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Recent Fertility Trends in Connecticut 1960 to 1970

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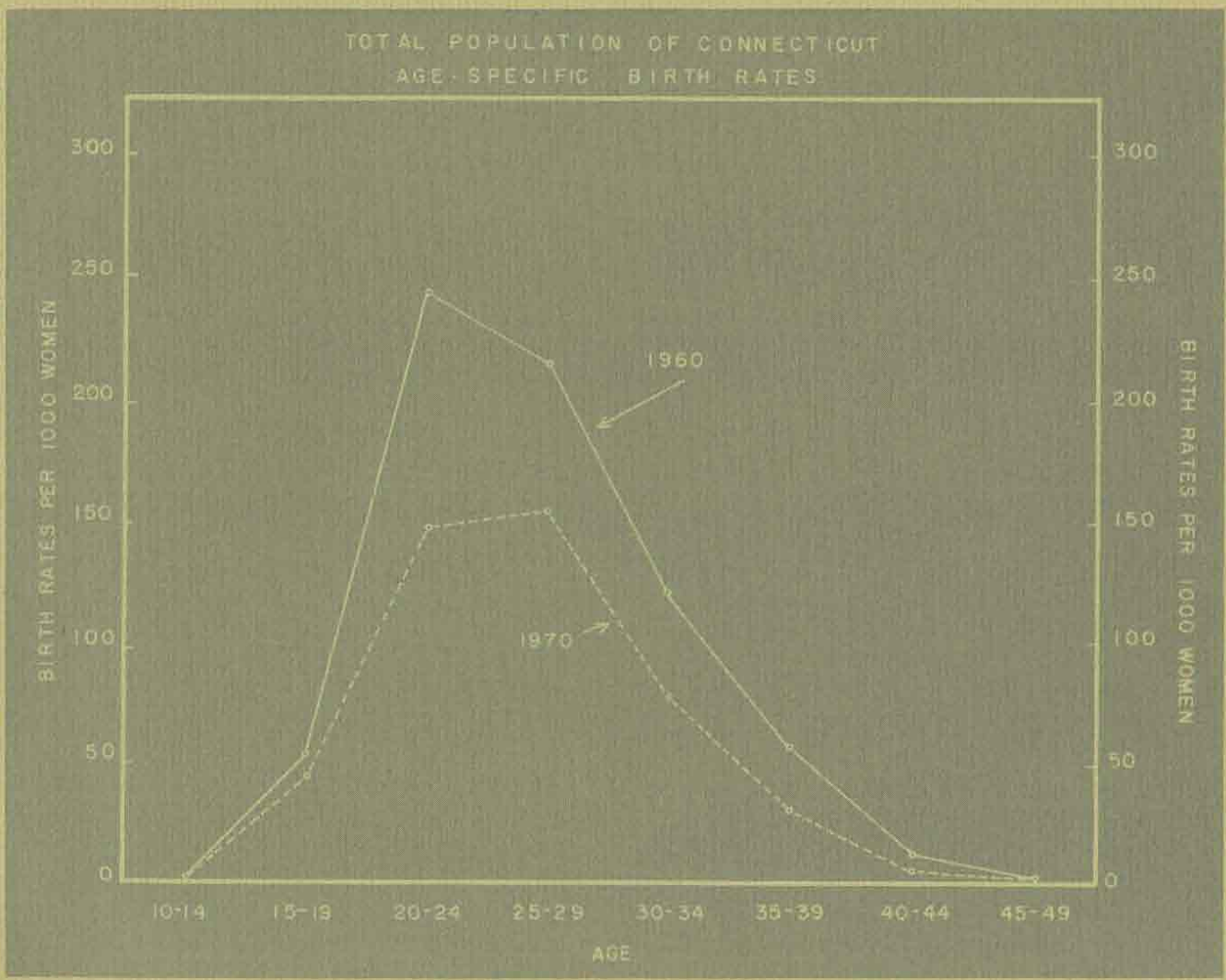

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INTRODUCTION

The state of Connecticut is rapidly becoming a heavily populated state. In 1970 the total population of 3,031,709 ranked Connecticut as the 24th largest state population in the nation. That represented a continuation of a thirty year trend in which Connecticut has steadily moved forward in the ranking of states by population size. In 1940, Connecticut ranked 31st in the nation, in 1950 it ranked 28th, and in 1960 it had the 25th largest state population. From 1960 to 1970 the population of Connecticut increased by 496,495 persons for a growth of 19.6 percent. That percentage change was the 11th most rapid in the nation and the absolute increase during the past decade was the 16th largest state increase in the nation.

A full understanding of the changing population of Connecticut would require an analysis of the demographic composition and geographic distribution of this population and the effects of these changes on fertility performance, mortality, morbidity levels, and patterns of in and out migration. The dynamic interrelationship of these three variables affect and are affected by changes in marriage rates, educational participation levels, changes in the occupational structure of the state, and other basic socioeconomic factors of our social system. Thus, a proper analysis of population dynamics in the state of Connecticut would involve the entire discipline of demography supported by a wide range of related social sciences. Clearly such an effort lies beyond the limits of the present project. An attempt will be made, however, to analyze major changes in one of the basic forces of population dynamics - fertility patterns.

The purpose of this report is to identify and analyze changes in the fertility performance of Connecticut's population that occurred from 1960 to 1970. Analysis will be accomplished in two major parts with the first part involving trends in births, crude birth rates, age-specific birth rates, and other measures of fertility performance. The second part will focus on the changing pattern of high risk births to Connecticut's mothers. Both parts will deal separately with white and nonwhite fertility patterns.

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It is recognized that a ten-year period is too brief for the detection of secular changes in fertility. Previous research has dealt with long term trends in the crude birth rate of Connecticut and outlined factors responsible for the historical decline of fertility.[1] However, significant changes in fertility during the 1960's, a rapidly growing nonwhite population in Connecticut, and a need for more detailed analysis were the reasons for selecting the shorter time period.

Population by Age and Color

As indicated in the Introduction, fertility will be analyzed in terms of numbers of births and birth rates. The calculation of a birth rate requires two sets of data, a) the number of births (the numerator) and b) a base population (the denominator). While annual birth data are readily available for Connecticut by race of mother, data for the denominator of the rates by race must be estimated. Table I presents the Connecticut population by color from 1960 to 1970.

The total, white, and nonwhite population figures for Connecticut in 1960 and 1970 are census counts but the figures for each of the intercensal years are estimates. Estimates of the total population were made by the Bureau of Census using an average of the results of two different estimation procedures. The methods used were a) the Component Method II of the Census Bureau which uses vital statistics to measure natural increase and school enrollment to estimate net migration, and b) the Regression Method in which changes in births, deaths, elementary school enrollment, number of Federal individual income tax returns filed, passenger automobile registrations, and employees on nonagricultural payrolls were used to estimate changes in population.[2] These yearly estimates of the total resident population of Connecticut are shown in Table I. Estimates from other sources were available but were not derived from as sophisticated a methodology.

Unfortunately estimates of nonwhite population in Connecticut for the intercensal years were not available from the Bureau of Census and had to be estimated with a separate methodology. There are many techniques of estimation with different assumptions as to the nature of population growth but an exponential growth curve, which is a compound interest type of change, was judged more appropriate than a simple linear estimation model, a geometric rate of change, or other possible estimation methods.[3] Exponential change during a ten year period may be expressed as

$$P_t = P_o e^{rt}$$

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1. Stockwell, Edward G. and Mostafa H. Nagi, Some Determinants and Consequences of Recent Fertility Trends in Connecticut, Storrs Agricultural Experiment Station, College of Agriculture, University of Connecticut, Storrs, Bulletin 406, (Oct 1968) pp. 3-21.
2. See, U. S. Department of Commerce, Bureau of the Census, Population Estimates and Projections, Series P-25 No. 460 (June 7, 1971) pp. 2-6 for a more detailed discussion of the methodology.
3. Shryock, Henry S. and Jacob S. Siegel and Associates, The Methods and Materials of Demography, U. S. Government Printing Office, Washington, D.C., 1971, Vol. 2, pp. 372-388 and 725-770.

Table I - Intercensal Population Estimates by Color, Connecticut, 1960 to 1970

Year	Total*	White		Nonwhite**	
		Number	Percent	Number	Percent
1960	2,535,234	2,423,816	95.6	111,418	4.4
1961	2,586,000	2,468,047	95.4	117,953	4.6
1962	2,647,000	2,522,250	95.3	124,750	4.7
1963	2,727,000	2,595,068	95.2	131,932	4.8
1964	2,798,000	2,658,326	95.0	139,674	5.0
1965	2,857,000	2,709,138	94.8	147,862	5.2
1966	2,903,000	2,746,624	94.6	156,376	5.4
1967	2,935,000	2,769,446	94.4	165,554	5.6
1968	2,964,000	2,788,735	94.1	175,265	5.9
1969	3,000,000	2,814,641	93.8	185,359	6.2
1970	3,031,709	2,835,458	93.5	196,251	6.5

Source: Bureau of the Census, Current Population Reports, Population Estimates and Projections, Series P-25, No. 460 (June 7, 1971) for total resident population.
* Intercensal estimates as of July 1 of each year.
** See text for method of nonwhite population estimates.

where

P_t is the estimated population at the end of the period,

P_o is the actual population at the beginning of the period,

r is the average annual growth rate,

t is the length of the time period, and

e is the constant

Since the nonwhite population of Connecticut is known for the beginning of the decade, 1960 and for the end of the decade, 1970, the above formula may be solved for r, the average annual growth rate of the nonwhite population in Connecticut from 1960 to 1970. The number of nonwhites in the state increased by 84,833 persons, from 111,418 in 1960 to 196,251 in 1970. This means that the average annual rate of

growth for nonwhites during the 1960's was 5.659 percent per year. If that very high rate of growth continues into the future, Connecticut's nonwhite population will double in size every 12.35 years. In any event, the large number of nonwhites in 1970, 92.3 percent of which are Negro, warrant separate fertility analysis. The white population for each intercensal year shown in Table I was obtained by subtraction of nonwhite from total population. These data provide the base for crude birth rates presented in the subsequent discussion.

In addition to annual estimates of population by color, the number of women in Connecticut by color and age are required for calculation of age-specific birth rates. Table II presents the number of women between 10 to 49 years of age, in five year intervals, for total, white and nonwhite populations in 1960 and 1970. These data are also valuable in assessing changes in the age structure of the female population over the decade - a factor that exerts a strong influence on fertility levels. In this regard, data in Table II show a substantial increase in the number of women in the younger, most reproductive years, the 15 to 29 year olds. That change in the age structure of the female population from 1960 to 1970 is observed for both white and nonwhite women, a fact which would suggest increases in the number of births. Implications of female age structure on fertility performance will be discussed in the following section.

TRENDS IN FERTILITY

Births and Birth Rates

A direct indication of fertility in a population is the trend in the number of births. Table III presents data on the number and rate of live births by color in Connecticut from 1960 to 1970. Several interesting trends emerge from these data. The number of total births during the decade has declined from 56,659 in 1960 to 50,738 in 1970, a decrease of 5,921 births or 10.4 percent less than 1960. However, there has not been a steady decline throughout the decade. The highest number of total births during the 1960's was recorded in 1961 at 57,046. The number of births the following year, 1962, fell to 55,480 but in 1963 and 1964 the number of births increased again to 56,496 and 56,611 respectively. From 1965 to 1968 the number of births declined each year and reached its lowest level in 1968 at 48,633 births. The last two years of the past decade recorded increases in the volume of births but remained below the birth levels of the early 1960's.

The total number of births in Connecticut is influenced by the total population size, among other factors, and one way to control for this variable is to calculate crude birth rates. The crude birth rate is the total number of live births divided by the total population times a constant, 1,000. It expresses the number of births per thousand population.

As shown in Table III, the crude birth rate for the total population of Connecticut exhibits a more regular trend than does the number of births. From 1960 to 1970 the crude birth rate fell from 22.3 to 16.7, a decline of 25.1 percent during the decade. For an eight year period during the last decade, from 1960 to 1968, the crude birth rate

Table II - Females by Age and Color, Connecticut, 1960 and 1970

Age	Total		White		Nonwhite	
	1960	1970	1960	1970	1960	1970
10-14	108,234	149,451	103,365	138,180	4,869	11,271
15-19	85,077	130,869	81,258	121,726	3,819	9,143
20-24	70,818	121,598	65,833	111,739	4,985	9,859
25-29	76,905	104,459	72,005	95,481	4,900	8,978
30-34	89,256	85,850	84,630	78,297	4,626	7,553
35-39	98,182	85,779	93,767	79,555	4,415	6,224
40-44	95,507	96,535	92,101	90,957	3,406	5,578
45-49	84,763	101,265	81,825	96,340	2,938	4,925

Source: U. S. Bureau of the Census, Census of Population, 1970, General Population Characteristics, Connecticut, PC(1)-B8, Table 21.

fell steadily until it reached a low level of 16.4 in 1968. The last two years of the 1960's exhibited a rise in the crude birth rate, a pattern following the increase in the number of births.

In 1960, 52,642 births were recorded for the white population of Connecticut and this represented 92.9 percent of the total births in the state. By 1970, 45,073 births were recorded for the white population, accounting for 88.8 percent of all births. Thus, during the past decade the growth in the number of nonwhites in Connecticut and the corresponding increase in the number of births to nonwhites are sufficient reasons for a separate analysis of fertility trends.

The number of white births during the decade declined by 7,569 or 14.4 percent below the 1960 level. There was a steady decline in the number of births from 1960 to 1968, the year in which the fewest white births were reported for the decade - 43,527. In 1969 the number of births to the white population increased to 44,768 and in 1970 the volume of births rose to 45,073. The trend in the crude birth rate for the white population in Connecticut follows that described for the volume of births, namely steady declines from 1960 (at 21.7) to a low level in 1968 (at 15.6) with a slight increase during the last two years of the decade (to 15.9 in 1970).

As indicated in the previous discussion, the number of nonwhites residing in Connecticut increased rapidly during the 1960's. The increase in the number of births to nonwhites reflects this general growth. In 1960 there were 4,017 births to nonwhites in Connecticut for a crude birth rate of 36.1 per thousand. From 1960 through 1965 the volume of

Table III - Number and Rate of Live Births by Color, Connecticut, 1960-1970

Year	Total Population		White Population		Nonwhite Population*	
	Number of Births	Crude Birth Rate	Number of Births	Crude Birth Rate	Number of Births	Crude Birth Rate
1960	56,659	22.3	52,642	21.7	4,017	36.1
1961	57,046	21.9	52,716	21.4	4,330	36.7
1962	55,480	20.8	50,978	20.2	4,502	36.1
1963	56,476	20.8	51,513	19.8	4,963	37.6
1964	56,611	20.4	51,582	19.4	5,029	36.0
1965	54,208	19.2	49,034	18.1	5,174	35.0
1966	52,131	18.1	47,039	17.1	5,092	32.6
1967	49,840	17.0	44,846	16.2	4,994	30.2
1968	48,633	16.4	43,527	15.6	5,106	29.1
1969	50,146	16.6	44,768	15.9	5,378	29.0
1970	50,738	16.7	45,073	15.9	5,665	28.9

Source: The State Department of Health, State of Connecticut, Registration Report of Births, Marriages, Divorces and Deaths, the 113th Report through the 123rd Report.

* In 1970, 92.3 percent of the nonwhite population in Connecticut were Negro.

nonwhite births steadily increased, reaching 5,174 births in 1965. For the next three years, from 1965 to 1968, the number of nonwhite births remained steady at approximately 5,000. The last two years of the decade, 1969 and 1970, exhibited a rise in the number of nonwhite births to 5,378 and 5,665 births respectively. Thus, over the ten year period the volume of nonwhite births in Connecticut increased by 1,648 or 41.0 percent more than in 1960, in contrast to the pattern discussed for white births. The crude birth rate for nonwhites was very high during the first half of the decade, at 36.1 in 1960 and 37.6 in 1963. From 1964 to 1968, the nonwhite crude birth rate fell each year, reaching 29.1 in 1968. The last two years of the decade recorded only a slight decrease in the crude birth rate, to 28.9. The declines in the crude birth rate for nonwhites were the result of a rapidly growing population that offset the increased volume of nonwhite births.

Age-Specific Fertility

While trends in the volume of births and crude birth rates provide a general view of fertility changes, a more detailed analysis is required for a fuller understanding of the dynamics of fertility change. Table IV contains data on various measures of fertility by color for Connecticut in 1960 and 1970. Of considerable interest are age-specific birth rates which are the total number of live births per 1,000 women in each five year age interval. Such fertility rates clearly indicate differential fertility by age of women, a factor known to have a strong influence on the number of births during the reproductive period.

It is immediately apparent from Table IV and Figure 1 that the total fertility performance of all age groups in Connecticut have declined markedly from 1960 to 1970. Birth rates in seven of the eight age categories, the exception being women 10 to 14 years of age, are substantially lower in 1970 than 1960. The birth rate for all women 15 to 19 years of age declined by 16.0 percent, from 53.1 in 1960 to 44.6 in 1970. Women 20 to 24 years of age, who account for the largest volume of births, declined in their birth rate by 39.2 percent from 1960 to 1970. Women 25 to 29 years of age decreased their birth rate by 27.8 percent during the 1960's, from 216.2 to 156.0 in 1970. Thus, women between the ages of 20 to 29 years, the ages of highest reproduction, were largely responsible for the decline in the total volume of births discussed in the previous section. The way in which this decline was accomplished will be explored in the following section on high risk births. It should also be noted that the largest proportional decline in fertility during the past decade occurred to older women 35 to 39 years of age. Their birth rate fell by 46.5 percent, from 58.6 in 1960 to 31.8 in 1970.

Age-specific birth rates for the white population, shown in Figure 2, of Connecticut exhibited patterns similar to those described for the total population, except at the younger ages. While white fertility declined in every age category except two, the very youngest and the very oldest age groups, the relative magnitude of the decline was greater than for the total population. White women 15 to 19 years of age reported birth rates of 48.3 per thousand in 1960 and 36.5 in 1970, a decline of 24.4 percent. The next age group, white women 20 to 24 years of age, reduced their fertility by 40.4 percent, from 241.1 in 1960 to 143.7 in 1970. The proportional declines in these two age groups was greater than for the total population. Also noteworthy is the consistent decline in fertility at the older ages. The largest proportional reduction during the 1960's was achieved by white women 35 to 39 years of age with a 46.5 percent decline in age-specific birth rates. Birth rates for white women 45 to 49 years of age remained unchanged from 1960 to 1970.

Nonwhites in Connecticut reported age-specific fertility rates, shown in Figure 3, which were both similar to and different than the pattern described for whites. A major similarity was the nonwhite age-specific fertility decline from 1960 to 1970 in every age category except the very youngest, women 10 to 14 years of age who reported an increase in their birth rate. But a major difference occurred in the proportional reduction of birth rates across the age categories. Nonwhite women between the ages of 15 to 19 years reduced their birth rate only slightly (2.4 percent) and thus remained at a high level of 152.8 births per thousand nonwhite women in 1970. That was substantially

Table IV - Measures of Fertility for Connecticut Population by Color, 1960 and 1970

Age & Fertility Measure	Total		White		Nonwhite	
	1960	1970	1960	1970	1960	1970
1 - Age Interval and Birth Rate						
10-14	.2	.5	.1	.2	3.1	4.3
15-19	53.1	44.6	48.3	36.5	156.6	152.8
20-24	245.2	149.0	241.1	143.7	299.7	208.8
25-29	216.2	156.0	217.1	157.5	203.3	140.9
30-34	122.4	79.7	122.2	79.9	120.4	77.8
35-39	58.6	31.8	58.3	31.2	65.9	39.8
40-44	14.4	7.8	14.3	7.7	18.3	9.7
45-49	.6	.5	.5	.5	1.4	.4
2 - Crude Birth Rate	22.3	16.7	21.7	15.9	36.1	28.9
3 - Standardized Birth Rate	22.3	14.8	22.1	14.4	27.5	20.1
4 - Total Fertility Rate	3.553	2.350	3.510	2.286	4.344	3.173
5 - Gross Reproduction Rate	1.730	1.140	1.708	1.108	2.137	1.545

1. All age-specific rates based on total live births per 1000 women.
2. Total live births, legitimate and illegitimate, registered during the year divided by the total Connecticut population of that year, times 1000.
3. Sum of age-specific expected births divided by the standard population times 1000. Standard was 1960 female population 10-49 years of age in Connecticut and the 1960 total population of Connecticut.
4. Sum of age-specific birth rates times width of the age interval (average births per woman).
5. Sum of age-specific female birth rates times width of the age interval (average female births per woman).

FIGURE 3

NONWHITE POPULATION OF CONNECTICUT

AGE-SPECIFIC BIRTH RATES

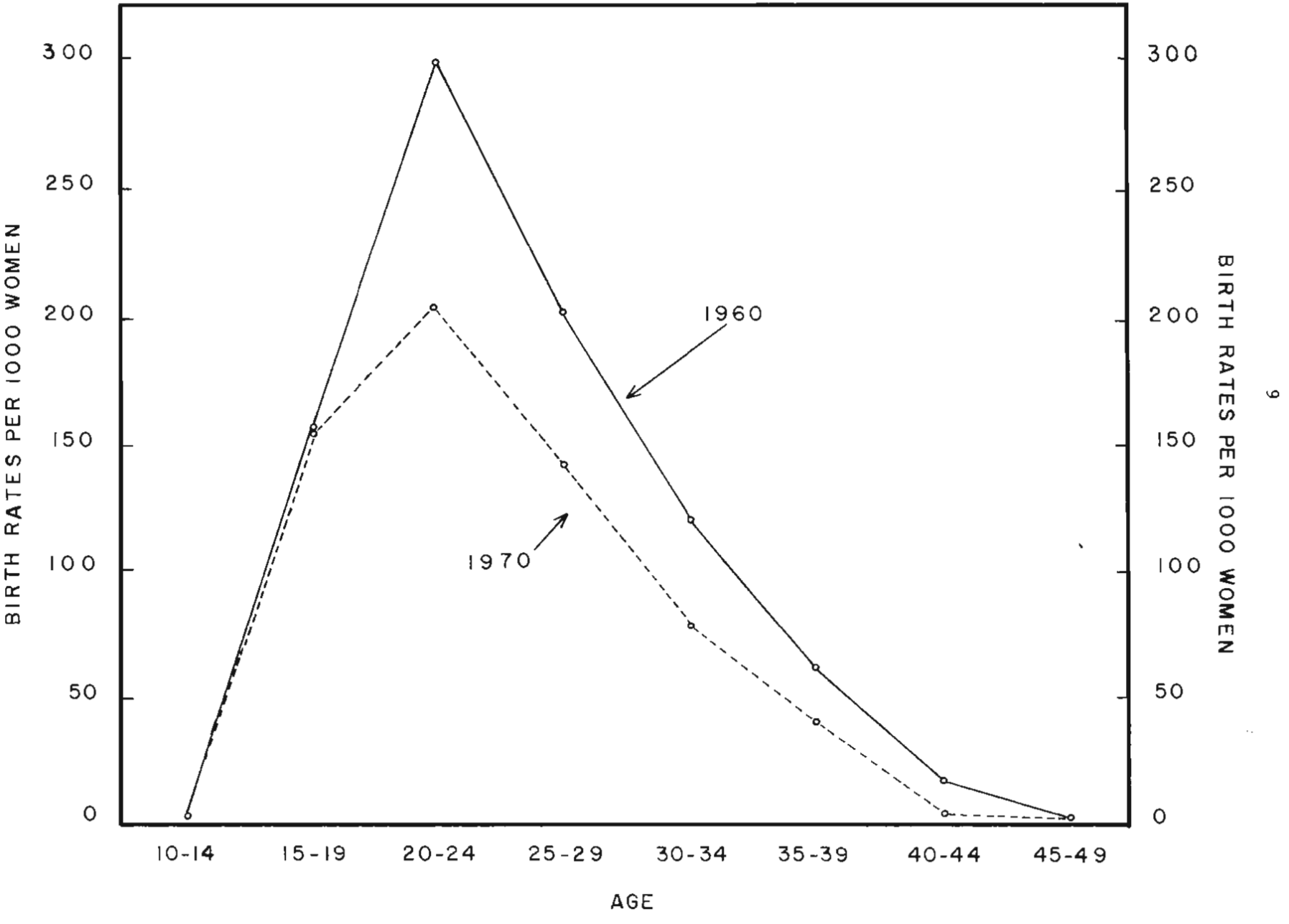
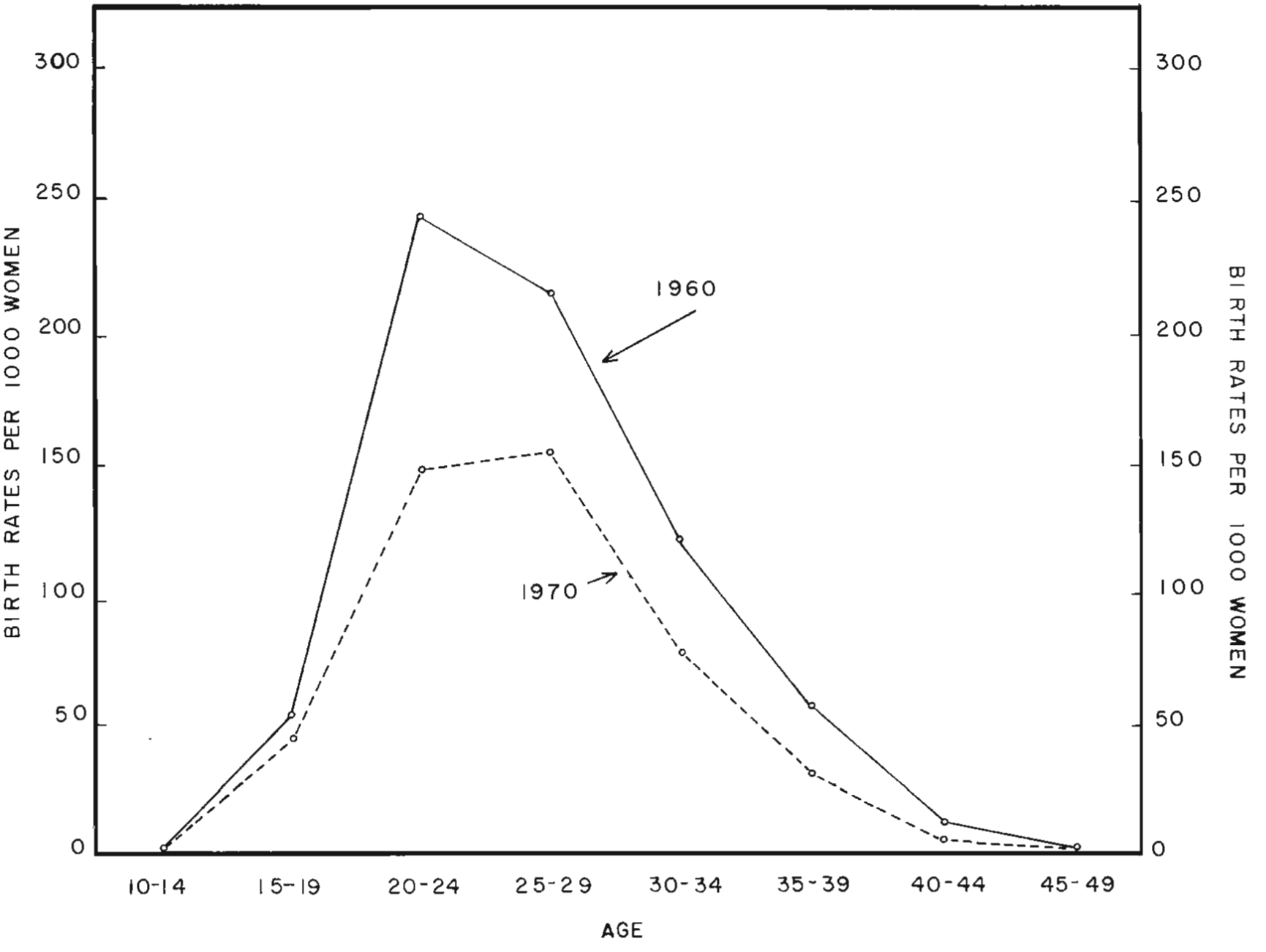


FIGURE 1

TOTAL POPULATION OF CONNECTICUT

AGE-SPECIFIC BIRTH RATES



higher than for white women of comparable age. Nonwhite women between 20 to 24 years of age reduced their fertility from 299.7 in 1960 to 208.8 in 1970, a decline of 30.3 percent. However, the 1970 rate remained well above that for white women of the same age. Nonwhite women in the next two categories, 25 to 29 and 30 to 34 years, exhibited larger proportional declines in their fertility than did white women and actually achieved lower age-specific birth rates than did their white counterparts. Nonwhite women 25 to 29 years of age reduced their birth rate to 140.9 by 1970, a decline of 30.7 percent. Nonwhite women 30 to 34 years of age reduced their fertility by 35.4 percent during the decade, reaching a low of 77.8 in 1970. Substantial age-specific birth rate reductions for nonwhite women were also achieved for each of the three older age groups. Thus, the increase in the volume of nonwhite births discussed in the preceding section was the results of a) the larger number of nonwhite women entering the reproductive ages, and b) very high fertility performance at the younger ages, ie., the 15 to 24 year olds.

Other Indicators of Fertility

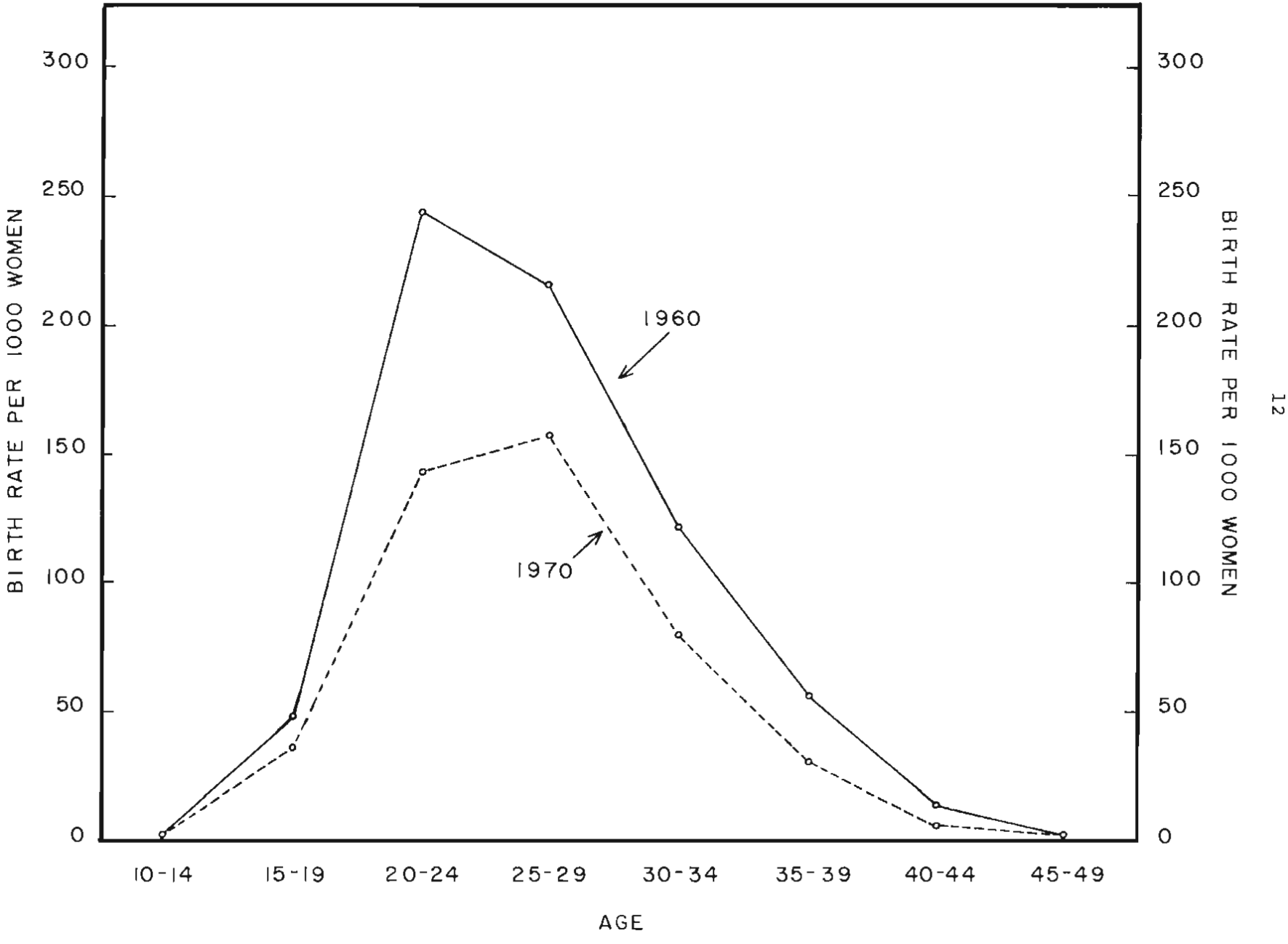
While age-specific birth rates provide a more detailed view of fertility, they do not fill the need for a single, comprehensive measure of fertility. The volume of births is sometimes used as a summary measure of fertility but it possesses the limitation of being strongly influenced by the number of women in a population as well as their level of fertility. The crude birth rate is then used as a rough means of comparing differential fertility but it possesses distinct limitations. First, the denominator is the total population in question and that includes many persons not exposed to the risk of pregnancy, e.g. men, young children, women beyond the reproductive age, etc.. Since the number of these persons varies from population to population, crude birth rates are not strictly comparable. Secondly, crude birth rates do not control for differences in the number of women in the reproductive ages. Thus, if two populations, such as whites and nonwhites, have identical crude birth rates one may not necessarily conclude they have identical fertility performance.

Age-standardized crude birth rates are calculated because they control for variations in female age structures. The standard population selected for the present analysis was the 1960 total female population 10 to 49 years of age in Connecticut and the total 1960 population in Connecticut. The method of direct standardization was used in which the actual age-specific birth rates are multiplied by the age-specific standard population to give an expected number of births.[4] The expected births are then summed over all age categories and divided by the total standard population times 1000. The resulting statistic is the birth rate that would have occurred in the actual population if it had the female age structure of the standard population. Age-standardized crude birth rates are therefore hypothetical, not actual, indicators of fertility that are directly comparable between different population groups over time.

As indicated in Table IV, the crude birth rate for the total population in Connecticut declined from 22.3 in 1960 to 16.7 in 1970, re-

4. Ibid., pp. 481-485.

FIGURE 2
WHITE POPULATION OF CONNECTICUT
AGE SPECIFIC BIRTH RATES



presenting a decrease of 5.6 points or 25.1 percent less than the 1960 crude birth rate. The standardized birth rate for the total population declined from 22.3 in 1960 to 14.8 in 1970, a decrease of 7.5 points or 33.6 percent less than in 1960. Thus, changes in the age structure of Connecticut's total population during the decade retarded by 1.9 points or 8.5 percent the decline in the birth rate from 1960 to 1970. In other words, the crude birth rate would have declined by 7.5 points, rather than 5.6 points, if the age composition had not changed during the decade. The changes in the age structure that did occur favored fertility and thereby retarded the decline in the crude birth rate by 8.5 percent. Table II discussed previously shows that the total number of women 15 to 29 years of age increased significantly from 1960 to 1970 and, although they recorded declines in age-specific birth rates, they were responsible for the less rapid decline in the crude birth rate.

The white population in Connecticut recorded a decline in their crude birth rate of 5.8 points, from 21.7 in 1960 to 15.9 in 1970, or 26.7 percent lower than 1960. However, the standardized birth rate fell from 22.1 in 1960 to 14.4 in 1970, a decline of 7.7 points or 34.8 percent. This means that changes in the age structure of the white population retarded the decline in their birth rate by 8.1 percent. Inspection of Table II reveals a substantial increase in the number of white women between 15 to 29 years of age, which is a shift favoring fertility.

Nonwhites in Connecticut exhibit a different pattern. In 1960 the crude birth rate was 36.1 while the 1960 standardized birth rate was 27.5, substantially lower. This means that the nonwhite female age structure in 1960 was highly favorable for fertility and if it had the age structure of the standard population, the crude birth rate would have been lower in 1960. From 1960 to 1970, nonwhites decreased their crude birth rate by 7.2 points or 19.9 percent. However, the standardized birth rate fell from 27.5 in 1960 to 20.1 in 1970, a decline of 7.4 points or 26.9 percent. Thus changes in nonwhite female age structure during the past decade retarded the decline in the birth rate by 7.0 percent. This proportion is lower than for whites because changes in the nonwhite female age structure were distributed differently than was the case for whites. Table II shows a large increase in nonwhite women 10 to 14 years of age and a proportionally smaller increase in all other age categories. In other words, the age structure in 1960 was highly favorable for fertility and remained that way in 1970.

The fourth indicator of fertility contained in Table V is the total fertility rate which is the summation of the actual age-specific birth rates times the width of the age interval.[5] This measure has the advantage of closely approximating the childbearing population and of not being effected by differences in the female age structure. The total fertility rate may be interpreted, given certain assumptions upon which it is based, as the extent to which parents are reproducing themselves. A total fertility rate near the value of 2 indicates that parents are nearly replacing themselves and are not contributing to total population growth.

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5. Ibid., pp. 484-485.

In 1960, the total fertility rate for Connecticut was 3.553 children per woman, considerably above the value needed for parents to replace themselves. By 1970 the rate had declined to 2.350 children per woman. This decline in Connecticut of 1.203 points in the total fertility rate means that there would be a reduction in the average completed family size by at least one child if a) Connecticut women continued to bear children at the 1970 age-specific rates throughout their reproductive life and b) none of the women died before reaching the end of their reproductive period.[6]

When the total fertility rates by color are examined, a pattern similar to that for the total population emerges. In 1960, the rate for the white population was 3.510 children per woman but by 1970 the rate had declined to 2.286 children per woman, a value close to that needed for parents to replace themselves. Nonwhites in Connecticut started with a higher level of fertility than whites with a total fertility rate of 4.344 in 1960. However, nonwhites also made substantial reductions during the decade and reached 3.173 children per woman in 1970, a decline of 1.171 points or over one child in the average completed family size given the assumptions discussed above. Nonwhite parents are still well above the fertility rate needed to replace themselves, however.

The final measure of fertility in Table IV is the gross reproduction rate which is the sum of the age-specific female birth rate times the width of the age interval.[7] It is similar to the total fertility rate in calculation and interpretation except that it is limited to female births only. The gross reproduction rate may be viewed as daughters per woman or the extent to which women are reproducing themselves under the assumptions described for the total fertility rate.

The gross reproduction rate follows the pattern already described of significant declines from 1960 to 1970. For the total population of Connecticut in 1960, women were reproducing themselves at a rate of 1.730 female births per woman which is well above the level required for replacement. By 1970 however, the gross reproduction rate fell to 1.140 female births per woman which is approximately the level required for female population replacement. Data by color exhibit the same pattern. The white population in Connecticut decreased its gross reproduction rate from 1.708 in 1960 to 1.108 in 1970, a decrease of 35.1 percent over the decade. Nonwhite gross reproduction rate remained at higher levels than for whites but it also declined from 2.137 in 1960 to 1.545 in 1970, a drop of 27.7 percent in the rate.

In summary, the decline in the volume of births and in the crude birth rates in Connecticut from 1960 to 1970 were the result of several factors. Since white births represent the majority of all births, white fertility patterns largely determine the trends for the state.

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6. The first assumption is more crucial to any inference about the future fertility performance of a cohort of women than is the second assumption. In modern societies the mortality of women in the reproductive ages is very low and would not make a substantial difference in the rate if included in its calculation but, as indicated by the 1960 data, age-specific fertility rates can change significantly during a ten year period.
7. Ibid., pp. 524-525.

It was shown that age-specific birth rates for the white population declined substantially during the past decade and, more importantly, the changes in the white female age structure did not offset the pattern of lower birth rates. In other words, white women were having babies at a lower rate and the increase in the number of white women in the reproductive ages was not great enough to result in an increase in the volume of white births from 1960 to 1970.

This point is clearly demonstrated in the fertility patterns of nonwhites in Connecticut. As indicated in the previous discussion, nonwhites recorded substantial declines in their age-specific birth rates. On this basis one might expect a decline in the total volume of nonwhite births. Data show, however, an increase in the number of nonwhite births from 1960 to 1970. The reason for this apparent contradiction is that the number of nonwhite women in the reproductive ages increased sufficiently to offset decline in age-specific birth rates. In other words, nonwhite women were having babies at lower age-specific rates but there were more nonwhite women having babies in 1970 than in 1960, thus the increase in the volume of nonwhite births. Age standardized birth rates for whites and nonwhites presented previously reflect this difference in female age structure by race.

HIGH RISK BIRTHS

Discussion of High Risk Births

Fertility changes in Connecticut's population were dramatic during the last decade. For this and other reasons it is of interest to examine more closely how fertility declines were achieved, even though the female population increased in size during the decade. As pointed out in the discussion of birth rates, the volume of births may be reduced, other factors constant, by declines in age-specific birth rates. However, data on age-specific fertility do not reveal changes in patterns of timing of births - a separate factor of basic importance to fertility performance. While two populations, or the same population at two time periods, may have the same number of births, the patterns of birth order by age of mother may be entirely different. Examination of data on parity and age for total, white, and nonwhite populations in Connecticut will provide the insight required for a fuller understanding of observed fertility declines.

When births are arranged by birth order - first birth, second birth, third birth, ... tenth birth or higher - and by age of mother in five year age intervals, it becomes possible to identify those births which represent rapid fertility and which involve elevated health risks for mothers and child. The number of births falling into these high risk categories can be calculated as a percentage of all births in that age interval. This procedure will provide a measure of changes in timing of births by age of mother and changes in the number of high risk births.

The criteria used in defining the high risk categories of births in this report were:

Age of Mother	High Risk Births
Under 15	All births
15-19	Births above 1st order
20-24	Births above 2nd order
25-29	Births above 3rd order
30-34	Births above 4th order
35-39	Births above 5th order
40-44	Births above 6th order
45-49	Births above 7th order

Using this set of criteria, a birth of the second child or more to women 15 to 19 years of age would represent rapid fertility and thus be counted as a high risk birth, e.g., as a birth that should either be avoided or delayed until an older maternal age. Likewise, all births to mothers under 15 years of age should be avoided on the grounds of maternal and child health risks, not to mention the social and economic hardships usually involved.

It is recognized that this set of criteria is somewhat arbitrary and the number and percent of high risk births would change with different criteria. There is, however, a growing body of research that provides support for the concept of high risk births and the need for a working definition. Evidence of associations between health risks to mothers and parity level,[8] between maternal death and parity level,[9] and between maternal age and child's potential for intellectual development[10] are being reported in recent literature. As early as 1968, Gordon W. Perkin suggested a method for assessing reproductive risk in nonpregnant women.[11] He points out that future reproductive risk in postpartum women may be inferred from factors associated with maternal mortality, such as age, parity, health history, pregnancy interval, and social background (income and marital status). While this approach is useful in classifying postpartum women, the detailed nature of the information required prohibits application of the method to aggregate populations. Recognizing this problem, Perkin suggested in a later paper that all births to women over 30 years of age and/or with three or more living children constitute a high risk health hazard for the mother.[12] This suggestion has some merit but seems incomplete and un-

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8. Beasley, J. D.; C. L. Harter and D. V. McCalister, "Aspects of Family Planning Among Low Income, High Risk Mothers", Advances in Planned Parenthood, Vol. II, (1967), pp. 197-204.
9. Marmal, J. G., et.al., "Maternal Death and High-Risk Pregnancy: An Analysis of 40 Maternal Deaths in the Collaborative Project", Obstetrics and Gynecology, Vol. 30 (1967), p. 816-827.
10. Lobl, Michele; Doris W. Welcher; E. David Mellits, "Maternal Age and Intellectual Functioning of Offspring", The Johns Hopkins Medical Journal, Vol. 128 (June 1971) pp. 349-359.
11. Perkin, Gordon W., "Assessment of Reproductive Risk in Nonpregnant Women", American Journal of Obstetrics and Gynecology, Vol. 101, No. 5, pp. 709-717.
12. Gordon W. Perkin, "Pregnancy Prevention in High-Risk Women: A Strategy for New National Family Planning Programs", a paper prepared for the International Planned Parenthood Federation, Bondring Conference (June, 1969), pp. 19.

necessarily restrictive. For example, births to very young mothers aged 15 and under are omitted from his criteria and moreover, the increased health risk to the mothers with three versus four living children is not clearly established.

Working independently, Hamilton and Li suggested a statistically more elaborate method of estimating the proportion of births that fall into a high risk category.[13] While their research did not involve explicit concern with the concept of high risk births, the methodology was similar. Two sets of criteria were used. By one criterion, births were counted as "excess" if the mother was under 15 or over 40 years of age and births over the first, second, third, fourth, and fifth parity to women of ages 15-19, 20-24, 25-29, 30-34, and 35-39, respectively. The second criterion was similar to the first except it allowed three children to women under age 25, four children to women under age 30, five children to women under age 35, and six children to women under age 40.

In summary, previous attempts to define the number of high risk births now rest more firmly on medical evidence and less on intuitive judgments of the researcher. A recent survey of published research from nations around the world supports the relationship between increasing physical and emotional health risks to mothers with increasing age and parity.[14] Research in the areas of family size, perinatal and childhood mortality, physical and emotional health, and the growth and development of children all suggests the general conclusion that risks of harmful effects increases with mother's age and the birth order.

The set of criteria used in this report was derived from this growing research theme but differs in that high risk births are not as restrictively defined. For example, the sixth birth to women 40 to 44 years of age is not counted as a high risk birth. In addition, illegitimate births were not entirely counted as high risk. Birth data for Connecticut do not list illegitimate births separately by age of mother and parity. Thus, an unknown number of low parity births by age of mother were not included in the high risk category. Such births would have been included had the data been available because health risks for illegitimate births are substantially higher than for legitimate births.[15] Thus, in terms of actual health hazards to mothers and newborns, the present criteria underestimate the actual number of high risk births.

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13. C. Horace Hamilton and Wen Lang Li, "Evaluation of a Simple Statistical Measure for Estimating the Need and Effectiveness of Family Planning Programs", a paper prepared for the Population Association of America (April, 1969), pp. 16.
14. Abdel R. Omran, The Health Theme in Family Planning, Carolina Population Center, University of North Carolina at Chapel Hill, 1970, pp. 130.
15. Data for the United States in 1967 show that fetal death rates for illegitimate births is 66.9 percent higher than fetal death rates for legitimate births and this difference increases with age of mother.

Trends in High Risk Births

Table V contains data on the percent of high risk births to total births by age of mother in Connecticut in 1960 and 1970. Both the number and proportion of high risk births declined during the decade. In 1960, 15,852 births or 28.0 percent involved elevated health risks to mother and child. By 1970, 11,114 or 21.9 percent of all births were in these high risk categories. This indicates that declines in age-specific birth rates discussed previously were achieved by improvements in timing of births, that is to say more high parity births by age of mother were avoided.

Table V - Percent of High Risk Births to Total Births by Age of Mother, Connecticut, 1960 and 1970

Age of Mother	1970 Births Total	1970 Births High Risk	1970 Births Percent	1960 Births Total	1960 Births High Risk	1960 Births Percent
Total	50,738	11,114	21.9	56,659	15,852	28.0
Under 15	83	83	100.0	25	25	100.0
15-19	5,841	1,306	22.4	4,521	1,250	27.6
20-24	18,117	3,335	18.4	17,367	4,806	27.7
30-34	6,847	1,859	27.1	10,925	3,051	27.9
35-39	2,730	824	30.2	5,758	1,390	24.1
40-44	758	217	28.6	1,378	303	22.0
45-49	48	18	37.5	48	12	25.0

Source: The State Department of Health, State of Connecticut, Registration Report of Births, Marriages, Divorces, and Deaths, the 113th Report and the 123rd Report. See text for definition of high risk births.

Note: Age-specific births do not sum to total births because age of mother was not reported in a few cases.

Closer examination of Table V by age of mother reveals that declines in the percent of high risk births were not uniform over all age categories. Young women between 15 to 29 years of age were largely responsible for the over-all decline in high risk births. In 1970 only 22.4 percent of the births to young women 15 to 19 years of age were second births or higher, and only 18.4 percent of births to women 20 to 24 years of age were third births or higher. Women 25 to 29 years of age recorded 21.3 percent of their births in the high risk category, substantially lower than their 1960 performance. Older women, on the other hand, show increases in the percent of high risk births. In 1970, women 35 to 39 years of age recorded 30.2 percent of their births as

the sixth birth or higher. While the number of high risk births to women in this age category in 1970 was lower (824 births) than in 1960 (1,390 births), the total number of births was also significantly lower in 1970. This pattern indicates that the reduction in births to women 35 to 39 years of age was accomplished by women with lower parity (with five births or less) and not by a reduction in the proportion of high parity births (six or more).

In brief, these data suggest that young women under 30 years of age in Connecticut exercised more control over the timing of their births in 1970 than in 1960. A full analysis of factors responsible for this lies beyond the scope of this report but there are several elements likely involved, such as increased use of contraceptive techniques and other methods which enable married couples to avoid unwanted pregnancies. In addition, increased concern among young persons over population growth and environmental quality and changes in norms for young persons concerning ideal family size may have discouraged a number of births. The effects of a restricted job market combined with continued economic inflation would discourage large families, particularly in an urban population. Finally, increases in formal education of younger persons is known to be associated with lower fertility performance. If these were in fact the major reasons for the observed fertility decline, one may expect increasing concentration of births at the lower parity levels. In statistical terms this means a smaller standard deviation of births by age of mother. It does not necessarily indicate future declines in birth rates nor in the volume of births. It is possible to have an increased volume of births concomitant with declines in high risk births. This point that high risk births reflect birth timing, not number of births, will be explored with subsequent data.

The percent of high risk births to total white births by age of mother in Connecticut is contained in Table VI. As expected, the pattern for white births follows that described for total births. The number of white births in 1970 was 45.073 of which 8,975 or 19.9 percent were high risk births, a substantial decline from the 26.0 percent high risk births in 1960. Data on births by age of mother show declines in the percent of high risk births at all ages except the older women, those 35 to 49 years of age. The most substantial decline in high risk births was achieved by white women 20 to 24 years of age in 1970, although this age group recorded an increase in the total number of births during the decade. This pattern clearly demonstrates the point that improvements in timing of births is independent of the total number of births to a given group of women. Specific factors responsible for the increasing bunching of births at the first and second parity for white women 20 to 24 years of age remains a matter for further research.

The percent of high risk births to total nonwhite births by age of mother in Connecticut is shown in Table VII. Several differences between nonwhite and white patterns are apparent. The proportion of high risk nonwhite births, but not the volume of course, is significantly higher than for whites in both 1960 and 1970. Similar to the pattern for whites, nonwhites have recorded a major decline in the proportion of high risk births, from 53.9 percent in 1960 to 37.8 percent in 1970. Unlike whites, nonwhites in Connecticut reduced the percentage of high risk births in every age category. Similar to whites, in 1970 the nonwhites exhibit increasing percentages of high risk births with increasing age of women, a pattern not present in 1960. This again indicates that young nonwhite women have improved control of timing of births, while achieving an over-all increase in the number of births.

Table VI - Percent of High Risk Births to Total White Births by Age of Mother, Connecticut, 1960 and 1970

Age of Mother	1970 Births Total	1970 Births High Risk	1970 Births Percent	1960 Births Total	1960 Births High Risk	1960 Births Percent
Total	45,073	8,975	19.9	52,642	13,688	26.0
Under 15	34	34	100.0	10	10	100.0
15-19	4,444	834	18.8	3,923	994	25.3
20-24	16,058	2,657	16.5	15,873	4,050	25.5
25-29	15,034	2,946	19.6	15,632	4,405	28.2
30-34	6,259	1,595	25.5	10,368	2,728	26.3
35-39	2,482	702	28.3	5,467	1,222	22.3
40-44	704	189	26.8	1,316	270	20.5
45-49	46	18	39.1	44	9	20.4

Source: The State Department of Health, State of Connecticut, Registration Report of Births, Marriages, Divorces, and Deaths, the 113th Report and the 123rd Report. See text for definition of high risk births.

Note: Age-specific births do not sum to total births because age of mother was not reported in a few cases.

One final comparison will further illuminate changes in the number of births by age of mother and the number of high risk births from 1960 to 1970. In both categories of births, the base for the percentage change is the corresponding figure for 1960. Table VIII contains these data for total, white and nonwhite births in Connecticut. For total births in Connecticut there was a 10.4 percent decrease in the volume of births from 1960 to 1970. In terms of the number of high risk births, there was a 29.9 percent decline in births falling into this category. Women in Connecticut between 20 and 24 years of age reported a 4.3 percent increase in the number of births over 1960 but recorded a 30.6 percent decrease in their high risk births. The pattern for white births was the same except the trends were more pronounced in comparison to the total population. For nonwhites there was a 41.0 percent increase in the volume of births during the decade but a 1.5 percent decline in the number of high risk births. An effective control of birth timing can be inferred for nonwhite women between 20 and 34 years of age because this category of women increased the total number of their births but decreased the number of high risk births. Only at the youngest nonwhite ages, women under 20 years of age, did the number of high risk births increase from 1960 to 1970.

Table VII - Percent of High Risk Births to Total Nonwhite Births by Age of Mother, Connecticut, 1960 and 1970

Age of Mother	1970 Births			1960 Births		
	Total	High Risk	Percent	Total	High Risk	Percent
Total	5,665	2,139	37.8	4,017	2,164	53.9
Under 15	49	49	100.0	15	15	100.0
15-19	1,397	472	33.8	598	256	42.8
20-24	2,059	678	32.9	1,494	756	50.6
25-29	1,265	526	41.6	996	610	61.2
30-34	588	264	44.9	447	323	58.0
35-39	248	122	49.2	291	168	57.7
40-44	54	28	51.8	62	33	53.2
45-49	2	0	0.0	4	3	75.0

Source: The State Department of Health, State of Connecticut, Registration Report of Births, Marriages, Divorces, and Deaths, the 113th Report and the 123rd Report. See text for definition of high risk births.

Note: Age-specific births do not sum to total births because age of mother was not reported in a few cases.

SUMMARY AND CONCLUSIONS

As we have seen, fertility trends in Connecticut have declined markedly during the decade of the 1960's. The total number of births in the state declined by 10.4 percent from 1960 to 1970 and the crude birth rate fell by 25.1 percent. The number of births to the white population in the state declined by 14.4 percent but the number of births to nonwhite persons increased by 41.0 percent from 1960 to 1970. While white births still dominate the fertility profile for the entire state, the last decade witnessed a rapidly growing and important nonwhite population component. If past nonwhite population growth rates continue throughout the present decade, their fertility performance will exert a major influence on state-wide birth data, and will mark the beginning of a new demographic situation for Connecticut.

Analysis of age-specific birth rates for the total population revealed substantial declines in seven of the eight age classes, the

Table VIII - Percent Change in High Risk Births and All Births, by Age and Color of Mother, Connecticut from 1960 to 1970

Age of Mother	Percent Change From 1960 to 1970 In Total Births		White Births		Nonwhite Births	
	Total	High Risk	Total	High Risk	Total	High Risk
Total	-10.4	-29.9	-14.4	-34.4	41.0	-1.5
Under 15	232.0	232.0	240.0	240.0	226.7	226.7
15-19	29.2	4.5	13.3	-16.1	133.6	84.4
20-24	4.3	-30.6	1.2	-34.4	37.8	-10.3
25-29	-2.0	-30.8	-3.8	-33.1	27.0	-13.8
30-34	-37.3	-39.1	-39.6	-41.5	5.6	-18.3
35-39	-52.6	-40.8	-54.6	-42.6	-14.8	-27.4
40-44	-45.0	-28.4	-46.5	-30.0	-12.9	-15.1
45-49	0.0	50.0	4.5	100.0	-50.0	-100.0

Source: The State Department of Health, State of Connecticut, Registration Report of Births, Marriages, Divorces and Deaths, the 113th Report (1960) and the 123rd Report (1970). See text for definition of high risk births.

exception being for women 10 to 14 years of age. Women 20 to 24 years of age, a group that accounts for a large volume of births, declined in their birth rate by 39.2 percent from 1960 to 1970. White women in this age category reported a decline of 40.4 percent in their birth rate while nonwhite women in this age group recorded a 30.3 percent decline in their fertility rate.

Other indicators of fertility refined the general conclusion of declining fertility in the state. Age-standardized crude birth rates for whites and nonwhites revealed that changes in the female age structure during the 1960's in both of these populations retarded further declines in the crude birth rate by 8.1 percent and 7.0 percent respectively. This suggests that future changes in the female age structure in Connecticut may offset possible declines in the rate of births and cause an increase in the number of births recorded during the 1970's.

A decade of change in the total fertility rate, an index of the extent to which parents are reproducing themselves, shows that the white fertility has reached the approximate level for replacement, while nonwhite fertility is still significantly above replacement levels. Trends in the gross reproduction rate, an index of the extent to which women are reproducing themselves, lead to similar conclusions, namely

white women are near the level required for replacement while nonwhite women are reproducing at rates above replacement. These patterns suggest that for Connecticut's white population, factors such as net migration may be more important for white population growth than future trends in their birth rates.

A final view of fertility was provided by an analysis of high risk births by age of mother. In terms of distribution of high risk births, 21.9 percent of all births occurred in the high risk categories in 1970. The white population recorded 19.9 percent of their births as high risk while nonwhites recorded 37.8 percent as high risk. In terms of change, the number of high risk births to the total population declined by 29.9 percent from 1960 to 1970 while the volume of all births decreased by only 10.4 percent. High risk white births decreased by 34.4 percent but high risk nonwhite births declined by only 1.5 percent. These patterns suggest an improved ability of women to avoid high parity births, especially women 20 to 29 years of age, and were exhibited by both white and nonwhite populations.

There are likely several factors responsible for fertility decline in Connecticut during the past decade. One factor is that the patterns of the 1960's represent a continuation of previous fertility trends which developed a demographic momentum that carried throughout the 1960's. It appears that a smaller family size became more popular during the 1960's than in previous decades. This conclusion is suggested by significant reductions in high parity births by age of mother. Moreover, Connecticut women seem to be spacing children further apart rather than bearing children as rapidly as possible during their younger years. The general conclusion is one of more control over fertility by Connecticut women during the past decade.

One item of concern, however, warrants mention. The youngest age category in 1970, women 15 to 19 years old, exhibited significant increases in total volume of their births, up 29.2 percent over 1960. If this age group, particularly nonwhite women, continues to bear children at high levels during the 1970's, the declines in fertility achieved during the 1960's may be reversed. The basic problem is whether or not the factors responsible for past fertility declines will continue to operate during the present decade. The answer to this question is, at the moment, a matter of speculation and personal judgment. A proper answer would be based upon a detailed analysis of fertility patterns by towns in Connecticut and how these patterns have changed over time in relation to changing local socioeconomic conditions.