Seasonal Variation in mortality for five main death causes. Cuba, 1996-2006

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Citation

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Abstract

Background and purpose: Mortality's seasonal variation has long been described all over the world for many death causes. Periodic changes in the weather conditions of temperate countries have been well recognised as risk factors for seasonal mortality but there is no sufficient evidence of this in tropical countries where seasons are not so well defined and there are no great differences in temperature. There are no recent studies about this matter in Cuba. The aim of this paper is to describe the seasonality of 5 different death causes (heart diseases, cerebrovascular diseases, accidents, suicides and homicides) based on monthly data collected during the period 1996-2006 using a simple and replicable method for undeveloped countries.
Methods: The presence of seasonal variation in several causes of death was explored with box and whiskers plots. Monthly total numbers of deaths were adjusted to a standard 30 days month in all time series. Death causes were selected acording to their relevance and data obtained from National Bureau of Statistics of the Cuban Ministry of Health for the period January 1996-December 2006.
Results: A total of 868 982 deaths occurred during the 11 year period of the study in Cuba: heart diseases (232 829), cerebrovascular diseases (89 263), accidents (53 341), suicides (19 007) and homicides (7 316). Monthly deaths due to heart diseases showed high median values in January, February and December. Deaths by cerebrovascular diseases showed their highest median values during the months of January, February, March and December. The median number of monthly deaths by accidents was highest during July and August. Deaths due to suicides were higher in Jun, May and July. Seasonality of monthly deaths by homicides was not so evident.
Conclusions: Seasonal variation of mortality for several death causes was highlighted using a simple, easy and replicable method to quickly ascertain the presence of seasonality of death causes which can be very atractive for undeveloped countries.

The work was done at: The National Unit of Trend Analysis. Cuban Ministry of Health.

INTRODUCTION

Seasonal variation of mortality has been described all over the world. [1] The influence of the different seasons of the year is largely documented and many researchers have studied the characteristical winter peak of several death causes as well as the effect of high temperatures and heat waves on mortality [2] . Periodic changes in the weather conditions such as those that normally occur in temperate countries are well recognised risk factors for seasonal mortality increasement, where extreme weather conditions can be the cause of hundreds of deaths. [3] However, the validity of this has not yet been well established in other climatic conditions such as those of tropical countries where seasons are not so well defined and there are no great differences in temperature.

There are no recent studies about this matter in Cuba and although the country has basically a tropical climate with average temperature of 25,5 ºC and high relative humidity frequently above 80%, two major seasons can distinctly be observed: a dry and colder season from november to april and a rainy season, very humid and hot from may to october(hurricane season goes from june 1 to november 30 and can be very active). [4] A previous study of seasonality in infant mortality led us to believe that perhaps mortality for other causes in the general population followed an identifiable seasonal pattern as well. [5]

A variety of statistical techniques have been used to examine the seasonal pattern of health events. Metodological issues and methods for the statistical analysis of such events were fully addressed by Hakko's paper in 2002 [6] . Most of the proposed statistical techniques are too complicated to implement for nationwide studies in Cuba. In 2004 Tobias et

al. [7] proposed a simple graphic method for describing the structure of a monthly seasonal time series especially the use of common box and whiskers plot.

Box and whiskers plots can be very useful for handling large amounts of data as in time series, allowing for an easy and quick exploration of the series since they provide an instant insight into the data dispersion and allow comparisons of two or more data sets. The five-number summary represented (median, quartiles, and the smallest and greatest values) are very easy to calculate even manually, which is an additional and very atractive feature of the method for seasonal variation analysis in underdeveloped countries. In a recent study we used these graphics to analize seasonal variation in monthly series of infant mortality and Aedes aegypti infestation with fair results. [8]

In this paper we present the analisis of seasonal variation of monthly mortality data for 5 death causes in Cuba during the period 1996-2006.

MATERIALS AND METHODS

Death causes were selected according to their relevance: Heart diseases, cerebrovascular diseases, accidents and suicides have been amongst the first 10 major death causes in the Cuban general population during the last twenty years, while homicides ere among the first 5 causes of death in the cuban population aged 10 to 49 years. [9] Deaths were coded according to International Classification of Disease (ICD) 9 th and 10 th revisions, from January 1996 to December 2000 (ICD-9) and from January 2001 to December 2006 (ICD-10)

Figure 1

CAUSE OF DEATH	ICD- 9 CODES	ICD- X CODES
Heart diseases	393-429	I05-I52
Cerebrovascular diseases	430-438	I60-I69
Accidents	E800-E949	V01-X59, Y85-Y86
Suicides	E950-E959	X60-X84, Y870
Homicides	E960-E969	X85-Y09, Y871

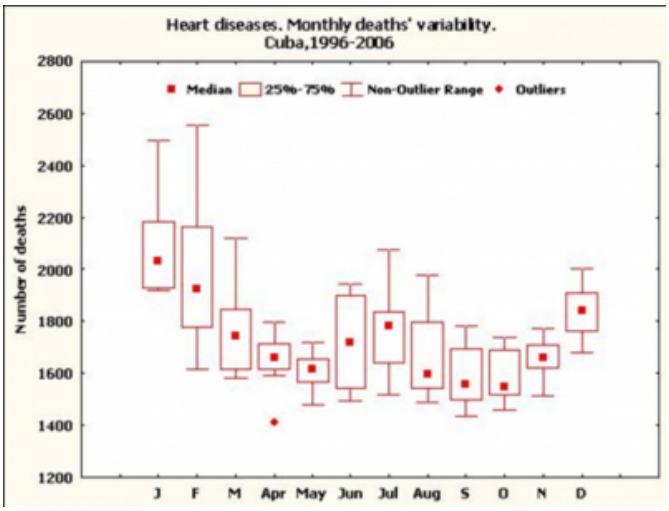
Mortality was computed as the monthly number of deaths for selected death causes. Since there were no noticeable changes in the population at risk in different months we did not consider necessary the use of monthly mortality rates. Data was extracted from the database of the National Bureau of Statistics of the Cuban Ministry of Health for the period January 1996- December 2006. To prevent bias due to the different number of days in each month, the monthly total of deaths were adjusted for a standard 30 days month. Monthly seasonality was ascertained with box and wiskers plots for each month for all death causes.

RESULTS

A total of 868 982 deaths occurred during the 11 year period of the study: heart diseases (232 829), cerebrovascular diseases (89 263), accidents (53 341), suicides (19 007) and homicides (7 316). Deaths by heart diseases represented the 26.79% of the total number of deaths.

Figure 2

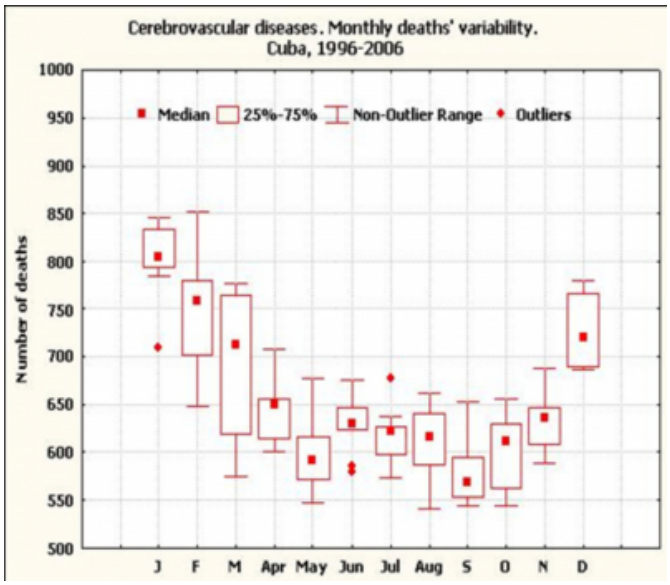
Figure 1



Monthly deaths due to heart diseases show the highest median value in January followed by February and December. Another peak is noticeable during June and July while the smallests values occur in September and October. The most consistent data can be observed in April and the highest variability in February and June. The highest monthly number of deaths also occurs in February (Figure 1).

Figure 3

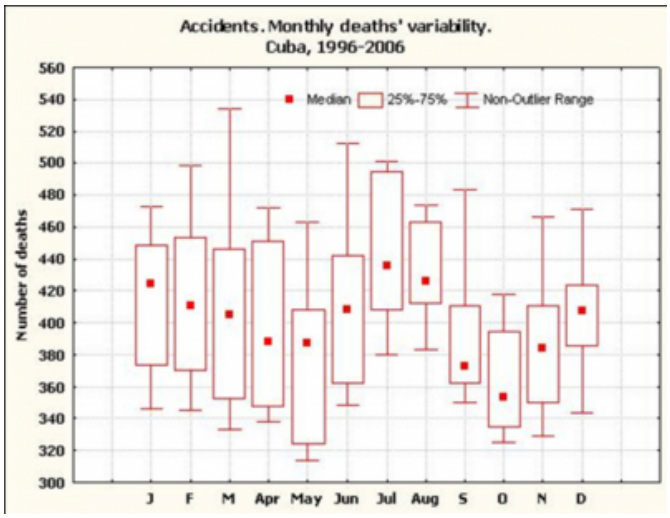
Figure 2



Monthly deaths by cerebrovascular diseases show the highest median values during the months of January, February, March and December without any other significant peak. Almost all the monthly deaths exhibit consistent behaviour with small boxes in every month with the exception of March in which data shows a considerable variation (Figure 2).

Figure 4

Figure 3

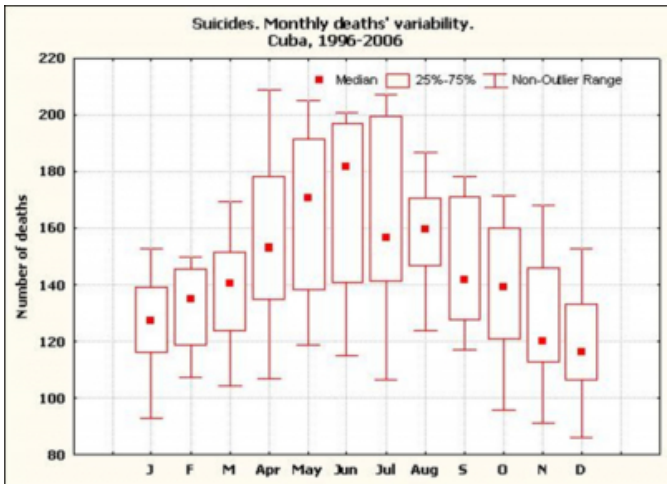


The median number of monthly deaths by accidents is highest during July, August, January and December. There is a great variation within every month although April has the bigger box (Figure 3).

The monthly deaths due to suicides exhibit its highest median value in Jun, May and July, with relatively smaller values the rest of the year. The variability is greater in these three months also but April and September also have bigger boxes. The smallest median values occur in December and November and January (Figure 4).

Figure 5

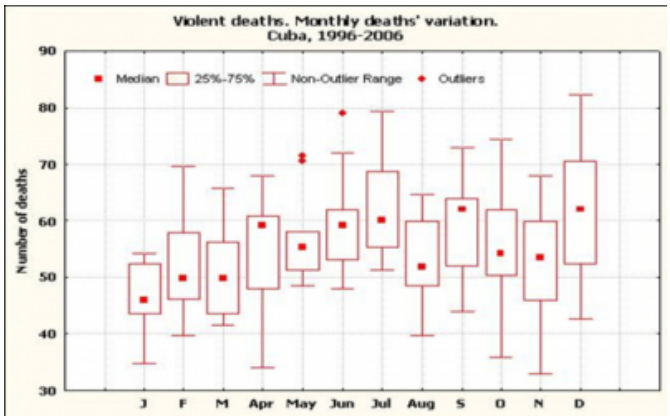
Figure 4



Monthly deaths by homicides show the highest median values during the months of September, December, April and July, although they're not as manifest as in other death causes. May and June show the smallest boxes but also the presence of outliers (Figure 5).

Figure 6

Figure 5



DISCUSSION

The increase of monthly deaths by heart diseases during the colder months of the year in Cuba is similar to other reports and especially to the one conducted in Brazil in 2002. [10] Although the majority emphasize the seasonality of deaths by Acute Myocardial Infarction, we consider our results quite consistent with these findings because this has been the

leading cause amongst the deaths by heart diseases in the last decades in the country, for example in 2006, deaths by heart disease amounted to 21 316, 15 225 of them were due to ischemic heart diseases (71.43%) and 7 183 (33%) to myocardial infarction. [11]

Monthly deaths by cerebrovascular diseases were also higher during the colder season in Cuba but evidence of seasonality for this group of death causes is controversial in other countries and varies from no significant differences between winter and summer mortality to the report of significant peaks during winter and spring [12] . A limitation of our study was the analysis of all cerebrovascular deaths causes together since seasonal patterns may vary according to the specific stroke type thus leading to a misrepresentation of the problem. [13]

Seasonality of different types of accidents such as motor vehicle accidents and drowning has been reported by several [14] . There was a high seasonal peak for accidents during the hottest months of the year in Cuba coinciding with the time of the year in which a large part of the population, namely children and young people, take their holidays and spend a large part of their time at beaches and rivers and travelling to and fro.

There is substantial evidence regarding heterogeneity of the seasonal variation of suicides, some authors do not even report the expected spring or summer peak in deaths from this cause [15] . Our findings do not agree with these results however we do coincide with Page et al. [16] who reported an effect of high temperature in suicide counts.

Even though authors expected higher median values for the hottest months according to the “thermic law”- which relates violent crime and hot weather or southern climates- seasonal variation of homicides in Cuba was not evident in this study opposed to the increase of deaths by this cause in summer reported by others in Canada, Finland and Colombia. [17]

The effect of high temperatures on the population and the consistent relationship between mortality and temperature has been well studied although some difficulties may arise in the correct ascertainment of this find since the majority of the studies have an ecological design. [18] Although the mechanisms underlying seasonal variation in Cuba's mortality have not yet been elucidated they may include persistent high inside and outside temperature that can lead to thermic stress, excess sunlight exposure, excess humidity, frequent heat waves, and risky lifestyles. Nevertheless this issue needs to be addressed properly in other studies.

CONCLUSIONS

The seasonal variation of mortality for several death causes has been highlighted using a simple method. Further studies may be needed to enligthen the causes of such variation and building complex models wiil bring a deeper comprehension of mechanisms generating all series. Nevertheless the possibility of using a very easy and replicable method to quickly ascertain the existence of seasonality of death causes is very atractive for undeveloped countries. Another advantage of the graphical approach proposed in this paper is the possibility of analising otther public health time series.

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