Geographic and Seasonal Variations in Births

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IN previous investigations we have attempted to demonstrate the relationship of climatic variations during the first trimester of pregnancy to the birth of mentally deficient children. In the most recent study we tested the hypothesis that above-average summer temperatures during the third month of pregnancy, the critical period of fetal central nervous system development, are associated with an increased risk of being born mentally defective. This hypothesis was substantiated for the period of 1913–48 based on the date of birth, and therefore of conception, of mentally defective children admitted to the Columbus State School, Ohio (*1*).

We have shown also that complications of pregnancy are significantly more frequently encountered in pregnancies resulting in winter deliveries (*2*). The importance of this finding is that mental deficiency and neuropsychiatric disorders during childhood which are attributable to brain injury were highly associated with complications of pregnancy (*3*). Thus, the complications of pregnancy as well as mental deficiency were far greater among children conceived during the late spring and early summer months than were expected. In interpreting this chain of evidence, we suggested that either decreased protein intake during the summer months or heat stress or both were etiologically related to the greater proportion of impaired children born during the winter months. Decreased protein intake and heat stress have been suggested as etiological factors in prenatal and postnatal mortality, morbidity, and congenital defects.

This study attempts to add still another dimension to our interest in climatic conditions and their impact on the birth process and prenatal and postnatal development. It has been known for a long time that there are marked seasonal variations in the birth rates in the United States and, indeed, throughout western civilization. According to data on all monthly births in 1955 by State, race, and sex which are reported in the United States vital statistics reports, there is a pronounced trough in the percentage of births occurring in the spring months of March, April, and May and a corresponding peak in the late summer months of August and September. This biannual variation applies to births of white and nonwhite and male and female children.

The August–September peak has traditionally and more or less facetiously been attributed to the longer and colder winter months. The explanation for the consistent spring dip in births has been more difficult to formulate. We believe that the annual spring decline in births may be attributed to three interrelated factors but primarily to the discomforts of high summer temperatures and high humidity. This

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discomfort (there is now a single discomfort index combining temperature and humidity readings which is used by the U.S. Weather Bureau) probably reduces the frequency of coition and consequently of conceptions. It is also possible that high temperatures operate in some way (for example, sperm attrition) to reduce the conception rate when coition is held constant. Incidentally, if this hypothesis is correct, the spring trough in births should be significantly more characteristic of births among the lower socioeconomic status groups, who are less able to escape the summer temperatures, than among the higher socioeconomic groups. This hypothesis has already been substantiated in one major city, Baltimore, Md. Births among upper class families, according to our unpublished data, were significantly more random than among the lower socioeconomic groups or among nonwhites.

If it is true that the greater the discomfort index in the summer, the smaller the percentage of spring births, then States which have the hottest, most humid summers should have significantly lower spring births than States which have cooler, less humid summers. From the 1955 data on births by month of year, State, sex, and race (*4*), data for the following groups of States were selected: (*a*) three southern States (Alabama, Louisiana, and Mississippi) of relatively similar socioeconomic composition and with hot summers and relatively warm winters; (*b*) two midwestern States (Minnesota and Wisconsin) having relatively short summers with extreme tempera-

Figure 1. Adjusted monthly variations in births of white males and white females in the United States, 1955.

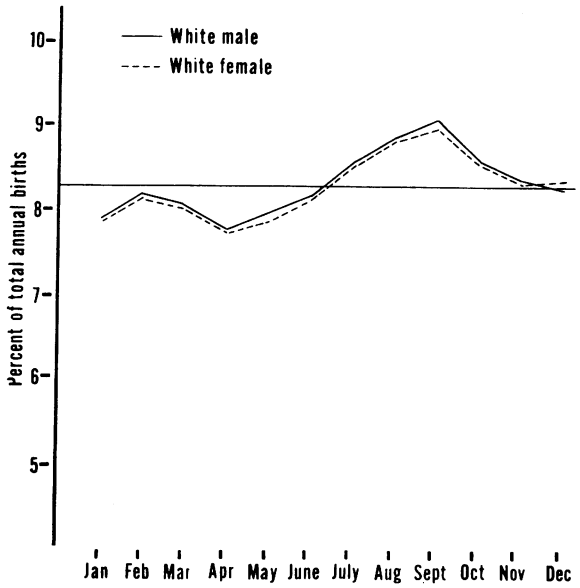


Figure 2. Adjusted monthly variations in births of white males and white females in Mississippi, 1955.

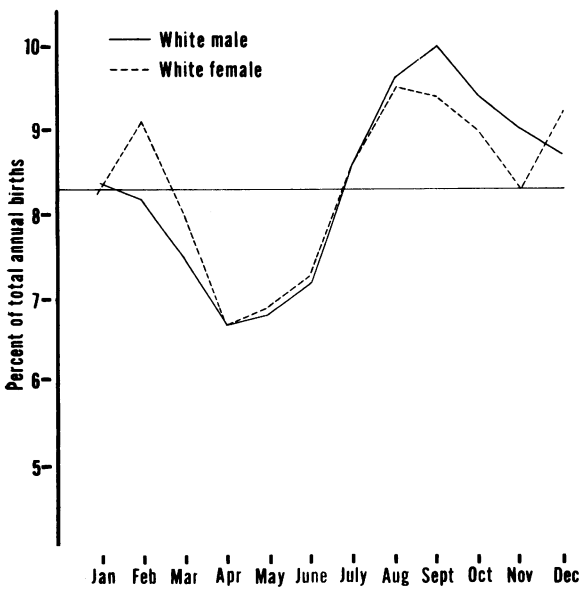
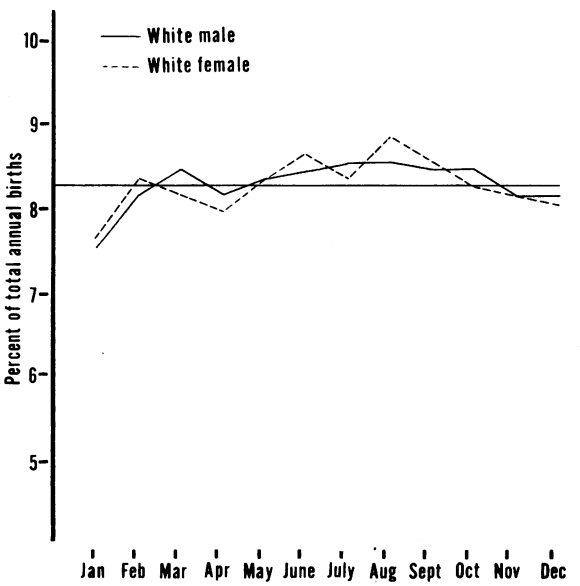


Figure 3. Adjusted monthly variations in births of white males and white females in Minnesota, 1955.



tures and long winters; (*c*) the three most northeasterly States (Maine, New Hampshire, and Vermont) characterized by cold winters and moderately cool summer temperatures; and (*d*) two northwestern States (Washington and Oregon) of temperate climate the year round.

The findings on the variations in the percentage of births by month and season of year in these four sets of States and in the United States tend to support the seasonal variation thesis with regard to births. Figures 1–5 present typical patterns in these regions. Our analysis is, however, based on all the aforementioned States. The southern States show a marked decline in births during the spring months and a correspondingly high peak in the number of late summer births. The midwestern and northeastern States show a lesser trough in spring births. The northwestern States of Washington and Oregon exhibit no spring trough at all. In fact, in these States the number of spring births is slightly higher than expected. The data also indicate, but not at all conclusively, that male births are fewer just prior to and during the descending curve of the spring depression. It has been demonstrated that males are apparently much more at risk of prenatal brain injuries than females (*5*).

Three interrelated factors are postulated as responsible for the decreased birth rate in the spring months in the United States as a whole and in the southern States in particular. First, it is suggested that uncomfortable temperatures in the summer reduce the frequency of coition and thereby the risk of conceiving during the summer months. This possibility was discussed previously. Second, an equally plausible hypothesis is that there is an increased fetal death rate among conceptions occurring immediately prior to and during the summer months. Some evidence is already available which lends credence to this proposition. For example, infant death rates in the first 28 days of life are higher in the spring months. Also, it has been shown that prenatal stress via the hypothalamic-pituitary-adrenocortical system and dietary deficiencies during the early critical period of fetal development, the first trimester, result in fetal deaths in animals (*6*).

The third explanation of the spring decline in births is purely statistical in character and admittedly accounts for a small fraction, at most 10 percent, of this decline. The argument here is that increased births during the peak summer months automatically decrease the risk of conception and delivery of children during the preceding and succeeding

Figure 4. Adjusted monthly variations in births of white males and white females in Maine, 1955.

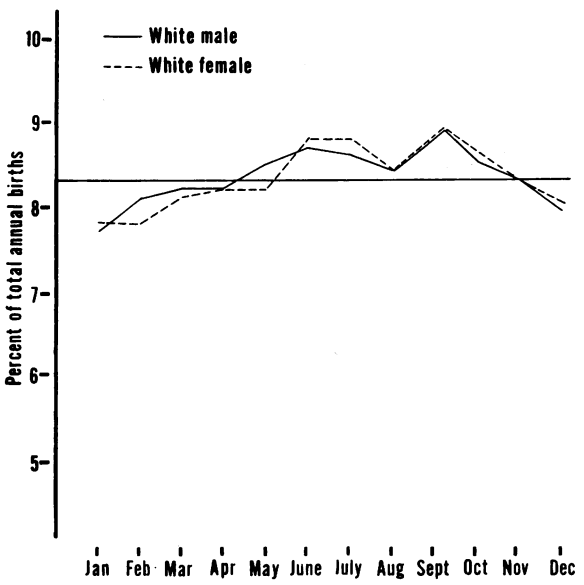
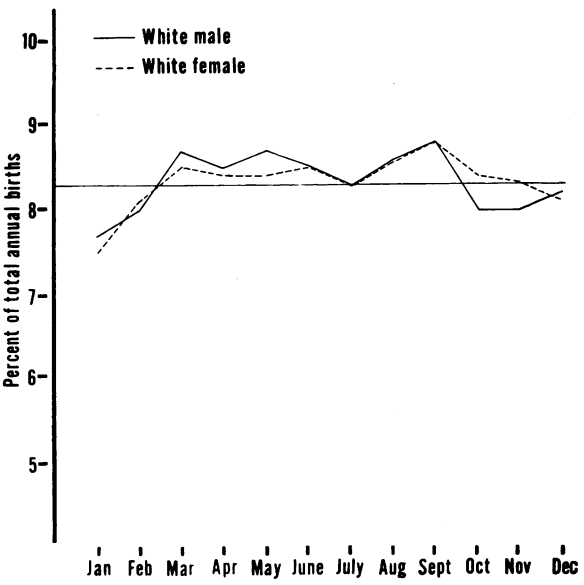


Figure 5. Adjusted monthly variations in births of white males and white females in Washington, 1955.



spring months. In some of the northern States with only a very minor annual spring decline this explanation alone might bring the curve up to the normal statistical expectancy.

A number of additional aspects deserve brief consideration in the interpretation of these findings. Major changes in marriage and birth patterns have occurred since the last war. Since we have restricted ourselves to postwar data, comparisons with earlier periods of time in the seasonal variations in these patterns should be a valuable next step in this series of studies. Nonetheless, it should be stressed that the impact of the seasonal peaks and troughs in marriages are biased against our hypothesis (that is, the effect of June marriages should increase the spring birth rate or at least help reduce the trough). Again, the improving economic situation of lower socioeconomic groups should, if our hypothesis is correct, eventually randomize the monthly variations in births in this stratum. Finally, the monthly birth variations for nonwhites are generally less extreme than for lower class whites. One plausible explanation for this phenomenon is the postulated greater stress encountered by nonwhites throughout the year so that stresses connected with high temperature add proportionately less variation in their birth rates than for lower class whites.

It would seem that the evidence, although incomplete, suggests another application of preventive measures that may affect maternal and infant mortality and morbidity. The increased access of many persons in our society to the means of reducing the stress associated with semitropical summer climates might make a very real difference in infant and maternal mortality and morbidity.

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Improper Drug Source Halted

Nasal inhalers containing basic amphetamine now will be sold only by prescription, as the result of a Food and Drug Administration regulation published in the *Federal Register* February 10, 1959. FDA received evidence of misuse of inhalers for nonmedical purposes by persons who removed the wicks and used the drug as a substitute for amphetamine tablets. The tablets always have been restricted to prescription sale but the inhalers have been sold directly to the public.

Action was taken on the basis of complaints of misuse from law enforcement officials and the agency's own investigation. Nasal inhalers containing other drugs are not affected by the ruling, the agency added.