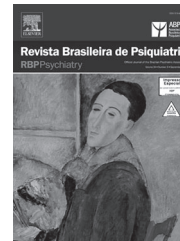




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ORIGINAL ARTICLE

Suicide rates and trends in São Paulo, Brazil, according to gender, age and demographic aspects: a joinpoint regression analysis

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DESCRIPTORS

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Abstract

Objective: To evaluate suicide rates and trends in São Paulo by sex, age-strata, and methods. **Methods:** Data was collected from State registry from 1996 to 2009. Population was estimated using the National Census. We utilized joinpoint regression analysis to explore temporal trends. We also evaluated marital status, ethnicity, birthplace and methods for suicide. **Results:** In the period analyzed, 6,002 suicides were accrued with a rate of 4.6 per 100,000 (7.5 in men and 2.0 in women); the male-to-female ratio was around 3.7. Trends for men presented a significant decline of 5.3% per year from 1996 to 2002, and a significant increase of 2.5% from 2002 onwards. Women did not present significant changes. For men, the elderly (> 65 years) had a significant reduction of 2.3% per year, while younger men (25-44 years) presented a significant increase of 8.6% from 2004 onwards. Women did not present significant trend changes according to age. Leading suicide methods were hanging and poisoning for men and women, respectively. Other analyses showed an increased suicide risk ratio for singles and foreigners. **Conclusions:** Specific epidemiological trends for suicide in the city of São Paulo that warrant further investigation were identified. High-risk groups - such as immigrants - could benefit from targeted strategies of suicide prevention.

DESCRITORES:

Suicídio;
 Brasil;
 Epidemiologia;
 Análise de regressão;
 Saúde pública;
 Grupos de alto risco.

Taxas de suicídio e tendências em São Paulo, Brasil, de acordo com gênero, faixa etária e aspectos demográficos

Resumo

Objetivo: Avaliar as taxas de suicídio e as tendências em São Paulo por gênero, faixa etária e métodos. **Métodos:** Dados de mortalidade foram coletados a partir de bases de dados da Prefeitura de São Paulo de 1996-2009. A população total foi estimada utilizando dados do Censo Nacional. Utilizamos o programa *Joinpoint regression analysis* para explorar tendências temporais. Também avaliamos estado civil, etnia, local de nascimento e métodos de suicídio. **Resultados:** No período, ocorreram 6.002 suicídios, uma taxa de 4,6 por 100.000 habitantes (7,5 em homens e 2,0 em mulheres), a relação masculino-feminino foi cerca de 3,7. Tendências de suicídio para os homens apresentaram uma queda significativa de 5,3% por ano entre 1996 e 2002, e um aumento significativo de 2,5% ao ano a partir de 2002. Mulheres não apresentaram alterações significativas na tendência. Para os homens, os idosos (> 65 anos) tiveram uma redução significativa de 2,3% ao ano, enquanto os homens mais novos (25-44 anos) apresentaram um aumento significativo de 8,6% ao ano a partir de 2004. Mulheres não apresentaram alterações significativas na tendência por faixa etária. Principais métodos de suicídio foram enforcamento e envenenamento, para homens e mulheres respectivamente. Outras análises mostraram um aumento do risco relativo ao suicídio para os solteiros e estrangeiros. **Conclusões:** Foram identificadas tendências epidemiológicas específicas do suicídio na cidade de São Paulo que merecem uma investigação mais aprofundada. Grupos de alto risco - como os imigrantes - poderiam se beneficiar com estratégias focalizadas na prevenção do suicídio.

Introduction

Suicide is the fourth leading cause of death among those aged 15-44 years worldwide¹ and one of the ten leading causes of death for all ages, representing an annual global mortality rate of 16 per 100,000 inhabitants. According to a World Health Organization (WHO) report, suicide rates might double until 2020, taking into account trends from recent years and also the ageing of the population.²

Brazil as well as the city of São Paulo have a suicide rate around five per 100,000,³ which is low compared to other countries, including neighboring Argentina (7.9 deaths per 100,000) and Uruguay (15.8).⁴ In Brazilian urban centers, though, the rates vary from 5 to 15 per 100,000. There is also wide variation when considering different subgroups.⁵ In fact, Brazil has almost 200 million inhabitants who present very heterogeneous demographic and socio-cultural characteristics. Thus, estimating trends for specific regions in Brazil is not straightforward as there is too much variance in the population that composes the country. Therefore, from an epidemiological perspective, specific locations should be analyzed separately as to better estimate their specific trends.

São Paulo - Brazil's largest city - is also the world's 6th largest city, with a population of more than ten million people. It is a rich city, although with important social inequalities. Historically, the city received massive African and European population migration between 1600 and 1850, European immigration from 1850 to 1950 and Asian immigration during the first decades of the 20th century, whereas in the last decades, South American immigration, thus composing a multi-ethnic population. Several studies on suicide were performed in São Paulo during the past 130 years,⁵⁻¹⁰ showing that suicide rates varied from 4 to 12 per 100,000 in the period. This wide range

of suicide rates over time fomented us to analyze this issue using appropriate analyses for temporal trends. However, these studies had some limitations such as the lack of quality in death reporting (which was improved only recently) as well as the estimation of temporal suicide trends without using regression analyses and probabilistic estimates (i.e., based only in adjusted suicide rates).

Therefore, our aims were: (I) to update and identify trends in mortality by suicide in the city of São Paulo from 1996 to 2009, according to age, sex, marital status, race and country of origin; (II) to identify groups of higher suicide risk.

Methods

The setting

The city of São Paulo is crossed by the Tropic of Capricorn and has an area of 1,525 km². According to 2010 National Census data, it has 11.2 million inhabitants, with an elevated degree of urbanization.

Data

Suicide mortality data were extracted from the PRO-AIM (*Programa de Aprimoramento das Informações de Mortalidade*) registry database. PRO-AIM was created by São Paulo City Hall, in 1989, with the aim of providing the information necessary to mortality health diagnosis, epidemiological surveillance and evaluation of health services.

All deaths with suspicion of suicide undergo forensic autopsy and, when confirmed, are coded according to the Tenth revision of International Classification of Diseases and Deaths (ICD-10). In our review, we used the codes that correspond to "intentional self-harm" (X60-X84).

The total number of inhabitants of São Paulo for the study period was based on the National Census Data and estimates from SEADE (*Sistema Estadual de Análise de Dados*) Foundation, both available on the PRO-AIM database.

The crude suicide rates (number of suicides divided by total population) were estimated for each year taking into consideration the number of deaths from PRO-AIM and the estimated population size in each year, provided by SEADE.

Data analysis

We used the Joinpoint Regression Program 3.4.3 software (developed by the National Cancer Institute, USA) to identify and estimate points of inflection in suicide rate trends. This is a relatively new software¹¹ initially used in cancer research to identify secular mortality trends. This software has been used in several studies to evaluate temporal trends in mortality rates, e.g. coronary heart disease and suicide. In recent years, it has been applied in psychiatric studies to evaluate time trends of suicide in Italy, Scotland, Taiwan, England and Wales,¹²⁻¹⁴ though not much explored in Brazilian studies. It uses Monte Carlo methods, which perform repeated random sampling of inputted data to compute results, which is useful when dealing with random oscillation of outcomes that is an issue for temporal analyses. This method also acknowledges annual percent change (APC) estimates and, thus, provides a more precise trend mortality estimate than traditional, non-probabilistic statistics.

Statistically, Joinpoint regression analysis is a log-linear, Poisson regression that applies Monte Carlo permutation test to identify points where the trend line changes significantly in magnitude or in direction. The analysis starts with the minimum number of joinpoints (a zero joinpoint, which is a straight line) and tests whether one or more joinpoints are significant and must be added to the model (a maximum of 3 joinpoints were allowed). In the final model, each joinpoint (if any were detected) indicates a significant change in the slope. Conversely, no joinpoints indicate that the slope

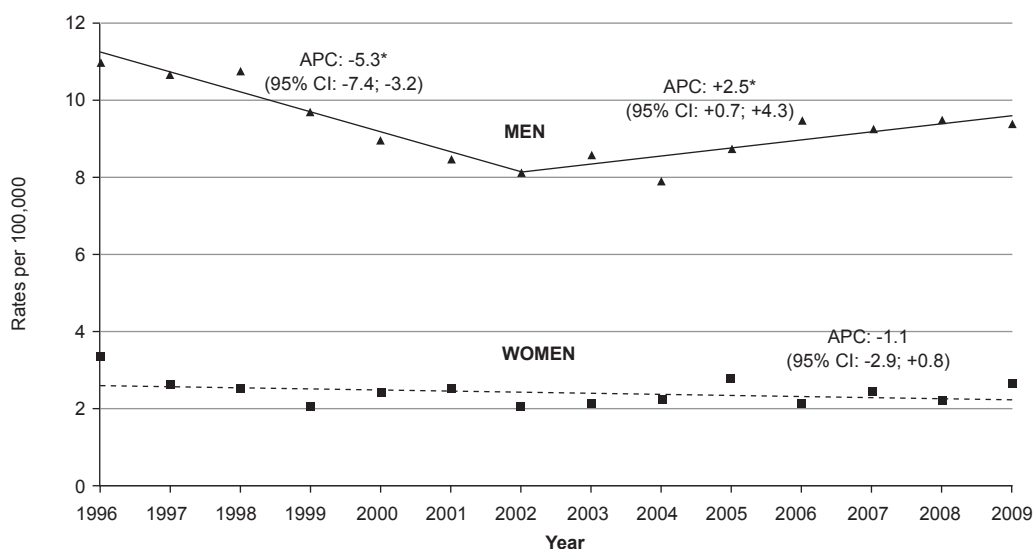
has not varied significantly. The permutation test, which estimates the optimal number of joinpoints, was applied after all analyses at a significance level of 0.05.¹⁵ The annual percentage change (APC) and 95% Confidence Interval (CI) is calculated for the time segments on either side of inflection points.

As several aspects in suicide differ between genders, all analyses were performed separately for men and women. To check for temporal trends by gender, we calculated the overall suicide rates for men and women using direct standardization. This approach adjusts crude rates according to the age distribution of one external, arbitrarily-defined population (in this case, WHO standard population) and it is useful to compare populations of different cities or countries (16). We also performed subgroup analyses for age (divided in four strata: 15-24, 25-44, 45-64 and 65 years),¹² suicide method (five groups: hanging, jumping, poisoning, firearm and undetermined), marital status (three categories: single, married and divorced/widower), race (four categories White, Black, Mixed [White and Black, a.k.a. "mulatto" or "pardo"] and Asian) and country of origin (immigrants were grouped in three categories from Asia, Europe and Latin America).

Results

The overall and crude suicide rates in the city of São Paulo from 1996 to 2009 were 4.63 per 100,000 inhabitants, 7.5 for men and 2.04 for women. The standardized, or age-adjusted rates, were 4.58, 7.61 and 1.99, respectively. The adjusted suicide rates for men presented a significant decline of 5.3% per year from 1996 to 2002, and a significant increase of 2.5% per year from 2002 onwards. Women did not present significant trend changes (Figure 1). We also observed that men had more than threefold risk of dying by suicide than women.

Analyses according to age-strata are shown in Table 1. For men, there was a significant reduction in trends of suicide rates in the older strata: in the elderly (> 65 years) the APC



*Statistically significant.

Figure 1 Suicide age-adjusted mortality rates by gender in the city of São Paulo, 1996-2009.

Table 1 Suicide mortality trends by age-strata and gender, Sao Paulo 1996-2009: joinpoint analysis

Ages	Period	Men		Women		
		APC	95% IC	Period	APC	95% IC
Age-adjusted**	1996-2002	-5.3*	(-7.4 to -3.2)	1996-2009	-1.1	(-2.9 to 0.8)
	2002-2009	+2.5*	(0.7 to 4.3)			
Overall crude	1996-2002	-5.3*	(-7.6 to -3.0)	1996-2009	-0.9	(-2.8 to 1.0)
	2002-2009	+2.9*	(0.9 to 4.9)			
15-24	1996-2009	-0.3	(-2.4 to 1.8)	1996-2009	-0.7	(-3.8 to 2.6)
25-44	1996-2004	-4.6*	(-7.3 to -1.8)	1996-2009	-1.2	(-3.2 to 0.9)
	2004-2009	+8.6*	(2.4 to 15.2)			
45-64	1996-2009	-2.4*	(-3.7 to -1.0)	1996-2009	-0.6	(-3.2 to 2.1)
65+	1996-2009	-2.3*	(-4.5 to -0.1)	1996-2009	-2.0	(-6.9 to 3.1)

*Significantly different from 0%;

**Adjusted: World Health Organization standard population;

APC: Annual Percentage Change.

Table 2 Deaths and suicide rates in São Paulo, according to marital status, race and country of origin

Marital Status* 1996-2008	N (%)	Rate**	Risk ratio	95% CI
Married	2,006 (32.4)	3.7	1	(reference)
Divorced/widower	740 (12.0)	5.1	1.38	(1.26 to 1.50)
Single	3,195 (51.7)	7.2	1.97	(1.86 to 2.09)
Unidentified	244 (3.9)	-		
Total	6,185 (100)	-		
Race*** 1998-2008				
Mixed	1,072 (22.1)	3.2	1	(reference)
White	3,302 (68.2)	4.4	1.38	(1.29 to 1.48)
Black	276 (5.7)	4.0	1.26	(1.10 to 1.43)
Asian	98 (2.0)	5.4	1.70	(1.38 to 2.09)
Not informed	95 (2.0)	-		
Total	4,845 (100)	-		
Country of origin 2002-2008				
Brazil	3,260 (96.9)	4.4	1	(reference)
All countries ¹	104 (3.1)	11.8	2.71	(2.24 to 3.29)
Europe ²	65 (1.9)	12.1	2.78	(2.18 to 3.56)
Latin America ³	11 (0.3)	9.5	2.18	(1.21 to 3.94)
Asia ⁴	28 (0.9)	13.0	2.99	(1.06 to 4.34)
Total	3,364 (100)	-		

*National Census (IBGE, 2000); **Rates per 100,000; ***According to São Paulo Metropolitan Area (IBGE & SEADE, 2000).

¹ All countries include Europe, Latin America, Asia;² Europe includes Denmark, France, Germany, Greece, Hungary, Italy, Poland, Portugal, Spain, United Kingdom, and Middle-Eastern;³ Latin America includes Argentina, Bolivia, Mexico, Uruguay, and Venezuela;⁴ Asia only includes China, Korea, and Japan.

was -2.3 (95% CI = -4.5 to -0.1) and in men between 45-64 years the APC was -2.4 (95% CI = -3.7 to -1). The suicide rates in the younger strata (15-24 years) remained stable (APC = -0.3 [95% CI = -2.4 to 1.8]) during the time period. Finally, the suicide rates for men aged 25-44 years-old decreased 4.6% (95% CI = -7.3 to -1.8) yearly from 1996 to 2004, when it reached its nadir, thereafter increasing 8.6% yearly

(95% CI = 2.4 to 15.2) until 2009. For women (Table 1), we observed that all age strata presented small decreases in mortality (ranging from -0.6 to -2.0% per year), although in none the changes were statistically significant. Nonetheless, in 1996 the oldest age strata represented the highest suicide rates, whereas in 2009 women ageing between 45-64 years had the highest rates.

Proportional mortality of suicide methods also varied according to gender from 1996-2009. For men, the most common method was hanging (Figure 2A), with a significant increase during the period analyzed (APC = +2.1; 95% CI = +0.9 to +3.2). Firearm was in the second place with no significant variation. Jumping and poisoning presented similar portions, the first showing a significant increase during the period analyzed (APC = +14.4; 95% CI = +9.3 to +19.8), the second showed a significant increase during 1996 to 2001 (APC = +42.7; 95%CI = +17.1 to +73.9). Conversely, for women the most common method was poisoning (Figure 2B), which significantly increased during all the evaluated period (APC = +7.1; 95% CI = +3.7 to +10.7), followed by hanging whose trends did not change during the evaluated period. Jumping was third place and presented a significant increase during the time frame (APC = +10.6; 95% CI = +6.5 to +14.9). Finally, undetermined methods significantly decreased for

both genders. For men, there were two segments, from 1996 to 2005 (APC= -8.2; 95%CI= -11.1 to -5.2) and from 2005 to 2009 (APC = -28.4; 95% CI = -35.9 to -20.0). For women, there was a single segment during the evaluated period (APC = -11.6; 95% CI = -14.9 to -8.2).

We also performed analyses for other variables including marital status, race and region of origin (Table 1). Compared to married people, divorced/widowers and singles showed a higher risk (1.38 [95% CI = 1.26 to 1.50] and 1.97 [95% CI = 1.86 to 2.09], respectively). Considering race, we observed a higher risk ratio for Asian (1.70 [95% CI = 1.38 to 2.09]), White (1.38 [95% CI = 1.29 to 1.48]), Black (1.26 [95% CI = 1.10 to 1.43]) and when compared to Mixed (reference category). Finally, foreigners had a two-fold higher risk ratio than Brazilians, being of 2.99 (95% CI = 1.06 to 4.34) for those born in Asia, 2.78 (95% CI = 2.18 to 3.56) for Europeans, and 2.18 (95% CI = 1.21 to 3.94) for Latin Americans.

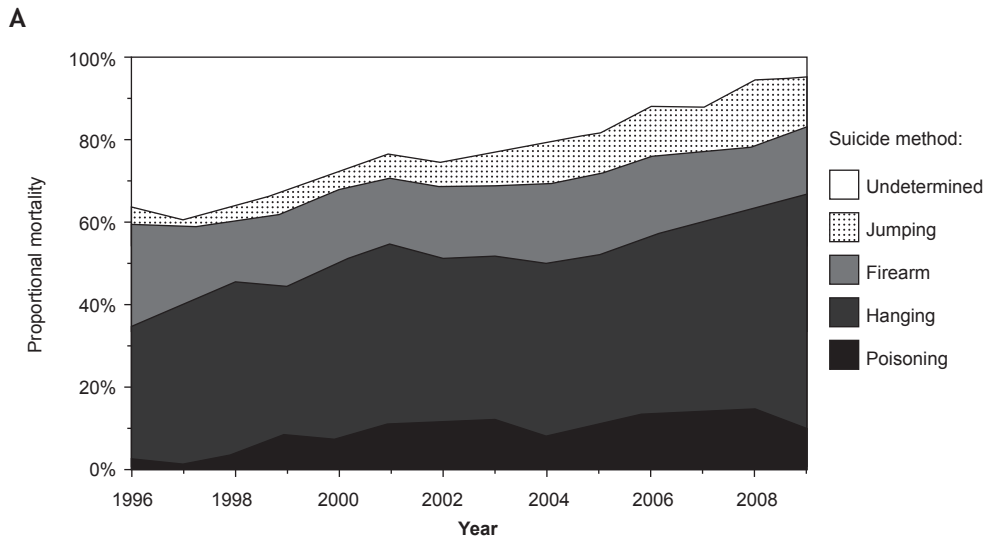


Figure 2A Methods for suicide among men from 1996 to 2009.

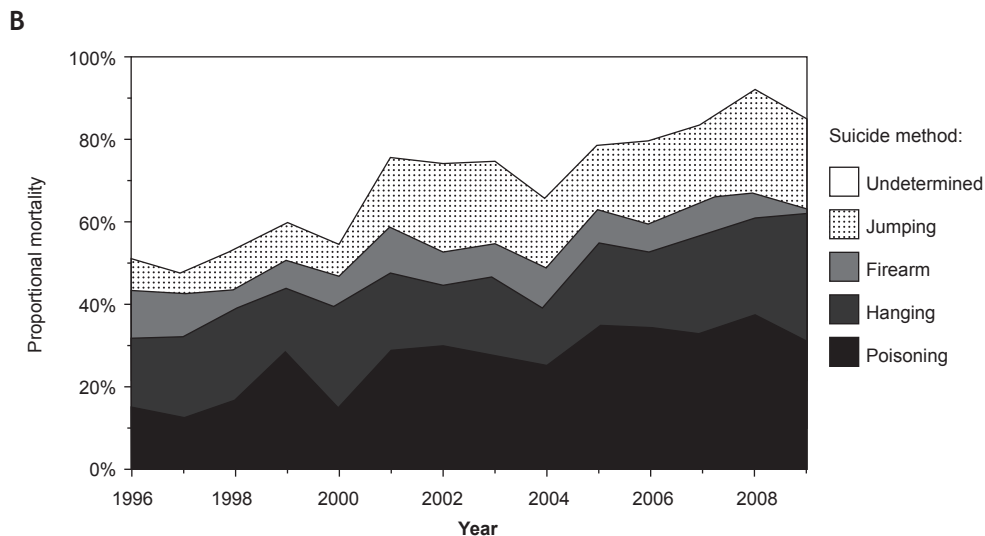


Figure 2B Methods for suicide among women from 1996 to 2009.

Discussion

Using descriptive data, our study found that the overall suicide rate in the city of São Paulo from 1996 to 2009 was 4.6 per 100,000 inhabitants. Men committed suicide three to four times more than women did. For men, suicide trends presented a significant decline of 5.3% per year from 1996 to 2002, and a significant increase of 2.5% per year from 2002 onwards. Women did not present significant trend changes. We also identified that, in the elderly (above 65 years), suicide rates presented a modest albeit steady decline trend. In fact, this group had the highest mortality rates for both genders in 1996, being outmatched by younger strata in 2009 (25-44 years for men, a subgroup that faced important increase in suicide mortality trends from 2004 onwards, and, for women, the 45-64 years strata whose rates remained constant in the last fourteen years). Moreover, we observed that most men committed suicide by hanging or firearm methods, whereas women mainly poisoned themselves, a method closely followed by jumping and hanging. Finally, we found that single and divorced/widower people (vs. married) had higher suicide risk ratio, as well as Asians, Whites and Blacks (vs. Mixed race) and foreigners (vs. Brazilian-born people).

In our study, we employed specific software built for temporal trend analysis (for a complete review, see Kim et al.¹¹). This method was primarily developed for analysis of cancer mortality rates during long time frames, although it has been also employed to identify mortality trends in other fields such as pulmonology and cardiology. This approach is particularly advantageous comparing to classic piecewise regressions, as it does not consider the regression functions to be constant at change points and, thus, is more sensible to identify changes in trend, especially when they are subtle. In the present study, we were able to identify recent changes in suicide trends, proving the usefulness of such analysis. Future studies in Suicidology could also benefit from it, especially for identifying more recent changes and planning public health policies.

In Brazil, recent studies that evaluated the same time frame^{17,18} had comparable findings for overall suicide mortality rates in Brazil (4 to 5.6 deaths per 100,000) and in the city of São Paulo (5.9 to 6.7 deaths). Mello-Santos et al.¹⁷ observed, in Brazil, a 20% increase in overall mortality from 1980-2000; with elderly presenting the highest rates.¹⁷ This was similar to Lovisi et al.¹⁸, that found a 29% overall increase in mortality from 1980-2006, also with a positive correlation between older age and higher rates. There was also a wide variation in suicide rates throughout Brazilian regions, with highest rates (up to 10 per 100,000) in the South. *Vis-à-vis*, the suicide rate observed in ours and other studies in Brazil is lower than in other Latin American countries and much lower than in East European countries (up to 40 per 100,000 inhabitants).^{1,4}

We also observed a predominance of male (vs. female) suicides, similar as showed in most countries. Several putative reasons partially explaining this difference are higher alcohol abuse in men,¹⁹ men choosing more lethal methods for suicide²⁰ and women coupling better with mental illness, thus looking for psychiatric services earlier than men.²¹ One important exception is China, where rates are higher among women than men, which might be explained by the soaring rate of suicide among young women in rural regions¹ (vs.

the worldwide trend of higher rates in older men in urban regions) and the higher prevalence of schizophrenia in women than men in China (a condition that increases in 24-fold the suicide risk and is more common in men in most countries).²²

Regarding age, we observed an important declining trend in elderly of both genders and also that, in 2009, younger groups had the highest suicide rates. This is contrary to classic observations in Suicidology that account for the highest rates among elderly, with putative reasons being comorbidity with physical illness, late-life depression and higher rates of complete suicides in elderly attempters (due to poor overall health and/or acceptance/complicity of caregivers of those severely infirmed). In addition, we found an increasing trend for suicide among adult men in the past five years. Nonetheless, other studies in the same time frame also observed a significant increase in suicide among men aged 20-59 years old in most Brazilian states,²³ and also in men aged 15-24 years old in the city of São Paulo.¹⁸ Such dual pattern of decreasing in elderly / increasing in younger strata for men has also been observed in the last decade for other countries²⁴ such as the U.S.,²⁵ Northern Ireland²⁶ and Scotland.¹³ The decreasing in the elderly strata can be attributed to some reasons such as: improved treatment of late-life mental disorders, increased life expectancy and development of better social retirement plans over the past decades; the increasing in suicide of younger men could be related to less religious support,²⁷ increased number of divorces,²⁸ higher proportion of youths living with stepparents or single parents,²⁹ a higher unemployment rate,³⁰ and substance abuse.²⁹

Suicide methods are influenced by cultural aspects and social dissemination of the method (for instance, charcoal burning was “created” in Hong Kong in the late ‘90s and is now the leading method of suicide death in several Asian countries by younger people,³¹ while being virtually non-existent in the Western world), accessibility to the method (e.g. less gunshot suicides where firearms are restricted, less drowning in the countryside etc.) and subjacent psychopathology (e.g. jumping is more associated with schizophrenia than depression³²). Nonetheless, men tend to choose more and women less lethal, violent and disfiguring means.³³

Suicide methods also vary over time: for instance, in the city of São Paulo, gunshot and poisoning were the leading methods in the late 19th and early 20th Century, for both genders.⁵⁻⁷ During the ‘50s, poisoning became the most common method for both sexes.⁹ From then onwards, poisoning remained the leading suicide method for women (although hanging appears as the leading method in one 1991 study), whereas, for men, the leading methods varied from poisoning to firearm in the ‘60s and ‘70s and to hanging from then onwards.⁸⁻¹⁰ Importantly, our study showed decreasing rates regarding undetermined methods for suicide for both genders, thus suggesting an improvement on quality ascertainment of suicide deaths.

We also observed that the suicide risk is higher among singles and the divorced/widowers, compared to married people. Indeed, being married seems to be a protective factor against suicide,¹ according to epidemiological data observed in Brazil¹⁸ and worldwide.^{27,34} Such relationship might be partially explained considering that being single or divorced is associated with major depression³⁵ and schizophrenia,³⁶

psychiatric conditions with increased suicide risk; and divorce and mourning are stressful life events, which might in turn precipitate suicidal attempts.

In addition, we observed that people with Asian, White and Black ethnic background had increased risk rates compared to Mixed people. Here, such results must be interpreted with caution as “race” classification is based on subjective reporting. Thus, “race” refers more to a socio-cultural construct rather than genetic ancestry and the differences here observed must be interpreted in this context, involving other variables such as income inequality and social disadvantage, which was not evaluated in the present study. Interestingly, our findings are in marked contrast with the U.S., where White present suicide rates three times higher than Asians, Hispanics and Blacks (14.4 vs. 6.2, 5.4 and 5.1, respectively).³⁷ Although Brazil and U.S.A. have a huge, multi-ethnic population, in the U.S. the concept of “race” translates to more overt socio-cultural differences, while in Brazil this issue is more covert and varies among different regions.

Nevertheless, higher rates in the Asian race and immigrants could be linked with some aspects of oriental culture, such as religiosity and moral values. The World Health Organization “Self-directed Violence” report¹ stated that religion presents an important factor in suicidal behavior, not only in countries where religious practices are prohibited or strongly discouraged, but also in regions where Buddhism, Hinduism or other Asian religions are predominant. Remarkably, ancient Confucian concepts such as loyalty, honor and filial piety, continue to exert an influence in Asia countries and could influence suicidal behavior.³⁸

Regarding place of birth, we observed that foreigners had a greater risk of suicide than Brazilians. Interestingly, previous studies from the turn of the 19th century also showed increased suicide risk for foreigners in São Paulo.^{6,7} We also identified such trend in our study. In fact, immigration is a known suicide risk factor as observed in many countries;¹ for instance, a meta-analysis of 33 studies from 50 nationalities in seven host countries found strong association of immigration and suicide.³⁹ Possibly, acculturation stress may result in a delay in help seeking and increasing the likelihood of suicide. In addition, recent immigrants are more likely to present psychotic episodes,⁴⁰ which are linked to suicide; also, immigrant refugees are more likely to present serious mental disorder and, thus, commit suicide. Social disadvantage is another putative reason for explaining increased suicide risk in immigrants. Importantly, the city of São Paulo shelters around 200,000 immigrants, which could be, according to our data, a high risk group for suicide and thus for developing prevention strategies.

Limitations

This study has some limitations. Its ecological design hinders subject-based analysis and, thus, it should be intended as to generate hypotheses to be verified in further studies as well as to identify socio-demographic trends. Another issue is data quality. Although PRO-AIM provides a complete, extensive record of mortality in the city of São Paulo, it still depends on medical diagnosis. Relatives of the victim might compel the attending physician to substitute a “suicide” diagnosis for an alternative one, for several reasons (such as religious and

legal). However, this type of bias is common in Suicidology and, although it can underestimate absolute rates, it does seem to exert considerable bias in temporal trends.

Conclusion

Suicide is an important cause of mortality worldwide including Brazil. Epidemiological analysis is an important tool to identify population subgroups at increased risk for suicide, thus helping to develop prevention and sentinel strategies for high-risk groups. Using joinpoint regression analysis, we showed a declining trend of the male suicide rate of 5.3% per year from 1996 to 2002, and a significant increase of 2.5% from 2002 onwards. Women did not present significant trend changes. Differently than observed in previous studies, subgroup analyses disclosed that, while suicides are declining in the elderly, they are increasing in adults of both genders. Moreover, in agreement with previous studies, we confirmed higher suicide rates for singles, men and immigrants. In addition, we observed that hanging and poisoning were the leading causes of death by suicide in men and women, respectively. To conclude, we identified some epidemiological trends for suicide in the city of São Paulo that warrant further investigation. This issue should be investigated by non-ecological approaches, for instance - (1) active surveillance of adult men at high-suicide risk; and (2) “psychological autopsy” (a qualitative approach that assesses psychosociological characteristics of individuals that committed suicide, which may strengthen the understanding of the suicide behavior) for individuals at high-risk groups. In clinical practice, the results of this study should be applied together with known psychiatric risk factors for suicide, thus being more accurate in monitoring and intervening high-risk patients. Moreover, the present study stresses the need for monitoring specific groups - such as immigrants, Asians, singles and adult men - that present a high risk for suicide. Preventive efforts - e.g., dial-up, hotline services for individuals at critical, imminent suicide attempt - could also play a role. Finally, another way to buffer the risk of suicide would be controlling access to the main methods used like firearms, poisons and high places.

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* Modest

** Significant

*** Significant. Amounts given to the author's institution or to a colleague for research in which the author has participation, not directly to the author.

References

- WHO. World report on violence and health: Self-directed violence. Geneva, 2002 [3 Feb 2011.]; Available at: [http://www.who.int/violence_injury_prevention/violence/global_campaign/en/chap7.pdf].
- Bertolote JM, Fleischmann A. Suicidal behavior prevention: WHO perspectives on research. *Am J Med Genet C Semin Med Genet.* 2005;133C(1):8-12.
- Bando DH, Scrivani H, Morettin PA, Teng CT. Seasonality of suicide in the city of Sao Paulo, Brazil, 1979-2003. *Rev Bras Psiquiatr.* [Research Support, Non-U.S. Gov't]. 2009;31(2):101-5.
- WHO. Suicide. 2010 [updated August 2011]; Available at: [<http://www.who.int/topics/suicide/en/>].
- Ramos R, Barbosa V. Estudos sobre a mortalidade por suicídio. I - Discussão sobre seu valor como indicador do nível de saúde mental. II - A mortalidade por suicídio no Município de São Paulo. *Arq Fac Hig S Paulo.* 1965;19(1-2):33-66.
- Alencar F. O suicídio em São Paulo: estudo médico-legal. São Paulo: School of Medicine and Surgery of São Paulo; 1926.
- Alvim JF. Contribuição ao estudo do suicídio em São Paulo. *Arq Soc Med Legal e Criminologia de São Paulo.* 1927:30-44.
- Barbosa V. Estudo descritivo do suicídio no Município de São Paulo (Brasil) - 1959 a 1968. *Rev Saude Publica.* 1974;8:1-14.
- Mello-Jorge MHP. Mortalidade por causas violentas no município de São Paulo, Brasil. III-mortes intencionais. *Rev Saude Publica.* 1981;15:165-93.
- Gawryszewski VP. A mortalidade por causas externas no Município de São Paulo. [MSc thesis] São Paulo: Universidade de São Paulo; 1995.
- Kim HJ, Fay MP, Feuer EJ, Midthune DN. Permutation tests for joinpoint regression with applications to cancer rates. *Stat Med.* 2000;19(3):335-51.
- Vichi M, Masocco M, Pompili M, Lester D, Tatarelli R, Vanacore N. Suicide mortality in Italy from 1980 to 2002. *Psychiatry Res.* 2010;175(1-2):89-97.
- Stark C, Stockton D, Henderson R. Reduction in young male suicide in Scotland. *BMC Public Health.* 2008;8:80.
- Thomas K, Chang SS, Gunnell D. Suicide epidemics: the impact of newly emerging methods on overall suicide rates - a time trends study. *BMC Public Health.* 2011;11:314.
- National Cancer Institute. Joinpoint regression Program, version 3.4.3. 2010 [April 2010.]; Available at: [<http://surveillance.cancer.gov/joinpoint/>].
- Ahmad OB, Boschi-Pinto C, Lopez A, Murray C, Lozano R, Inoue M. A new WHO standard population. Age standardization of rates: a new WHO standard. *GPE Discussion Paper Series: Geneva, World Health Organization.* 2001;31.
- Mello-Santos C, Bertolote JM, Wang YP. Epidemiology of suicide in Brazil (1980-2000): characterization of age and gender rates of suicide. *Rev Bras Psiquiatr.* 2005;27(2):131-4.
- Lovisi GM, Santos SA, Legay L, Abelha L, Valencia E. [Epidemiological analysis of suicide in Brazil from 1980 to 2006]. *Rev Bras Psiquiatr.* 2009;31(Suppl2):S86-94.
- Schneider B. Substance use disorders and risk for completed suicide. *Arch Suicide Res.* 2009;13(4):303-16.
- Kanchan T, Menon A, Menezes RG. Methods of choice in completed suicides: gender differences and review of literature. *J Forensic Sci.* 2009;54(4):938-42.
- Lizardi D, Stanley B. Treatment engagement: a neglected aspect in the psychiatric care of suicidal patients. *Psychiatr Serv.* 2010;61(12):1183-91.
- Phillips MR, Yang G, Li S, Li Y. Suicide and the unique prevalence pattern of schizophrenia in mainland China: a retrospective observational study. *Lancet.* 2004;364(9439):1062-8.
- Brzozowski FS, Soares GB, Benedet J, Boing AF, Peres MA. Suicide time trends in Brazil from 1980 to 2005. *Cad Saude Publica.* 2010;26(7):1293-302.
- Liu KY. Suicide rates in the world: 1950-2004. *Suicide Life Threat Behav.* 2009;39(2):204-13.
- Hu G, Wilcox HC, Wissow L, Baker SP. Mid-life suicide: an increasing problem in U.S. Whites, 1999-2005. *Am J Prev Med.* 2008;35(6):589-93.
- Largey M, Kelly CB, Stevenson M. A study of suicide rates in Northern Ireland 1984-2002. *Ulster Med J.* 2009;78(1):16-20.
- Stack S. Suicide: a 15-year review of the sociological literature. Part II: modernization and social integration perspectives. *Suicide Life Threat Behav.* 2000;30(2):163-76.
- Baudelot C, Establet R. Suicide: The hidden side of modernity. Cambridge.: Polity Press.; 2008.
- Gunnell D, Middleton N, Whitley E, Dorling D, Frankel S. Why are suicide rates rising in young men but falling in the elderly? - a time-series analysis of trends in England and Wales 1950-1998. *Soc Sci Med.* 2003;57(4):595-611.
- Meneghel SN, Victora CG, Faria NM, Carvalho LA, Falk JW. [Epidemiological aspects of suicide in Rio Grande do Sul, Brazil]. *Rev Saude Publica.* 2004;38(6):804-10.
- Yip PS, Law CK, Fu KW, Law YW, Wong PW, Xu Y. Restricting the means of suicide by charcoal burning. *Br J Psychiatry.* 2010;196:241-2.
- Chen YY, Lee MB, Chang CM, Liao SC. Methods of suicide in different psychiatric diagnostic groups. *J Affect Disord.* 2009;118(1-3):196-200.
- Denning DG, Conwell Y, King D, Cox C. Method choice, intent, and gender in completed suicide. *Suicide Life Threat Behav.* 2000;30(3):282-8.
- Stack S. Gender, Marriage, and Suicide Acceptability: A Comparative Analysis. *Sex Roles.* 1998;38(7-8):501-20.
- Bulloch AG, Williams JV, Lavorato DH, Patten SB. The relationship between major depression and marital disruption is bidirectional. *Depress Anxiety.* 2009;26(12):1172-7.
- Salokangas RK, Honkonen T, Stengard E, Koivisto AM. To be or not to be married - that is the question of quality of life in men with schizophrenia. *Soc Psychiatry Psychiatr Epidemiol.* 2001;36(8):381-90.
- Crosby AE, Ortega L, Stevens MR. Suicides - United States, 1999-2007. *MMWR Surveill Summ.* 2011;60(Suppl):56-9.
- Chan WS, Law CK, Liu KY, Wong PW, Law YW, Yip PS. Suicidality in Chinese adolescents in Hong Kong: the role of family and cultural influences. *Soc Psychiatry Psychiatr Epidemiol.* 2009;44(4):278-84.
- Voracek M, Loibl LM. Consistency of immigrant and country-of-birth suicide rates: a meta-analysis. *Acta Psychiatr Scand.* 2008;118(4):259-71.
- Hutchinson G, Haasen C. Migration and schizophrenia: the challenges for European psychiatry and implications for the future. *Soc Psychiatry Psychiatr Epidemiol.* 2004;39(5):350-7.