Seasonal Variation of Conception and Suicide

By

Eiji Takahashi

From the Department of Hygiene, Tohoku University
School of Medicine, Sendai

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Seasonal variation of conception rate and suicide death ratio is studied on the data of UN and WHO. Although the peak of conception curve coincides with that of suicide death ratio in most European countries and in Japan, the fact is not universal. The peak of the seasonal variation of conception rate moves from midsummer in subfrigid climate countries to winter in subtropical countries. Such geographic alteration does not seem to be found by suicide death ratio, though the data are not enough to conclude it, and the peak of the curve seems to be always in spring.

The peak of the seasonal conception curve is usually found in the season when the monthly average temperature is about 20°C. However, in most European countries and in Japan the curve rises only in spring. By Japanese data, the peak of the seasonal variation of suicide deaths moves by age group. The younger the subject, the earlier in spring the peak appears.

As a remarkable case of the effect of physical environment on human body, the seasonal variation of births has been studied since long ago by Quetelet, Prinzinger, Huntington, Missenard and many other authors. Birth rate usually rises from winter to early spring in many countries of temperate climate in western Europe and in Japan. It means that the conception increases from spring to early summer in these countries. On the other hand, it is also known that suicide deaths usually increase in the same season, as de Rudder mentioned.

Although it may be considered that the seasonal variation of conception is influenced by the seasonal accumulation of marriages and by some kind of social and religious events, higher occurrence of conception in spring seems to mean the activation of reproductive potentiality. At the same time intensified libido in spring seems to be one of the dominant motive of spring accumulation of suicide deaths also.

In the present paper the seasonal variation of conception rate and of suicide death rate is compared geographically and the relationship between them is discussed by the international data from the reports of the United Nations, World Health Organization and other sources. Monthly conception rate is
expressed with monthly birth rate by antecedent 9 months, neglecting stillbirths, in the Monthly Bulletin of Statistics, U.N. In the Bulletin crude birth rates and marriage rates for individual months are computed whenever possible on the corresponding monthly estimates of population and are adjusted to an annual basis, taking into account the exact number of days in the period considered. When corresponding monthly population estimates are not available, the rates are computed on the midyear population or on the latest available estimate. As the rate is often corrected in the succeeding numbers of the Bulletin, the final figures of monthly birth rates of each country is adopted.

In Figs. 1–3 the seasonal variation of conception rate is shown by two lines; the dotted line means the average of the monthly rate from 1950 through 1954 and the solid line from 1955 through 1959. The average monthly marriage rate, which is considered by some people as one of the most important factor influencing the seasonal variation of conception rate, is drawn in so far as the data are appeared in the U.N. statistics. As a most important climatic element the monthly average of temperature in the main city which seems generally to represent the whole country is also shown in these figures, though in some big countries such as India and U.S.A. it does not cover the whole territory.

As the average monthly frequency of suicide deaths, division into 12 months of equal length of a yearly average of 1200 cases on the data for 5 years from 1954 through 1958 is adopted from the vital statistics of the World Health Organization.

*Seasonal variation of conception rate*

As shown in Fig. 1, in subfrigid climate countries such as Finland and Sweden the conception rates are the highest in summer months in which average temperature does not reach to 20°C. The irregularity of the curve of Finland in 1955/59 seems to be caused by the general trend of decreasing births; the seasonal variation curve in 1946/49 was rather similar to that of 1950/54\(^8\)). Sweden shows a slight rise of conception rate in December, which seems to be a trace of the effect of Christmas holidays which was remarkable in the last century. Generally to say in these countries the curve of seasonal variation of conception rates is roughly parallel to the curve of monthly average temperature. However, in these countries the curve of marriage rate makes its peak in June, and the effect of the seasonal accumulation of marriages on the summer rise of conception rates cannot be neglected.

In temperate climate countries the summit of the curve of seasonal variation of conception rate precedes the rise of the temperature curve by a few months. The seasonal variation of the conception rate in the countries of western Europe such as England and Wales, Netherlands, Spain and Portugal is not so remarkable as in the countries of middle Europe. It seems to be the effect of the mild climate caused by the Gulf Stream. Yearly range of the monthly average of
Fig. 1. Seasonal variation of conception rate, marriage rate and monthly average temperature (1).
Fig. 2. Seasonal variation of conception rate, marriage rate and monthly average temperature (2).
temperature is smaller in these countries than in other European countries.

There seem to be some different seasons of marriage by country. In England and Wales, May seems to be the marriage month, and in western Germany, August especially for 1955/59. But they do not accompany the rise of conception rate. In Switzerland the curve of marriage rate makes two peaks, namely in May and in October. Notwithstanding the May peak of the marriage curve accompanies the July peak of the conception rate, the October peak does not accompany any rise of conception rate. The same is seen also in Italy where the rise of marriage rate happens in April and in October (Fig. 2).

The remarkable rise of the conception rate in April following the dip in March is found not only in Italy but also in Yugoslavia, Greece and Syria. It seems to be the effect of the religious event of the Catholic. Lent, forty weekdays to Easter, is the period of fasting and penitence for the nations, and the blooming season follows Easter.

The sudden rise of the conception rate in April is also seen in Japan which is not a Catholic country. It is caused by false reporting of births. In Japan previously age was given at every New Year. Parents do not like to notify the real date of birth especially when the girl is born in late December, because younger age is profitable for marriage when she becomes adult.

Previously in Italy and in Japan the trough of the conception curve was also found in August to September which is caused by hot summer temperature. The similar effect of hot summer is also seen in the South of U.S.A.

In tropics and subtropics the seasonal variation of conception rate is different by country or race.

The graduation of conception rate in Fig. 2 is reduced by Japan, Taiwan, Hong Kong and Singapore, because in these Asian areas the seasonal variation of conception rate is so big. About the reason for it, it should be considered that in these areas the regulation of indoor temperature is not common and the influence of natural climate especially of hot, humid summer on human body seems to be stronger than in Western countries.

In Taiwan (Formosa) the peak of the conception curve is in March and the bottom in October, though the peak of the marriage curve is in February and the bottom from July to September. In Hong Kong and India where the monthly average temperature comes down under 20°C only in the cooler season from December to March, though the latter has so vast territory that it contains provinces of various climate. Israel seems to show the similar tendency to them, though the bottom is in the different season from Hong Kong and India.

Singapore, where climate shows only slight seasonal variation of temperature and yearly range of the monthly average does not come over much the range of diurnal variation, has also the similar curve of conception rate to that of Hong
Kong and India, though the bottom is flat. The rise of conception curve in cooler season is also seen in Hawaii where over half of the population is occupied by the oriental origin. Puerto Rico also seems to show the similar pattern to Hong Kong in the seasonal variation of conception rate.

Reviewing the seasonal variation of conception rate in these countries in the Northern Hemisphere, its geographic distribution seems to have some rule in relation to the seasonal variation of temperature. It is roughly observed that the rise of conception rate moves ahead from summer through spring to winter, from the Northern Subfrigid Zone countries to the Torrid Zone countries. The peak of the conception curve usually appears in the season when monthly average temperature is up to about 20°C, which is fit for physiological optimum, and in the Temperate Zone only in spring but not in autumn. In subtropic countries, the conception rate rises in winter (cooler season) to early spring, when the temperature comes down to about 20°C.

However, it should be noticed at the same time that there are two other patterns of seasonal variation of conception rate on the globe. In countries of seasonally less variational climate in the tropics, subtropics and in the Temperate Zones such as Ceylon, Mexico and Chile the rise of conception rate appears in season of the highest temperature. In flat land of Ceylon the monthly average temperature is over 25°C throughout the year. However, the conception curve rises about May, when the temperature is the highest. Although Mexico city is on the table-land of over 2200 meter altitude and has a cooler climate compared to the peripheral low land, the seasonal variation of temperature shows the same pattern alteration as the latter. The conception curve has a bigger rise in March to May when the temperature is going up to the top, though the conception curve is not so smooth as in other countries. Chile has a long territory from north to south, but the climate is so mild that the yearly range of monthly average temperature is within 10°C at most places, under the influence of the Peru Ocean Current. The conception curve rises in summer when the monthly average temperature goes up to about 20°C. Also the Union of South Africa seems to have the same pattern of the seasonal variation of conception rate.

It seems to be plausible that in these countries the climate is so mild and the rapidity of seasonal change of temperature is so slow that the seasonally rising temperature does not stimulate the conception rate.

Another exceptional pattern of the seasonal variation of conception rate is seen in Canada, U.S.A. and probably also in countries of eastern Europe including the Union of Soviet Russia\(^2,\)\(^4\). The conception curve of Canada seems to be resemble that of Finland in 1950/54, except the rise of January, February and April. March dip and April peak seem to be related to Lent and Easter. The peculiar pattern of the seasonal variation of conception rate in the United States of America has long been recognized. Notwithstanding the North
Fig. 3. Seasonal variation of conception rate, marriage rate and monthly average temperature (3).
Temperate Zone country, the United States lack in spring rise of conception rate, and more remarkable is the existence of the autumn rise. June seems to be the marriage month, but without accompanying the rise of conception rate. The United States have a vast territory and it is natural that the conception curve might be considered separately by region. Recently Waggoner and Schachter\(^9\) have analyzed the seasonal variation of births in this country by region on the data of 1948/54, and also Pasamanick, Dinitz and Knobloch\(^10\) on the data of 1955.

In the South of the United States the peculiar pattern of the conception curve is most exaggerated; a pronounced trough of the conception curve in July and August, which is explained by the influence of hot and humid summer climate, is the deepest, and the corresponding peak in late autumn to winter, in November and December, is the highest in the South. The general pattern of the conception curve seems to be resembled rather to the subtropics, but the rise is a little earlier. These peculiarities of the conception curve are diminished in other regions. However, the basic pattern of the curve does not disappear by region as well as by race, and also by time progress. No suitable hypothesis seems to be found to explain the late autumn rise of conception rate in the United States.

Finally, the seasonal rise of conception rate in spring which is seen in most temperate climate countries especially in West Europe and in Japan is not fixed. The rise of conception rate comes in midsummer in subfrigid climate countries and in less variational climate countries, in the cooler season in most subtropic countries, and in autumn in the United States and Canada, and in countries of East Europe.

It is clear that the fecundity of human kind is influenced by natural climate. The conception rate rises almost always in the season when average temperature comes roughly about 15–20°C which is the physiological optimum temperature for human body. In such environment man's physical strength is filled up and also sex might be full. Seasonal hot climate diminishes sex and consequently the conception rate, that is especially remarkable in Asian countries. In the era when people thought acclimatization of the European in the tropics was difficult, there was known many reproductive difficulties: dysmenorrhea, amenorrhea, dysgenesis, dysgalactia, etc. in the tropics especially for females from northern Europe. Also in the colony of macacus monkeys living at Baltimore, a greater irregularity of the menstrual cycle and an increase in amenorrhea is found during summer\(^11\). However, where man can artificially neutralize the indoor temperature by air-conditioning, and avoid extreme natural climate in summer and in winter by going for a change of air, the seasonal variation of conception rate is diminishing. Such an effect might be suspected as the dominant cause of the diminishing seasonal variation of birth rate not only in the upper socio-economic class\(^12\), but also in the whole urban population in the Western advanced countries where the decrease was already found in the early decades of this century.\(^13\)
The influence of marriage seasonality on the seasonal variation of conception rate is less effective than that of seasonal variation of climate, as seen in the instances of Germany, Switzerland, Italy, England and Wales, and the United States. Many authors seem to have the similar opinion. There is also found in Japan the evidence that not only primiparity but also multiparity accumulate in the season rising birth rate\(^\text{14}\). The same was also found in Hong Kong\(^\text{11}\). It would be rather considered that the season when the conception rate rises suits to marriage.

It is clear that social especially religious events such as Lent and Easter—holidays in Catholic countries have some effects on the seasonal variation of conception rate.

**Relation of seasonal variation between conception and suicide deaths**

Higher incidence of suicide in spring than in other seasons is long known in many civilized countries in the Temperate Zone. It is not unnatural to think about the relation between the spring rise of conception rate and that of suicide deaths, and it is interesting to pursue whether the seasonal accumulation of suicide deaths shows the similar geographic alteration as the conception rate or not.

Data of the monthly suicide deaths are got from WHO report on 16 countries: Canada, United States, Japan, Germany (Federal Republic), Belgium, Denmark, Finland, France, Italy, Netherlands, Portugal, England and Wales, Scotland, Sweden, Switzerland and Australia. In the Epidemiological and Vital Statistics Report, division into 12 months of equal length of a yearly average of 1200 suicides appeared for the 5 lasting years of the recent decade, and therefore, the average monthly frequency of suicide cases is corrected to 100 for all countries.

In Denmark, Finland, Netherlands, Portugal and Scotland, the absolute total figures of suicide deaths are not over 1,000 each in a year, and the data seem to be unfitting for statistical analysis. Only in Japan and the United States it comes over 10,000 and seems to be scarcely enough to analyze statistically.

As shown in Figs. 4 and 5 the peak in the seasonal curve of suicide death ratio is found from March to July in 15 countries of the Northern Hemisphere, especially from April to June in most countries. In average of these 15 countries the seasonal curve of suicide deaths makes a plateau from April to May and a base from December to January.

In Australia, only one country data given in the Southern Hemisphere, although the yearly total incidence of suicide is about 1,000 and the final pattern is not sure because of small number in total, the rise is seen in October and in February.

Although it is difficult to precisely analyze the seasonal tendency of suicide deaths by each country, it seems to be sure that the peak of the seasonal variation almost always comes from spring to early summer and does not move by latitude,
Fig. 4. Seasonal variation of suicide death ratio (1).
Seasonal Variation of Conception and Suicide

Fig. 5. Seasonal variation of suicide death ratio (2).

Fig. 6. Seasonal variation of suicide death ratio by sex and age group in Japan, 1957/61.
at least in the subfrigid and temperate climate countries.

From this point of view, absolute figure of temperature does not seem to be the most important factor responsible for the seasonal variation of suicide death ratio. The intensity of sunlight or ultraviolet rays might be suspected as an agent stimulating more men to suicide. Kato et al.\textsuperscript{15)} calculated the correlation coefficient between monthly average of atmospheric pressure, temperature, humidity and sunshine hours, and number of suicide deaths by Japanese local data. Significant correlation is found between monthly suicide deaths and atmospheric pressure ($r=-0.77$, $P<0.01$), temperature ($r=0.88$, $P<0.01$), and monthly sunshine hours ($r=0.68$, $P<0.05$). Moreover, the correlation between number of suicide deaths and monthly change of temperature is significant ($r=0.87$, $P<0.01$).

Noticeable is the fact, when the Japanese data for 5 years, 1957/61, is divided by age into 4 groups, the youngest age group of 15–24 years makes the peak from February to April, the eldest age group of 65 years and over from April to July, and the middle intermediate, as shown in Fig. 6. Elder people seem rather to prefer warmer seasons to commit suicide compared to younger people. Therefore, when man wants to study precisely the seasonal variation of suicide in a country, he should consider the age composition of the subject. It is well-known on the suicide death rate of younger generation Japan is the highest.

In conclusion, although the peak of conception curve coincides with that of suicide death ratio in most European countries and in Japan, the fact is not universal. The peak of the seasonal variation of conception rates moves from mid-summer in subfrigid climate countries such as Sweden and Finland to winter (cooler season) in subtropical countries such as India and Hong Kong. Such geographic alteration does not seem to be found by suicide death ratio, though the data are not enough to conclude it, and the peak of the curve seems to be always in spring.

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