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A proposal for using the ratio of attempted to completed suicides across several countries worldwide

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Abstract

Completed suicide (CS) is a leading cause of death worldwide and its rates are available for most developed countries. On the other hand, attempted suicide (AS) is a risk factor for CS but there are limited data on its rates in various countries. In constructing a ratio for AS/CS rates, most would agree that for CS, the denominator should be the annual suicide rate (per 100 000). As for the ratio's numerator (AS) per 100 000, there are three possible calculations: (1) annual prevalence from population surveys, (2) annual prevalence from national clinical registers or (3) lifetime prevalence from population surveys. We think that the first possibility would probably be the best choice but, unfortunately, surveys providing the annual prevalence of AS are lacking for most countries. Annual prevalence from national registers is also lacking for most countries and is contaminated by under-reporting. Therefore, in this editorial, we are left with only the last option, a ratio for lifetime prevalence of AS (per 100 000) divided by annual rate of CS (per 100 000). This ratio for AS/CS rates appears to differ substantially across countries worldwide but presents no big regional differences other than two remarkable exceptions, one per continent. In Europe, Spain and France had greater ratios (174.4 and 152.5, respectively) than Italy (64.1). In Asia/Pacific, New Zealand has a higher ratio (345.9) compared with China (75.8) and Japan (76.9). The ratio for AS/CS rates could be a good index for implementing evidence-informed decision-making regarding suicidal behaviour (SB) among health service managers, and for helping them in the allocation of health resources for the prevention of SB.

Completed suicide (CS) is a leading cause of death worldwide, particularly among young people (Patton *et al*., 2009). According to the World Health Organization (WHO), in 2015, there were 788 000 deaths worldwide by CS; this is equivalent to an annual global age-standardised suicide rate of 10.7 per 100 000 (WHO, 2015). While CS rates are usually provided by most developed countries, there are almost no national statistics on attempted suicide (AS) (Bertolote *et al*., 2005). Therefore, little is known about the worldwide burden of AS.

Lack of knowledge of AS rates is a concern because AS represents the most relevant risk factor for CS (Oquendo *et al*., 2006). Few authors have explored the relationship between AS and CS: (1) Anestis and Bryan compared the ratio of non-lethal AS to CS in the US military general population (Anestis and Bryan, 2013); and (2) Hawton *et al.* calculated a correlation coefficient between AS and CS in young people in various countries across Europe (Hawton *et al*., 1998). This editorial proposes a ratio of AS/CS rates which might assist health providers in better allocating the always-scarce resources directed towards fighting suicidal behaviour (SB), and open new avenues of research by comparing the ratio across countries.

In the current editorial, we aim to: (1) explore the difficulties in developing a ratio for AS/CS rates; (2) describe prior studies comparing AS and CS; (3) make a first attempt to calculate this ratio across several countries worldwide; (4) review its major limitations; and (5) explore its potential use.

Difficulties in developing a ratio of AS/CS rates

Developing a ratio of AS/CS rates is not easy. If one starts with the CS rates, one needs to acknowledge that there are no common criteria for certifying a death as a CS, and values and cultural beliefs about suicide still influence its registration (e.g. countries with majority Muslim populations tend to under-report CS (Hawton and van Heeringen, 2009)). As a matter of fact, Giner and Guija (2014) demonstrated that, between 2006 and 2010, the agency responsible for conducting autopsies in Spain provided higher rates of CS (per 100 000) than the demographic agency. In 2006, the rates were 7.85 *v.* 7.05, and in 2010, 7.61 *v.* 6.32, with an

average difference during these 5 years between these two rates of 0.97 (SD 0.10) (Giner and Guija, 2014).

If one focuses on AS, one finds that most developing countries do not have an adequate register and AS remains misclassified due to a mixture of obstacles (Vijayakumar *et al.*, 2005) including (1) nomenclature problems and (2) lack of homogeneity in AS rate reporting.

Regarding the first issue, even after the seminal work on nomenclature developed mainly by Silverman *et al.* and O'Carroll *et al.* (O'Carroll *et al.*, 1996; Silverman *et al.*, 2007), the concept of AS is more ambiguous than the more 'objective' concept of CS; thus, Borges *et al.* have stated that we 'lack a data-driven method to assess the risk of suicide attempts' (Borges *et al.*, 2010*a*). This lack of homogeneity in evaluating AS manifests in many countries' registries as an absence of national statistics (Christiansen and Jensen, 2004).

Regarding the lack of homogeneity of AS rate reporting, at present, we find three AS rates per 100 000 based on two parameters: (a) time schedule: either annual or lifetime; and (b) data source: either population surveys or clinical registers: (1) annual prevalence from AS population surveys, (2) annual prevalence from AS national clinical registers or (3) lifetime prevalence from AS population surveys. AS population surveys should provide the first and third rates. However, population surveys: (1) usually calculate lifetime AS prevalence and do not calculate annual prevalence (Welch, 2001); (2) are based on retrospective self-reporting information of SB that can be affected by recall bias and under-reporting; and (3) can vary in how the AS questions are formulated (Borges *et al.*, 2010*a*).

Annual prevalence of AS from national clinical registers underestimates AS rate by ignoring suicide attempters who are not seen by any health providers. In a Mexican study, the population survey provided an AS annual prevalence of 0.8%, while the clinical data indicated that only 0.13% were seen by health providers (Borges *et al.*, 2010*b*). A WHO study indicated that medical attention following a SA ranged in various countries from 22 to 88% (Bertolote *et al.*, 2005). Other sources of confusion in the estimation of AS rates are the use of different ways of targeting the population and diverse recruiting methodologies (Welch, 2001).

Despite all of these inconveniences, recent international studies are trying to provide better data on AS rates. The literature provides annual rates of 0.3% in developed countries (Borges *et al.*, 2010*a*), 0.4% in developing countries (Borges *et al.*, 2010*a*), 0.5% in the USA (ranging from 0.1 to 1.5) (Crosby *et al.*, 2011), and 0.46 and 0.045% in European females and males, respectively (Platt *et al.*, 1992; Schmidtke *et al.*, 2004).

The literature provides lifetime AS rates of 1.3% (or 1300 per 100 000) in six European countries (Bernal *et al.*, 2007), and 0.4–4.2% (or 400–4200 per 100 000) in an intervention study of ten countries (Bertolote *et al.*, 2005).

Prior articles exploring the greater frequency of AS *v.* CS

Reviews propose that AS is 10–40 times more frequent than CS (Platt *et al.*, 1992; Schmidtke *et al.*, 2004). In a more recent worldwide study, the authors reported a mean of 14.6 AS per each CS with a range of 9.1–53.7 (Borges *et al.*, 2010*a*). In 2015, the WHO provided a global age-standardised CS rate of 10.7 per 100 000 people (WHO, 2015). If it is correct that AS is 10–40 times higher than CS, the rate of AS should range between 107 and 428 per 100 000.

Our calculation of a ratio for AS/CS rates

We have described three possible ratios, depending on the numerator (AS), as the denominator (CS) is always the same (annual suicide rate per 100 000). The first possibility is using population surveys to obtain annual AS rates, which would probably be the best choice but, unfortunately, we lack information on AS annual rates for most countries worldwide. The same problem faces the second possibility: we could use clinical registers to obtain AS rates, but there are almost no AS registers with some notable national exceptions (Christiansen and Jensen, 2004). Thus, we are only left with the third possibility, which uses lifetime AS in the numerator and annual CS rates in the denominator. As the numerator uses lifetime rates and the denominator uses annual rates, the AS/CS ratio is probably inflated due to the different time schedules used (lifetime *v.* annual).

Table 1 and Fig. 1 summarise the values of the third ratio: lifetime AS/annual CS rates. Our numerators, the lifetime rates of AS per 100 000 were extracted from a WHO review (Nock *et al.*, 2008), which includes previous surveys carried out in the following continents (and countries): Africa (Nigeria and South Africa); the Americas (Colombia, Mexico, and the USA), Asia/Pacific (Japan, New Zealand and China), Europe (Belgium, France, Germany, Italy, the Netherlands, Spain and Ukraine) and the Middle East (Israel and Lebanon). The estimated global lifetime prevalence of AS was 2.7%. Although there were remarkable differences in prevalence cross-nationally, they found similar results between developed and developing countries. Our denominator (annual suicide rate per 100 000) for the ratio was extracted from the publicly available data from the WHO web page (http://apps.who.int/gho/data/node.sdg.3-4-data?lang=en). Given that it was not always possible to match data for AS and CS from the same year in some countries, we used the most proximate year with available AS and CS in each country.

Our AS/CS ratio ranged from 48.8 (Ukraine) to 750 (Mexico). We consider an AS/CS ratio >200 as 'high' (with low risk for lethality); high values were found in the Americas (Mexico, Colombia and the USA), Lebanon, South Africa, the Netherlands and New Zealand. We consider an AS/CS ratio <100 as 'low' (with high risk for lethality); low values were found in Nigeria, China, Japan, Italy and Ukraine. The countries with the lowest ratios, Japan and Ukraine, appear to have very high rates of CS. In Ukraine, tragic life events (wars and nuclear explosions), economic hardship and a high rate of alcohol abuse are some of the factors that have been pointed to as influencing the high rates of CS (Nordstrom, 2007). Japan has a social organisation strongly idiosyncratic when compared with Western developed countries. Devotion to authority, high sense of responsibility and honour, and the lack of religious taboos against CS make CS a culturally accepted tradition in Japan. Historically, hara-kiri has been considered an extreme but honourable way to put an end to personal crises (McCurry, 2006).

We observed no big regional differences in our ratio of AS/CS rates with two remarkable exceptions. In Europe, Spain and France had greater ratios (174.41 and 152.46, respectively) than Italy (64.1). This difference is difficult to explain because they are usually considered culturally similar countries. Low AS and CS rates characterise all three of these European countries, but both France and Spain appear to have more AS than Italy. If this difference is correct, one possible explanation is that Spain and France may have too many suicide attempters for their cultural background. Thus, health providers might consider investing

Table 1. Rate of suicide attempts and suicides, and AS/CS ratio in the general population in selected countries worldwide

Country	Suicide attempts per 100 000 (year, original source[a])	Suicides per 100 000[b] (year)	AS/CS ratio
Africa and the Middle East			
Lebanon	2000 (2002–2003, Lebanon)	3.1 (2005)	645.2
Nigeria	700 (2002–2003, (NSHMW)	9.6 (2005)	72.9
South Africa	2900 (2003–2004, SASH)	11.8 (2005)	245.8
Israel	1400 (2002–2004, NHS)	7.6 (2005)	184.2
Europe			
Germany	1700 (2001–2002, ESEMeD)	14.7 (2000)	115.
The Netherlands	2300 (2001–2002, ESEMeD)	9.8 (2000)	234.7
Belgium	2500 (2001–2002, ESEMeD)	22.7 (2000)	110.1
France	3400 (2001–2002, ESEMeD)	22.3 (2000)	152.5
Italy	500 (2001–2002, ESEMeD)	7.8 (2000)	64.1
Spain	1500 (2001–2002, ESEMeD)	8.6 (2000)	174.4
Ukraine	1800 (2002, CMDPSD)	36.9 (2000)	48.8
Asia			
China	1000 (2002–2003, WMH)	13.2 (2000)	75.7
Japan	1900 (2002–2003, WMH-J)	24.7 (2000)	76.9
New Zealand	4600 (2004–2005, NZMHS)	13.3 (2005)	345.9
The Americas			
Colombia	4700 (2003, NSMH)	6.7 (2005)	701.5
Mexico	2700 (2001–2002, M-NCS)	3.6 (2000)	750
USA	5000 (2002–2003, NCS-R)	11.3 (2000)	442.5

[a]The WMH Survey Initiative includes information from previous surveys carried out in selected countries: ESEMeD (The European Study Of The Epidemiology Of Mental Disorders); NSMH (The Colombian National Study of Mental Health); NHS (Israel National Health Survey); the World Mental Health (WMH) Survey; WMH-J (World Mental Health Japan Survey); M-NCS (The Mexico National Comorbidity Survey); NZMHS (New Zealand Mental Health Survey); B-WMH (The Beijing World Mental Health Survey); CMDPSD (Comorbid Mental Disorders during Periods of Social Disruption); NCS-R (The US National Comorbidity Survey Replication).
[b]For retrieving the rate of CS we used the publicly available data from the WHO web page (http://www.who.int/mental_health/prevention/suicide/suicideprevent/en/).

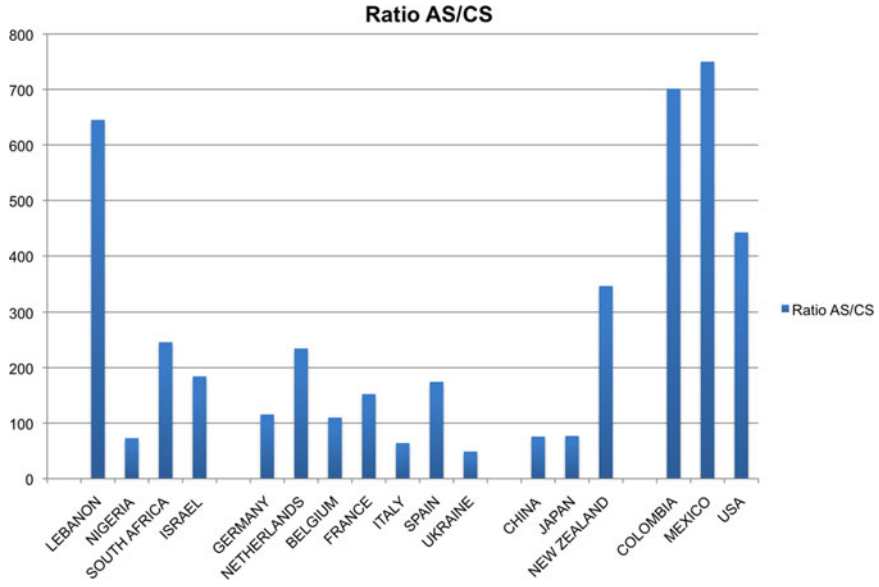

Fig. 1. Ratio AS/CS across several countries worldwide.

more money to preventing AS in France and Spain. In the Asia/Pacific area, New Zealand (345.9) has a much higher ratio compared with China (75.8) and Japan (76.9). These differences are probably explained by ethnic and cultural differences.

Major limitations in our ratio for AS/CS rates

Our limited attempt to develop a ratio has taught us about the absence of national statistics or registers on annual rates of AS

in most countries worldwide. By using lifetime rates instead of annual rates of AS, we are probably providing ratios that are too high. However, all countries faced the same limitation, thus making the data comparable across countries worldwide. In any case, there is an urgent need of spreading adequate national registers with homogeneous international criteria that allow better comparisons and allow us to estimate a ratio of AS/CS rates. Furthermore, there is still an important misclassification in CS registers, especially in developing countries (Vijayakumar *et al.*, 2005; Wei and Chua, 2008). Until that is resolved, we must be aware of potential biases when using the ratio of AS/CS rates in those countries. Finally, the potential use of our ratio of AS/CS rate to compare trends in SB in different age groups (see below) might be compromised because of the nature of the numerator (lifetime information). Thus, ratios are probably too high when using younger populations, as AS and CS are more and less frequent, respectively, in them. Reversely, our ratio of AS/CS will be lower in older populations. In the same way as expressed above, given that all countries would face the same limitation, the data will be comparable across countries worldwide.

Potential use of the ratio of AS/CS rates

We see potential for the ratio of AS/CS rates here proposed, despite its limitations and, more importantly, once a better version of the ratio can be calculated. The ratio may provide help regarding several issues related to the prevention of SB, such as: (1) improving the accuracy of comparing trends in SB between socially or geographically distinct groups (age, sexes, ethnicity, culture, etc.) and the exact magnitude and impact of SB (Giner and Guija, 2014); (2) identifying populations with high risk of fatal SB (low index), so that specific prevention programmes could be implemented; and (3) assisting governments in deciding where to allocate the mental health resources to prevent SB (either AS or CS, or both). Some have said that limited mental health resources are a reason for the high suicide rates in the West (https://www.wscos.org/in-the-news/2017/3/7/the-hidden-epidemic). But even in high-resource countries, resources allocated to suicide prevention are finite (McPhedran and Baker, 2012). How can a manager decide where to allocate these limited resources? To AS or CS? Or to both? For instance, there were significantly fewer suicides in regions with a lower ratio of psychiatric beds or a higher ratio of psychiatrists compared with residents in Japan (Nakanishi and Endo, 2017).

But even considering all these potential uses, the ratio by itself does not provide information on causality. In conclusion, we believe that the ratio of AS/CS rates here presented can be considered a first approximation for the development of a ratio of AS/CS rates using homogeneous and standardised data worldwide. This is a first step towards the development of a simple working tool potentially useful in helping health service managers make evidence-informed decisions when allocating resources to the prevention of SB, and generating hypotheses for future studies in this field.

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