Is the month of Ramadan marked by a reduction in the number of suicides?

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Abstract For Muslims the month of Ramadan is a time of fasting but during the evenings after sunset it is also an occasion for family and social gatherings. Therefore, according to the Bertillon-Durkheim conception of suicide (that is based on the strength of social ties), one would expect a fall in suicide rates during Ramadan. Is this conjecture confirmed by observation? That is the question addressed in the present paper. Surprisingly, the most tricky part of the investigation was to find reliable monthly suicide data. In the Islamic world Turkey seems to be the only country whose statistical institute publishes such observations. The data reveal indeed a fall of about 15% in suicide numbers during the month of Ramadan (with respect to same-non-Ramadan months). As the standard deviation is only 4.7% this effect has a high degree of significance. This observation, along with the fact that other occasions of social gathering such as Thanksgiving or Christmas are also marked by a drop in suicides, adds further credence to the B-D thesis.

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Suicide and social ties

Suicide is a phenomenon which often seems to frustrate our “instinctive” expectations. For instance, in the northern hemisphere, whether in South Korea or in Turkey, the suicide rate is lowest in November and highest in May or June. Another surprising observation is that suicide is not in the least affected by socio-political events. Thus, even first magnitude events such as the Pearl Harbor or 9/11 attacks had no visible effects on suicides. For 9/11 this is true not only at country-wide level but even for suicide rates in New York City itself and whether at monthly, weekly or daily level (Roehner 2007, p. 205-208).

To this day the main guideline in the understanding of suicide is still based on the discoveries made by the sociologists Louis-Adolphe Bertillon and Emile Durkheim in the late 19th century. They found that married people had lower suicide rates than bachelors or widowed persons of same age. Moreover, they observed that among married people, suicide rates decreased with increasing number of children (Bertillon 1879 p. 474, Durkheim 1897, chapter II,3). This lead them to the hypothesis that the propensity for suicide was determined by the number and strength of family bonds. So far, however, little (if any) evidence was available to show the effect of social links beyond the family circle. The present paper shows that in Turkey during the month of Ramadan the suicide rates are about 15% lower than during the same time of the year not marked by Ramadan.

Why do we think that this observation can be accounted for by the Bertillon-Durkheim conjecture? To see it more clearly one must give a closer look to the characteristics of Ramadan. During the month of Ramadan Muslims fast during the day from dawn to sunset but after sunset they break the daily fast by sharing food with those in need and celebrate with family and friends. This makes Ramadan a time of social gathering.

Of course, at this point it is impossible to know whether the fall in suicides is due to fasting, to social gatherings or to some other facet of Ramadan. In order to strengthen the contention that it is indeed social gathering which is the key-factor one must analyze other events marked by social gathering, such as for instance Thanksgiving in the United States. This will be done briefly at the end of the paper.
Data

We need to ask ourselves the following questions. (i) What suicide data do we need? (ii) Do such data exist? (iii) Are they reliable?

We need monthly data from a country (or a region within a country) whose population is over 90% Islamic. Unfortunately, in most Islamic countries the suicide rates as reported by the World Health Organization are very low. In Egypt, Syria, Pakistan, Jordan, Malaysia, Indonesia, Kuwait the rate is under 2 per 100,000. In several (if not all) of these countries suicides are under-reported. This is shown convincingly in the case of Malaysia by T. Maniam (1995) and is related with the fact that many suspicious deaths are just classified as undetermined deaths. Eventually, Turkey turned out to be the only mostly Muslim country for which we were able to find monthly statistics which seem fairly sound. These data seem to exist since 1974 but Internet availability is limited to the period 2000-2012. Over these 13 years the month of Ramadan shifted from December to July (every year it moves backward by some 10 days).

Most often Ramadan overlaps two successive months but the degree of overlapping may change widely: from one half in each month (as in 2004 when it covered 15 October to 14 November) to a perfect match with a calendar month (as in 2008 when it covered 1 September to 30 September). Needless to say, when a calendar month is a mixture of Ramadan days and non-Ramadan days, this is not a favorable situation for the purpose of our experiment. Therefore we restricted our analysis to those cases in which the number of non-Ramadan days was less or equal to 5. As an illustration, in 2002 the Ramadan was from 6 November to 5 December which means that in November there were 5 non-Ramadan days. In other words, based on our criterion, 2002 can be included in our sample of favorable cases. Altogether there are $n = 6$ favorable cases, namely $F = \{2000, 2002, 2003, 2005, 2008, 2011\}$.

Method

There will be two phases in our analysis. In the first we simply wish to get an overall view of suicide numbers during the Ramadan periods.

Fig. 1a shows the number of suicides per month. It reveals two features which will be of importance...
for our analysis. Firstly, there is an upward trend. Secondly, there is a strong seasonal pattern with a maximum occurring in June or July and a minimum in November. It is easy to get rid of the annual trend by dividing each year of the primary data by their annual averages. This leads to a normalized time-series which is fairly stationary. The seasonal fluctuations are of the order of $\pm 20\%$ which, as we will see, is of the same order of magnitude as the Ramadan effect. For the effect to emerge out of the background the level of noise must be reduced by an averaging procedure over the $n$ favorable cases. This will be done below in the discussion about statistical significance.

**Results**

**Graph**

Fig. 1b gives a graphical overview of the behavior of suicide during Ramadan. It is based on the data from the normalized stationary series. If the month of Ramadan were at the same time every year, then Fig. 1b would have little significance. For instance, with Ramadan in November one would anyway observe a dip around $x = 0$ just because of the seasonal pattern. What helps us here and makes the graph relevant is the fact that between 2000 and 2011 Ramadan moved from December to August. Therefore, the dip cannot be simply due to the seasonal pattern.

**Statistical significance**

The level of significance of the dip will be estimated through a procedure which aims at discarding the influence of the seasonal pattern. To each of the favorable years listed in Fig. 1b we associate...
what will be called a reference year that is defined in the following way. Consider for instance 2008. Ramadan is in September. The year 2000 will be chosen as the reference year. In 2000, Ramadan is in December. Therefore the month of August, September and October 2000 will not be affected by Ramadan and can be considered as “reference months”. The positivity of the difference

\[ D = \left[ S_{\text{Aug}}^{2008} - S_{\text{Sep}}^{2008} \right] - \left[ S_{\text{Aug}}^{2000} - S_{\text{Sep}}^{2000} \right] \] (1)

will test the Ramadan effect independently of the seasonal pattern. Indeed, if the reference series decreases between August and September (due to the seasonal pattern), then for \( D \) nevertheless to be positive, the Ramadan series will have to decrease more than the reference series.\[ \text{significantly} \]

For the purpose of estimating the statistical significance we introduce the following notations.

- \( z_i^{(k)} \) will denote the variable respective to case number \( k \) of \( F \). Ramadan month will be \( i = 0 \), whereas the months before Ramadan and after Ramadan will be \( i = -1, 1 \).
- In same way, the variable \( a_i^{(k)} \) will denote the reference variable corresponding to case number \( k \). By letting \( k \) cover the set \( F \), one defines the realizations of two random variables \( X_i \) and \( A_i \).

Now, in the same manner as in (1), let us define the following variables.

\[ X_i = \frac{(Z_i - A_i)}{A_i}, \quad i = -1, 0, 1 \quad D_{-1} = X_{-1} - X_0, \quad D_1 = X_1 - X_0 \] (2)

Whether or not there is a fall in suicides during Ramadan will depend upon whether or not the \( D_i \) are (significantly) positive. One gets the following results for the means and standard deviations.

\[ D_{-1} : \quad \overline{D_{-1}} = 5.0\% - (-11.5\%) = 16.5\% \quad \sigma = 4.75\% \quad \Rightarrow \quad \overline{D_{-1}}/\sigma = 3.4 \]
\[ D_1 : \quad \overline{D_1} = -3.5\% - (-11.5\%) = 8.0\% \quad \sigma = 4.0\% \quad \Rightarrow \quad \overline{D_1}/\sigma = 2.0 \]

If one wishes to interpret these results in terms of significance one needs to make a specific assumption about the probability distribution of the \( D_i \). When (as is the case here) no information is available regarding the probability distribution of the random variables under consideration, it is a standard

\[ \text{Can one use as reference series the seasonal pattern itself, that is to say the average over all years of the monthly data? As such an average will obviously be affected by the Ramadan effect it may seem that it cannot serve as a good reference series. Nevertheless, it turns out that this procedure leads to fairly similar results as the one used below. This is certainly due to the fact that the Ramadan effect is too weak to affect the average in any substantial way.} \]
practice to assume that they are Gaussian. Under this assumption, based on a table of the Gaussian distribution function, one can say that $D_{-1}$ is positive with a degree of confidence higher than 0.9999, whereas $D_1$ is positive with a degree of confidence of 0.95. Actually, the fact that $D_1$ is smaller than $D_{-1}$ is quite natural because it can be expected that after the Ramadan shock the system does not return to its equilibrium (i.e. reference) level instantaneously. As a matter of fact, Fig. 1b suggests that the time constant of the system is of the order of 2 months.

Conclusion

Is there a similar effect for Thanksgiving? The answer is yes. Because US daily suicide statistics have been published since 1972, this question was already studied in the 1970s and 1980s (see for instance Phillips and Liu 1980).

In public holidays there are two components: (i) most of them (e.g. Thanksgiving, Christmas, Memorial Day) are marked by family gatherings (ii) all of them are federal holidays which means that many persons (especially those employed by the federal government or by state administrations) do not have to work.

Should the suicide effect be attributed to the first factor, to the second or to both of them together?

It turns out that the suicide effect is much weaker for the Martin Luther Day than for Christmas or Thanksgiving. Is that due to the fact that it brings about less social gatherings or simply to the fact that it is a day off for a smaller proportion of people. It is difficult to know.

In contrast, Ramadan is not a time of vacation. This narrows down possible explanations and points at social gathering as the key-factor, thus providing additional backing for the Bertillon-Durkheim thesis.

References

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²In order to test this assumption one would need some 200 data points, that is to say much more than can ever be expected.
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