Original Research

Predicting the natural suicide rate in Belgium

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Abstract: This paper presents results of a time series (1950-1997) and an ecological study of suicide and homicide in Belgium and its ten provinces. Study 1 was based on Durkheim's classic theory of suicide and Henry and Short's model of suicide and homicide. Study 2 calculated the 'natural suicide rate', i.e. suicide rate if the social conditions are made 'ideal' (zero divorce and unemployment rates). Study 1 found that the rates of suicide in Belgium over time were positively associated with unemployment and divorce rates, and negatively correlated with marriage and birth rates. On the level of provinces only population density and ethnicity correlated with suicide. Contrary to Henry and Short's theory, the homicide and suicide rates showed similar associations with social indicators. The natural suicide rate in Belgium was 12.1 per 100,000 (time series study) and 10.9 per 100,000 (ecological study). The studies supported the assumptions that the association between social variables and suicide differs depending on the aggregation level and even if the socio-economic conditions were made 'ideal' from the sociological point of view, the suicide rate in Belgium would still be positive and nonzero.

Belgium is a Western European country with a relatively high suicide rate and significant differences in the incidence of suicide among its three geographical and administrative regions: the northern Flemish region, the southern Walloon region, and the capital region of Brussels. The Belgian suicide rate rose from 12.9 per 100,000 per year in 1950 to 23.8 in 1984 before dropping to 18.0 in 1991 (Lester & Yang, 1998). In 2011 the suicide rate in Belgium was 19.0 per 100,000 with 2,084 self-inflicted deaths recorded, and the regional suicide rates for Flanders, Brussels, and Wallonia were 18.1 per 100,000, 13.0 per 100,000 and 22.6 per 100,000, respectively (Statistics Belgium, 2014). Two questions regarding the epidemiology of suicide in Belgium arise: which social indicators may be associated with the yearly suicide rate and could the suicide rate ever be zero?

Durkheim's (1897) classic theory of suicide proposed that decreases in social integration and social regulation would increase suicide rates. Based on Durkheim's theory it can be expected that high rates of divorce in a country will be associated with increases in the suicide rate since divorce decreases social integration and indicates a lack of social regulation. On the other hand, high rates of marriage and births would be associated with lower rates of suicide as they are related to higher social integration. Lester and Yang (1998) examined these associations by analyzing in a time-series study the suicide rate of a sample of 29 nations from 1950 to 1985. They found that divorce rates were a much more consistent correlate of suicide rates than were birth or marriage rates. Divorce rates were positively correlated with suicide rates for 22 of the 29 nations. Marriage rates were negatively correlated with suicide rates for 20 of these 29 nations, and the correlations between suicide and birth rates were also inconsistent: 12 of the correlations were positive and 17 correlations were negative. In case of Belgium, Lester and Yang (1998) found a significant positive correlation between suicide rates and divorce rates, while the correlation between suicide and marriage rates, and suicide and birth rates, was not significant. Other cross-sectional and longitudinal studies also demonstrated a positive correlation between divorce and suicide, indicating that the suicide rates of divorced people are often higher than the suicide rates of married people, and the higher the divorce rate, the higher the rate of suicide (Stack, 2000a). Using more recent time-series data, Lester and Yang (2013) also found that the unemployment rates in nations were accompanied by higher suicide rates, a result frequently reported in cross-sectional and longitudinal studies (Platt, 2011).

Although Durkheim's theory did not consider homicide, Henry and Short (1954) argued that homicide would show opposite associations to those for suicide. According to Henry and Short (1954), societies where external restraints and pressures on the citizens were strong would have higher homicide rates and lower suicide rates. Conversely, societies where external restraints and pressures were weak would have higher suicide rates and lower homicide rates. Lester (1989, 1995) explored the theories and empirical work suggesting that suicide and homicide may be generated by similar etiological factors differing only in the direction of aggression and concluded that there may be some merit in the suggestion.

According to Durkheim (1897), suicide rates are higher at very high and at very low levels of social integration and regulation. However, his theory did not stipulate that the suicide rate would be zero at intermediate levels of social integration and social regulation. Moreover, Maris (1981) speculated that the suicide rate could never be zero however ideal the socio-economic conditions were. Yang and Lester (1991, 2009) empirically explored the notion that the suicide rate of a society could never be zero (i.e., a 'natural suicide rate'), even if the social and economic conditions were made 'ideal' from the point of view of suicide, i.e., the country had no divorce and no unemployment (two well-established suicide risk factors). In a demonstration with thirteen nations, Yang and Lester (2009) showed, that, if divorce and unemployment rates were entered into a linear regression equation to predict the suicide rate over time, and then if these rates were set to zero, the regression equations still predicted a positive suicide rate for the nations[1].

Although the epidemiology of suicide in Belgium was studied extensively up to the 1990s (Linkowski, Martin, & De Maertelaer, 1992; Maes, Cosyns, Meltzer, De Meyer, & Peeters, 1993; Moens, Loysh, Honggokoesoemo, & van de Voorde, 1989; Moens, Loysch, & van de Voorde, 1988; Moens, van Oortmarssen, Honggokoesoemo, & van de Voorde, 1987), since 1997 no annual mortality data for the whole country have been available (Bossuyt & Van Casteren, 2007), and suicide mortality data have become available only for a few recent years, including 2005 (Statistics Belgium, 2014). The current study aims to fill in the gap in the literature and

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[1] It should be noted that this type of analysis is based on the assumption that the unemployment and divorce rates in the 'ideal' society would be zero. Other social indicators, such as birth or marriage rates, are not included in the estimation of the natural suicide rates as it is not possible to know what their values would be in an 'ideal' society, i.e., one which minimizes its suicide rate.

provide insights into the associations between social indicators and suicide (and homicide) in Belgium.

The present paper reports two studies. Study 1 explores the associations between the social indicators and suicide and homicide rates in Belgium (time series analysis over 1950-1997) and between the social indicators and the suicide rates in the ten provinces of the country (ecological study data for 2005). Based on the same data, Study 2 calculates the natural suicide rate for Belgium over 1950-1997 and for the ten provinces in 2005. Many sociological theories and models of suicide have been proposed since Durkheim's classic theory (Pescosolido & Rubin, 2000; Stack 2000a, 2000b) and Durkheim's theory itself has been a subject of scientific scrutiny and critique (Wray, Cohen, & Pescosolido, 2011). Nonetheless, in line with previous work (Lester & Yang, 1998; 2013), we have decided to apply the original concepts as developed by Durkheim (1897) and Henry and Short (1954). The present study focuses on both suicide and homicide rates in Belgium in order to explore the question whether the correlates of suicide rates are the same as or different from those of homicide rates.

Method

The suicide rates for Belgium in the time series study were obtained from www.who.int and from Lester and Yang (1998) for the period 1950 to 1997, the latest year for which the WHO data base had suicide rates for Belgium. Divorce, marriage and birth rates were obtained from the United Nations *Demographic Yearbook* (annual) and unemployment rates from the International Labour Office's *Yearbook of Labour Statistics* (annual).

In the ecological study the population and area of each province was obtained for the ten provinces of Belgium[2] (statoids.com/ube.html) for January 1, 2005. The number of unemployed for December 31, 2005, marriages and divorces for 2005, and suicide rates of the provinces for 2005 were obtained from Statistics Belgium (2014).

Analysis

SPSS 18.0 was used to calculate Pearson correlations between the variables and to run stepwise regressions. T-test was used to compare the suicide rates and social indicators between provinces in Flanders and in Wallonia. The study derived regression equations predicting the suicide rate of Belgium and of the ten provinces from the divorce and unemployment rates. Once the divorce and unemployment rates were set to zero the constant term provided an estimate of the natural suicide rate.

[2]Antwerp, East Flanders, Flemish Brabant, Hainaut, Liège, Limburg, Luxembourg, Namur, West Flanders and Walloon Brabant, (Brussels excluded).

Study 1: The Durkheimian Analysis

Results

The associations between the social indicators and suicide rates over time (time series) are shown in Table 1.

Table 1: Correlations over time (1950-1997) between social indicators and the suicide rate

	Year	Suicide rate			Homicide rate
		Total	Male	Female	Total
Correlations					
Unemployment	0.67*	0.80*	0.87*	0.60*	0.82*
Divorce rate	0.94*	0.83*	0.89*	0.65*	0.88*
Birth rates	-0.93*	-0.88*	-0.85*	-0.83*	-0.86*
Marriage rate	-0.87*	-0.78*	-0.86*	-0.58*	-0.80*
Year	-	0.85*	0.87*	0.74*	0.87*

* p < .001

It can be seen that all four social indicators were strongly associated with the suicide rate in the expected way. Years with higher divorce and unemployment rates had higher suicide rates, while years with higher marriage and birth rates had lower suicide rates. These associations are consistent with Durkheim's theory of suicide since marriage and birth rates would be predicted to increase the degree of social integration and regulation while divorce and unemployment would be predicted to decrease the level of social integration and regulation. The associations between the homicide rates and the social indicators were similar to those for the suicide rate, opposite to the prediction of Henry and Short (1954) that the associations would be reversed for homicide rates.

The suicide rates of the ten Belgium provinces (ecological study) differ considerably, ranging from 15.6 in Limburg to 26.6 in Luxembourg (Table 2). The correlations between the suicide rates of the provinces and the social variables are shown in Table 3.

The suicide rate was significantly associated with the population density (negatively), but not with the other social variables. A comparison between the five Flemish provinces and the five Wallonian provinces indicated that they differed significantly in population density and unemployment rate, as well as in their suicide rate. The mean suicide rate for the Flemish provinces was 18.5 per 100,000 per year (SD = 2.67) and for the Wallonian provinces 22.5 (SD = 2.50) (t = 2.43, df = 8, two-tailed p = .04).

Table 2: Suicide rates in the ten provinces of Belgium in 2005 per 100,000 (Statistics Belgium, 2014)

Flanders	
Antwerp	16.7
East Flanders	19.9
Flemish Brabant	18.0
Limburg	15.6
West Flanders	22.3
Wallonia	
Hainaut	20.9
Liège	23.1
Luxembourg	26.6
Namur	21.5
Walloon Brabant	20.3

Table 3: Correlations over the ten provinces between social indicators and the suicide rate

	Correlations	Regression (betas shown)
Population density	-0.74*	-1.08#
Population	-0.47	0.83
Marriage rate	0.61	-0.19
Divorce rate	0.32	0.54
Unemployment rate	0.29	-1.29
Flemish provinces	-0.65*	-1.21
Multiple R		*0.92*

* p < .05
#significant in backward multiple regression

Study 2: The Natural Suicide Rate

Results

The regression equations for predicting suicide and homicide rates in the times series study from divorce and unemployment rates were:

Total suicide rate = 12.06 + 2.34*(divorce rate) + 0.32*(unemployment rate)

Male suicide rate = 16.65 + 3.12*(divorce rate) + 0.51*(unemployment rate)

Female suicide rate =7.50 + 1.66*(divorce rate) + 0.14*(unemployment rate)

Total homicide rate = 0.39 + 0.38*(divorce rate) + 0.04*(unemployment rate)

Setting the divorce rate and unemployment rate to zero gives natural suicide rates of 12.06, 16.65 and 7.50 for the total, male and female suicide rates, respectively and 0.39 for the homicide rate. Thus, in an ideal Belgium (sociologically), the suicide rate might be close to 12 per 100,000 per year and the homicide rate close to 0.4.

Using the same technique, the following equation estimated the natural suicide rate for the ten provinces:

Total suicide rate = 10.91 + 3.39*(divorce rate) + 0.14*(unemployment rate)

Thus, if there were no divorce and no unemployment in the provinces, the estimated natural suicide rate based on the ecological study in Belgium would be 10.91.

Discussion

The time-series analysis (Study 1) found that suicide rates in Belgium were positively associated with indices of social disintegration and weakened regulation as predicted by Durkheim's (1897) classic theory of suicide. This association was found both in males and in females and for the total suicide rates. However, in our study homicide rates showed similar associations with these social indicators as those for suicide, the opposite of the prediction made by Henry and Short (1954). Apparently, homicide and suicide require different theoretical explanations (Lester, 1995).

Study 1 found few correlates of the provincial suicide rate in Belgium. Only population density and the ethnicity of the provinces (i.e., Flemish versus Wallonian) were significantly associated with the suicide rate in the ecological study. A negative correlation between suicide mortality and population density has also been reported in the study of community-level correlates of suicide mortality in Flanders (Hooghe & Vanhoutte, 2011). Earlier studies on the regional differences in epidemiology of suicide in Belgium (Moens et al., 1988; Reynders et al., 2011) found higher suicide rates in the French-speaking provinces of Wallonia than in Dutch-speaking Flanders, a phenomenon possibly related to differences in availability of suicide methods, socio-economic factors and cultural differences between these two parts of Belgium. Contrary to results of the time-series analysis, marriage, divorce and unemployment rates did not yield significant results. This disparity between the results of the two components of Study 1 might be explained in relation to the different level of analysis:

the time series study used aggregated data for the whole of Belgium while the ecological study focused on data for the ten provinces. The associations between socio-economic characteristic and suicide might depend on the size of areal units, and the impact of variables related to social integration and regulation may vary on different levels of social organization (Rehkopf & Buka, 2005). The present study did not allow testing these assumptions; however, smaller units may be more homogenous sociologically and better reflect the socio-economic position of an individual, and some contextual processes related to social cohesion or networks might work differently on smaller levels of aggregation (Rehkopf & Buka, 2005).

Study 2 showed that if divorce and unemployment rates in Belgium and in the ten provinces were zero, there would still be positive and nonzero suicide and homicide rates. The estimated natural rate based on a time-series analysis was 12.1 per 100,000 for suicide (and 0.4 per 100,000 for homicide), not far different from an estimate of 10.9 per 100,000 in the ecological study and 10.3 per 100,000 over 1950-1985 reported earlier by Yang and Lester (2009). Such positive, nonzero natural suicide rates have also been found in other countries in Europe, as well as in North America, Asia and in Australia (Yang & Lester, 2009). Of interest, the estimates of the natural suicide rate differ considerably among countries, ranging from 2.9 per 100,000 in Norway and 5.0 per 100,000 in the Netherlands to 19.3 per 100,000 in Sweden and 25.0 per 100,000 in Japan. A number of explanations have been proposed regarding the question why natural suicide rates differ between nations (Yang & Lester, 2009). Genetically caused, physiologically based factors, such as the Finno-Ugrian gene, found primarily in Finnish and Hungarian people (Voracek, Fisher, & Marusic, 2003) and the distribution of blood types associated with psychiatric disorder and suicide (Lester, 2004), have been proposed as factors determining the differential natural suicide rates of different nations. Nonetheless these explanations remain speculative and require further studies.

The present study has several limitations. All of the measures used in the present study (suicide and homicide rates and social indicators) increased over time during the period studied. Thus, there was a high degree of inter-correlations between all of the variables. Furthermore, many social indicators might be examined for their association with suicide and homicide rates. However, in order to estimate the natural suicide and homicide rates, it is necessary to have variables that can be set to an 'ideal' level, and so it is appropriate to use social indicators (such as unemployment) than can be set to zero. Nonetheless, choosing other social indicators for the regression equation might give different estimates of the natural suicide and homicide rates. The present study is also limited by the absence of data for the suicide rate in Belgium for recent years and by the small sample size for the regional study. Future research should update the time-series study as more recent data become available and expand the regional study to smaller communities, for example, at the district (arrondissement) level, so that the sample size for the regions is larger, thereby permitting a more reliable analysis.

Conclusions

The time series study provided support for the Durkheim's (1897) theory of suicide, as indicators of social integration correlated with suicide rates in Belgium in the expected direction. The ecological study found a different set of correlates than the time series study suggesting that the impact of socio-economic variables might differ depending on the aggregation level. Our results did not support an assumption that suicide and homicide may be generated by similar etiological factors, the only difference being the direction of the expressed aggression. The estimations of natural suicide rate found for Belgium and the provinces supported the proposition that, even if the socio-economic conditions were made 'ideal', the suicide rate in the country would still be positive and nonzero.

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