A Study in the Seasonal Disease Calendars by Age

by

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(Received November 11, 1963)

Abstract

With a view to clarifying the age structure of the high winter mortality in recent years (See "High Winter Mortality of ‘Seasonal Diseases’", Papers in Meteorology and Geophysics, XII, 2, 1961), we summarize in this paper the results of our study in the seasonal disease calendars by age groups. This is the 5th paper of our concerning the calendars of seasonal diseases and the high mortality in the cold months.

High winter mortality is conspicuous in all the age groups but two, the 5-9-year-old and 10-19-year-old. The mortality peak is very low and appears in summer for these two groups. It is also noteworthy that the death rate rises along with the increase of age before 4 years old and after 40 years old.

Fairly big differences exist among various age groups in the fluctuation of deaths from seven major diseases. For 0-4-year babies, the death toll is extremely high, and its peak comes in winter for pneumonia (including bronchitis) and gastritis (including duodenitis, enteritis and colitis); and the lowest for tuberculosis and heart disease, but the peak also appears in winter.

For the following four age groups (5-9, 10-19, 20-29 and 30-39 years old), enteritis shows very low death rates, and rages in the cold season though it prevails for a very short period in summer; and deaths from tuberculosis, heart diseases, etc. increase as the age advances. After 50 years of age, notable changes occur in the calendar of seasonal diseases: mortality rises, from senile maladies in particular, and touches the highest mark (more than 1,000 per 100,000) at the age of over 70 years. It is also worth mentioning that cancer shows the mortality peak in autumn at 50's, 60's and over 70's, and that gastritis prevails twice a year, in summer and winter, at 60's and 70's.

Thus, it can be seen that mortality is apparently high in winter at old ages, and that deaths from pneumonia and gastritis are very high in winter for infants (0-4 years old).

1. Fluctuation of Total Deaths by Age

In the previous papers, we have provided statistical evidence for the high winter mortality in Japan and some other countries in the world. I have extended my studies by preparing seasonal disease calendars by age groups in Japan. For this purpose, the deaths are divided into seven age groups, namely, 0-4, 5-9, 10-19, 20-29,
30-39, 40-49, 50-59, 60-69, and over 70 years. And the survey covers from 1957 to 1960.

1) Seasonal Fluctuation of Total Death Index by Age.

As shown in Fig. 1, at ages of 0 and 0-4 years a considerable difference exists in mortality between summer and winter: the death index rises as high as 120-150 from December through March, whereas it drops to 70 or so in the hot months. In this and the following figures, the death index (the annual average at 100, and the annual total at 1,200) is used, instead of the mortality rate, so that the seasonal variation may be shown more clearly.

A complete change, however, takes place at ages of 5-9 and 10-19 years: for these the summit of mortality appears in the June-September period.

At ages of 20-29 and 30-39 years, the curve markedly levels off: there is almost no seasonal fluctuation except a very slight down curve in summer. At ages of 40-49 and 50-59 years, on the contrary, the fluctuation gradually curves up in the cold months, and it shows a very high peak in winter at 60's and over 70's. It is of great interest that much similarity is seen in the death curve between old ages and infants.

To quantify such seasonal variation of the death index, the seasonal change coefficient is calculated as shown in Table 1. The coefficient comes at 0.326, or the
biggest, for 0-4-year infants and at 0.243, or the second biggest, for 0-4-yers-olds. Next comes the old age of over over 70 years with 0.175.

On the other hand, the coefficient markedly curves down to 0.053 and 0.059, respectively, for 20-29 and 30-39 years. It is worthy of special mention that, with the 20's and 30's as the turning point, the variation coefficient rises along with the increase and decrease in age.

A comparison of local seasonal variation curves by age reveals some interesting facts. For instance, similarity exists between the national and local fluctuations (from Hokkaido in the north, Iwate Prefecture, Tokyo Metropolis, Osaka Prefecture, and Kagoshima Prefecture in the south). The seasonal fluctuation gets conspicuous at ages of 0-4, 60-69 and over 70 years in all localities, and shows a marked peak not in winter but in summer at ages of 5-9 and 10-19 years.

2) Total Mortality Calendar by Age

Fig. 2 shows the total mortality calendar by age groups on the basis of the seasonal fluctuations of total mortality above explained. The most interesting fact in it is that in all age groups except two (5-9 and 10-19 years old) mortality is high from December through April. At ages of 5-9 and 10-19 years, the death peak appears in the hot season, but stands at 50-150, or much lower than at other ages. At 20's, the rate comes to 200-250, or the second lowest. At higher ages, the rate gradually goes upward and exceeds 2,000 at such old ages as 60 and 70 years.

For 0-4-years-old infants, too, the death rate is deplorably high, that is, 500-2,000. For 0-year-old babies, it is as high as for the 60's and 70's. This claims particular attention.

3) Seasonal Variation of Deaths from Accidents

To find out factors responsible for the exceptional mortality fluctuation for ages of 5-9 and 10-19 years, let us investigate into the seasonal fluctuation of deaths from accidents. It is self-evident that at the above two ages mortality from diseases is much smaller than at other ages, but that from accidents much bigger.

The seasonal variation of the accidental death index is shown in Fig. 3(a) and 3(b). It can be seen that the up curve is very sharp in July and August at ages of 5-9 and 10-19 years, that a small peak appears in summer at ages of 0-4 and 20-29 years, and that the summer summit is replaced by the winter one at ages of over 40 years.

4) Seasonal Variation by Age of Total Mortality
(Less Deaths from Accidents)
Fig. 3. Seasonal fluctuation of death index from accidents.

Fig. 4. Seasonal fluctuation of total death index (less accidental deaths.)
It seems likely that the seasonal fluctuation will be smaller even at ages of 5-9 and 10-19 years if deaths from accidents are excluded from the total mortality. As expected, the summer peak disappears even at these ages in the total mortality curve (less accidental deaths) as shown in Fig. 4, and almost no seasonal variation now is seen as at 20's and 30's.

The seasonal variation coefficient slips off from 0.155 to 0.113 at the age of 5-9 years, and from 0.106 to 0.067 at the age of 10-19 years. At other ages, no visible change takes place even if deaths from accidents are counted out. But the variation coefficient rises from 0.175 to 0.254 at the old age of over 70 years and from 0.243 to 0.278 for infants (0-4 years old).

It goes without saying that the moderate curve of seasonal variation in the whole year indicates that there is little influence of seasonal changes upon human health and mortality. From the foregoing analysis, therefore, it may be concluded that the smallness of the seasonal variation coefficient accounts for the physical strength and strong resistance against disease and seasonal changes at the ages of 10-39 years, so much so indeed that the seasonal changes bring about almost no effect to bear upon the death rate, and that the winter peak for 0-4-year-old babies and old people (over 70 years old) is not so remarkable as at ages 20-30 years.

(a) Pneumonia and Bronchitis
(b) Gastritis and Enteritis Group
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Fig. 5. Seasonal fluctuation of death index
(over 60 years in age) reveals their vulnerability to seasonal changes, especially to winter cold.

2. Seasonal Fluctuation by Age of Mortality from Various Diseases

1) Seasonal Variation by Age of Death Index by Disease

Death statistics by age are available only for seven major diseases, i.e. pneumonia (bronchitis included), gastritis (duodenitis, enteritis and colitis included), tuberculosis, heart diseases, apoplexy, cancer, and senility, and they cover the period from 1957 to 1960. Age groups are nine, as in the case of total mortality, from 0-4 years downward to over 70 years.

The death index seasonal curves by age groups are shown in Fig. 5(a) to 5(f).

The death index is high in winter but low in summer at all ages for pneumonia (see Fig. 5(a)).

As for gastritis, the curve differs from that for pneumonia and widely varies from one ailment to another: it rises into a peak in winter for 0-4-year-old babies but in summer for 5-9 and 10-19 years old. As the age advances, another small summit appears in winter, and it becomes higher at the age of over 60 years as can be seen in Fig. 5(b).

In the case of tuberculosis, at ages of over 30 years the seasonal variation curve sharply rises, but another minor peak appears in May and June at younger ages as shown in Fig. 5(c).

The seasonal fluctuations of the death index for senile diseases are seen in Fig. 5(d) and 5(e). For heart diseases, the curve markedly rises in the cold season and caves off in the hot months, indicating definitely marked seasonal variation at all ages. For apoplexy, the variation is just the same as in the case of heart diseases at the ages of over 30 years: the up curve is conspicuous in winter but less sharp at 30's and 40's. At the age of less than 20 years, mortality is so small that the seasonal variation curve is quite irregular.
As shown in Fig. 5(f), the seasonal variation of cancer is less marked than that of other maladies and, moreover, the peak appears not in winter but in fall at ages above 50 years.

2) Seasonal Disease Calendars by Age Groups

Based upon the above analysis of the seasonal death variation, the seasonal disease calendars by age groups are prepared for the seven diseases as shown in Fig. 6(a, b, c).
For 0-4-year-old babies, mortality from pneumonia and gastritis is considerably high in winter, and that from tuberculosis and heart diseases is the lowest but rises in the cold season.

At the ages of 5–9, 10–19, 20–29 and 30–39 years, the mortality peak, though a very small one, appears in winter for all maladies except gastritis. The death rate rises along with the increase of age for such ailments as tuberculosis and heart diseases.

At 50’s, visible changes occur in the seasonal disease calendar. First of all, mortality gradually curves up, particularly from apoplexy and cancer. This tendency becomes all the more conspicuous at 60’s, and mortality further soars to the peak for all diseases except tuberculosis at the age of over 70 years.

As explained in the previous papers, cancer rages in autumn, and this trend appears all the more clearly in the seasonal disease calendars by age groups. As shown in Figs. 7 and 8, deaths from cancer show no seasonal variation at the younger
ages (10-39 years), and they steeply curve upward in fall, with October as center, at 60's and 70's.

At the ages of over 60 years, gastritis has two death peaks, one in summer and the other in winter, as shown in Fig. 8b, widely differing from other age groups.

Thus it is seen that the seasonal disease calendar varies from age to age, but that the difference is relatively small at ages not much different from one another.

It is again confirmed that high winter mortality is quite conspicuous at the old age. On the other hand, there is one new finding: 0-4-year-old babies die from pneumonia and gastritis quite frequently in winter.

For such babies, death statistics are available for 14 diseases, and a seasonal disease calendar for them is specially prepared, covering these diseases (see Fig. 9). All ailments prevail in winter, and mortality is especially high for pneumonia and gastritis.

The above analysis of the seasonal disease calendar by age groups again shows, among others, the winter high mortality of old-age people. At the age of over 50 years, senile diseases rage in the cold season, and so utmost care must needs be taken of old people's health in this season. It is worth mentioning that old people have come to suffer from tuberculosis, and that the death rate rises in winter also for this malady. This fact is reflected in the total mortality index.

Due attention has to be paid also to the health of babies and infants. Mortality from pneumonia and gastritis is the highest for babies if we exclude the old age exceeding 70 years, and too much importance cannot be attached to the fact that mortality is very high in winter. It is reasonable to suppose that babies are so vulnerable to coldness in winter that the slightest carelessness may cause their death.

It is young people less than 20 years old that are hardly affected by the seasonal changes in the whole year, winter coldness in particular. They are rapidly growing and have strong resistance against any change in environmental conditions. Then, mortality is relatively low for the ages of 5-9, and 20-29 years, and these age groups are also impervious to coldness.

After all, more care must be taken of health in the cold season, especially in
the case of babies and old people. Coldness is the most deadly enemy for them: all maladies except cancer prevail in winter, and mortality is much higher in winter than in summer. Cancer alone rates high in autumn.

Physical training against winter coldness is also as essential as anything else. The above analysis of the seasonal disease calendars by age tells that such training must be practised at the ages of 10–29 years in accordance with a well-planned scientific program founded upon medical and sanitary sciences.

References

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