.6	1.9	0.4	0.5	6.9
	Switzerland	0.7	0.4	3.9	0.1	7.9	2.2	2.3	0.6	18.1
	Total	0.6	0.4	5.5	0.2	1.3	1.4	1.0	0.6	11.0
Test	Chi-square	57.4	41.1	320.1	84.0	383.1	72.4	107.0	29.9	442.6
	p-value	<0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0078	<0.0001
Females	Belgium	0.7	0.3	2.3	0.2	0.5	0.9	0.6	0.2	5.6
	England	0.5	0.1	1.0	0.0	0.0	0.1	0.1	0.0	1.7
	Estonia	1.2	0.2	3.5	0.0	0.2	0.5	0.0	0.0	5.5
	Finland	2.3	0.1	2.5	0.2	0.7	1.1	1.1	0.5	8.5
	France	0.7	0.1	1.2	0.1	0.2	0.8	0.2	0.2	3.5
	Germany	0.6	0.1	0.9	0.1	0.1	0.6	0.4	0.2	2.9
	Hungary	0.6	0.1	1.6	0.1	0.1	0.7	0.3	0.2	3.7
	Ireland	1.6	0.0	2.6	0.4	0.1	0.1	0.1	0.0	4.9
	Luxembourg	0.0	0.0	2.0	0.0	0.0	0.7	0.0	0.0	2.7
	Netherlands	0.2	0.0	1.2	0.1	0.0	0.4	0.7	0.1	2.9
	Portugal	0.0	0.2	0.4	0.1	0.1	0.3	0.0	0.1	1.3
	Scotland	2.7	0.1	3.6	0.1	0.0	0.4	0.2	0.1	7.1
	Slovenia	1.0	0.7	2.3	0.1	0.1	1.0	0.9	0.6	6.9
	Spain	0.1	0.1	0.6	0.0	0.0	0.8	0.1	0.1	1.7
	Switzerland	1.0	0.1	1.2	0.1	0.3	1.0	1.2	0.2	5.2
	Total	0.6	0.1	1.1	0.1	0.1	0.6	0.3	0.1	3.0
Test	Chi-square	66.7	14.3	58.6	14.9	26.4	25.8	44.7	15.3	122.7
	p-value	<0.0001	0.427	<0.0001	0.384	0.023	0.028	<0.0001	0.361	<0.0001

Table 3
Distribution of 8 suicide methods in EAAD countries by gender in age group 15–24 (calculated on the average suicide numbers and populations per year for the years 2000–2004/5)

Gender	Countries	Distribution in % of suicide methods								
		Poisoning (drugs)	Poisoning (other)	Hanging	Drowning	Firearms	Jumping	Moving object	Other methods	Total
Males	Belgium	6.2	2.5	51.5	3.9	9.5	6.2	15.7	4.5	100
	England	8.2	7.1	64.8	0.6	2.3	4.4	9.1	3.4	100
	Estonia	3.2	1.1	79.4	0.0	8.5	4.8	1.1	2.1	100
	Finland	7.4	5.6	26.6	1.6	28.0	13.4	12.7	4.8	100
	France	5.6	2.0	49.5	1.2	19.1	11.1	4.3	7.1	100
	Germany	5.3	4.0	48.1	1.5	5.6	14.2	14.6	6.7	100
	Hungary	5.3	2.0	53.8	1.3	8.0	16.0	6.0	7.5	100
	Ireland	4.0	2.2	71.4	7.8	9.5	2.7	2.4	0.0	100
	Luxembourg	3.2	3.2	32.3	0.0	12.9	35.5	3.2	9.7	100
	Netherlands	5.2	1.3	42.5	2.4	2.4	14.6	25.5	6.1	100
	Portugal	3.1	9.7	36.4	4.1	17.9	14.4	1.5	12.8	100
	Scotland	13.6	2.9	69.3	1.1	1.9	5.9	3.2	2.1	100
	Slovenia	3.8	12.6	47.8	1.3	15.1	7.5	5.7	6.3	100
	Spain	1.7	3.0	44.6	1.3	8.9	27.7	5.9	6.9	100
	Switzerland	3.8	2.0	21.7	0.5	43.6	12.0	12.8	3.6	100
	Total	5.5	3.6	50.0	1.7	11.5	12.5	9.3	5.9	100
Females	Belgium	13.3	5.1	40.8	4.1	8.2	15.3	10.2	3.1	100
	England	26.5	3.6	54.8	1.4	1.1	4.7	5.7	2.2	100
	Estonia	21.2	3.0	63.6	0.0	3.0	9.1	0.0	0.0	100
	Finland	27.2	1.2	29.6	1.9	8.0	13.0	13.6	5.6	100
	France	21.4	2.5	34.5	1.5	6.0	22.0	4.9	7.0	100
	Germany	21.0	3.0	32.1	2.2	2.9	20.2	13.3	5.3	100
	Hungary	16.3	1.6	43.4	2.3	2.3	19.4	8.5	6.2	100
	Ireland	32.1	0.0	53.8	9.0	1.3	1.3	2.6	0.0	100
	Luxembourg	0.0	0.0	75.0	0.0	0.0	25.0	0.0	0.0	100
	Netherlands	8.6	0.6	42.9	4.3	0.6	15.3	25.2	2.5	100
	Portugal	2.3	15.9	34.1	4.5	11.4	22.7	0.0	9.1	100
	Scotland	38.2	0.7	50.7	0.7	0.0	5.1	2.9	1.5	100
	Slovenia	14.9	10.6	34.0	2.1	2.1	14.9	12.8	8.5	100
	Spain	6.8	2.9	33.8	0.7	0.7	43.9	5.8	5.4	100
	Switzerland	20.0	1.8	23.6	2.7	5.5	19.1	22.7	4.5	100
	Total	20.2	2.8	37.8	2.2	3.6	18.9	9.4	5.0	100

by drugs than female suicides in all countries except Portugal. There was more variation by country for all other suicide methods (Table 4).

4. Discussion

4.1. Recent rates and trends of youth suicides

The present study addressed gender-specific suicide rates, trends and distributions of suicide methods used in the age group 15–24 in 15 European countries combined and separately during the years 2000–2004/5.

The average annual suicide rates (per 100,000) varied widely in participating countries: for males from 5.5 (Portugal) to 30.2 (Estonia) and for females from 1.3 (Portugal) to 8.5 (Finland). Finland and Slovenia showed extremely high suicide rates for both gender, while Spain, England and Portugal showed the lowest rates for both gender. The high suicide rates among youths during the study period corresponded with very high overall suicide rates for Estonia, Finland and Slovenia. Similarly, countries with low overall rates also experienced low rates for youth average suicide rate of the age group 25–34 in EAAD countries combined for the years 2000–2004 are higher in comparison with the age group of 15–24 (males 11.0 per 100,000 for studied youth and for females 2.9). The only exception was found in Slovenia, where for females the rate of youth suicide exceeded suicide rates of age group 25–34. In contrast, youth suicide rates were two times lower than rates in the age group 25–34 for males in England, Portugal and France and for females in Luxembourg and Portugal.

In general, rates of suicides for young males are far higher than for females (Mittendorfer-Rutz and Wasserman, 2004b; Wasserman et al., 2005) with the

Table 4
Relative risks for different suicide methods in EAAD countries comparing male suicides to female suicides in age group 15–24

		Poisoning (drugs)	Poisoning (other)	Hanging	Drowning	Firearms	Jumping	Moving object	Other methods
Belgium	RR	0.46*	0.49	1.26	0.96	1.17	0.40*	1.54	1.46
	95% CI	0.25–0.88	0.18–1.39	0.99–1.66	0.34–2.74	0.58–2.43	0.22–0.75	0.84–2.91	0.57–4.66
England	RR	0.31*	1.98*	1.18*	0.44	2.17	0.94	1.60	1.58
	95% CI	0.23–0.41	1.06–3.74	1.06–1.33	0.14–1.39	0.71–6.72	0.53–1.71	0.97–2.66	0.70–3.64
Estonia	RR	0.15*	0.35	1.25*	u.c.**	2.79	0.52	u.c.**	u.c.**
	95% CI	0.06–0.41	0.05–2.65	1.00–1.71		0.5–16.40	0.17–1.75		
Finland	RR	0.27*	3.06*	0.90	0.86	3.49*	1.03	0.93	0.86
	95% CI	0.19–0.40	1.02–9.36	0.69–1.19	0.26–2.91	2.08–5.99	0.67–1.63	0.61–1.46	0.42–1.77
France	RR	0.26*	0.8	1.44*	0.82	3.19*	0.50*	0.88	1.01
	95% CI	0.21–0.33	0.45–1.32	1.29–1.61	0.41–1.66	2.34–4.36	0.42–0.60	0.60–1.28	0.74–1.38
Germany	RR	0.25*	1.33	1.50*	0.66	1.96*	0.70*	1.10	1.26
	95% CI	0.21–0.31	0.87–2.04	1.35–1.67	0.39–1.13	1.29–2.99	0.60–0.83	0.91–1.34	0.92–1.73
Hungary	RR	0.33*	1.29	1.24*	0.57	3.45*	0.83	0.70	1.21
	95% CI	0.20–0.55	0.33–5.14	1.02–1.55	0.17–1.98	1.17–10.38	0.56–1.24	0.38–1.34	0.60–2.49
Ireland	RR	0.12*	u.c.**	1.33*	0.86	7.44*	2.08	0.95	u.c.**
	95% CI	0.07–0.22		1.10–1.68	0.41–1.87	1.35–42.68	0.36–12.40	0.25–3.80	
Luxembourg	RR	u.c.**	u.c.**	0.43	u.c.**	u.c.**	1.42	u.c.**	u.c.**
	95% CI	–	–	0.22–1.18	–	–	0.42–8.10	–	–
Netherlands	RR	0.61	2.13	0.99	0.56	3.91	0.95	1.01	2.49
	95% CI	0.33–1.14	0.34–13.44	0.81–1.23	0.23–1.38	0.66–23.48	0.63–1.46	0.75–1.39	0.93–6.74
Portugal	RR	1.35	0.61	1.61	0.90	1.58	0.63	u.c.**	1.41
	95% CI	0.23–8.51	0.29–1.37	0.71–1.72	0.23–3.71	0.70–3.79	0.34–1.22		0.56–3.79
Scotland	RR	0.36*	4.00	1.36*	1.45	u.c.**	1.14	1.09	1.45
	95% CI	0.26–0.50	0.68–24.03	1.15–1.65	0.22–9.65		0.52–2.58	0.38–3.18	0.36–6.02
Slovenia	RR	0.25*	1.18	1.40	0.59	7.09*	0.51	0.52	0.74
	95% CI	0.09–0.69	0.50–2.95	0.95–2.21	0.08–4.48	1.31–41.07	0.22–1.20	0.19–1.44	0.26–2.17
Spain	RR	0.25*	1.03	1.32*	1.81	12.34*	0.63*	1.03	1.27
	95% CI	0.14–0.47	0.49–2.17	1.11–1.58	0.47–7.10	3.40–45.40	0.54–0.74	0.61–1.74	0.75–2.17
Switzerland	RR	0.19*	1.12	0.92	0.19*	8.00*	0.63	0.56*	0.79
	95% CI	0.10–0.36	0.28–4.64	0.63–1.36	0.04–0.93	3.80–17.41	0.40–1.01	0.37–0.87	0.30–2.07
Total	RR	0.27*	1.28*	1.32*	0.77	3.19*	0.67*	0.99	1.19*
	95% CI	0.25–0.30	1.02–1.61	1.26–1.39	0.58–1.02	2.63–3.86	0.61–0.73	0.88–1.12	1.00–1.41

*$p<0.05$.
**Uncalcuable.

exceptions of Sri Lanka, El Salvador, Cuba, Ecuador, and China, where the suicide rates among young females exceed those of males (Wasserman et al., 2005). Particularly high male to female differences were found in Estonia and Ireland, and to a lesser degree in Hungary and Portugal. Given that these countries have all recently joined the European Union, this may be explained by the recent social and political changes that have created high demands especially the male populations in these countries. This male sensitivity to social change is reflective of social change typical of societies in transition (Värnik et al., 1998).

Contrary to the studies reporting an increase in suicide rates among youths in former years from the 1970s until the end of 1990s (Blum and Nelson-Mmari, 2004; Wasserman et al., 2005; Mittendorfer-Rutz and Wasserman, 2004a), the overall suicide trend in 15 European countries combined showed a significant downward trend for males and a relatively stable trend for females between 2000 and 2004. Similarly to recent findings from England and Wales (Biddle et al., 2008), Scotland (Stark et al., 2008), the US (Lubell et al., 2007), and Canada (Steele and Doey, 2007), a significant decline in suicide trends since 2000 has been observed in the age group 15–24 for males in Germany, Scotland, Spain and England and for females in Ireland. This decline might be attributable to national actions on suicide prevention in these countries (Mittendorfer-Rutz and Wasserman, 2004c; Stark et al., 2008; Biddle et al., 2008). However the duration of observation period is rather short in order to draw valid conclusions.

4.2. Variation of suicide methods among youths

Overall, differences in the distribution of suicide methods among males and females in youths were expected, as traditionally, females suicides have been

associated with less lethal suicide methods and males have chosen techniques that are more violent and whose consequences are more likely to be irreversible (Värnik et al., 2008; Hawton, 2000). However, the differences by gender for youths were not as remarkable as have been found for older age groups. Similarly, cross-national differences in terms of methods used in suicides were less pronounced in the younger age group (Värnik et al., 2008).

Just as hanging is the most prevalent suicide method in Europe, it is the most employed method in New Zealand (68% for male, 45% for female) in the age group 15–24 (Beautrais, 2000) and in Canada in the age group 10–19 (48%) (Shaw et al., 2005). In the present study, hanging was the most prevalent method among females in all countries with very high proportion for both genders in northern Europe, what could perhaps indicate to the converging gender life-styles as women 'behave more like men'?

With regard to the use of firearms as suicide method, Switzerland and Finland are similar to the United States, where the highest rates for firearms and hanging were reported in the age group 15–24 (Lubell et al., 2007). In Finland, firearms are easily available with 40% to 50% of all households having firearms (Lönnqvist, 2001; Commission on Crime Prevention and Criminal Justice, 1997). Similarly, Switzerland has high suicide rates by firearms, which corresponds with the wide availability of firearms. In Switzerland, men must perform compulsory military service and must keep a rifle or a gun at home after their first training at the age of 19–20. Also, there are very permissive laws for obtaining a firearm in Switzerland including that anyone can sell his own weapon to someone else (Perret et al. 2006).

The second used suicide method for females in EAAD countries combined was poisoning by drugs, a method which yields a lower lethality because of a slower rate of action and progress in toxicology. Poisoning, which accounts for about a third of all suicides worldwide, is more frequent among young females (23%) compared to young males (9.1%) in EAAD countries. However, it is much lower in Europe in comparison to Asia, where self-poisoning with pesticides is serious concern (Bertolote et al., 2006). It is likely that pesticide poisoning is the most frequently used method of suicide worldwide (Gunnell and Eddleston, 2003). A study from northern India found that more than half (56%) of the suicides in the age group under 20 were committed by poisoning with pesticides, which are easily available in India and have high toxicity (Sharma et al., 2003). Among EAAD countries, a considerable number of intentional deaths using pesticides occur in Portugal (Teixeira et al., 2004), which is also confirmed by the outcomes of this study.

Similarities between EAAD countries in the distribution of suicide methods might be explained by their geographic proximity, which also points to the socio-cultural similarities, as well as by availability of means. For example, central Europe (Germany, Belgium and Netherlands) had similar proportions for hanging and use of a moving object as a means. This could be due to the particularly highly developed set of railways and metros in these countries, and poisoning by drugs available due to high living standard including health care providing medicines; England and Scotland were similar with regard to the prevalence of hanging as suicide method, in spite of the fact that suicide rates are much higher in Scotland.

Jumping, which ranked third for both genders in EAAD countries, was particularly frequent in Luxembourg perhaps explained by the numerous bridges there. The most famous Le Pont Rouge (Red bridge) is known as a suicide hot spot. Ireland is unique with a high proportion of drowning suicides; also in the age group 15–24 for both males and females drowning was higher in Ireland where many jumped from cliffs into the ocean and from bridges into rivers. A national survey in Switzerland has shown higher rates of jumping suicides in areas with bridges and concludes that availability of bridges attracts suicidal people to use that method (Reisch et al., 2007).

Further, the Finno-Ugrian suicide hypothesis (Marusic and Farmer, 2001; Voracek et al., 2003) suggests that high suicide rates in J-shaped curve from Austria to Finland might be associated with a shared genetic vulnerability. However, this does not seem to affect the distribution of suicide methods in youths, which are very different in Finland, Hungary, Estonia and Slovenia.

4.3. Methodological considerations

We are unaware of any other studies examining X-coded suicide methods of youth by gender in European countries. While our study represents about 38,065,400 young people in the age group 15–24, the fact that there are small suicide numbers by specific suicide methods in some countries poses methodological challenges and implies caution in drawing conclusions.

One of the limitations of the study is that two different classifications of causes of death were used: in England, Ireland and Portugal, the 9th revision of the ICD was used and had to be re-classified into ICD-10 codes. In all other countries cause of death was recorded according to ICD-10 X-codes.

With respect to individual countries, the data from Belgium represents only the Flemish region. Also, as England and Scotland are two separate sites in the EAAD, they are cautiously reported here as two separate countries.

The use of suicide (X60–X84) numbers without events of undetermined deaths (Y10–Y34) continues to be problematic considering the possibility of "hidden suicides". For youth, deaths "due to drug overdoses" and "due to traffic accidents" are especially problematic in this regard. A study from the US estimated that suicide rates related to poisoning are underreported by approximately 30% and overall suicide rates are underreported by 10% (Donaldson et al., 2006). A Finnish study assessed that suicide mortality might be underestimated by 10% (Ohberg and Lönnqvist, 1998). However, the rates and trends of undetermined deaths in children and adolescents show noticeable variation across many countries (Pritchard and Hansen, 2005); especially high proportion of undetermined deaths has been reported in Portugal (Chishti et al., 2003).

4.4. Prevention possibilities

The key factors of child and youth suicide methods are availability and lethality (Ohberg et al., 1995; Shaw et al., 2005) with local customs seeming to play a role as well (Steele and Doey, 2007). Restricting access to lethal means is considered to be an evidence based, effective mean for preventing suicides according to a review examining the effectiveness of specific suicide-preventive interventions (Mann et al., 2005).

The present study confirms that there is a high proportion of hanging in youths, which is extremely difficult to restrict outside institutional settings (Bennewith et al., 2005). However, effective efforts for suicide prevention include reduction of firearms, restrictions on pesticides, detoxification of domestic gas, restrictions on the prescription and sale of barbiturates, changing the packaging of analgesics to blister packs, mandatory use of catalytic converters in motor vehicles, construction of barriers at jumping sites, and the use of new, lower-toxicity antidepressants (Mann et al., 2005).

Frei et al. (2006) have stated that the use of firearms in suicides, particularly the use of army weapons by young, well-educated men in Switzerland, requires more attention and debate in policy formation regarding the restriction of access to firearms as a means of preventing suicide in Switzerland. Following the introduction of legislation restricting ownership and access to firearms in New Zealand, firearm-related suicides significantly decreased, particularly among youths. Overall rates of youth suicide also decreased over this time; however it is not possible to determine the extent to which this was accounted for by changes in firearms legislation or other causes (Beautrais et al., 2006). Studies of Canadian youths have shown a decrease in firearm use, which might be attributable to gun control laws passed in Canada.

Unfortunately, substitution of methods has also been observed (Shaw et al., 2005). There has been an increasing trend in suffocation deaths, especially hanging (Beautrais et al., 2006; Shaw et al., 2005). This trend has also been noticed in the United States, where the use of firearms has recently declined (Lubell et al., 2007).

Restricting the availability of means might have only temporary effect — one method tends to be replaced by another. However, individual level studies have shown that suicidal persons who have a preference for a specific method are not very likely to substitute it with another method (Daigle, 2005). A suicidal crisis is often short-term, thus the prevention of access to means helps to curtail impulsive suicides especially among young people (Ohberg et al., 1995). In conclusion, restricting availability to means might have an effect in preventing suicide among the young.

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Conflict of interest

No conflict declared.

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