SOCIO-ECONOMIC AND SEASONAL VARIATIONS IN BIRTH RATES[1]

BENJAMIN PASAMANICK, M.D., SIMON DINITZ, PH.D., AND HILDA KNOBLOCH, M.D.

In recent years few serious scholars have interested themselves in the effect of climatic variations upon social phenomena. Even when seasonal variations have been apparent, as, for example, in the rate of various types of reported crime, sociological and psychological explanations have prevailed. In this process of utilizing cultural and psychological interpretations in preference to climatic, interest in the latter has waned. This is perhaps unfortunate since useful insights might be gained by analyzing climatic variables as they affect social phenomena.

This paper attempts to summarize some of our findings on the hypothesized relationship of seasonal variations to the birth rate, to the rate of complications of pregnancy, to the frequency of birth of mentally deficient children, and to socio-economic status.

Our interest in and research on the etiology and control of the complications associated with pregnancy and the effects of these complications on the frequency of neuropsychiatric and other disorders in children almost inadvertently led us into the area of climatic variations. In a series of studies of month of birth of mentally deficient children, (Knobloch and Pasamanick, 1958) and of the complicated pregnancies which are associated with mental defect, (Pasamanick and Knobloch, 1958) it was found that the peak period of conception was late spring and early summer. From this it followed that the critical period for fetal central nervous system development, the 8th to 12th weeks of gestation, had occurred during the summer months. Further, the highest rates of mental deficiency

[1] Research Division, Columbus Psychiatric Institute and Hospital, Department of Psychiatry, College of Medicine, The Ohio State University.

occurred in those years in which the summer temperatures were above the median. In interpreting this excessive rate of reproductive casualty resulting from early summer conception, two etiologic factors were postulated. These were decreased protein intake during the summer and heat stress.

Not only are the complications of pregnancy and mental deficiency associated with season of conception, but previous evidence (Pasamanick and Knobloch, 1958a) shows these abnormalities have an even more important association with socio-economic status. Since these complications are much more frequent in the lower socio-economic strata, both white and Negro, it is necessary to eliminate the socio-economic factor in order to substantiate the role of summer and its concomitants, heat stress and reduced protein intake, in producing complications of pregnancy and injury to the fetus. Two aspects need to be considered: (1) the general pattern of seasonal variations in birth and conception and (2) the socio-economic variations in season of birth.

Seasonal Variations in Birth

It has long been known that there are marked seasonal variations (Huntington, 1938 and Mills, 1939) in the birth rate in the United States and, indeed, throughout the Western world. These variations include a pronounced trough in the percentage of total 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 the births of whites and non-whites, and males and females.

The August–September peak has traditionally and rather facetiously been attributed to increased sexual activity during the longer and colder winter nights. The explanation for the consistent spring depression in births has been less obvious. Three interrelated variables have been postulated as explanations. The first and most obvious is that *high* summer temperatures and humidity reduce the risk of conception. There are

two ways in which this may occur. Temperature discomfort may, first, reduce sexual activity and, second, adversely affect the viability of the sperm. There is some very interesting evidence in support of this reduced conception risk hypothesis. If sexual activity and/or sperm viability is reduced or increased with temperature and humidity variations, then those states which have semi-tropical summer climates should exhibit the greatest troughs in spring births while states with only minor annual fluctuations in temperature should have only a slight spring depression or none at all. In order to assess the validity of this hypothesis, the monthly birth rates were compared in four groups of states as well as in the United States as a whole. The four groups of states in order of their presumed gradient in lowered spring births were the Southeastern, Midwestern, Northeastern, and Northwestern (Shapiro and Halpin, 1947).

From the 1955 data on births by month, state, sex, and race (Table 23, pp. 207–211) issued by the National Office of Vital Statistics, it was apparent that the spring dip did correspond to summer temperatures. Instead of the normal 8.3 per cent expectancy, the percentage of April white male births, for example, was 7.8 per cent in the United States, 6.7 per cent in Mississippi, 8.0 per cent in Wisconsin, 8.2 per cent in Maine, and 8.5 per cent in Washington. Similar results (Pasamanick, Dinitz and Knobloch, 1959) were also obtained for contiguous states in the same region.

These same data also lend credence to the second hypothesis, which suggests that there is an increased fetal death rate among conceptions occurring immediately prior to and during the summer months. As noted previously, the suggested causes for the increased fatalities are protein deficiencies and heat stress. The hypothesized mechanism could be via the hypothalamic-pituitary-adreno-cortical system which has been implicated in fetal deaths in animals consequent to experimental stress. It should be noted, also, that the peak period of neonatal death rates in the first 28 days of life is the spring. This again indicates that these children were conceived when there was prob-

ably maximum temperature stress and, equally probably, some concurrent dietary deficiencies, which give rise to brain damage.

The third explanation for the spring decline in births is purely statistical in character and admittedly accounts for a small fraction of this decline. The point here is that increased births during the late summer months automatically eliminate the conception and delivery of children during the preceding and succeeding spring months.

Socio-Economic Variations in Births

The preceding data leave little doubt that, however interpreted, climatic variations play an important role in birth and infant death rates. These effects, however, are not randomly distributed among all segments of the population. The lower the socio-economic group, the more closely its vital statistics tend to conform to the general pattern of the spring trough. The higher the socio-economic group, the less the departure from the normal expectancy of 8.3 per cent.

No reports of monthly births by socio-economic groups are available for the United States or any of the States; such data were therefore gathered for a five-year period, 1952–1956, in Baltimore, Maryland. The census tract of residence of the mother was used as the criterion of socio-economic status. For the whites the census tracts were divided into ten groups on the basis of median rental or value of the dwelling property. Non-whites were treated as a single group.

During the period 1952–1956, there was an annual average of 23,100 births to Baltimore residents. Of these, some 37 per cent were non-white births. Somewhat surprisingly, the number and percentage of births in the highest socio-economic fifth of the population exceeded the number in any of the other socio-economic fifths. This is probably largely a function of the census tract classification used and the larger number of non-white residents in the other four socio-economic categories.

Table 1 presents the adjusted (for number of days per month) number and percentage of births in the non-white

Table 1. Adjusted monthly distribution of births to Baltimore residents, 1952–1956, by white socio-economic fifths and non-whites.

Month	Non-White		Lowest Fifth		Lower Middle Fifth		Middle Fifth		Lower Upper Fifth		Highest Fifth	
	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
January	3,493	8.2	1,216	8.5	1,186	8.5	1,052	8.5	1,097	8.4	1,423	7.5
February	3,466	8.1	1,186	8.3	1,174	8.4	1,049	8.5	1,125	8.6	1,690	8.9
March	3,308	7.7	1,155	8.1	1,073	7.7	988	8.0	1,028	7.9	1,584	8.3
April	3,055	7.1	1,031	7.2	1,000	7.2	939	7.6	991	7.6	1,542	8.1
May	3,080	7.2	1,009	7.1	976	7.0	912	7.4	933	7.2	1,569	8.2
June	3,599	8.4	1,164	8.1	1,104	7.9	964	7.8	1,122	8.6	1,529	8.0
July	3,894	9.1	1,304	9.1	1,231	8.8	994	8.1	1,152	8.8	1,627	8.5
August	3,937	9.2	1,277	8.9	1,283	9.2	1,140	9.2	1,079	8.3	1,605	8.4
September	3,931	9.2	1,337	9.4	1,338	9.6	1,146	9.3	1,170	9.0	1,702	8.9
October	3,642	8.5	1,274	8.9	1,222	8.7	1,010	8.2	1,097	8.4	1,600	8.4
November	3,593	8.4	1,158	8.1	1,185	8.5	1,031	8.4	1,079	8.3	1,569	8.2
December	3,770	8.8	1,176	8.2	1,207	8.6	1,113	9.0	1,164	8.9	1,641	8.6
Total	42,768		14,287		13,979		12,338		13,037		19,081	

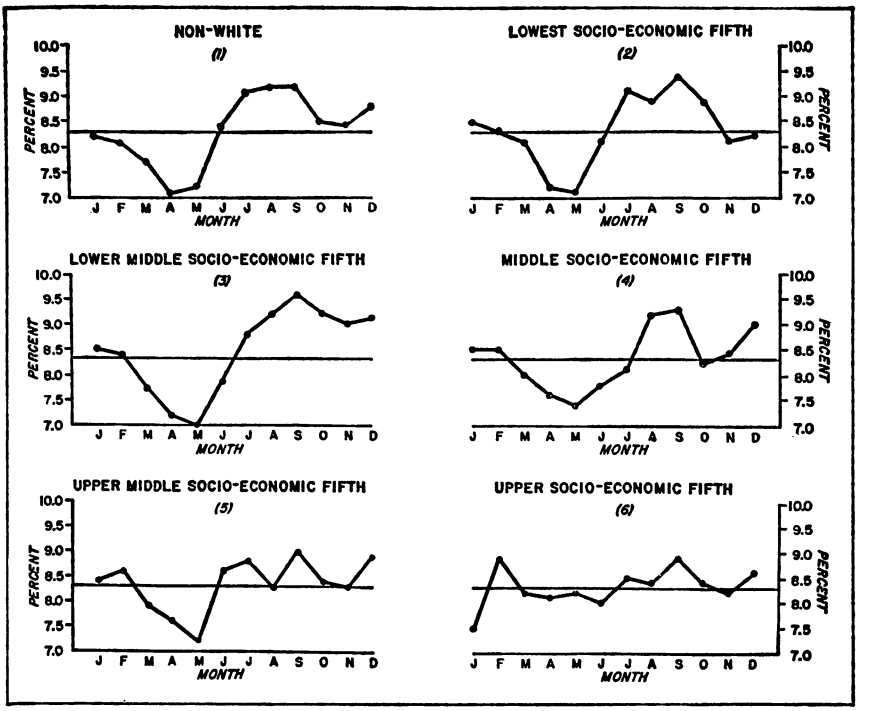

Fig. 1. Adjusted monthly births to Baltimore residents, 1952–1956, by white socio-economic fifths and by non-white.

group and in each of the white socio-economic fifths. Observations of this table, and of Figure 1 which portrays the same data graphically, reveals that there is a very pronounced but not quite perfect gradient in the percentage of summer and of spring births. As predicted, the amount of over-representation of summer births varies inversely with socio-economic status. The highest summer birth rates are to be found in the non-white group and in the lowest three fifths of the socio-economic continuum. Even more significantly from the point of view of this paper, the greatest spring trough in births occurs in these same groups. On the other hand, the highest socio-economic status category exhibits the smallest monthly variability in births. The curve for this group comes close to approximating a straight line.

Tests of significance for the various distributions add statistical validity to this graphic picture. The spring trough in births

was significantly different whether the white births were divided into highest and lowest socio-economic deciles, fifths or even into halves.

It would appear therefore that a variety of socio-economically determined factors are operating to create these monthly rate disparities. These probably include, among others, the ability of the higher socio-economic status groups to modify, by air conditioning, suburban homes, and country vacations, the effects of climate. With better nutritional practices they are also able to minimize protein and other dietary deficiencies. Finally, family planning practices resulting from the greater frequency and efficiency of utilization of birth control devices help randomize the monthly birth rates.[2]

The various links in this chain of evidence point to a fertile area for preventive measures. The ability of all persons to acquire the resources necessary for reducing the stresses associated with seasonal variations in climate might effect significant reductions in the complications of pregnancy and in infant morbidity and mortality.

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[2] It is possible that seasonal differences in marriage rates, by class, might account for the differential troughs and peaks noted above. Such an interpretation does not seem very probable. An investigation of class variations in the month and season of marriage in Franklin County, Ohio from 1933–1958, conducted by these authors, proved negative on this point.