

# CLIMATOLOGICAL INFLUENCES IN MENTAL DEFICIENCY AS RELATED TO THREE ETHNIC GROUPS\*

CHARLES C. CLELAND, IRA ISCOE, AND WILLIAM F. PATTON  
*The University of Texas, Austin, Texas, U.S.A.*

Seasonal variations are known to influence both plants and animals in a variety of ways. Among animals, the entire phylogenetic spectrum appears sensitive to these seasonal forces (Fraser, 1964; Masland, 1958; Milne and Milne, 1962). Migratory behavior, activity levels, mating, etc., are only a few of the behaviors among the vertebrates at the sub-human level apparently related to seasonal variations.

In the study of human behavior and specifically, the major determinants of human mentality, experimental embryologists have isolated three primary forces. Brondsted (1956) labels them: ". . . a geno-typical, a foetal-environmental, and a postnatal-environmental factor," and it is toward the foetal-environmental force that this study is directed. If seasons influence the development of plants and animals in such a variety of ways, it appears reasonable to expect certain relationships between the seasons and human characteristics. Previous investigators have adduced suggestive evidence in support of this premise relative to the temperature variable. This study is an attempt to further define this relationship.

Both psychotics (mainly schizophrenics) and mental defectives have been studied previously and incidence has been related to season of birth (Barry and Barry, 1961, and Knobloch and Pasamanick, 1958). Barry and Barry, studying psychotics' monthly distribution of births as reported "by 7 independent investigators: 3 in Europe and 4 in the United States," indicate that all seven were in agreement "in showing that the birth rate of schizophrenics was above the control rate in the first trimester (January-April) and below the control in the second (May-August)." In the work of Knobloch and Pasamanick wherein mental defectives admitted to the Columbus State School between

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1913 and 1948 (1946 excluded) were studied ( $N = 5,855$ ), ". . . it was found that significantly more had been born in the winter months, January, February, and March." Thus, the relationship of seasonal influences on psychosis and mental deficiency and the issue of month of conception versus month of birth represent foetal-environmental dimensions of importance to epidemiological investigators. Barry and Barry (1961), in discussing the explanations offered by earlier investigators on the relationship between season of birth and psychosis (and mental deficiency) have proposed two principal explanatory categories: "Atypical seasonal distribution of procreations and adverse season coinciding with critical stage of development."

As is true of all epidemiological studies, however, not all the conceivably important factors could be included in the above-mentioned investigations. Two notable omissions of possible importance were the possibility of ethnic differences, and the likelihood of differences being attributable to a heterogeneous as opposed to a homogeneous climate. In the Barry and Barry summarization, Swiss, German, Dutch and Northeastern U.S. psychotic subjects comprised the samples, while the work of Knobloch and Pasamanick on mental defectives was limited to patients from a region having marked seasonal variations.

The present study, representing a partial replication of the work of Knobloch and Pasamanick also sought to explore the possible relationships of ethnicity and a relatively stable, generally warmer climate on the incidence of retardation. Texas has a large, institutionalized population of retardates and warm or hot temperatures prevail for a large part of the year, instead of during the short three-month summer of the north. Compared to other parts of the United States, Texas has between 2300 and 2900 hours where outdoor temperatures are above eighty degrees Fahrenheit as contrasted with 100 to 300 for the upper New England states and 300 to 900 for the upper Great Lakes and Central Appalachian regions (Schuler, 1954). Corroborative evidence on Texas temperatures for the period from 1931 to 1960 was obtained from U.S. Weather Bureau sources.\* The relative heteroethnicity of the Texas population presented a unique study opportunity. In the 1960 Texas census,† 72.6 percent were Anglo, 14.8 percent had Spanish surnames and 12.6 percent were non-white of a total population of 9,579,677. Based on these seasonal and population characteristics it appeared indicated to determine whether previously

\* Source: U. S. Weather Bureau: *Decennial Census of U. S. Climate—Monthly Normals of Temperature, Precipitation, and Heating Degree Days—Texas*. Climatology of the United States. No. 81-36. U. S. Gov't. Prntg. Office, Washington 25, D. C., 1962.

† Source: U. S. Bureau of the Census. *U. S. Census of Population: 1960 Subject Reports. Persons of Spanish Surname*. Final Report PC (2)-1B. U. S. Gov't. Prntg. Office, Washington 25, D. C.

reported relationships would be reflected when such differences were controlled. Since earlier studies employed institutionalized samples and because a large residential subject pool was available through the Biometrics Division of the Mental Health and Mental Retardation Department ( $N = 11,000$  retardates), these  $S$ 's were accordingly selected for this study.

#### PROCEDURE

From the total of 11,000 institutionalized retardates, 6,771  $S$ 's on whom complete ethnic data were available were selected for study. The sample included those  $S$ 's born during the period of 1940–1964. The Texas State Department of Health, Bureau of Vital Statistics, supplied the data on Texas' live births by occurrence for the years 1940–1964. During this period, a total of 5,233,300 live births were recorded—this total being broken into the monthly and yearly occurrence from which expected versus actual frequencies were obtained. Climatic data were obtained from the U.S. Department of Commerce Weather Bureau for computing the hottest and coldest trimesters and quarters. A thirty year climatic mean was employed since this time span was representative of the birth years included in this study. Based on recent census figures for the State of Texas and using an overall incidence rate of 3 percent (Jordan, 1961), it is estimated that the institutionalized population of retardates approximates 5 percent of the total retardates in Texas.

In the investigation of Knobloch and Pasamanick (1958), mean temperatures for June, July and August were calculated to yield respectively  $70.19^{\circ}$ ,  $74.30^{\circ}$ , and  $72.73^{\circ}$  F. Weather data for Texas, calculated for a thirty year period, yielded mean June, July and August temperatures of  $91.5^{\circ}$ ,  $93.9^{\circ}$  and  $93.9^{\circ}$  F. respectively. These differences are obviously highly significant. Since Texas summers are consistently hotter, the present study made no distinction between "hotter and colder" summers *per se*, but focused analyses on expected versus observed incidence of retardation by comparing on quartile and trimester bases for the "hot-cold dimension."

#### RESULTS

The results are best discussed in the form of certain questions that can be asked of the data:

1. *For the State of Texas, does the institutionalized population of mental retardates show a different pattern in regard to month of birth than that of a normal population?*

In order to answer this question, the expected number of births of retardates by month was calculated based upon the total live birth rate of Texas for the years 1940–64 inclusive, and compared to the total number of retardates born within this period, or specifically, the total number of institutional re-

TABLE 1  
Observed vs. Expected Births of Retardates

	Observed	Expected	Difference
January	566	577	-11
February	520	515	+ 5
March	551	528	+23
April	447	471	-24
May	529	485	+44
June	520	507	+12
July	599	595	+ 4
August	614	646	-32
September	612	630	-28
October	589	626	-37
November	606	589	+17
December	618	602	+16

tardates alive and institutionalized. These were compared with the actual number of births in each of the months using a frequency comparison ( $X^2$ ). These data are given in Table 1. The p. of  $> .30$  indicates there is no consistent trend. The months of August, September, and October are the three highest months of frequency of birth in the state of Texas for the twenty-five year period (1940-1964). For those persons who were eventually diagnosed as retarded and admitted to a state institution, the three highest months of frequency of birth are December, August, and September. It would appear, that in terms of observed versus expected frequency, month of birth of retardates is not significantly different from that of the normal population. To be considered here, however, is the fact that we are dealing only with an institutionalized population, and loss by separation or mortality, particularly of severely retarded, is not included in the figures.

2. Does month of conception make a difference?

To test whether the month after conception is a differentially more critical period in the incidence of retardation, a test was made comparing those retardates who were in the first month of fetal life during one of the four hottest months of the year with those in the first fetal month during one of the four coldest months of the year (assuming a full-term pregnancy). A comparison of these frequencies yielded a  $X^2$  of 3.91 which is significant at the .05 level. The same analysis was made using the criterion that the first month of conception occurred during the *three* hottest or three coldest months of the year, i.e., June, July, August versus December, January, February. Here again a sig-

nificant  $X^2$  ( $p. < .05$ ) was obtained. To test further, an analysis was made assuming that the critical period would be the second month after conception. For the four hottest months of the year and the four coldest months of the year no significant differences were obtained. In order to test further the hypothesis that month of birth rather than conception season is the crucial variable,  $X^2$ s were run on two groups—those retardates born in hot months and those born in cold months. The months November-February constituted the cold months, and the months June-September constituted the hot months. No significant differences were found using these four months periods or using three months periods, i.e. December-February or June-August.

It would appear that based on the above findings there is a differential monthly incidence of mental retardation and that systematic variation follows the season of conception or more specifically, the month after conception rather than the month of birth. There may be factors other than temperature variation which contribute significantly to the above finding, but the findings offer reasonable support for previous studies with regard to patterns of incidence as related to temperature fluctuations. Further elaboration and consideration of other possible factors is taken up in the discussion.

3. *Are there differences between ethnic groups with respect to seasonal patterns of the birth of retardates?*

It will be recalled that the population of Texas may be divided into three ethnic groups—an Anglo majority and Negro and Mexican-American minorities. From the information available it was possible to carry out such a division with regard to ethnic origin. The frequency of retardates by birth month for the three ethnic groups is given in Table 2. A plus indicates that there were more retarded births than would be expected; a minus indicates less; and an equal indicates expectancy. An overall  $X^2$  test showed significant differences between the three groups, but none between any combination of only two groups. However, from the table, a definite trend is visible in that the Mexican-Americans contribute a higher proportion of their share during the first half of the year and less than their share during the last half.

In order to explore further the question of the contribution of ethnic groups to the population of retardates and its relationship to temperature,  $2 \times 2$  contingency tables were set up comparing two groups at a time, using the four months February-May versus July-October inclusive. Anglo versus Mexican-Americans differed significantly with a  $X^2$  value of 6.75 ( $p. < .01$ ). They also differed significantly on the three month span, i.e., February-April versus July-September ( $p. < .02$ ). For the Anglo versus Negro population there was no significant difference in either three or four month spans. The Negro versus Mexican-American groups, however differed at the .01 level on

TABLE 2  
*Incidence of Retardation by Ethnicity*

Month	Anglo	Negro	Latin
January	+	-	+
February	+	-	+
March	-	+	+
April	-	-	+
May	+	-	=
June	+	-	=
July	-	+	-
August	+	-	-
September	+	-	-
October	+	+	-
November	-	+	-
December	+	-	-

$X^2 = 36.105$  ( $p. < .05$ )

Trends in the data may be easily seen thru the valence code. + indicates that there were more retarded births than would be expected; - means less and = means as expected.

the February-May versus July-October comparison and at the .05 level for the February-April versus July-September analysis. Within the framework of Table 2 we should note the differences between Mexican-Americans and Negroes and lack of differences between Anglos and Negroes when the hot versus cold months are subjected to analysis of frequencies.

4. *Are there any sex differences overall or within any ethnic group?*

In order to answer this question appropriate  $X^2$  tests were run between Mexican-American males and Mexican-American females for the months February-May versus July-October.  $X^2$  was non-significant as it was for the same comparisons for Anglo males versus females and Negro males versus females. It would appear, therefore, that although differential rates of retardation exist between some of the ethnic groups, these differences are not accounted for by differential proportions of retardates in regard to sex.

5. *Are there any ethnic differences within levels of retardation?*

A comparison of Negro versus Anglo and Negro versus Mexican-American retardates did not reveal any significant differences at any of the three levels of retardation; i.e., where Level I encompassed IQs of 19 and below; Level II, IQ from 20 to 49; and Level III, IQ from 50 to 75. A further analysis, comparing Anglos versus Mexican-Americans in Level I (profound re-

TABLE 3

*Frequency by Intellectual Level, Ethnicity, and Dichotomous Temperature Periods*

	Profoundly Retarded (Level I)				Educable Retarded (Level III)			
	Anglo		Mexican-American		Anglo		Mexican-American	
	Observed	Expected	Observed	Expected	Observed	Expected	Observed	Expected
Feb.-May	331	341	127	117	318	326	60	52
July-Oct.	418	408	129	139	390	382	54	62
	N = 1,005		X <sup>2</sup> = 2.11 (n.s.)		N = 822		X <sup>2</sup> = 2.63 (n.s.)	
	Anglo		Mexican-American		Anglo		Mexican-American	
	Observed	Expected	Observed	Expected	Observed	Expected	Observed	Expected
Feb.-Apr.	240	290	102	103	234	239	45	40
Aug.-Oct.	331	281	101	100	298	293	43	48
	N = 774		X <sup>2</sup> = 3.89 (p. < .05)		N = 620		X <sup>2</sup> = 1.36 (n.s.)	

df = 1.

tardation) for the entire year yielded a  $X^2$  value of 2.133 and a  $p < .05$  suggesting additional analyses.

Table 3 presents comparisons of Anglos versus Mexican-Americans on the variables of levels of retardation as related to dichotomous temperature periods, i.e., hot or cold months. It may be seen that for the profoundly retarded, for the months of February-May versus July-October, no differences obtained between the two ethnic groups. However, for the months of February-April versus August-October, a significant frequency difference was obtained,  $X^2 = 3.89$  ( $p < .05$ ). In the educable retarded group (IQ 50-75) no significant differences were obtained between Anglos and Mexican-Americans for any combination of months or overall comparisons. It would appear, therefore, that overall the Mexican-American group presents proportionately more profoundly retarded than the Anglo group, but that there were no differences between ethnic groups for the higher levels of the institutionalized mentally retarded. Evidently the hot-cold dimension was not the important factor in this differential because when only the hot-cold months were compared for Mexican-Americans versus Anglos, no significant differences resulted. A possible interpretation is advanced in the discussion section.

#### *6. What effect may be attributable to parental education?*

A sample of 5,037 institutionalized retardates was available for comparison of level of father's education and frequency of retardation by month of birth. It was felt that the father's education level would correlate sufficiently well with socioeconomic status to permit inferences to be made regarding social class and economic condition. Three levels of education were: (1) illiterate; (2) schooling completed through junior high school; and (3) completion of high school or beyond. The distribution of the illiterate sample was 63.3 percent Mexican-American, 21.5 percent Anglo, and 15.2 percent Negro. An overall comparison between month of birth and education of father, using the three educational categories described above, was non-significant. When hot versus cold months were compared, significant differences were obtained.

Table 4 shows the observed and expected frequencies during the three hottest and three coldest months for the three educational levels. The raw data suggest that the illiterate fathers' group contributes more than the other groups combined to the significant departure from expectation.

#### SUMMARY AND DISCUSSION

In general, the results afford mild support for the hypothesis that month of conception is an important variable insofar as incidence of mental retardation is concerned. Especially is this a tenable inference if the month of conception

TABLE 4

*Incidence of Mentally Retarded as Related to Level of Paternal Education,  
Temperature Variation, and Month of Birth*

Month of Birth	Illiterate Fathers		Junior High School		High School Graduates	
	Observed	Expected	Observed	Expected	Observed	Expected
Feb.-Apr.	278	239	426	421	406	450
Aug.-Oct.	256	295	515	520	599	555

df = 2

$X^2 = 19.41$  (p. <.001)

is during one of the hottest periods of the year. Unquestionably other factors require consideration. The present study is more suggestive than definitive and indeed suggests further careful attention to socioeconomic, climatic and educational variables.

From Table 4 it may be observed that the pattern established in relation to month of birth shows the illiterate group to contribute above the expected number of retardates for the months of February-April. This pattern was not observed for the Negro nor Anglo groups but holds only for the Mexican-American. Why? If illiteracy were the deciding factor it should hold across groups. However, since it correlates only with the Mexican-American group the influence or apparent influence of illiteracy is likely an artifact and may be linked to the work patterns of the unskilled Mexican-American laborer in Texas. That is, during the months of conception which would occur in August, September, October and November, the likelihood that the illiterate Mexican-American would be engaged in migratory, farm labor is much greater than is true for the Negro or Anglo illiterate groups (Browning and Mc-Lemore, 1964). Among Negro illiterates the more typical family structure would be classified as matriarchal (Frazier, 1948) whereas the Mexican-American family more typically reflects a patriarchal orientation (Rubel, 1966). For the Anglo illiterate, migratory work is not a widespread practice in Texas. Thus, if during the critical period of gestation, i.e., somewhere in the first three months, the Mexican-American mother is exposed to greater travel, increased physical strain, a disruption of habits of elimination and perhaps significant dietary change, it is possible that this factor alone could significantly influence the greater numbers of profoundly retarded reaching the institutions. Even if one were to argue that the pregnant Mexican-American mother were to remain with relatives while the husband travelled long distances to work as a farm laborer, it is still possible that the psychological impact of

separation would be differential for the Mexican-American mother. It appears that the elevated incidence of itinerant workers among Mexican-American illiterates, over and above the other ethnic groups, would represent the most logical available explanation for the phenomenon of more profoundly retarded offspring of the Mexican-Americans being in institutions. It is apparent that profoundly retarded children could only, with special and tremendous effort, be included on such extended journeys as face the migrant laborer. It should be emphasized that our analyses throughout are based upon an institutionalized population and whether similar relations would obtain for non-institutionalized retardates remains unresolved. For the retarded group wherein educational level of father was studied, it was not possible to obtain complete information on this variable and consequently the sample obtained ( $N = 5,037$ ) represents a 25.6 percent shrinkage.

In conclusion, the present study of 61.6 percent of the 11,000 institutionalized retardates resident in six Texas institutions provides modest support for previous studies relating season of birth to incidence of retardation. That season of birth is an important variable, but more especially so among the Mexican-American illiterate group, remains the most interesting finding of this study. Important too, although forming a less pronounced pattern, is the incidence pattern mildly consistent with earlier studies. This pattern, it should be noted, was obtained in a much more homogeneous and warmer climate than in previously reported studies. In addition to the relationship reported relative to temperature variations, the season of conception would appear from the present study to merit increased research attention.

Unquestionably, numerous other interpretations, among them nutritional differences, the known concentration of Mexican-Americans in South Texas, humidity differences, etc., could be invoked. Such issues and the possible interdependencies existing among these variables remain for future investigation.

No attempt was made in this study to examine the records of deceased retardates who were at one time in their lives part of the institutional population, nor to trace out or examine the information on students who were at one time residents in state institutions, but who have, for reasons other than death, departed the institution.

Finally, it should perhaps be mentioned that although recent trends prohibiting the notation of race, religion, etc. are doubtless designed to safeguard individual rights, it does constitute a significant handicap to the conduct of studies wherein ethnicity and other social class variables are deemed important. If further work should in fact demonstrate that ethnicity is linked to retardation in any systematic manner, some method for responsible investigators to obtain such information should be worked out by an inter-ethnic scientific board.

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## ABSTRACT

Knobloch and Pasamanick (1958), Barry and Barry (1961) have studied the influence of season on the incidence of mental retardation and mental illness. Such investigations have utilized subjects living in temperate zones possessing seasonal patterns. In the Knobloch study, increased numbers of retardates occurred whenever the critical stage of fetal development coincided with hot summers.

The present study investigated the relationship between season of conception and subsequent birth of mental defectives. Utilization of the Texas institutionalized population affords a differential assessment of the effects of temperature since Texas is warmer in contrast to the home of subjects used in earlier studies. Subjects were grouped according to ethnicity, (Anglo, Negro, Mexican-American), level of retardation, sex, and paternal education level.

Analyses indicate that more retardates seem to have been conceived, relative to expectation, in the hotter months of the year for the Mexican-American sample. No such trend was found for the total 11,000 retardates. Those subjects with IQ < 20 also seem to have been conceived in greater numbers during the hotter months than expected. Seasonal variations in season of conception

among retardates also reflect wide differences with respect to paternal educational level.

#### RESUMEN

Knobloch y Pasamanick (1958) y Barry y Barry (1961) han estudiado la influencia de las estaciones en la incidencia del retardo y enfermedades mentales. Estas investigaciones han usado sujetos que habitan climas templados con cambios regulares de estaciones. En el estudio de Knobloch el número mayor de retardados se produjo cada vez que el estado crítico del desarrollo fetal coincidió con veranos muy calurosos. En nuestro estudio investigamos la relación entre la estación de la concepción seguida del nacimiento de un retardado mental.

La utilización de la población institucionalizada de Texas permite una valoración diferente de los efectos de la temperatura ya que Texas es más caluroso comparado con el lugar donde habitaban los sujetos utilizados en estudios anteriores. Agrupamos los sujetos según su origen étnico, (anglo, negro, americano-mejicano), nivel de retardo, sexo, y nivel de educación de los padres.

Los análisis indican que más retardados de lo que se esperaba parecen haber sido concebidos en los meses más calurosos del año en la muestra americana-mejicana. No se encontró esta tendencia en el total de los 11,000 retardados. Los sujetos con un coeficiente intelectual,  $IQ < 20$  también parecen haber sido concebidos en mayores proporciones de lo esperado durante los meses más cálidos. Las variaciones climáticas en la estación de la concepción de retardados, también refleja grandes diferencias con respecto al nivel educacional de los padres.

#### RESUMO

A influência das estações do ano na ocorrência do retardamento e de doenças mentais já foi estudada por Knobloch e Pasamanick (1958), bem como por Barry e Barry em 1961. Nestas pesquisas foram usados sujeitos provenientes de zonas com climas temperados e com mudanças regulares de estações. No estudo de Knobloch se verificou que um número maior de retardados ocorre quando o período crítico de desenvolvimento fetal coincide com verões muito quentes. Em nosso estudo investigamos a relação entre a estação de concepção e o nascimento de retardados mentais.

A utilização da população institucionalizada de Texas permitiu uma apreciação diferente dos efeitos da temperatura, já que este Estado é mais quente quando comparado aos locais onde habitavam os sujeitos utilizados em estudos anteriores. Os sujeitos foram agrupados segundo sua origem étnica

(anglo-saxão, negro, americano-mexicano), nível de retardamento, sexo, e nível de educação dos pais.

Os dados indicam que um número maior que o provável de retardados foram concebidos durante os meses mais quentes do ano, na amostra americana-mexicana. Não se encontrou esta tendência quando o total de 11.000 retardados foram tomados em consideração. Sujeitos com um coeficiente de inteligência (IQ) < 20 também parecem terem sido concebidos em maior proporção do que a provável, durante épocas mais quentes do ano. As variações climatológicas na estação de concepção de retardados, também reflete grandes diferenças com respeito ao nível educacional dos pais.