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Suicide in chidren less than 20 years. Mexico 1998-2011

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Thematic update

ABSTRACT

Introduction

During the last decade, an increase in children and adolescents' completed suicide has been reported nationally and internationally. Psychiatric disorders, family circumstances and sociocultural influences are associated risk factors.

Objective

To describe suicidal tendency in children under the age of 20 during 1998-2011 in Mexico.

Method

Records on mortality of the National Health Information System and population projections of the National Population Council (1998-2011) were analyzed. The truncated age-standardized mortality rate, the rate of change, and the years of life lost index were calculated.

Results

In the 5 to 19 year group population, the completed suicide deaths accounted for 7% of the external cause injuries; the male-female ratio was 2.2:1. Overall, the tendency increased from 18.5 to 31.9 by 10^6. Hanging was the method most often employed with 75.7%. The percentage of change was greater in women with 6%. The state with the highest trend was Hidalgo with 17.2%. In 2011, Tabasco was the state with the highest index of years lost by suicide with 67%.

Discussion and conclusion

The results achieved, such as the increase in suicide in the adolescent's group, the hanging method, the low socioeconomic status and the problems with the registry's death system are data that have also been reported by other authors. The suicide mortality trend has increased. Hanging was the preferred method nationally. A deficient recording system remains an unresolved issue.

Key Words: Suicide, adolescent, trends, methods, Mexico.

RESUMEN

Introducción

Durante la última década se ha reportado un incremento de suicidios en niños y adolescentes a nivel nacional e internacional. Los factores de riesgo asociados son trastornos psiquiátricos, circunstancias familiares e influencias socioculturales.

Objetivo

Describir el comportamiento del suicidio consumado en menores de 20 años en el periodo 1998-2011 en México.

Método

Se analizaron las bases de defunciones del Sistema Nacional de Información en Salud y las proyecciones de población del Consejo Nacional de Población de 1998 a 2011. Se calcularon las tasas truncadas de mortalidad estandarizada por edad, la velocidad de cambio y el índice de años de vida perdidos.

Resultados

En la población de cinco a 19 años, el suicidio representó el 7% de las muertes por lesiones de causa externa; la razón hombre/mujer fue de 2.2:1. En general, la tendencia aumentó de 18.5 a 31.9 por 10^6. El método más empleado fue el ahorcamiento con el 75.7%. Las mujeres presentaron el mayor porcentaje de cambio con el 6%. El estado de Hidalgo presentó una mayor tasa con 17.2%. En 2011, el mayor índice de años de vida perdidos por suicidio se presentó en Tabasco con 67%.

Discusión y conclusión

Los resultados obtenidos, como el incremento del suicidio en adolescentes, el método por ahorcamiento, las malas condiciones socioeconómicas y los problemas de registro de las muertes, son datos obtenidos y que coinciden con lo reportado por otros autores. La tendencia de la mortalidad por suicidios se ha incrementado. El método por ahorcamiento ocupa el primer lugar a nivel nacional. El subregistro en sistemas de información es un problema sin resolverse.

Palabras clave: Suicidio, adolescentes, tendencias, métodos, México.

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INTRODUCTION

Suicide accounts for the most serious component of a set of non-continuous and heterogeneous behavior spectra that are considered as "suicidal behavior". This concept includes self-harm, suicidal ideation, planning, attempts and completed suicide. These behaviors may or may not be interconnected, depending on the analyzed context.[1] This work focuses exclusively on completed suicide.[2,3]

The World Health Organization has reported an increase in youth suicide from 1990; in some countries this is the second or third leading cause of death.[2,4,5,6] In Eastern Europe, youth suicide is more common in the Soviet Union. In Western Europe, France and Finland recorded the highest rates worldwide, while Greece and Spain had the lowest rates.[7,8,9] WHO, in its "Health in the World 2000" report, ranked Mexico as the country with the highest annualized percentage change (APC) with 61.9% in the 81-83/93-95 period, above India, Brazil and the Russian Federation.[4] From 1990 to 2000 suicide increased 150% in the 5-14 year-old group, and 74% in the 15-24 year-old group. These figures represented the further increase among 28 countries surveyed.[10,11,12] From representative national and metropolitan surveys, Borges et al., placed suicide as the third leading cause of death in 15-19 year-old adolescents and the fifth in children under the age of 15.[13] In Mexico, the recording of this cause of death within the 10-14 age group dates back to the 1930s, but the first reported suicides in younger population (5-14 years of age) were reported until the 1970s.[14,15]

The report of suicidal tendencies in young children is scarce and inconsistent, suggesting that parental misreporting, misclassification of suicides as "accidents" as mentioned by McIntire (1997, cited by Tishler, 2007) and previous notions of "cognitive immaturity" have contributed to underevaluate this phenomenon. There is an emphasis that, either if the intention to provoke self-harm or death is what defines suicidal behavior in children, this is independent of the cognitive ability to measure purpose, lethality or outcome of the act (Tishler, 2007).[16]

Among the triggering factors of suicidal behavior reported in the relevant literature the following are cited: a. Painful events such as parental divorce, loss of a loved one, abandonment, etc.[17,18,19,20] b. Consistent risk factors such as psychiatric disorders,[21,22,23] aggressiveness, impulsivity, difficulty to solve problems, high emotional reactivity, family history of psychiatric problems and c. Adversity in childhood as institutionalization, sexual or physical abuse, or *bullying* and *cyberbullying*.[19,21,24] Recently, a model that includes psychosocial risk and protective factors is proposed, as well as the presence of stressful events in the suicidal behavior (Nock, 2013).

Regarding the method by which death is caused by suicide, there is international data affirming that males use more frequently firearm, then hanging, poisoning, and motor vehicle accidents. In contrast, women use more frequently drug overdose, self-harm and, recently, firearm.[7,25,26] In Mexico, the most common method is hanging for both sexes, secondly for men firearm and for women pesticide poisoning.[1,12,13,27] According to geographical distribution, the states with the highest suicide rates in children under the age of 20, in 2004, were Durango, Yucatán, Nuevo Leon, Mexico City and Chihuahua, with a male/female mortality rate of 2.5:1[28] and by place of occurrence eight out of 10 suicides occurred at home.[28,29] However, little is known about these problems over time.

OBJECTIVE

Knowing the distribution, trend, rate of change, and years lost by suicide in children under the age of 20, by sex, method and federal entity during 1998-2011.

METHOD

A retrospective analysis of the 1998-2011 death databases was conducted. The National Health Information System (SINAIS, in Spanish) of the Ministry of Health of Mexico was the source. 1998-2011 population projections of the National Population Council (CONAPO, in Spanish) were used.

For the Truncated Age-Standardized Mortality Rates (TASMR) the direct method was used. The population used was the world standard population modified by Doll et al.[30] Truncated rates were calculated since it is a small population group (5-19 years of age). The denominator was the 5-19 years-of-age population and the quotient is multiplied by one million inhabitants (10^6). In order to know the magnitude and distribution of this event nationwide, mortality was classified into quartiles: ver y high, high, medium and low. For municipalities the Annualized Average Mortality Rate (AAMR) was calculated; 2005 being the last considered year. The annualized percentage change (APC) was calculated by the Poisson regression method. This test indicates the increase or decrease of suicide in a given period of time — when the result is (+) greater than 1.0 there is an increase in the number of suicides, and when (-) or less than 1.0 there is a decrease of the event. Years of potential life lost (YPLL) was calculated to determine the percentage of premature deaths of an entity with respect to the national average; results greater than 1.0 indicate excess premature deaths. The codes included were of X60 to X84 category of the International Classification of Diseases.[31] The classification used by the National Institute of Statistics and Geography was taken for code groups.[32] Group I: Poisoning by medicines, drugs and biological substances (X60–X64), hereinafter "medicines"; Group II: Poisoning by gases, vapors, alcohol and pesticides (X65–X69), "pesticides"; Group III: Hanging,

Table 1. Suicide mortality in men and women under 20 years of age. Mexico 1998 - 2011

Year	Deaths from injury of external causes	Suicide deaths			Ratio*
		Total	Male	Female	
1998	10 101	601	434	167	0.06
1998	11 531	565	407	158	0.05
2000	10 713	585	417	168	0.05
2001	10 897	676	456	220	0.06
2002	10 826	686	465	221	0.06
2003	10 162	689	468	221	0.07
2004	10 010	681	488	193	0.07
2005	9 754	691	474	217	0.07
2006	10 030	727	489	238	0.07
2007	9 611	660	466	194	0.07
2008	9 923	786	537	249	0.08
2009	10 656	908	573	335	0.09
2010	10 861	859	581	278	0.08
2011	11 220	1 108	741	367	0.10
Total	146 295	10 222	6 996	3 226	0.07

Source: Death Registration, National Health Information System [Sistema Nacional de Información en Salud (SINAIS)], SSA. Mexico 1998-2011.
* Ratio based on deaths from external causes of injury.

strangulation or suffocation (X70), "hanging"; Group IV: Firearm (X72-X74); Group V: Sharp object (X78); Group VI: Jumping from a high place (X80); Group VII: Jumping or placing in front of a moving object (X81) and Group VIII: All others (X71, X75, X76, X77, X79, X82, X83, X84).

The formulas to get the percentage difference, percentage points, and annualized average rate are as follows:

$$PD = \frac{RD - PrD}{PrD} * 100$$

$$PP = RD - PrD$$

$$AAR = TD/IP*(1\ millón)/TY$$

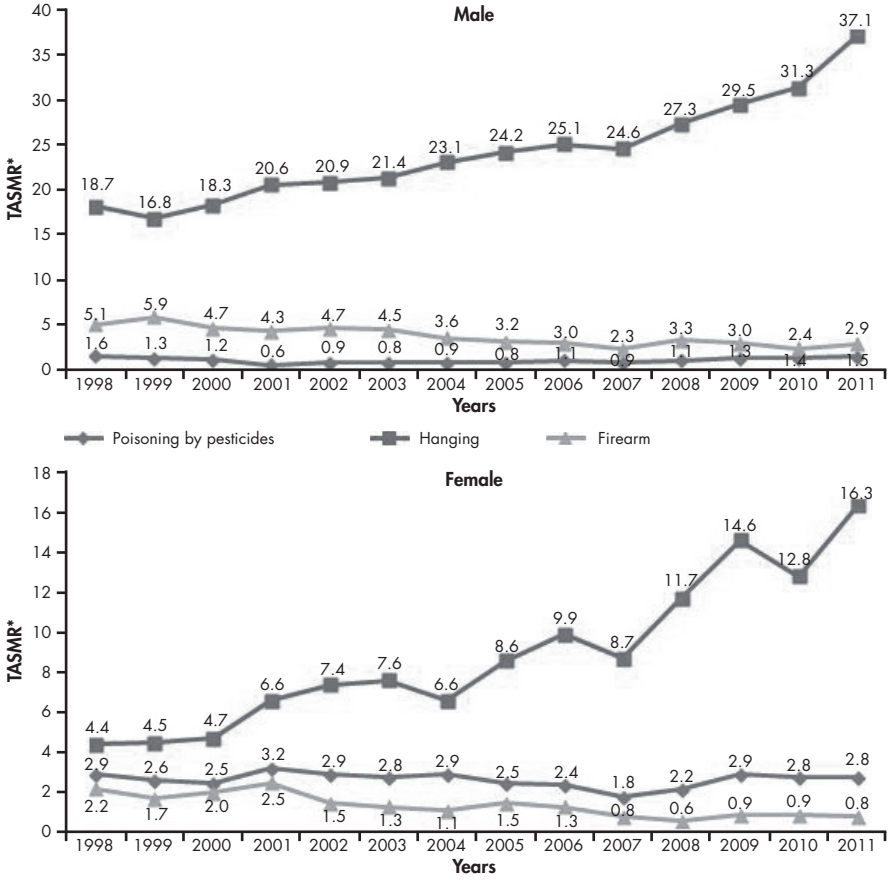
Where: PD = Percentage Difference; RD = Recent Data; PrD = Previous Data; PP = Percentage Points; AAR = Annualizaed Average Rate; TD = Total Deaths of Period; IP = Intermediate Population of Period; TY = Total Years of Period.

For the information analysis, death databases were refined, excluding records without information on variables of age, sex, place of residence or with residence abroad. The statistical programs used were SPSS V.12 and STATA V.12.

Table 2. Annualized Percentage Change (APC) according to method of suicide by sex in 20-year-old minors. Mexico 1998–2011

Group	Description	Truncated rate* 1998	Average age at death	Truncated rate* 2011	Average age at death	APC**	95% CI	
							(-)	(+)
Men								
I	Poisoning by medicines, drugs and biological substances.	0.3	17	0.2	17	–4.1	–14.1	7.0
II	Poisoning by gases, vapors, alcohol and pesticides.	1.6	18	1.5	17	–0.3	–4.4	4.0
III	Hanging, strangulation or suffocation.	18.7	16	37.1	16	5.6	4.5	6.7
IV	Firearm.	5.1	17	2.9	17	–3.9	–6.4	–1.2
V	Sharp or blunt object.	0.3	17	0.2	18	–4.1	–14.1	7.0
VI	Jumping from a high place.	–	–	0.1	18	–	–	–
VII	Jumping or placing in front of a moving object.	–	–	0.1	19	–	–	–
VIII	Other***	0.6	16	0.4	17	–2.2	–9.3	5.5
	Total	26.6	17	42.5	18	3.9	3.0	4.9
Women								
I	Poisoning by medicines, drugs and biological substances.	0.7	17	0.8	16	1.6	–4.4	8.0
II	Poisoning by gases, vapors, alcohol and pesticides.	2.9	16	2.8	16	0.1	–3.0	3.2
III	Hanging, strangulation or suffocation.	4.4	16	16.3	16	10.9	8.7	13.2
IV	Firearm.	2.2	17	0.8	16	–7.2	–11.5	–2.7
V	Sharp or blunt object.	–	–	0.1	18	–	–	–
VI	Jumping from a high place.	–	–	–	–	–	–	–
VII	Jumping or placing in front of a moving object.	–	–	0.1	19	–	–	–
VIII	Other***	0.1	15	0.3	16	8.6	–4.0	22.8
	Total	10.4	16	21.1	17	6.0	4.5	7.5

Source: Death Registration, National Health Information System [Sistema Nacional de Información en Salud (SINAIS)], SSA. Mexico 1998-2011.
* Truncated rate in the 5-19 year age group; ** APC = Annualized percentage change; *** = Includes self-inflicted injuries by drowning and submersion, explosive material, smoke, fire or flames, steam and hot objects, blunt object, motor vehicle collision and other unspecified means.



Source: Death registration of the National Health Information System [Sistema Nacional de Información en Salud (SINAIS)], SSA. Mexico 1998-2011. Population estimates of the National Population Council, 1998-2011.
* TASMR: Truncated Age-Standardized Mortality Rate by 106 inhabitants.

Figure 1. Mortality trend for suicides in 20-year-old minors in accordance to sex and method. Mexico 1998-2011.

RESULTS

In the analysis period, 146,295 deaths occurred due to external cause injuries (ECI) in children under the age of 20, 7% were suicides (*n* = 10 222). Proportion of deaths by ECI was 0.07 (table 1). Of all the deaths from suicide, 68.4% were men and 31.6% women. The male/female ratio was 2.2:1. Suicide had a percentage growth of 66% with an increase of four percentage points (not included in tables). The average age of death increased one year in both sexes, from 17 to 18 years for men and from 16 to 17 years for women (table 2). By age group, suicide was higher in the 15-19 year group with 78.2%, followed by the 10-14 year group with 21.5% and by the 5-9 year group with 0.3%.

Nationally, preferably methods used were: hanging (75.7%), firearm (11.7%), and pesticides (8.6%). The states with the highest percentage of suicides by hanging for men were: State of México (12.2%), Mexico City (8.6%), Guanajuato (8.2%), Jalisco (7.3%), and Puebla (5.0%). For women: State of México (14.1%), Mexico City (8.7%), Jalisco (7.0%), Puebla (6.2%), and Veracruz (5.9%).

In connection with the TAAMR for suicides in Mexico, a value of 22.5 was obtained; this means that on average 22 people under the age of 20 die each year by suicide per million of inhabitants between 5-19 years of age. In sex differences there is a value of 30.3 for men and 14.4 by 106 inhabitants for women.

1998-2011 suicide tendency, according to the TASMR in men increased from 26.6 to 42.5, with an increase of 16 percentage points. In women, the rate was elevated from 10.4 to 21.1 by 106 inhabitants, i.e. 11 percentage points (table 2).

With regard to the method used and TASMR in men, hanging increased from 18.7 to 37.1 (18 percentage points), firearm decreased from 5.1 to 2.9 (two percentage points), and in pesticide poisoning there were no changes (1.6 and 1.5 in 1998 and 2011 by 106 inhabitants, respectively). The rest of the methods were less than one.

In women it was observed that the method with most positive trend was hanging, with an increase from 4.4 to 16.3 (12 percentage points), followed by pesticide poisoning, which remained constant with a rate of 2.9 and 2.8. The firearm method showed a decrease ranging from 2.2 to 0.8

Table 3. Mortality rate according to method of suicide by state in 20-year-old minors. Mexico 2011

	Group I	Group II	Group III	Group IV	Group V	Group VI	Group VII	Group VIII	
Entidad	Poisoning by medicines	Poisoning by chemical products	Hanging	Firearm	Sharp object	Jumping from a high place	Jumping in front of a moving object	All others	Total
Aguascalientes	2.64	0.00	41.74	0.00	0.00	0.00	0.00	0.00	44.38
Baja California	1.01	0.00	20.44	0.00	0.00	0.00	0.00	0.00	21.44
Baja California Sur	0.00	0.00	5.07	5.22	0.00	0.00	0.00	0.00	10.30
Campeche	0.00	7.71	31.09	3.85	0.00	0.00	0.00	0.00	42.65
Coahuila	0.00	0.00	25.22	0.00	0.00	0.00	0.00	1.21	26.44
Colima	0.00	5.12	20.69	5.12	0.00	0.00	0.00	0.00	30.93
Chiapas	0.00	7.67	18.69	1.79	0.60	0.00	0.00	0.60	29.35
Chihuahua	0.00	0.93	29.90	2.94	0.00	0.00	0.00	0.00	33.78
Mexico City	1.33	0.00	38.55	2.26	0.00	0.89	0.89	0.44	44.37
Durango	1.82	1.91	15.09	1.91	0.00	0.00	0.00	1.91	22.63
Guanajuato	0.56	2.25	40.20	3.91	0.00	0.00	0.56	0.00	47.48
Guerrero	0.00	8.56	8.51	0.86	0.00	0.00	0.00	0.82	18.76
Hidalgo	1.22	0.00	43.45	3.59	0.00	0.00	0.00	0.00	48.26
Jalisco	0.00	4.87	30.17	1.78	0.00	0.00	0.00	0.00	36.82
State of Mexico	0.00	1.72	27.99	1.52	0.22	0.00	0.00	0.65	32.10
Michoacán	0.72	2.15	20.74	0.72	0.00	0.00	0.00	0.00	24.33
Morelos	0.00	3.69	16.58	0.00	0.00	0.00	0.00	0.00	20.27
Nayarit	0.00	0.00	15.02	3.00	3.00	0.00	0.00	0.00	21.02
Nuevo León	0.00	0.00	15.08	0.00	0.00	0.00	0.00	0.76	15.84
Oaxaca	2.34	1.55	15.56	1.55	0.00	0.00	0.00	0.00	20.99
Puebla	0.53	1.06	30.65	2.63	0.00	0.00	0.00	0.00	34.87
Querétaro	0.00	1.70	36.01	6.90	0.00	0.00	0.00	0.00	44.61
Quintana Roo	0.00	4.85	38.68	0.00	0.00	0.00	0.00	0.00	43.53
San Luis Potosí	2.38	1.21	37.26	2.42	0.00	0.00	0.00	0.00	43.26
Sinaloa	1.17	1.17	15.18	3.52	1.17	0.00	0.00	0.00	22.23
Sonora	0.00	0.00	26.36	3.77	0.00	0.00	0.00	2.51	32.67
Tabasco	0.00	1.44	47.21	1.42	0.00	0.00	0.00	1.44	51.50
Tamaulipas	0.00	0.00	13.64	1.06	0.00	0.00	0.00	0.00	14.70
Tlaxcala	0.00	8.00	34.82	2.70	0.00	0.00	0.00	0.00	45.52
Veracruz	0.43	2.13	20.01	0.42	0.00	0.00	0.00	0.00	22.99
Yucatán	0.00	0.00	45.51	0.00	0.00	0.00	0.00	0.00	45.51
Zacatecas	0.00	2.14	21.34	6.43	0.00	0.00	0.00	2.14	32.05
National	0.49	2.13	26.64	1.85	0.12	0.06	0.09	0.38	31.86

Source: Death Registration of the National Health Information System [Sistema Nacional de Información en Salud (SINAIS)], SSA. Mexico 2011
Population estimates of the National Population Council or Consejo Nacional de Población (CONAPO). Mexico 1998 - 2011
* TASMR = Truncated age-standardized mortality rate by 106 inhabitants.

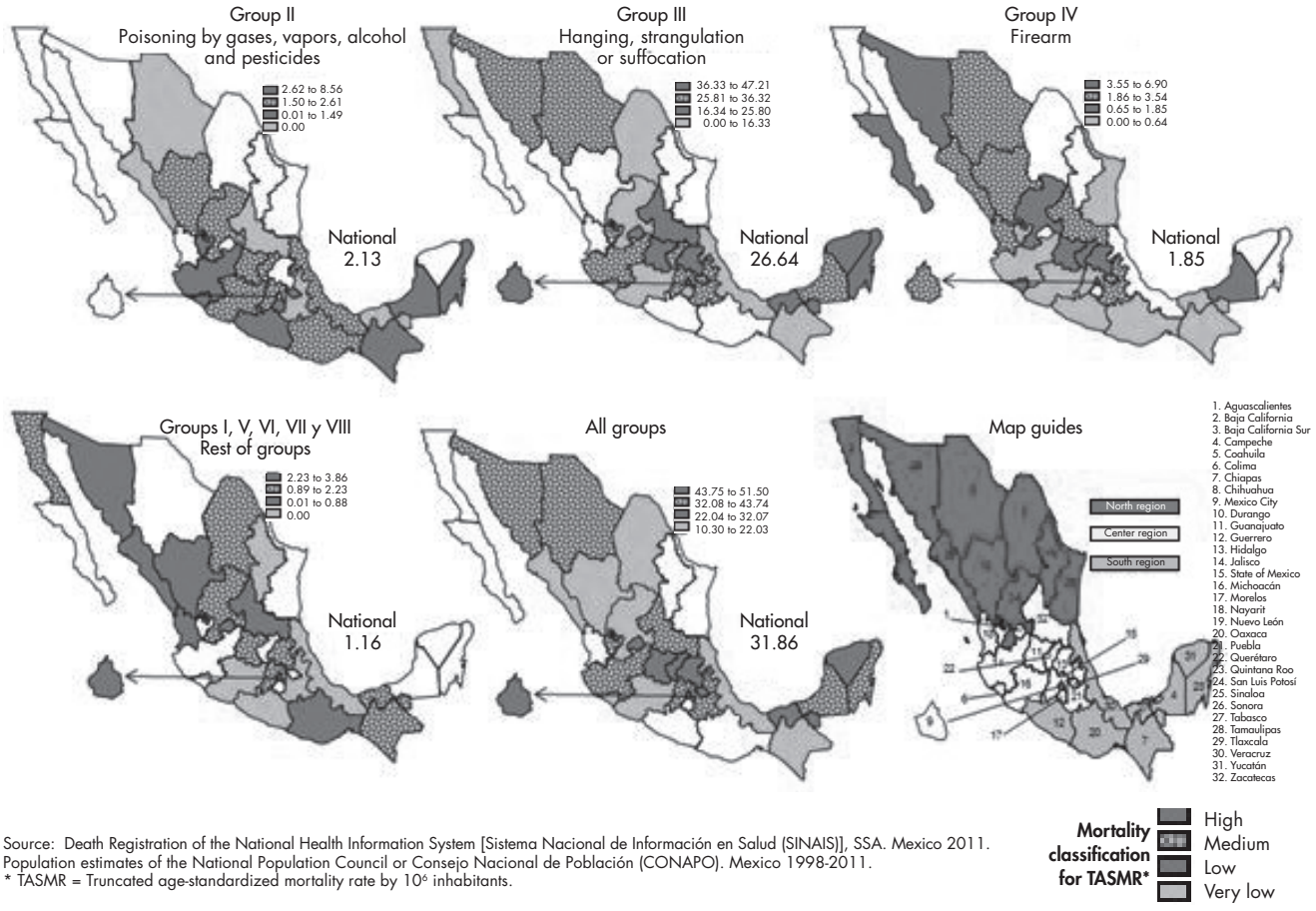
(one percentage point) in 1998 and 2011, respectively (table 2, figure 1).

The APC showed the most (+) significant change towards an increase for women with 6%, in contrast to the 3.9% obtained for men. According to the method, hanging was the most (+) significant change in both sexes with 5.6% for men and 10.9% for women. The other methods were (+) but not significant for women (table 2).

According to the classification in quartiles of the TASMR regarding the main methods of suicide by state in 2011, it was observed that hanging showed the highest rates in the following states: Tabasco, 47.21; Yucatán, 45.51 and Hidalgo, 43.45. Pesticide poisoning was presented as follows: Guerrero, 8.56; Tlaxcala, 8.0; Campeche, 7.71 and Chiapas, 7.67 and finally firearm was observed as follows: Querétaro, 6.90; Zacatecas, 6.43; and Baja California Sur, 5.22 by 106 inhabitants. (image 1 and table 3).

By state, 12 states presented the (+) significant APC, the highest were Hidalgo 17.2%, Yucatán 10.6% and Aguascalientes 8.7%. By entity, in 11 states there were (+) significant changes in the case of men: Hidalgo 27.6%, Zacatecas 13.5%, and Sinaloa 12.0%. For women there were (+) significant changes in eight states, the following being the main three: Querétaro 14.1%, San Luis Potosí 11.5%, and Hidalgo 11.1% (table 4).

When analyzing the municipalities with the largest AAMR, stands out the municipality of Medellín in Veracruz, with 188.4; Apizaco, Tlaxcala, with 17.4; Ciudad del Carmen, Campeche, with 16.1; León, Guanajuato, with 10.9; Cabo San Lucas, Baja California Sur; Durango, Durango;



Source: Death Registration of the National Health Information System [Sistema Nacional de Información en Salud (SINAIS)], SSA. Mexico 2011. Population estimates of the National Population Council or Consejo Nacional de Población (CONAPO). Mexico 1998-2011.
* TASMR = Truncated age-standardized mortality rate by 10^6 inhabitants.

Figure 2. Main suicide methods for entity in 20-year-old minors. Mexico 2011

and Benito Juárez, Quintana Roo, all with 9.4 by 106 inhabitants (table 5).

As for the sociodemographic variables analyzed, it was found that, in relation to marital status, 86% were single, 8.6% married, and 5.4% not applied or unknown. Regarding the TASMR, single persons showed a positive trend (upward), ranging from 17.7 to 29.6 by 106 inhabitants. Those with incomplete primary studies showed an increase in TASMR, from 0.89 to 4.1; and those who completed high school the rate ranged from 2.7 to 5.8 by 106 inhabitants. In the labor field, the TASMR showed an upward trend for those who worked, which changed from 6.7 to 11.1 by 106 inhabitants.

For the YPLL in 2011, the states with the greatest percentage of premature deaths were: Tabasco (1.67), Hidalgo (1.59), and Guanajuato (1.53) (figure 2).

The most affected population in 2011 was 15-19 years of age, with an age-specific rate of 77.3. The 10-14 year group obtained a rate of 22.0 by 106 inhabitants and ECIs were the third leading cause of death for both groups this year. By place of occurrence, 80% took place at home, 3% on the street and 17% elsewhere.

Regarding the autopsies of the 10,222 deaths from suicide, 84.7% underwent an autopsy. From the above, 63.3% were certified by a forensic surgeon, coroner or personnel authorized by the Ministry of Health and 36.7% by physicians without such specialization.

DISCUSSION AND CONCLUSION

Overall, mortality from suicide in children and adolescents showed an upward trend, with predominance of males, similar to international reports, except for China, where the male/female figure is reversed.[33-37] It bears mentioning that in Mexico suicide in children under 10 years of age is rare — 115 suicides have been reported from 1979 to 2002. It should be noted that in the period from 2003 to 2011 there were no records of suicides in this age group. Another factor contributing to deficient recording is when children or adolescents are terminally ill and end their life by suicide, and physicians report the disease and not the external cause (suicide); as Ávila -Burgos (2010) suggests — in Mexico, usually the type of injury is recorded but not the external cause.[38] It is

Table 4. Annualized Percentage Change (APC) of suicide by state in 20-year-old minors. Mexico 2011

	General			Male			Female		
		95 % CI			95 % CI			95 % CI	
State	APC	(-)	(+)	APC	(-)	(+)	APC	(-)	(+)
Aguascalientes	8.7	0.7	17.3	10.7	0.5	22.0	4.3	–8.4	18.9
Baja California	0.8	–4.3	6.2	–1.1	–6.8	4.9	7.6	–4.6	21.5
Baja California Sur	–9.7	–20.4	2.4	0.0	0.0	0.0	2.2	–15.1	22.9
Campeche	3.3	–4.0	11.1	4.3	–4.1	13.5	–0.3	–14.2	16.0
Coahuila	1.8	–3.1	7.0	0.8	–4.5	6.5	6.6	–6.0	20.9
Colima	–0.5	–8.8	8.5	1.6	–9.4	14.0	–3.5	–15.9	10.7
Chiapas	8.1	3.6	12.9	8.1	2.6	13.9	8.3	0.3	17.0
Chihuahua	–0.7	–4.2	3.0	–2.0	–6.3	2.5	1.9	–4.2	8.5
Mexico City	4.8	2.3	7.4	3.9	1.1	6.9	7.5	2.2	13.1
Durango	0.2	–5.8	6.5	–2.6	–9.6	4.9	7.5	–5.2	22.0
Guanajuato	4.0	1.2	6.8	3.9	0.7	7.1	4.2	–1.3	10.0
Guerrero	5.6	–0.2	11.6	0.1	–7.6	8.5	10.8	1.8	20.6
Hidalgo	17.2	9.1	25.9	27.6	9.4	48.8	11.1	2.1	20.8
Jalisco	6.1	3.0	9.3	5.2	1.7	8.9	8.4	2.3	14.9
State of Mexico	5.0	2.7	7.3	4.1	1.3	6.9	6.5	2.7	10.3
Michoacán	4.3	0.1	8.7	4.4	–0.8	9.9	4.0	–2.9	11.4
Morelos	–0.9	–6.9	5.6	2.4	–6.3	11.8	–4.4	–13.0	5.1
Nayarit	2.6	–6.1	12.1	4.3	–5.1	14.7	0.0	0.0	0.0
Nuevo León	0.2	–4.6	5.1	–3.2	–8.6	2.5	11.2	–1.2	25.1
Oaxaca	6.9	1.4	12.6	6.4	–0.3	13.5	4.9	–4.6	15.3
Puebla	6.9	3.2	10.6	10.0	4.9	15.3	3.6	–1.5	9.0
Querétaro	5.5	0.0	11.4	1.6	–4.8	8.5	14.1	1.8	27.9
Quintana Roo	3.9	–2.8	11.2	5.1	–2.7	13.6	–0.2	–13.1	14.5
San Luis Potosí	5.3	0.8	9.9	3.4	–1.5	8.6	11.5	1.1	22.8
Sinaloa	7.1	0.1	14.6	12.0	1.7	23.3	3.2	–6.4	13.8
Sonora	1.8	–2.8	6.6	1.9	–3.5	7.6	1.6	–7.0	11.0
Tabasco	0.9	–2.7	4.7	–0.4	–4.6	4.0	4.3	–2.9	12.0
Tamaulipas	–1.0	–6.5	4.8	–1.0	–6.9	5.3	–0.9	–14.8	15.2
Tlaxcala	6.3	–0.7	13.7	4.7	–3.6	13.7	9.3	–3.1	23.3
Veracruz	7.6	3.6	11.8	6.4	1.8	11.2	10.8	2.7	19.6
Yucatán	10.6	3.8	18.0	8.5	1.6	15.8	0.0	0.0	0.0
Zacatecas	8.2	0.6	16.4	13.5	3.1	24.9	–7.3	–22.2	10.3
Nacional	4.1	3.4	4.9	3.9	3.0	4.9	6.0	4.5	7.5

Source: Death registration of the National Health Information System [Sistema Nacional de Información en Salud (SINAIS)], SSA. Mexico 1998-2011. Population projections. National Population Council or Consejo Nacional de Población (CONAPO) 1998-2011.
*APC= Annualized Percentage Change by truncated mortality rate.

necessary to conduct studies to determine the causes and extent of the deficient recording, including other sources such as judiciary police and the medical forensic service.

The problem of the deficient recording is not limited to suicide on a specific age group or to the specific field of health institutions. The problem is given by various reasons such as family (stigma), administrative and related to registration systems under the responsibility of medical and/or judicial authorities in the opinion of the cause of death or due to the "wrong completion" of the death certificate. In this regard, Freuchen et al., in a Norwegian study, based on psychological autopsy, found it difficult to determine if the cause of death was suicide or accident.[39]

As for the absence of records in children under 12 years of age, our data are consistent with Tishler (2007) who highlights the shortage of data and their inconsistency in young children and their misclassification as "accidents". In Mexico, the ECIs, including suicide, have a deficient recording at a public hospital level. Ávila-Burgos (2010) emphasizes that in the Mexican Social Security Institute (IMSS, in Spanish) the hospital discharges databases do not contain information from the external cause; at the Institute for Social Security and Services for State Workers (ISSSTE, in Spanish) there are no (outpatient) ambulatory care databases for injuries, and in the Ministry of Health "only the 2003-2006 period could be analyzed" (and not until 2007) as the information was only available for that period. In private clinical practice, due to the "fragmentation and little regulation" this sector did not provide data.

The risk of suicide increases with age, affecting more adolescents in the late stage.[40-43] In this study, the most af-

Table 5. Main municipality by state with higher suicide mortality in 20-year-old minors. Mexico 1988–2011

State	Municipalities	Suicides	AAMR*
Aguascalientes	Aguascalientes	77	7.6
Baja California	Tijuana	68	3.5
Baja California Sur	Cabo San Lucas	21	9.4
Campeche	Ciudad del Carmen	45	16.1
Coahuila	Saltillo	83	9.1
Colima	Colima	14	7.5
Chiapas	San Cristóbal de las Casas	14	6.1
Chihuahua	Juárez	150	8.2
Mexico City	Iztapalapa	187	7.3
Durango	Durango	70	9.4
Guanajuato	León	196	10.9
Guerrero	Acapulco	34	3.4
Hidalgo	Pachuca	15	3.9
Jalisco	Guadalajara	153	6.7
State of Mexico	Ecatepec de Morelos	155	6.6
Michoacán	Morelia	55	5.7
Morelos	Cuernavaca	17	3.5
Nayarit	Tepic	32	6.8
Nuevo León	Monterrey	96	6.0
Oaxaca	Oaxaca de Juárez	22	5.9
Puebla	Puebla	164	7.9
Querétaro	Querétaro	76	7.4
Quinta Roo	Benito Juárez	75	9.4
San Luis Potosí	San Luis Potosí	93	9.0
Sinaloa	Mazatlán	34	6.0
Sonora	Hermosillo	77	7.8
Tabasco	Villahermosa	63	8.0
Tamaulipas	Reynosa	40	5.5
Tlaxcala	Apizaco	18	17.4
Veracruz	Medellín	103	188.4
Yucatán	Mérida	93	8.5
Zacatecas	Fresnillo	19	6.8

Source: Death Registration, National Health Information System [Sistema Nacional de Información en Salud (SINAIS)], SSA. Mexico 1998-2011.
Population estimates of the National Population Council or Consejo Nacional de Población (CONAPO). Mexico 1998-2011.
AAMR = Annualized average mortality rate.
Reference year: 2005.

fected population accounted for the late adolescents (15-19 years of age).

Another important aspect is the unreliability of the certificate data on suicides. For example, it is considered that in order to make an accurate report of death by suicide, the autopsy must be performed by trained medical staff following an established protocol. In this study it was found that 36.7% were autopsies certified by non-forensic surgeons or non-coroners, plus 15.3% of not conducted autopsies, account for more than 50% of information which reliability would be in doubt.

In this study, the most commonly used method was hanging (76%). No variations were found in the different regions and states as reported by other authors, internationally.[44,45] As mentioned by Beautrais, Dervic and Pompili, among others,[17,33,36,46,47] hanging is the most widely used method since it is inexpensive, easy to install and does not require a laborious planning; although lethality is lower than other methods. In Mexico, there are no studies indicating the reasons for which this method is the most widely used for both men and women.

The firearm method is little used in Mexico, unlike the US where it is the main form of suicide.[17,21,34] However, this method is most often used in the States of Zacatecas, Baja California Sur, and Sonora.

The method for pesticide poisoning presented a stable trend. The States with the highest rates were Guerrero, Tlaxcala, Campeche, and Chiapas (image 1). This does not mean that the method is less used, but probably the most used and depending on the agent, dose and duration between intake and medical care, lethality varies, either giving or not giving chance to the patient for medical attention. A recent study by Reyna et al. identified the aluminum phosphide as the most used and lethal in 40 suicidal patients of the State of Mexico.[48]

In the 2454 municipalities existing in Mexico, the municipality of Medellín, Veracruz, and Apizaco, Tlaxcala, presented the highest AAMR. This atypical result of the rate could be explained based on the fact that the denominator (population size) is very small and the increase or decrease in the numerator (deaths) makes it very unstable.

Regarding the APC by entity, 10 States had (+) significant changes. The State of Hidalgo is notable for having grown rapidly, becoming the first place overall, and the State of Yucatán the second place, both with an increase higher than 10%. (table 4).

Regarding socio-demographic factors, the data are consistent with the observations made by Borges and Benjet (2008), with respect to an increased risk in adolescents with low levels of schooling and those who worked. The most common place was home (80%), similar to what other authors found.[47,49-51]

A very high percentage of autopsies certified by doctors not belonging to the field of forensics was found in this study; even in 15% of suicides this procedure was not performed, which contributes to poor quality and low reliability information, increasing the deficient recording of suicide. In other more advanced countries in forensic medicine, a forensic and judicial study protocol is carried out to accurately rule the cause of death and intent (accident, homicide or suicide) as mentioned by Danielle Shaw[37] in her study. Therefore, when interpreting official information sources of deaths from suicide in Mexico should be made with reservation and caution.[4,52]

In a recent analysis (Ávila-Burgos et al., 2010) regarding the granted consultations, hospital discharges and inpatient days related to injured people who demanded attention at the three main health institutions of Mexico (Ministry of Health, IMSS and ISSSTE) between 2003 and 2007, the authors concluded that concerning intentional injuries there is a problem which real magnitude is unknown.[38]

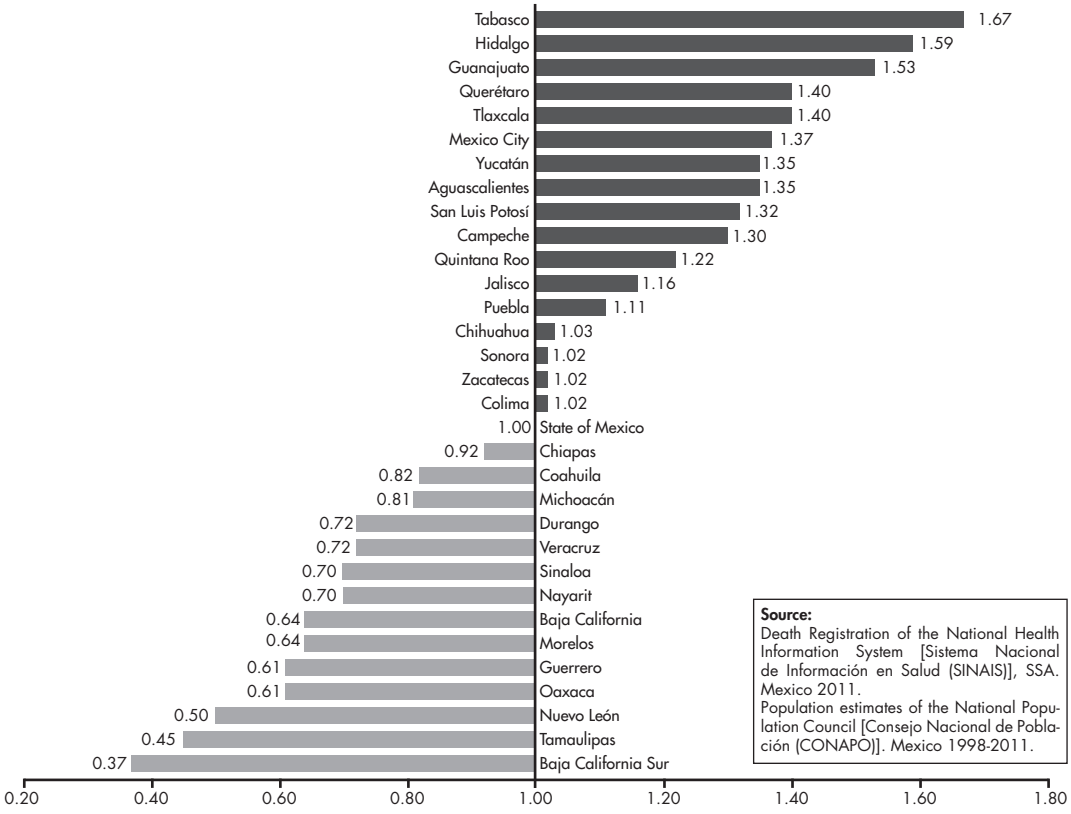


Figure 3. Rate of lost years for suicides by federative entity in 20-year-old minors. Mexico 2011.

Limitations

This review should take into consideration that the number of deaths by geographic area, age groups or method used, can be very low and, therefore, rates can cause unstable values.

Moreover, information on death databases was obtained from death certificates, which are limited regarding the number of variables of epidemiological interest.

Suicide in children under the age of 20 (1998-2011) showed a positive trend, demonstrated by the increase in rates, percentage change, and premature deaths.

In the last years of this study, suicide in children under the age of 10 was virtually null, data that does not match other countries' reports. In this population group the suicide attempt may be less obvious,[23] so it is essential for future analysis, to assess "accidental" deaths in this age group.

To improve the information the Directorate General of Health Information (DGIS, in Spanish) should implement the Injuries-from-External-Cause Registration System in the health sector hospital units; as well as integrating and unifying the medical–legal information system of the public prosecutor and forensic offices to support the conduct of studies to determine the causes of deficient recording in the information systems.

The most widely used method by both sexes was hanging, thus, future studies could deepen the choice of this method in children under 20 years of age in Mexico.

An important finding was the use of a firearm in some States of the northern region of Mexico, perhaps related to the proximity to the US.

Low production of epidemiological studies of suicide in children and adolescents is probably related to ethical, financial and administrative issues hindering research of this phenomenon.

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Conflict of Interest

The authors declare no conflict of interest.

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REFERENCES

1. World Health Organization. Prevention of suicide: guidelines for the formulation and implementation of national strategies. Genova, Suiza: World Health Organization; 1996.
2. Sarracent A, Corpeño M. Comportamiento de la conducta suicida en el hospital general "Calixto García Iñiguez" (años 2000-004). [Monografía en Internet]. [Consultado 2012 julio 17]. URL: www.psiquiatrico-hph.sld.cu/hph0206/hph02206.htm
3. Sánchez Loyo L, Mújica Zepeda G, Martínez Hernández L. Características sociodemográficas y psicopatológicas de pacientes con múltiples intentos de suicidio en la ciudad de Guadalajara. En: Ponencia. Jalisco: Universidad de Guadalajara; 2005.
4. OMS (Organización Mundial de la Salud). The World Health Report 2000. Mental Health: New understanding, new hope, 2001. [Consultado 2012 julio 18]. URL:www.who.int/whr.2001
5. Boue A, Boue A, Tarragó F, Corona H et al. Comportamiento clínico epidemiológico del intento suicida en adolescentes de la Policlínica Pedro del Toro Saad 2006–2007. Correo Científico Médico Holguín 2009;13(2):1-12.
6. Chávez A, Medina M, Macías L. Modelo psicoeducativo para la prevención del suicidio en jóvenes. Salud Mental 2008;31:197-203.
7. Greydanus D, Bacopoulou F, Tsalamanios E. Suicide in adolescents: A worldwide preventable tragedy. Keio J Med 2009;58(2):95-102.
8. Ruiz-Pérez I, Olry de Labry A. El suicidio en España hoy. Gac Sanit 2006;20(1)25-31.
9. Arán M, Gispert R, Puig X, Freitas A et al. Evolución temporal y distribución geográfica de la mortalidad por suicidio en Cataluña y España. Gac Sanit 2006;20(6)473-480.
10. Bridge J, Goldstein T, Brent D. Adolescent suicide and suicidal behavior. J Child Psychology Psychiatry 2006;47(3-4):372-394.
11. Puentes E, López L, Martínez T. La mortalidad por suicidios: México 1990-2001. Rev Panam Salud Publica 2004;16(2):102-109.
12. INEGI. Estadística de los suicidios de los Estados Unidos Mexicanos, México: 2006.
13. Borges G, Orozco R, Benjet C, Medina-Mora ME. Suicidio y conductas suicidas en México: retrospectiva y situación actual. Salud Pública Mex 2010;52(4):292-304.
14. Secretaría de Salud (SSA). Mortalidad por suicidio. Principales causas de mortalidad general. México: 2001.
15. Celis A, Gómez L, Armas J. Tendencias de mortalidad por traumatismos y envenenamientos en adolescentes, México 1979-1997. Salud Pública México 2003;45(supl 1):S8-S15.
16. Tishler C, Staats N, Rodes A. Suicidal behavior in children younger than twelve: A diagnostic challenge for emergency department personnel. Academic Emergency Medicine 2007;14:810-818.
17. Beautrais A. Child and young adolescent suicide in New Zeland. Aust New Z J Psychiatry 2001;3585:647-653.
18. Brent D, Baugher M, Bridge J, Chen T et al. Age and sex related risk factors for adolescent suicide. J Am Acad Child Adolesc Psychiatry 1999;28:918-924.
19. Pérez B. ¿Cómo evitar el suicidio en los adolescentes?, Sociedad Cubana de Psiquiatría [Consultado el 1 de enero de 2013]. URL disponible en: http://es.scribd.com/doc/13299393/Perez-Barrero-Sergio-P-Como-Evitar-El-Suicidio-en-Adolescentes.
20. Biddle L, Donovan J, Hawton K, Kapur N et al. Suicide and internet. BMJ 2008;336:800-802.
21. Nock M, Deming C, Fullerton C, Gilman S et al. Suicide among soldiers: A review of psychosocial risk and protective factors. Psychiatry 2013;76(2):97-125.
22. Borges G, Benjet C, Medina M, Orozco R et al. Suicide ideation, plan, and attempt in the Mexican adolescent mental health survey. J Am Acad Child Adolesc Psychiatry 2008;47(1):41-52.
23. Freuchen A, Kjelsberg E, Lundervold A, Grholt B. Differences between children and adolescents who commit suicide and their peers: A psychological autopsy of suicide victims compared to accident victims and a community simple. Child Adolescent Psychiatry Mental Health 2012;6(1):1-12.
24. Cash S, Bridge J. Epidemiology of youth suicide and suicidal behavior. Curr Opin Pediatr 2009;21(5):613–619.
25. Spicer R, Miller T. Suicide acts in 8 states: Incidence and case fatality rates by demographics and method. American J Public Health 2000;90(12)1885-1890.
26. Biddle L, Brock A, Brookes S, Gunnell D. Suicide rates in young men in England and Wales in the 21st century: time trend study. BMJ | ONLINE FIRST | bmj.com 2008:1-5.
27. Borges G, Medina-Mora M, Orozco R, Ouéda C et al. Distribución y determinantes sociodemográficos de la conducta suicida en México. Salud Mental 2009;32(5):413-425.
28. Instituto Nacional de Estadística, Geografía e Informática (INEGI). Estadísticas de intentos de suicidios y suicidios. Boletín de estadísticas, demográficos y sociales. México: 2005.
29. Villagómez B, Balcázar M, Paz R. Suicidio en jóvenes. Rev Fac Med, UNAM 2005;48(2):54-57.
30. Doll R, Payne P, Waterhouse JAH. Cancer incidence in five continents, Vol. I, Ginebra, UICC: Brlin, Springer; 1996.
31. Organización Mundial de la Salud (OMS). CIE 10. Trastornos Mentales y del comportamiento: Descripciones clínicas y pautas para el diagnóstico. Madrid: Meditor; 1992.
32. Instituto Nacional de Estadística y Geografía. [Consultado 18 mayo 2013]. Acceso: http://www3.inegi.org.mx/sistemas/sisept/default.aspx?t=mvio38&s=est&c=22653
33. Dervic K, Friedrich E, Oquendo M et al. Suicide in Austrian children and young adolescents aged 14 and younger. Eur Child Adolesc Psychiatr 2006;15(7):427–434.
34. Vieweg V, Linker J, Anum E, Turf E et al. Child and adolescent suicides in Virginia: 1987 to 2003. J Child Adolescent Psychopharmacology 2005;15(4):655-663.
35. Campi R, Barbato AD, Avanzo B, Guaiana G et al. Suicide in Italian children and adolescents. J Affective Disorders 2009;113:291–295.
36. Pompili M, Masocco M, Vichi M, Lester D et al. Suicide amond Italian adolescents: 1970-2002.Eur Child Adolesc Psychiatry 2009;18:525–533.
37. Shaw D, Fernandes J, Rao C. Suicide in children and adolescents: A 10-year retrospective review. American J Forensic Medicine Pathology 2005;26(4):309-315.
38. Ávila L, Ventura C, Barroso A, Aracena B et al. Las lesiones por causa externa en México. Lecciones aprendidas y desafíos para el sistema de salud. (Perspectivas en Salud Pública, Sistemas de Salud). Ciudad de México/Cuernavaca: Instituto Nacional de Salud Pública; 2010.
39. Freuchen A, Kjelsberg E, Grøholt B. Suicide or accident? A psychological autopsy study of suicide in youths under the age of 16 compared to deaths labeled as accidents. Child Adolesc Psychiatry Ment Health 2012;30(6):1-12.
40. Agerbo E, Nordentoft M, Bo M. Familial, psychiatric, and socioeconomic risk factors for suicide in young people: nested casecontrol study. BMJ 2002;325(13):74-77.
41. Blanes S. Conductas autolesivas en niños: Suicidio y parasuicidio. Su diferenciación. [Consultado: 3 agosto 2013]. URL Acceso: http://psicologiajuridica.org/psj213.html
42. Ladrón de Guevara S. El desarrollo cognoscitivo como determinante del origen del concepto de muerte. Procesos Psicológicos y Sociales Vol. 2 Año 2006 No. 1. [Consultado: 3 agosto 2013]. Acceso:http://www.uv.mx/psicologia/files/2013/06/El-desarrollo-cognoscitivo.pdf
43. Dervic K, Brent D, Oquendo M. Completed suicide in childhood. Psychiatric Clinics North America 2008;31(2):271-291.
44. Ganz D, Sher L. Adolescent suicide in New York City: plenty of room for new research. Int J Adolesc Med Health 2011;24(2):99-104.
45. Pitman A, Krysinska K, Osborn D, King M. Suicide in young men. Lancet 2012;379:2383-2392.
46. Skinner R, McFaull S. Suicide among children and adolescents in Ca-

nada: trends and sex differences, 1980–2008. CMAJ 2012;184(9):1029-1034.

47. **Uzun I, Karayel F, Akyıldız E, Turan A et al. Suicide among children and adolescents in a province of Turkey. J Forensic Sci 2009;54(5):1097-1100.**
48. **Reyna M, Vázquez G, Valdespino E. Revisión de la conducta suicida en el sur del Estado de México. Med Int Mex 2013;29:257-264.**
49. **Portzky G, Audenaert K, Heeringen K. Suicide among adolescents: A psychological autopsy study of psychiatric, psychosocial and personality-related risk factors. Soc Psychiatry Psychiatr Epidemiol 2005;40:922–930.**
50. **Holder D, James K, Bridgelal R, Bailey A et al. Suicide among adolescents in Jamaica: What do we know? West Indian Med J 2012;61(5):516-520.**
51. **Cano F, Rico A, Marín R, Blanco M et al. Suicidio en menores de 26 años en Sevilla. Cuad Med Forense 2012;18(2):55-62.**
52. **Breiding M, Wiersema B. Variability of undetermined manner of death classification in US. Injury Prevention 2006;12(Supl II):ii49–ii54.**

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