

**VITAL and HEALTH STATISTICS**

**DOCUMENTS AND COMMITTEE REPORTS**

# Fertility Measurement

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## A Report of the United States National Committee on Vital and Health Statistics

Recommendations concerning the collection and interpretation of data on fertility in the National Center for Health Statistics and the U.S. Bureau of the Census and discussion of the period and cohort measures of fertility, the interview survey as a source of fertility data, and the problems of projecting fertility rates.

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Washington, D.C.

September 1965

U.S. DEPARTMENT OF  
HEALTH, EDUCATION, AND WELFARE

Anthony J. Celebrezze  
Secretary

Public Health Service  
Luther L. Terry  
Surgeon General



Public Health Service Publication No. 1000-Series 4-No. 1

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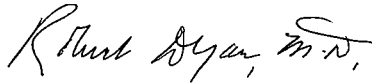
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## FOREWORD

This report, prepared under the auspices of the U.S. National Committee on Vital and Health Statistics, is concerned with the adequacy of measures currently available to indicate change in fertility trends. It discusses the problems of fertility measurement and recommends other sources of data for assessment of trends and for projections of fertility rates. Also, recommendations are made for research and development needed in the field of fertility statistics.

It is hoped that this report will serve as a basis for further discussion by organizations and agencies capable of providing needed data and that it will stimulate research and special studies.

A handwritten signature in cursive script that reads "Robert Dyar, M.D.".

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*IN THIS REPORT the present means of measuring fertility in the United States are presented and discussed in terms of the adequacy with which they portray current trends.*

*Data published by the National Center for Health Statistics such as the crude birth rate, age-sex-adjusted birth rate, gross reproduction rate, and general fertility rate indicate recent declines in fertility. Plans for the development of new measures include additional cohort fertility rates, followback studies, and the use of proposed new items of information on the revised U.S. Standard Certificate of Live Birth.*

*Data prepared by the U.S. Bureau of the Census include data on women by number of children ever born, on women by number of children present in the home, and on childspacing. Plans for the future include obtaining additional data from the Current Population Survey.*

*The interrelationship of period and cohort measures is described, and the evidence of change in current fertility, as demonstrated by these measures, is analyzed.*

*Fertility interview surveys measure aspects of fertility not available from birth registration or the decennial census. Birth expectations data are an important adjunct to the analysis of current trends.*

*Population projections have not taken account of all the variables which have a bearing on fertility. The introduction of social and economic as well as demographic variables is necessary for the improvement of projection methodology.*

*It was concluded that a change in fertility has taken place in the United States, that currently published measures are adequate, that these measures can be improved and should be supplemented by surveys, and that further research should be encouraged in the field of fertility measurement. Recommendations directed toward the improvement of the measures and suggestions for the extension of research are provided.*

#### SYMBOLS

Data not available-----	---
Category not applicable-----	...
Quantity zero-----	-
Quantity more than 0 but less than 0.05-----	0.0
Figure does not meet standards of reliability or precision-----	*

# FERTILITY MEASUREMENT

## REPORT OF THE U.S. NATIONAL COMMITTEE ON VITAL AND HEALTH STATISTICS

### INTRODUCTION

#### General

A new wave of interest in fertility trends in the United States has been created by such diverse situations as the current decline in the crude birth rate, the open discussion of fertility regulations, the impending increase of youngsters entering the labor market, marrying, and starting families of their own, and the rapid expansion of the world population.

A postwar peak in the number of births was reached in 1957, when about 4.3 million live births were recorded. The crude birth rate for that year was 25.3 live births per 1,000 population. Since 1957 the annual number of live births has hovered around 4.2 million, and the crude birth rate has declined every year. The rate for 1964 was about 21.2, the lowest since 1945. The general fertility rate declined from 122.9 births per 1,000 women of childbearing age (15-44 years) in 1957 to 105.6 in 1964 (see figure 1).

That a downturn in the Nation's fertility had taken place became apparent by the latter half of 1961 after the seasonally adjusted birth rate and fertility rate had declined for several months. The decline continued almost without interruption through 1964. By the end of 1964 the birth rate and the fertility rate, seasonally adjusted, were about 13 percent below the rates 4 years earlier. More

refined measures of fertility such as the age-parity-specific fertility rates have revealed that women of almost all ages and parities have contributed to the current decline in fertility.

Questions have been raised concerning the significance of the decline. Was it to be of short duration? Was it a return to the long-range decline apparent before World War I? Questions also have been raised concerning related developments such as the apparent decline in age-specific fertility, the shift from the temporary shrinking of the group of women of childbearing age to the impending entrance of the baby boom youngsters into the labor force, and reproductive ages. There also have been questions about the achievement of desired family size by the major childbearing cohorts. On another level questions have been raised regarding the effect of motivations, expectations, desired family size, and socio-economic factors on fertility change.

This increased interest has raised questions concerning the adequacy of measures of fertility in current use, the problem of developing better measures of fertility, and the means by which the findings of fertility research may be better communicated. In the hope that it would contribute to a better understanding of these questions, the U.S. National Committee on Vital and Health Statistics in 1963 named a Subcommittee on Fertility Measurement to study these matters and to prepare a report. The importance of fertility meas-



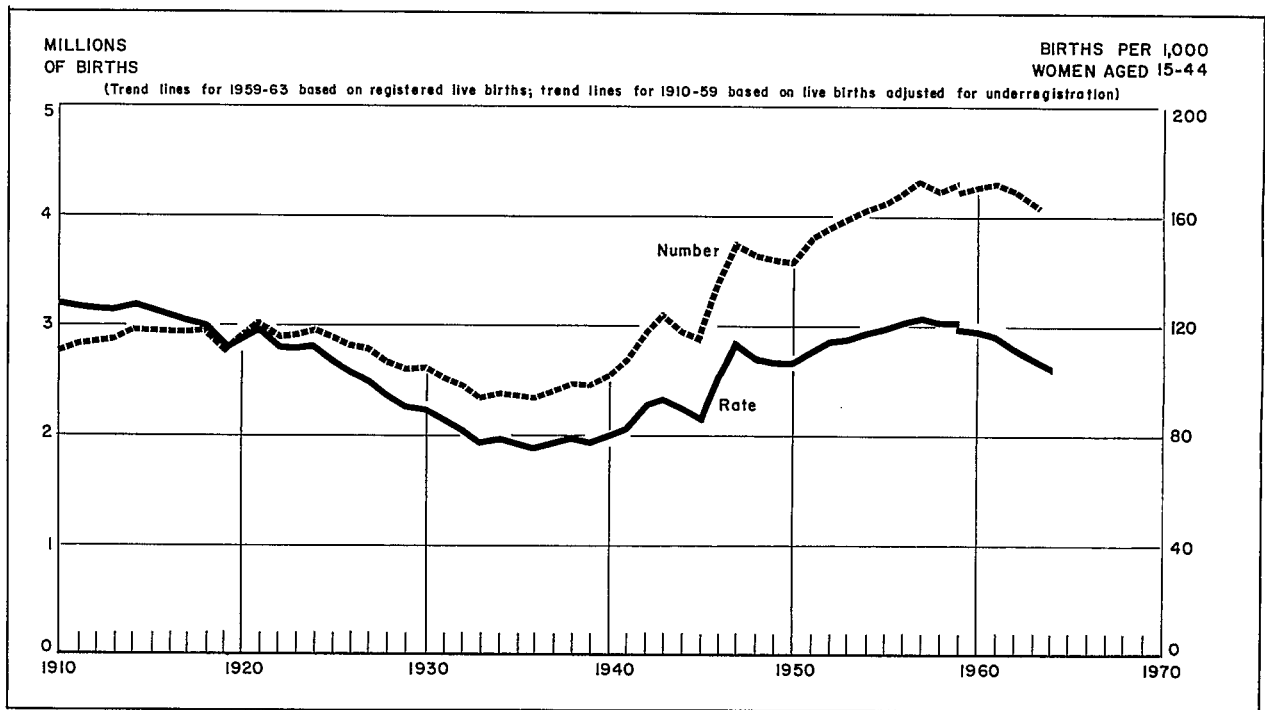


Figure 1. Live births and fertility rates, 1910-64.

urement has been emphasized in the reports of three previous subcommittees on fertility:

- (1) Statistics needed concerning fertility, *Vital Statistics—Special Reports*, Vol. 33, No. 11, Feb. 25, 1952.
- (2) Progress in development of fertility statistics and population estimates, *Vital Statistics—Special Reports*, Vol. 39, No. 8, May 14, 1956.
- (3) Fertility studies based on data for the 1960 census period, *Vital Statistics—Special Reports*, Vol. 47, No. 5, June 8, 1959.

### Objectives

The objectives of this study were

*General:* To determine whether a change in fertility is developing and whether currently published measures are adequate to reflect changes

in fertility; to recommend needed improvement or alternative series with a view to providing the best feasible measures of current trends of fertility in the United States; to give attention to measures that might have some value for projections into the future; and to recommend research that may be needed in order to develop such measures.

*Specific:* To report, in particular, on the following:

- (1) Period fertility and cohort fertility: their measurement and interrelation.
- (2) Evidence of change in current fertility (period and cohort).
- (3) Fertility statistics in the National Center for Health Statistics.
- (4) Census data on fertility.
- (5) Population projections.
- (6) The use of sample surveys in fertility research.
- (7) Recommendations.

# CONCLUSIONS AND RECOMMENDATIONS

The following are conclusions from this study with appropriate recommendations:

## I. A Change in Fertility Has Been Developing in the United States<sup>b</sup>

There is no doubt about the decline in period fertility rates during the past several years. All the currently published measures portray this decline.

The high birth rates following World War II had been associated with earlier age at marriage, early family formation, and an increase in the average size of the family. The change in fertility after 1957 was due partly to changes in the age composition of the population; in 1960 there were over 1 million fewer women in the most fertile age group (20-29 years) than in 1950. The decline in the birth rate was due also to lower age-specific rates after 1957. It seems probable that during the remainder of this decade the age-specific birth rates above age 30 years will continue to decline and that rates below age 30 may decline or stabilize at their current levels. The trend toward earlier marriages has ceased. For reporting States the median age of brides at first marriage leveled off at 19.9 years after 1958, and the median age of grooms at first marriage leveled off at 23 years, or slightly under, after 1959.

The trend toward younger childbearing may have reached a limit; the median age of mothers at the birth of the first child is still low but has leveled off since 1960 at 21.4 years.

---

<sup>b</sup>*Definition of fertility.* For many years in the United States the general term fertility has been taken to refer to the actual number of children born within a given time period, by a given age, or during a lifetime. As such it is distinguished from *fecundity*, which related to the physiological capacity to reproduce. The fertility or the reproductive performance of an aggregate of individuals may be expressed as a rate or as rates, each rate having a numerator of live births occurring to a specific population in a specified time period and a denominator of a number of persons, women, or person-years of exposure with the same specifications. In this sense fertility is the rate at which children are born in a given population within a given time period or to a cohort of women by a given age or over a lifetime.

Cohort fertility data indicated that the trend toward higher completed fertility may be approaching an upper limit.

Data on expectations of women on the number of children they expect to have in the next few years show that more recent cohorts (those of 1936-42) expect fewer children than those of 1931-35. It now appears likely that complete fertility will stabilize or decline slightly among cohorts born in the late 1930's and early 1940's.

Because of the complexity of the problem it is not possible to suggest specific types of data that will give definitive answers to questions regarding future trends in period or cohort fertility. Major political, economic, and social changes could bring unpredictable changes in marriage rates, birth rates, and family size.

In regard to the immediate future, increased numbers of potential parents are beginning to enter the picture as a result of the large contingents of babies born following World War II. The rates at which these groups will marry and raise families are not known. Period measures provide only slight clues about future trends. The main indication of future developments in cohort fertility is that afforded by data on expectations regarding number of children.

## II. Currently Published Measures Are Adequate to Reflect Certain Changes in Fertility but Require Improvement and Refinement

Currently published national birth rates indicate the existence of changes in period fertility. A deficiency in these data, and one which makes interpretation difficult, is the lack of information on the marital characteristics of the population. Data such as age at marriage and duration of marriage for the parents and for the total childbearing population in each year are necessary to obtain a more complete picture of the factors underlying the changing birth rates. In addition, information on the spacing of children in relation to date of marriage and date of birth of the previous child would permit an evaluation of the effects of changes in the timing of births in terms of both period and cohort fertility measures. In-

formation on socioeconomic status of parents would also be useful.

It is recommended that the National Center for Health Statistics request more information on the Standard Certificate of Live Births. A question on month and year of previous birth and also month and year of first marriage should be added. An item on education of mother and father on the certificate would lay the foundation for better statistics on socioeconomic differentials in fertility.

The National Center for Health Statistics should press more vigorously toward improvement of the data on marriage and divorce, since both of these are highly relevant to fertility trends. The marriage-registration area, which now includes 36 States, and the divorce-registration area, comprised of 22 States, should be expanded to include all States as quickly as possible. While it is recognized that many problems exist, the National Center for Health Statistics should work closely with the States to bring this about. The Center is to be commended for its development of the marriage-registration area and the divorce-registration area through the present time.

It is recommended that the National Center for Health Statistics through its various Divisions contribute to the development of new data in the area of fertility statistics. This may be done through followback studies and by questions on the number of children ever born and the date of first marriage of married women in the National Health Survey. The Center could gradually build up a store of data that would permit analysis of nuptiality and fertility in relation to health and disease.

As for cohort fertility, currently published, national data provide only a background for changes in fertility in terms of past cohort behavior. Special studies involving an interweaving of cohort fertility data and data on fertility expectation for younger women would help provide clues regarding trends in cohort fertility.

It is recommended that two series of cohort fertility rates be maintained, i.e., one for birth cohorts and one for marriage cohorts. Birth cohort fertility is influenced both by marriage rates and marital fertility. Marriage cohort

fertility indicates the fertility trend for married women by duration of marriage.

The U.S. Bureau of the Census is to be commended for its continuous efforts to collect detailed and meaningful data on fertility. The Subcommittee endorses the periodic collection of information on children-ever-born and child-spacing.

In some cases the Bureau has collected and tabulated important data that cannot be published because of insufficient funds. In such instances efforts should be made to obtain money from other government agencies or private organizations to publish the data.

### III. More Research is Required in the Area of Fertility Projections

It is axiomatic among demographers that fertility is extremely difficult to predict. Human reproduction is especially sensitive to unforeseen changes in the social, political, and economic life. Nevertheless, the importance of such projections in the national life and at local levels should be recognized. It is recommended that the Bureau of the Census and the National Center for Health Statistics increase their investigations in this area.

Through the Current Population Survey the Bureau of the Census should collect periodic data on expectations regarding ultimate size of family and expectations of births during the next 5 years. Research on models for population projections is wholeheartedly endorsed. The National Center for Health Statistics should itself enter the field of making fertility projections.

It is also recommended that the work of private institutions be sustained and enlarged. Research of the type being done in the Growth of American Families Studies, the Princeton Study of Fertility, and the Detroit Area Studies has already gone far in developing the techniques for collecting and analyzing expectations data. The periodic provision of data from the Current Population Survey and the Natality followback studies of the National Center for Health Statistics would provide national benchmark materials that would enhance the value of the work of private institutions collecting such data regularly.

#### IV. Further Research is Required in Areas Where Data Are Absent or Scarce

Little is known about human fertility, which lies at the base of rapid population expansion, one of the pressing problems of our time. It is urgently required that research in human fertility be extended.

It is recommended that foundations, universities, and other private institutions in the United States continue their efforts in areas in which official data are absent or scarce. This includes, in particular, data on family planning practices and attitudes, fecundity and fecundity impairments, and religion of parents. Because of the persistence of high fertility among nonwhites and Catholics in the United States, studies especially designed for these groups should be encouraged.

#### V. Information on Fertility Developments Should be Communicated to the Public

While there is considerable public interest in the subject of population growth, there appears to be a need for the education of the general public in the meaning of birth statistics. In addition to supplying technical information to other agencies of the National Government and to the vast number of economic and other organizations which utilize the data, the Bureau of the Census and the National Center for Health Statistics are urged to devote a portion of their program to those publications which will inform the lay public concerning their work.

It is recommended that the National Center for Health Statistics continue to prepare periodic evaluations of current fertility trends that would bring together all of the latest information on cohort fertility, timing, and expected childbearing from a variety of sources. Particular attention should be given to estimating the extent to which recent variations result from changes in the timing of fertility as compared with changes in the size of completed family. This review of current trends should be written in nontechnical language and be made available to the news media. It may include a technical discussion for demographers, but its main purpose should be to give to laymen a well-informed discussion of the meaning of current birth statistics.

## CHAPTER I. FERTILITY STATISTICS FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

### Types of Data Pulished

The Division of Vital Statistics, National Center for Health Statistics, is responsible for producing the Nation's basic source of fertility statistics, published in the annual *Natality* volume of *Vital Statistics of the United States*. The volume contains detailed frequency tabulations of births for each State, each metropolitan area, and other geographic areas. Data are shown by color, sex, nativity of white mother, month of birth, age of father and mother, birth order, attendant at birth, birth weight, plurality, and legitimacy. Each volume also contains period and cohort fertility rates. The period fertility rates include the crude birth rate, age-sex-adjusted birth rate, general fertility rate, age-specific birth rate, gross reproduction rate, net reproduction rate, birth rate by age of mother and live-birth order, birth rate by month, illegitimacy rate and ratio, and intrinsic rate of birth, death, and natural increase. The data based on cohort fertility analysis include age-parity-specific rates and percentage distributions of the female population by age and parity. Prior to 1962 the *Natality* statistics volumes include a brief analysis of birth statistics focusing on the current year. Included as new measures of fertility are cumulative birth rates for cohorts of women and the total fertility rate. These will be incorporated as a regular feature into subsequent volumes of *Vital Statistics of the United States*.

In addition, the Division publishes the *Monthly Vital Statistics Report* (MVSR), which presents provisional statistics on births by month as reported by the States and provides crude birth rates and general fertility rates for the month. An advance report of final natality statistics for the year appears annually in the MVSR prior to their publication in *Vital Statistics of the United States* some months later. The advance report includes a brief analysis of the Nation's fertility for the year supplemented with tables showing fertility rates by age of mother, live-birth order, and color.

Provisional fertility data on a monthly basis are also published in the *Health, Education, and Welfare Indicators*; these include a time series of birth rates and fertility rates, adjusted and unadjusted for seasonal variation, and a brief descriptive statement of the trend of these period measures.

Separate publications include the former *Vital Statistics—Special Reports*, which have from time to time provided details on births by age of mother, color, and live-birth order; child-spacing; cohort fertility; quality of birth statistics; illegitimacy rates and ratios; and other selected topics that are now reported in Series 21 of the National Center for Health Statistics Report Series. All the natality tabulations are derived from information on the certificate of live birth as provided by each State. The nature and scope of the fertility measures are therefore limited by the content of the certificate. The Standard Certificate of Live Birth is prepared by the National Center for Health Statistics in close collaboration with representatives of the various States and is revised about once every 10 years. A revision of the present certificate is now under consideration and is expected to be recommended to the States for adoption as of January 1, 1967. The items proposed for revision reflect both the continuing interest in an improved document as a

statistical source and the present need for new and refined fertility measures.

### Recent Trends in Fertility as Determined From Natality Statistics

A decline in actual numbers of births in the United States has been evident since 1957, when the largest annual number of births was recorded (4,308,000). In 1963 the number of births was 4,098,020, which is 4.9 percent below that in 1957. The decline was experienced by both white and nonwhite groups, as indicated in table A.

All the conventional measures of fertility also showed declines during this period:

	1963	1957	Percent change
Crude birth rate (per 1,000 population)-----	21.7	25.3	-14.2
Age-sex-adjusted birth rate (per 1,000 population)-----	28.4	32.2	-11.8
Gross reproduction rate-----	1,623.0	1,837.0	-11.6
General fertility rate (per 1,000 females 15-44 years)-----	108.4	122.9	-11.8

Table A. Live births by color: United States, 1957-63

Year	Total	Number of births	
		White	Nonwhite
1963 <sup>1</sup> -----	4,098,020	3,326,344	638,928
1962 <sup>1</sup> -----	4,167,362	3,394,068	641,580
1961-----	4,268,326	3,600,864	667,462
1960-----	4,257,850	3,600,744	657,106
1959 <sub>5</sub> -----	4,244,796	3,597,430	647,366
1958 <sup>2</sup> -----	4,255,000	3,598,000	657,000
1957 <sup>2</sup> -----	4,308,000	3,648,000	660,000

<sup>1</sup>Figures by color exclude data for residents of New Jersey because this State did not require reporting of the item.

<sup>2</sup>Births adjusted for underregistration.

Source: National Center for Health Statistics: *Vital Statistics of the United States*, 1963, Volume I. Public Health Service. Washington, U.S. Government Printing Office, 1964. sec. 1, table 1-2.

The crude birth rate, which is the most widely used measure of fertility, showed the greatest decline during this period. The crude birth rate, however, is not an adequate measure of fertility because its comparability over a period of years may be affected by changes that take place in the age and sex composition of the population. By standardizing this rate to the 1940 population of the United States, a figure free from this kind of distortion can be derived. The standardized, or age-sex-adjusted, birth rate decreased about 12 percent during the period 1957-63.

The general fertility rate, which measures births in terms of the population at risk—women in the childbearing ages—also showed a decline of almost 12 percent, from 122.9 to 108.4 live births per 1,000 females aged 15 to 44 years. The general fertility rate, while it is more refined than the crude birth rate, can still be affected by differences in age composition among females within the childbearing period when comparisons are made over several years. By looking at the fertility of females in 5-year age groups, this problem of comparability is largely overcome. The age-specific rates shown in table B reveal that women of every childbearing age experienced a declining rate of childbearing during the period 1957-63.

The gross and net reproduction rates, essentially summary measures of this array of

rates for all eight age groups, showed declines of over 11 percent during the period.

One of the most specific measures of fertility now available is the age-parity-specific birth probability. It is the probability that a woman of a given parity and exact age  $x$  will bear a child before reaching exact age  $x+1$ . Summaries of such probabilities for 5-year age groups are presented for recent years in table C. They show that in the main childbearing ages women of nearly all parities have contributed to the recent decline in fertility.

The rates now published indicate adequately the main trends in period fertility in the United States. However, the Division recognizes the desirability of publishing additional measures to aid in understanding the factors underlying these trends. To obtain such measures, it would be necessary to have better information than is now available on such topics as the marital status of parents and their duration of marriage. An important step toward this goal would be to obtain the date of first marriage. This would permit comparisons of the family building patterns of women marrying in different years and at different ages. Better legitimacy and illegitimacy rates could be prepared. Although the proportion of births that are illegitimate is small (about 6 percent in 1963), trends in the rates for these births

Table B. Birth rates by age of mother: United States, 1957-63

Year	Age of mother							
	10-14 years	15-19 years	20-24 years	25-29 years	30-34 years	35-39 years	40-44 years	45-49 years
1963-----	0.9	76.5	231.3	185.4	105.9	51.2	14.2	0.9
1962-----	0.8	81.3	243.8	191.3	108.7	52.6	14.8	0.9
1961-----	0.9	88.0	253.6	197.8	113.3	55.6	15.6	0.9
1960-----	0.8	89.1	258.1	197.4	112.7	56.2	15.5	0.9
1959-----	0.9	89.1	257.5	198.6	114.4	57.3	15.3	0.9
1958 <sup>1</sup> -----	0.9	91.4	258.2	198.3	116.2	58.3	15.7	0.9
1957 <sup>1</sup> -----	1.0	96.3	260.6	199.4	118.9	59.9	16.3	1.1

<sup>1</sup>Births adjusted for underregistration.

Source: National Center for Health Statistics: Vital Statistics of the United States, 1963, Volume I. Public Health Service. Washington. U.S. Government Printing Office, 1964. sec. 1, table 1-6.

Table G. Birth probabilities for specified years, by exact age and parity of mother:  
United States, 1957, 1960, and 1963

Exact age of mother as of January 1 each year	Parity					
	0	1	2	3	4	5
<u>20-24 years</u>						
1963-----	163.7	312.2	252.8	260.4	300.0	351.8
1960-----	186.8	341.4	281.0	299.8	349.7	406.0
1957-----	194.7	337.8	275.8	295.5	348.4	414.4
<u>25-29 years</u>						
1963-----	137.7	233.9	168.5	168.4	190.1	229.6
1960-----	140.2	252.3	181.0	183.7	207.6	258.3
1957-----	139.2	253.8	178.8	184.0	217.5	266.8

Source: National Center for Health Statistics: Vital Statistics of the United States, 1963, Volume I. Public Health Service. Washington. U.S. Government Printing Office, 1964. sec. 1, table 1-15.

have some influence on the trend in total fertility. This influence should be taken into account in any complete analysis of fertility trends in this country.<sup>c</sup>

Information required in relation to the timing of births would ideally include the dates of birth of each child born alive and each fetal death. Date of the termination of last pregnancy and outcome, while somewhat more limited, can also provide excellent material for studying current child-spacing patterns. The addition of the latter question and an item of date of first marriage is being recommended on the next revision of the Standard Certificate of Live Birth.

<sup>c</sup>*Statistics on illegitimacy.* The extent of illegitimacy is hard to measure. Illegitimacy ratios are derived by relating recorded illegitimate live births to total live births. Illegitimacy rates measure the number of illegitimate births per 1,000 unmarried women aged 15-44 years. The estimate of unmarried women is prepared by the Bureau of the Census on the basis of a sample survey; therefore, a sampling variability is associated with these rates. However, improvement in the measure of illegitimacy lies in another direction, the completeness of the record on illegitimate births. Sixteen States do not require reporting on illegitimacy; there are misstatements on the birth record to conceal illegitimacy status. The most that can be said about the illegitimacy figures is that they indicate the minimum extent of illegitimacy.

In order to broaden the interpretation of changes in fertility, further information is required on the socioeconomic background of the parents. The only useful item on the present Standard Certificate of Live Birth which has bearing on this matter is that of race or color. An item on occupation is not tabulated in the national statistics because of reporting and coding difficulties. An item on education of the mother, particularly, would provide needed information, and this item is being considered for inclusion on the Standard Certificate. Details on family income and religion would be most useful, but it is improbable that these items will soon appear on the Standard Certificate. In the case of income and religion and other useful details which are not likely to be placed on the Standard Certificate, it is suggested that such information be obtained through surveys as is currently being done in fertility research.

#### Future Publication Program

The program for natality statistics in the Division of Vital Statistics as regards tabulation and publications reflects the continuing development of the National Center for Health Statistics, which underwent reorganization in October 1963.

There is an increase in emphasis on the technical and professional aspects of the work. There has been a general speeding up of the publications timetable. The entire processing and publications schedule from the close of a data year to final publication is being reduced from about 24 months to approximately 12 to 14 months. As a consequence of the accelerated program annual Natality volumes for both 1961 and 1962 were prepared for publication during 1963. One factor in the speedup was the decision to exclude the textual analysis from the 1962 volume; the text was published separately in the new NCHS Report Series for *Vital and Health Statistics*, Series 21, Natality. This series will replace the *Vital Statistics—Special Reports* mentioned above.

The 1964 annual Natality volume, which will also be prepared at an early date, will include a number of other changes and additions. Because of considerable interest in Negro fertility the category of nonwhite will include the subclass of Negro in major fertility tables (live births by age of mother and live-birth order for each State, metropolitan and nonmetropolitan counties in each State, and each standard metropolitan statistical area). Also, for the United States it is planned to tabulate live births by age of mother and live-birth order for specified races (white, Negro, Indian, Chinese, Japanese, and other races). The last detailed tables on multiple births were published in the 1958 annual volume. Since that year tables on live births in plural deliveries only have been published with no detail concerning those born alive or dead in sets, by sex. It is planned to collect and tabulate matched sets of multiple births beginning with data year 1964, contingent upon State participation.

A special project on the fertility of Puerto Rico will be completed in 1965 by the National Center for Health Statistics. The introduction of new items on the Puerto Rican certificate of live birth has made possible studies on fertility by duration of marriage (legal and consensual unions) and by education of mother and father.

In 1964 the National Center for Health Statistics took over the production of cohort fertility tables heretofore prepared by the Scripps Foundation for Research in Population Problems. It is anticipated that the methodology will be re-

viewed by the Bureau of the Census and the Division of Vital Statistics and possibly revised. In 1960 the first of a series of special reports (*Vital Statistics—Special Reports*, Vol. 51, No. 1) "Fertility Tables for Birth Cohorts of American Women," prepared by Whelpton and Campbell, was published. Additional cohort fertility rates will be published.

A series of followback studies was started using the live-birth certificate as a sampling frame to provide more detailed information on many factors not otherwise available from the certificate. Annual sample surveys will be conducted to obtain information on childspacing, socioeconomic and health characteristics of parents, prenatal care, and birth expectations.

Considerable attention has been given recently to the problem of data quality control. In addition, the National Center for Health Statistics is currently expanding its program of fertility research while continuing to provide basic natality data of general consumer interest.

## CHAPTER II. CENSUS DATA ON FERTILITY

### Types of Data Collected

The Bureau of the Census obtains several types of data on fertility that complement birth-registration data. The data are collected in decennial censuses and in some monthly sample surveys of the population, the latter generally at 2- or 3-year intervals. The main types of information collected are data on women by number of children ever born, data on women by number of young children present in the home, and occasionally data on childspacing or on intervals between births. Tables on the population by age and sex may also be used for some information on fertility, such as for ratios of young children to women of childbearing age, and, with the aid of certain adjustments, for the computation of other measures, such as gross and net reproduction rates by an indirect standardization procedure. The Bureau also provides the population bases used for the computation of birth rates from vital statistics and provides other data of



indirect value for the study of fertility, such as annual data on the marital status of the population and on household and family composition. Much of the data are available by geographic, demographic, social, and economic characteristics.

### Recent Trends in Fertility According to Census Data

In general, decennial census data and current population survey data show that the average number of children ever born per woman at ages 25 years and over is still increasing. There is some evidence that the trend toward earlier marriage and earlier childbearing has ceased for women under 25 years, but these young women have not completed a sufficient proportion of their lifetime childbearing for a valid assessment of their eventual family size. The figures in table D illustrate these points.

It may seem from table D that the women aged 30-34 years in 1962 had already borne nearly as many children, on the average, as those 35-39 years of age. The younger cohort probably had completed somewhat more than 75 percent of its eventual lifetime childbearing; and the latter, somewhat more than 93 percent. (The percentages cited are based on retrospective data for women 44 years of age in 1959 obtained from fertility histories; because of their earlier marriage and childbearing the younger cohorts probably had completed more of their lifetime childbearing by ages 30-34 years or 35-39 years than the

cohort that was 44 years of age in 1959. Data for 1962 on the fertility expectations of married women, obtained by the Growth of American Families Study [not by the Census Bureau], indicate that women aged 30-34 years had already had 88 percent of their total fertility and those 35-39 years of age already had 95 percent.) Even a large drop in birth rates at each remaining childbearing age for the cohort 30-34 years in 1962 as compared with the cohort 35-39 years would result in considerably more children per woman by age 44 years for the younger cohort than for the older cohort. This pattern of expected future increase in family size despite possible declines in annual birth rates at each advanced childbearing age may serve as a caution that secular trends in age-specific birth rates do not necessarily reflect correct trends in lifetime numbers of children per woman.

Census data show that between 1950 and 1960 the proportion of childless women and of women with only one child declined considerably, while the proportion with two or more children increased. For example, in 1960 among women aged 30-34 years who had ever married, only 10.4 percent were childless, 14.7 percent had borne only one child, 62.4 percent had borne two to four children, and 12.5 percent had five or more children; in 1950 the corresponding figures for women 30-34 years of age were 17.3, 23.4, 51.5, and 7.9 percent, respectively.

The census data on children ever born are subject to some undercount. The Bureau does not ask single women about births. (For purposes of

Table D. Children ever born per 1,000 women of childbearing age, by marital status: United States, 1950, 1957, 1960, and 1962

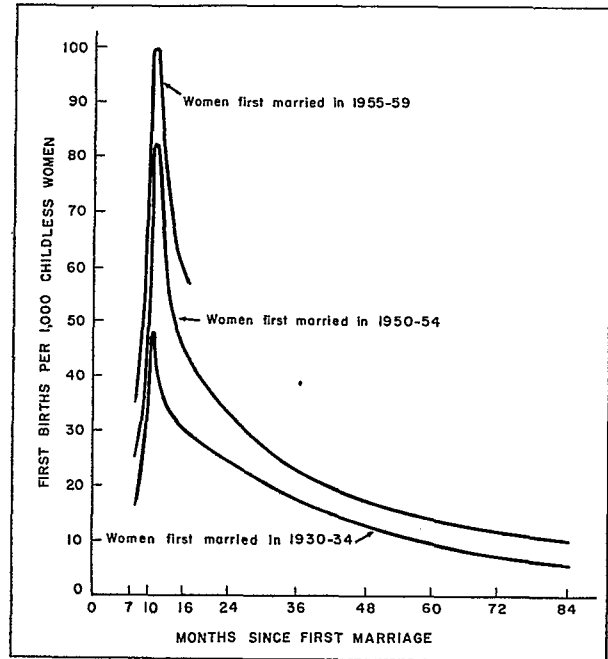
Age of woman	Children per 1,000 total women including single women				Children per 1,000 women ever married			
	1962	1960	1957	1950	1962	1960	1957	1950
15-19 years-----	105	127	108	105	702	792	672	604
20-24 years-----	1,015	1,032	971	738	1,434	1,441	1,368	1,082
25-29 years-----	2,092	2,006	1,900	1,436	2,318	2,241	2,139	1,654
30-34 years-----	2,586	2,445	2,249	1,871	2,797	2,627	2,425	2,059
35-39 years-----	2,664	2,523	2,457	2,061	2,812	2,686	2,612	2,247
40-44 years-----	2,552	2,409	2,342	2,170	2,694	2,564	2,514	2,364

the tabulations the single women are assumed to be childless.) There is also some underreporting by women ever married. Data on retrospective birth rates for distant dates (such as the period 1930 to 1934), obtained from fertility histories in 1959, show annual birth rates that run about 5 percent below those from contemporary vital statistics for white women and about 8 percent for nonwhite women. The census data include illegitimate births to the extent that such are reported by women who have married, but the vital statistics have more complete coverage of illegitimate births.

Fertility histories obtained in 1959 provide direct evidence that recent marriage cohorts had more births earlier after marriage than some earlier cohorts. Figure 2 illustrates the rise in first birth rates at short intervals after marriage.

The same survey (1959) shows that among white births in the period 1955 to 1959 the median spacing since first marriage of the mother was 16.2 months for first births, 49.0 months for second births, 82.7 months for third births, and 108.4 months for fourth births. The medians cited represent reductions of 4 to 6 months over the corresponding medians for white births in the period 1935 to 1939. The survey shows that roughly 90 percent of first births occur by 5 years after the first marriage of the mother. Roughly 80 percent of births of second and higher order occur in the period 1 to 4 years after the birth of a previous child. The very high concentration of events within a narrow spacing range indicates that information on the number of women by interval since the latest birth would be of considerable value for improving short-run projections of births.

Increases after 1940 in the fertility of women in various subgroups of the population have generally more than offset the effect of certain trends that might otherwise have caused some decline. For example, a trend toward increased urbanization of the population tended to cause some decline because urban fertility has been much lower than rural fertility, but this has been offset by a relatively larger rise in urban fertility than in rural fertility with the result that urban-rural differences in fertility have narrowed since 1940. Another example is the trend toward increased educational attainment of the population and the tendency for the better-educated groups



SOURCE: Emerging Techniques in Population Research, 1963. Milbank Memorial Fund, p.99.

Figure 2. First births in successive months since first marriage per 1,000 women childless at beginning of the month, for specified marriage cohorts of white women.

to have fewer children than the less-educated; this has been offset by a relatively larger rise in fertility among women at higher education levels. Comparisons of 1940 and 1950 census data indicate that shortly after World War II the population groups which previously had the lowest fertility had the most increase with the result that fertility differentials by social and economic status narrowed somewhat. Data from the 1960 census indicate, in general, a continuation of the trend although the relative increases in fertility were similar for many social and economic groups between 1950 and 1960. Except at very young childbearing ages the fertility of the nonwhite population increased more than that of the white population between 1950 and 1960.

Census data on women by number of own children under 5 years of age in 1950 and 1960 indicate that changes in the numbers of women at each age were such that there would have been a

decline in the total number of own children under 5 years had this not been offset by the effect of a rise in the proportion of women each age who had married and by higher fertility per ever-married woman of each age. The absolute number of own children under 5 years increased from 15.6 million in 1950 to 19.5 million in 1960 for the conterminous United States. If only the numbers of women at each age had changed, there would have been a decline of about 0.5 million own children under 5 years. Increases in the proportion of women of each age who had married added an estimated 0.6 million own children under 5 years to the population, and increases in the number of own children per woman ever married added 3.8 million. Thus, in terms of the data used, the rise in current fertility of the ever-married women was a more important component of change than the effect of different numbers of women at the two dates or of different proportions married. Other data and dates may yield quite different results.

Annual data on the marital status of the population by age and sex from the Current Population Survey suggest that the trend toward relatively more married women at the young childbearing ages has halted, and, in fact, there is some evidence, not statistically significant so far, that a slight decline in proportion ever married has occurred for girls 14 to 17 years of age, especially among nonwhites.

We may sum up the information presented above by stating that census data do not yet show any significant evidence of a decline in the average number of children ever born to women despite downward trends since 1955 or 1957 in such crude vital statistics measures as births per 1,000 population or per 1,000 women of childbearing age.

### Prospects for Future Data

A special report is available from the 1960 census on women by number of children ever born in relation to many characteristics of the women and their families. The Bureau of the Census is exploring the possibility of obtaining funds from foundations and other government agencies for completing some of the other special 1960 census reports the Bureau was unable to

complete with decennial census funds. It has been successful in securing support for special tabulations on childspacing and on own children under 5 years of age. The Bureau published some data on children ever born and on own children under 5 years in Volume I of the *1960 Census of Population*, thereby making the data available for a wider variety of areas than ever before although these data were not cross-tabulated with social and economic characteristics such as will appear in the special reports. Data on children ever born were collected in the March 1962 Current Population Survey.

The Bureau of the Census collected data in the summer of 1964 in the Current Population Survey on fertility by social and economic characteristics of women and their families; such information has not been obtained from surveys made during the 10 years after 1952.

The Bureau probably will continue to ask questions on children ever born at 2- or 3-year intervals in the Current Population Survey. If there is sufficient demand, the Bureau may also obtain fertility histories every 5 years or so.

The Bureau will continue to do research in the field of fertility although, like the National Center for Health Statistics, it is primarily a collector of basic data. Some of the materials may be used in a demographic model that is being developed by the Bureau, and some may be used in projections of population.

## CHAPTER III. PERIOD FERTILITY AND COHORT FERTILITY: THEIR MEASUREMENT AND INTERRELATION

Fertility is generally discussed in two different ways: as the number of children born to a woman during her life and as the birth rate in a population during a year. An important measurement problem is the relationship between these two faces of fertility.

Lifetime fertility can be measured through a continuing registration of the births that occur age by age to an aggregate of women born at the same time, called a birth cohort. To eliminate from the record the influence of mortality and migration on the size of the group, it is customary

to compute a separate birth rate for each age interval of experience. The set of such birth rates for all reproductive ages is called a cohort fertility-age function. The sum of these rates, called the cohort total fertility rate, gives the level of fertility. It is interpretable as the number of births to a thousand women—or whatever other base may be used for the component rates—during a lifetime (in abstraction from the selectivity of mortality and migration).

The second view of fertility begins with the crude birth rate, the number of births in a particular year per 1,000 population. Since children are born only to women within the reproductive age span and differentially by age within this span, the birth rate depends on the distribution of the population by age and sex. To provide a fertility record which is independent of this distribution, it is customary to compute separate birth rates for women of each age. The result, as before, is a fertility-age function, but this time for a period. The level of fertility in a period may be obtained by summation of the age-specific birth rates to give the period total fertility rate.

The basic component of the period and cohort fertility-age functions is the same: the birth rate for women of a particular age and time. If such rates are shown in a table with years as columns and ages as rows, the rates in each column represent a period fertility-age function, while the rates in each diagonal (from upper left to lower right) represent a cohort fertility-age function because in each such diagonal, age and time increase *pari passu* as they must for any cohort. Because period and cohort fertility-age functions are derived differently from the basic table of birth rates by age and time, their summary measures, such as the total fertility rates, are not generally the same. As a generalization, the relationship between period and cohort fertility rates depends on changes in the age distribution of cohort fertility. For example, if earlier cohorts concentrate their childbearing in older ages and later cohorts concentrate their childbearing in younger ages (i.e., if the mean age of cohort fertility declines), then period total fertility rates will be higher than cohort total fertility rates during that era because the components of period fertility consist of the relatively high birth rates at older ages of

the earlier cohorts and the relatively high birth rates at younger ages of the later cohorts.

In recent American reproductive history the time series of period and cohort total fertility rates have diverged both in the short run and in the long run. Short-run fluctuations of fertility from period to period are reflections of temporary disturbances of childbearing in response to experiences like war or depression. Since these affect all ages more or less, the period total fertility rate registers the impact immediately and directly and then a little later rebounds when the persons concerned recover the births which have been delayed. The participating cohorts show the marks of depression on their birth rates in the ages they occupied when it occurred and also the marks of recovery in subsequent ages. Thus, the fluctuation is observable for cohorts in a disturbance of the age distributions of their fertility without necessary changes in their total fertility rate.

Underlying the fluctuations of the last few decades has been a persistent trend toward younger childbearing from cohort to cohort. This has had the consequence of distorting the period total fertility rates upward to give the spurious impression of a greater rise in cohort fertility than in fact occurred. Most of the rise in period fertility between the late 1930's and the 1950's is attributable to the trend toward younger childbearing from cohort to cohort. Thus, the period total fertility rate moves differently from the cohort total fertility rate when there is either a long-run evolution or a short-run disturbance of the age distribution of cohort childbearing.

The relationship between the number of children a woman has during her life and the annual birth rate may be summarized under two headings: changes in the age pattern of cohort fertility, which determine the relationship between time series of the cohort total fertility rate and the period total fertility rate, and changes in the age distribution of the population, which determine the relationship between time series of the period total fertility rate and the crude birth rate. The crude birth rate is a weighted average of the age-specific birth rates which constitute the period total fertility rate, the weights being the proportions of the population that are females in the various ages of reproduction. These proportions

respond to all influences on the age structure, but, in particular, to the movements of the birth rate a generation before, because they determine the size and age structure of the group of persons currently bearing children. A decline in the birth rate a generation earlier will tend to make the current birth rate decline relative to the period total fertility rate and conversely for a rise. Since the crude birth rate in the United States has experienced many changes in recent history, the prospect is that the crude birth rate and the period total fertility rate will move differently for many years to come. Since short-run and long-run changes in the ages at which cohorts bear children are also not unlikely, it is clear that movements of the crude birth rate will continue to be misleading clues to the trend in cohort fertility.

In attempting to determine the trend in cohort fertility for recent years, appropriate control of the influence of the changing age distribution of the population can be made by studying period fertility-age functions, but no way exists of handling the current relationships between period and cohort measures. The problem is that the cohorts which are the major contributors to contemporary fertility will not reach the end of their reproductive span for many years. Not only do their total fertility rates remain unknown in the meanwhile, but the changing age pattern of their fertility remains unknown also, and without the latter information it is impossible to determine the extent to which current period total fertility rates are giving a distorted picture of underlying cohort fertility. For example, the period total fertility rate for the United States declined from 1957 to 1963. Among the possible interpretations of this movement is a decline in cohort total fertility or a rise in the mean age of cohort fertility. Only the passage of time can provide the data required to translate movement of the period total fertility rate into statements about the exact trend in cohort fertility.

Beyond the level of fertility measures based on age-specific birth rates, it is feasible, using appropriate registration and enumeration data, to determine birth rates in each age group and time period separately for women of the different parities, i.e., in terms of the numbers of previous births to them. This addition of parity detail to the information about the level of fertility age by

age is a valuable contribution to an inquiry into the sources of observed changes in fertility, but it does not resolve the question of the relationship between period and cohort total fertility rates, which is the crux of the determination of the contemporary trend in fertility. Thus, from a period standpoint any age-specific birth rate is a product-sum of the proportions of women in the age group in each parity and their respective parity-specific birth rates. The birth rate in the age group changes from year to year in part because the parity distribution of the group likewise changes and that parity distribution reflects the previous reproductive histories of the women concerned. In the study of fertility fluctuations relative to movements of socioeconomic indexes, for example, it is desirable to remove from the fertility measurements whatever may be ascribable to the fertility of previous years, and this is accomplished by parity-specificity. Similarly, the enlargement of the detail about cohort fertility histories to encompass the changing parity distribution year by year makes it possible to identify the sources of past modifications of the level and age distribution of childbearing within the separate parities as well as ages. But there is nothing about this procedure which helps to solve the problem of the distortion of cohort measures by period measures.

The conclusion reached for measurements based on parity-specificity applies with equal force to all attempts to make the fertility process more specific. From appropriate registration and enumeration data birth rates may be constructed which are, for example, specific for the number of years married or for the number of years since the previous birth (so-called duration-specific or interval-specific rates). These make possible more refined discrimination of period-specific perturbations and enlarge the detail of knowledge about the changing patterns of cohort childbearing, but they are inherently incapable of providing reliable predictions about the subsequent fertility of cohorts of women who are currently in the childbearing ages, and this is what is required to make an exact statement now about the current trend in fertility. One further source of information which may help answer this question, based on reports of women in the childbearing ages concerning the children they expect to have, is discussed later in this report.

## CHAPTER IV. EVIDENCE OF CHANGE IN CURRENT FERTILITY

### Changes in Cohort Fertility

Figure 3 shows the average number of children ever born per 1,000 women (i.e., cumulative birth rates) by exact ages 20, 25, 30, 35, and 50 years for cohorts of women born every fifth year from 1878 to 1943. The broken lines for age 50 years (when childbearing is assumed to be complete) are projections based in part on the number of births expected by a national sample of wives in the childbearing period, interviewed in 1960.<sup>1</sup> These expectations suggest that complete fertility is approaching an upper limit of about 3,100-3,400 births per 1,000 women for the cohorts of the early 1930's. More recent cohorts (specifically those of 1936-42) expect fewer children than those of 1931-35; this may mean that the trend toward higher fertility will cease or reverse.

Suggestive evidence that completed fertility will stabilize or decline is provided by comparisons among interview surveys of three independent samples of white wives 18 to 39 years of age, conducted in 1955, 1960, and 1962. In each of these surveys the wives were asked how many births they thought they would have altogether. The results are presented in table E for four age groups. (The average numbers of births in table E are not comparable with those shown in figure 3 because the former relate to white married women and the latter to all women.) A comparison between ages 18-24 years and 25-29 years in the 1960 and 1962 studies shows that the younger group expects about 10 percent fewer children than the older. Since there may be some tendency for expectations to increase with age, however, it is more valid to make intercohort comparisons at the same ages for different dates. The use of this procedure does not suggest as sharp a decline in completed fertility (Compare births expected by wives 18-24 years in 1955, 1960, and 1962.), but it does indicate the likelihood that the completed fertility of the cohorts born in the late 1930's and early 1940's will be equal to or below that of the cohorts of the early 1930's.

The number of children ever born by age 20 years has already fallen slightly between the

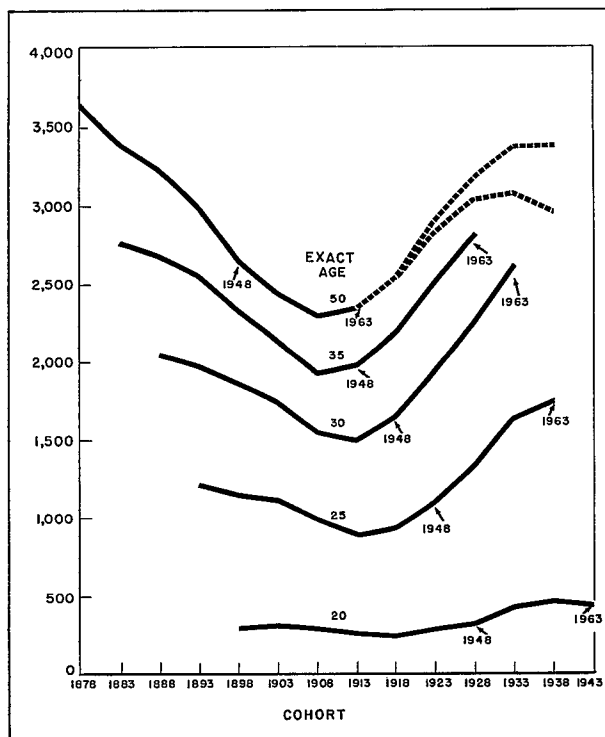


Figure 3. Number of children ever born per 1,000 women, by exact age specified, for every fifth cohort from 1878 to 1943.

cohorts of 1938 and 1943 (a decline which occurred between 1958 and 1963). This does not mean that the 1943 cohort will necessarily have fewer children than the 1938 cohort, but it is consistent with the prospective stability or decline in completed fertility.

The upward trend in births by age 25 years has not yet reversed direction, but it has slowed down, as is shown in figure 3. This also may be taken as an indication that cumulative fertility rates are approaching upper limits.

Another important cohort trend is the tendency for couples to have more of their children while the mother is still in the early part of the childbearing period. The proportion of children born before the mother's thirtieth birthday, for example, was 65 percent for the 1913 cohort and 78-85 percent for the 1933 cohort (depending on how many births these women have altogether).

Table E. Average number of births expected, by wife's age, for couples with white wives 18-39 years of age: United States, 1955, 1960, and 1962

Wife's age	1955	1960	1962	Cohorts to which rates relate		
				1955	1960	1962
18-24 years-----	3.2	3.0	3.1	1931-37	1936-42	1938-44
25-29 years-----	3.1	3.3	3.4	1926-30	1931-35	1933-37
30-34 years-----	3.0	3.2	3.2	1921-25	1926-30	1928-32
35-39 years-----	2.9	3.0	2.9	1916-20	1921-25	1923-27

Source: Freedman, R., Goldberg, D., and Slesinger, D. P.: Current fertility expectations of married couples in the United States. Population Index 29(4):369, Oct. 1963.

The trend toward younger childbearing has been closely associated with a trend toward earlier marriage. The proportion of women who were married by age 20 years, for example, was between 37 and 40 percent before World War II according to the 1920, 1930, and 1940 Census of Population. After the war, however, the proportion ever married by age 20 years rose to 50 percent in 1950 and to 54 percent in 1960. This trend can also be seen in the proportion ever married by age 25 years: 71-72 percent during the interwar period, 83 percent by 1950, and 87 percent by 1960. The tendency toward earlier marriage would have brought about a younger age at childbirth even if there had been no change in the timing of births within marriage. But it is also evident that postwar children were born with less delay after marriage than previously.<sup>2</sup> Together these trends reduced age at childbearing greatly.

The tendencies toward higher completed fertility and younger age at childbirth raised the birth rates at younger ages greatly. The number of births per 1,000 women during ages 20-24 years, for example, was 615 for the 1913 cohort (during 1933-37) and 1,207 for the 1933 cohort (during 1953-57). Without the trend toward younger age at childbirth the rate for the latter cohort would have been between 810 and 890 rather than 1,207. Thus, birth rates in the recent past have been high not only because couples were having

larger families but also because they have been marrying younger and having a higher proportion of their children while the mother is young. It now seems likely that this trend toward younger childbearing is also reaching a limit.

Most of the births that have brought about the rise in average number of children ever born and the trend toward younger childbearing occurred in the 15-year period during 1948-62. (This period is indicated in figure 3 by the arrows for January 1, 1948 and 1963, which point at the cumulative rates achieved by these dates.) In the years ahead two different cohort tendencies will dominate period fertility rates. First, as noted before, completed fertility will probably level off for the cohorts born in the late 1930's and afterwards and may decline; this means stability or decline in rates at the younger ages. Secondly, very high birth rates at the younger ages mean lower birth rates at the older ages. Again comparing the experience of the 1913 and 1933 cohorts, the earlier group had 841 births per 1,000 women after age 30 years, but the more recent cohort will have 750 at most (if, as seems unlikely, maximum birth expectations are realized) and may have as few as 450.

In summary, cohort trends together with expectations data strongly suggest stability or decline in age-specific birth rates at the younger childbearing ages and decline at the older ages.

## Changes in Period Fertility

Between 1957 and 1963 the crude birth rate dropped from 25.3 to 21.7, a reduction of 14 per cent. Whelpton has shown that this decline was due partly to changes in the age composition of the population and partly to lower age-specific birth rates.<sup>3</sup>

The age-specific birth rates for 1957 and 1962, shown in table F, reflect the cohort changes discussed above. The 1962 rates are down at the younger ages (especially at ages 15-19 years); this is consistent with the leveling off or reduction of completed fertility in the cohorts of 1938-47. They are also down at the older ages as a result of the concentration of childbearing at younger ages.

The outlook for period fertility rates during the remainder of this decade is that age-specific birth rates above age 30 years will continue to decline and that rates below age 30 may decline or stabilize at approximately their current levels (which are very high relative to the prewar period). It does not seem probable that age-specific birth rates will increase although the rates at younger ages would increase if completed fertility were to rise to 3,400 (or more) births per 1,000 women and if the trend toward younger childbearing were to continue. Both possibilities now seem unlikely.

Although age-specific birth rates are expected to stabilize or decline, the annual number of births may tend to rise. This is due to increases in the number of women at the younger

childbearing ages. These increases resulted from the increase in the number of births that occurred after World War II. The prospective trend in the number of women 18-29 years of age is as follows:

Year	Estimated number of women 18-29 years on July 1 <sup>4</sup>
1960-----	13,910,000
1965-----	15,958,000
1970-----	19,232,000

These projections show an increase of 38 percent in this age group in 10 years.

A set of population projections prepared by the Scripps Foundation<sup>5</sup> shows that moderately lower age-specific birth rates together with higher numbers of women would maintain the crude birth rate at approximately the current level of 22 per 1,000 for the remainder of the 1960's. These projections also show that a substantial decline in completed fertility and a trend toward later childbearing could lower the annual crude birth rate for the period 1965-70 to 19 per 1,000. In contrast a continuation of the rise in completed fertility and of the trend toward earlier childbearing could raise the birth rate in 1965-70 to 26 per 1,000. At present the assumptions that would bring about either the high or low extreme do not appear to be likely.

Table F. Estimated age-specific birth rates for all women: 1957 and 1962

Woman's age	1957	1962	Percent change	Cohorts to which rates relate	
				1957	1962
15-19 years-----	97.9	83.9	-14	1938-42	1943-47
20-24 years-----	257.2	243.2	- 5	1933-37	1938-42
25-29 years-----	195.8	191.2	- 2	1928-32	1933-37
30-34 years-----	116.8	107.4	- 8	1923-27	1928-32
35-39 years-----	59.8	53.0	-11	1918-22	1923-27
40-44 years-----	15.4	14.8	- 4	1913-17	1918-22

Source: Estimated by the Scripps Foundation for Research in Population Problems.



## The Relationship Between Fertility Trends and Economic Conditions

There is much concern about the social and economic causes of recent fertility trends in this country. Has the high fertility of the postwar period been due, at least in part, to relatively good economic conditions? Before we can begin to answer this question, we must again distinguish between the period and cohort approaches to the study of fertility.

So far the available evidence shows that marriage rates and period fertility rates are affected by economic conditions, that is, birth rates change from year to year partly in response to changes in economic conditions as measured by indexes of unemployment, income, and industrial production.<sup>6</sup> Evidently more couples marry and more married couples try to have children when economic conditions are good. Marriages and births are often postponed under less favorable circumstances.

However, there is as yet no evidence that the total number of children couples have is influenced by economic conditions *per se*. This conclusion is based on a study of the relationship between the completed fertility of cohorts and measures of the economic conditions prevailing while those cohorts were in the most fertile years of the childbearing period.<sup>d</sup> This study shows that completed fertility dropped steadily up to the 1909 cohorts in spite of rapidly improving economic conditions. The upturn in completed fertility began with the 1910 cohort and was continued by later cohorts. Yet the 1910 cohort spent the highly reproductive ages 20-29 years in the decade of the 1930's. The 1912 cohort was hit hardest during the high-fertility years of life; these women reached age 18 years in 1930; yet they had as many births by the end of the childbearing period as the women of the 1906 cohort, who spent ages 18-24 years in the relatively prosperous 1920's. Thus, it does not seem likely that completed fertility has been influenced discernibly by changing economic conditions. It is possible that some other aspect of

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<sup>d</sup>This study was conducted at the Scripps Foundation for Research in Population Problems.

our changing economy affected couples' desires for children. Obviously the shift away from childless and one-child families (which is an important part of the trend that is expressed by the upward movement of completed fertility rates) is strong and widespread. It must be related to some equally impressive changes in our culture, and these changes may well be related to economic trends even though they are not measured by the commonly used indexes of economic conditions. However, we have not yet established what they are.

## CHAPTER V. THE SURVEY AS A SOURCE OF FERTILITY DATA

Beginning with the Indianapolis Study of 1941, the interview survey has become an important source of information on fertility in the United States. This instrument of research has helped us to measure aspects of fertility, such as the timing of births, that have not been available from birth registration and the decennial census, and it has also increased our knowledge of many factors influencing trends and differentials in fertility.

Two kinds of fertility surveys have been conducted in the United States. First, there are surveys designed primarily to test hypotheses about the relationship between fertility and social and psychological variables. Examples of these are the Indianapolis Study of 1941,<sup>7</sup> the Princeton Study (a panel survey begun in 1957),<sup>8</sup> and the Detroit Area Study (D.A.S.) of 1962.<sup>9</sup>

The second type of survey is designed primarily to describe the distribution of fertility variables in the country as a whole and to show how these variables differ and change for broad segments of the population. Examples of these are the Growth of American Families (G.A.F.) Studies of 1955 and 1960<sup>10</sup> and the national surveys of the University of Michigan's Survey Research Center, which include questions on past and expected childbearing.<sup>11</sup> Another important descriptive survey is conducted about once every 2 years as part of the Census Bureau's Current Population Survey.<sup>12</sup> It is designed to get current information on the number of children ever born

to women ever married and sometimes on the spacing of these births.

During the past 10 years it has become increasingly evident that the survey can be used to expand greatly the variety of fertility data typically available from government agencies. The specialized surveys have obtained a wealth of material which should aid in the assessment of current and future fertility trends—expectations data, ideals, preference orders, impairments to reproduction, and methods of family limitation. All of these data have been collected with no indication of a negative response on the part of the people who were interviewed. In fact, response rates for the fertility studies have been exceptionally high.<sup>9</sup> Data on number of children expected as well as other kinds of fertility data made available through the surveys should be sensitive to changes in cohort behavior, probably more sensitive than a continued refinement of conventional data. For example, 1955-57 age-specific birth rates for all women imply a total fertility of about 3.7 children per woman; yet there is nothing in the survey data collected from married women to suggest that any national cohort will approach that level.

Many of the subjects covered in the specialized fertility surveys are probably best left to university-based, research organizations. This is particularly true of many topics included in surveys designed to probe deeply for the social and psychological factors underlying trends and differentials in fertility. It may also be true of information of a more personal nature, such as impairments of the reproductive system and methods of family limitation. Even these subjects may eventually be considered proper subjects of government inquiry, inasmuch as they are related to health.

However, there are certain subjects which should be covered on a regular basis and may be considered appropriate for government-sponsored surveys. One of these has already been mentioned: the number of children ever born, which is provided by the Census Bureau on an

<sup>9</sup>For example, the 1955 G.A.F. Study and the 1962 D.A.S. both resulted in the completion of between 91 and 92 percent of the interviews with eligible response. Moreover, questions dealing with fertility and matters related to fertility had response rates as high as or higher than typical socioeconomic questions.

intermittent basis. Another is the number of children expected.

Questions about the number of children expected were first used on a nationwide scale in the Growth of American Families Study of 1955. Each wife in the sample was asked whether or not she thought she could have more children and if she could how many she thought she would have. There was, of course, some justifiable skepticism about the accuracy of the wives' replies to such questions, and a 1960 survey was conducted partly in order to evaluate the 1955 statements. The 1960 Study did not deal with the same wives as the 1955 Study but with women who had the same characteristics. In other words, the 1960 survey was designed to see whether or not wives could predict accurately the number of children that women like themselves would have.

As far as the average number of children born in a 5-year period is concerned, the replies of the 1955 wives were amazingly accurate. The nonsterile wives in this survey expected an average of 0.8 children in 1955-60, and comparable wives in the 1960 Study reported that they had borne an average of 0.8 children. Even more surprising is the fact that the predicted and actual distributions of women by number of children born in 1955-60 are not significantly different. This is shown in table G.

This surprising accuracy of the aggregated replies of a large group of women does not result from a high degree of accuracy for individual women. Many women undoubtedly had more children than they expected, and many had fewer. But these deviations appear to be due to accidental factors (unintended pregnancies and unforeseen fecundity impairments) that tend to cancel each other's effects.

Other studies support the idea that aggregate predictions of future fertility based on expectations data are accurate. Westoff, Mishler, and Kelly found that statements of desired family size at time of engagement and completed fertility some 20 years later for a panel of 145 fecund, predominantly college-educated, Protestant couples differed by less than 4 percent.<sup>13</sup> In Detroit between 1955 and 1958 the substantial change in the economic conditions of that community did not affect the expectations of a panel of 237 women. At the beginning of the period they

Table G. Percent distribution by number of births in 1955-60 expected by nonsterile wives in 1955 and reported by comparable wives in 1960: Growth of American Families Study.

Number of births	Percentage expecting specified number of births in 1955-60 (from 1955 Study)		Percentage having specified number of births in 1955-60 (from 1960 Study)
	Minimum number expected	Maximum number expected	
Total-----	100	100	100
None-----	52	52	50
One-----	25	24	28
Two-----	17	18	16
Three-----	5	5	5
Four+-----	1	1	1

Source: Campbell, A. A., Whelpton, P. K., and Tomasson, R. F.: The Reliability of birth expectations of U.S. wives. *Proceedings of the International Population Conference*. New York, 1961, Volume I. London. John Wright and Sons, Ltd., 1963. pp. 49-58.

collectively expected to have an additional 176 children. When reinterviewed in 1958, this sample of women had given birth to 84 children and expected 94 more—a total difference of two expected births, or less than .01 per woman.<sup>14</sup> Similarly, after an interval of 3 years reinterviews with 905 two-parity women in the Princeton Study revealed a change of less than 1 percent in the desired number of children.<sup>15</sup>

The relative stability of expectations data over varying periods of time does not necessarily apply to all identifiable subpopulations within the samples mentioned above. For example, a comparison of the 1955 and 1960 Growth of American Families data reveals a small but significant increase in expected family size as the cohort ages.<sup>16</sup> Whether this is a general phenomenon or a characteristic of the period being examined is undetermined. Another analysis of cohort changes in expected family size over time (1955-62) indicates that increases in cohort expectation with increases in age are entirely attributable to the behavior of Catholic cohorts. The Catholic cohorts of 1926-37 increased their expectations by about 10 percent according to results from relatively small samples covering the 7-year interval being studied. In contrast to the instability of Catholic cohorts comparable non-Catholic co-

horts remained exceptionally consistent in their expectations.<sup>17</sup>

Although particular subgroups within the population may be unable to predict their eventual fertility with great accuracy, it can be regarded as well-established that, in the aggregate, wives' predictions of their eventual number of children do bear some relationship to reality, and it appears now to be a fairly close relationship. The collection of more data on childbearing expectations is required to see how well groups of wives are able to predict fertility over an extended period of time and to establish the general nature of the modifications that have to be made to these data. In other words, birth expectations are needed at fairly regular intervals—perhaps once every 5 years from a large nationwide sample. The Subcommittee hopes that some agency of the government will regard birth expectations as an appropriate subject of inquiry on a regular basis. The Census Bureau's Current Population Survey is ideally suited to this task.<sup>f</sup>

<sup>f</sup>Although a time series of national expectations data is available from annual studies conducted by the Survey Research Center, the sample size is too small to analyze reliably the birth expectations of selected key groups—women under 25 years or nonwhites, for example.

It is true that completed fertility changes, but it does not change rapidly nor does it behave erratically. For example, the average change between one cohort and another in the cumulative number of children born by age 40 years (when fertility is nearly complete) has been only 1.6 percent (cohorts of 1877-1923). The main point is that fertility values are embedded in a cultural context which changes slowly, and these values are the most important determinant of the number of children expected and the number actually born.

There is good reason to believe that birth expectations can assist in observing important trends that are beginning to develop before these trends can be identified in current birth statistics. On the basis of data collected in 1960 and 1962, it appears that the completed fertility of the cohorts of 1936-40 will be equal to or below the completed fertility of the cohorts of 1931-35. Yet by 1960 the 1936-40 cohorts had borne 13 percent more children by ages 20-24 years than the earlier group had borne by the same ages. It will not be possible to use numbers of registered births to estimate the final number of children borne by both of these cohort groups until about 1975, when the 1936-40 group will be 35-39 years of age. In other words, data on expectations may have indicated a turning point 15 years earlier than it would have been recognized safely from numbers of registered births. It may be concluded that the use of expectations data to project trends in completed fertility is well worth continued investigation on a large scale and that the necessary information can best be collected through university-based, research organizations supplemented by occasional surveys sponsored by a government agency.

## CHAPTER VI. FERTILITY CHANGES—IMPLICATIONS FOR POPULATION PROJECTIONS

Estimates of future population are essential to national planning in all its ramifications. It is therefore important that methods of preparing population projections, by various characteristics, be improved. The failure of earlier projections to predict population accurately or to offer a sufficiently narrow range to be practical should be a spur to further effort.

Projections of population generally have been made either by some type of mathematical extrapolation of the total population or by the application of projected age-specific birth and death rates to the population or to separate segments of it. They generally carry stated assumptions regarding gains or losses through migration.

Since births are the principal variable in national population projections (death rates being fairly constant and at low levels and immigration being rather small in volume in the United States), measurements of fertility that are relevant to the prediction of the future level of births are of practical importance. It is well, then, in assessing the measurement of fertility to consider the status of fertility projections at present and what is needed to improve them.

### Activity in the Field of Projections

The first official projections based on age-specific rates were made under the auspices of the National Resources Committee by Thompson and Whelpton in 1938. Next, detailed projections with considerable analytical detail were prepared under the auspices of the Bureau of the Census by Whelpton, Eldridge, and Siegel in 1947. The Census Bureau has since revised the projections periodically. It is now preparing extensive revisions of its projections of 1958.

Another set of birth projections has developed from the first, or 1955, survey of the Growth of American Families Study—a joint project of the Scripps Foundation for Research in Population Problems at Miami University at Oxford, Ohio, and the Survey Research Center at the University of Michigan. These projections are based upon an artful interweaving of birth cohort fertility data with data concerning number of births expected, described in previous paragraphs. A second survey in 1960 provided at once an evaluation of the method and a basis for revising the data.

There are besides these formal sets of projections a number of projects testing methods of projections. Several years ago Waggoner and Schachter (both then with the National Office of Vital Statistics) and Whelpton published projections made by extrapolating age-parity-specific rates. Grabill of the Census Bureau has recently

made projections by the marriage-parity progression method. Both Ryder at the University of Wisconsin and Lawrence of the Census Bureau have been studying mathematical relationships in cohort fertility to find ways of extrapolating future fertility. Other experimentation is being done in the National Center for Health Statistics and in the Estimates and Projections Branch of the Bureau of the Census.

Closely related to population projections are the demographic models. They utilize the same variables and much the same data input, but they are designed mainly to study the interaction of the demographic variables as such rather than to predict the future. Thus, instead of designing the model to use the data available, the input is tailored to fit the model. Although the models are useful in developing methodology, they are not capable as yet of producing realistic projections. Orcutt and his colleagues at the University of Wisconsin have devised a demographic model as part of a larger socioeconomic model. More recently Brunsman at the Bureau of the Census has undertaken the design of another model.

In summary, there is considerable activity in population projections, but the efforts have been diffuse, and there is need for more concerted effort on this problem.

### Problems in Methodology

Improvements in the measurement of fertility in the last decade have opened the way to improvements in the forecasting of births. There is a need for further research into the methodology underlying projections if the potentialities of the new information are to be realized. Some of the directions that need to be explored may be pointed out.

More needs to be done in working out the relationship of cohort and period rates. An important innovation of the past decade has been to adjust age-specific rates to completed fertility by cohort. Since completed cohort fertility is more stable than period fertility and reflects the experience of actual women (though with important limitations), projections based on cohorts should be more accurate and have a narrower range of variation than those made by extrapolating period rates. However, there are pitfalls in the use of cohort analysis to project births. It

is period fertility, not cohort fertility, that needs ultimately to be projected. Cohort rates must be converted to period rates before they can be used to project births, and the period rates must not be incongruous.

In projections made by extrapolating period rates, the assumption regarding the distribution of births by age of mother has little impact on the results. In projections made by cohort, even seemingly small differences in age distribution may have a major impact on the resulting period fertility. Variations in age have a long-run effect arising from the change in the length of a generation. They also have a short-run effect which arises from the change in the age distribution of mothers from one cohort to another and causes an overlapping or fanning out of fertility between successive cohorts. Stated in another way, borrowing is implicit in any assumption made regarding age of mother. The importance of age of mother may be appreciated if one considers that according to Whelpton change in timing of births was more important than change in expected size of family in explaining the high fertility of the 1950's. A shift in the pattern of timing of births from that of the cohort born in 1935 back to that born in 1915 would decrease the Nation's births by some 7 million in the next 20 years (more in the long run) even if there were no increase in average lifetime number of births per woman.

There has been considerable controversy as to whether or not the basic assumptions regarding cohort fertility should be based on extrapolation of past trends or on the expressed expectations of women as derived from a survey such as the Growth of American Families Study. Although the results of the survey should certainly be taken into account, its usefulness is somewhat limited, since the survey cannot cover women not yet of childbearing age and in a very few years it will be they who will be bearing most of the children. Even if survey results are used to establish the level of completed fertility, it may be desirable to use past experience to determine the timing of births as the Scripps Foundation has done in its projections.

A further problem in the application of cohort fertility is in the splicing of future fertility with past fertility. Period rates derived from cohort rates may show sharp discontinuities between past and future unless there is an arbitrary

provision to assure smoothness. Period rates of the past have not shown sharp discontinuities from one year to the next except in unusual circumstances such as that of the postwar year of 1946. It would seem reasonable to reject models of future fertility which imply precipitous declines in fertility in a short period, such as a single year.

No project for making birth projections now takes account of all the variables which have been shown to have a bearing on the level of fertility and for which data are available. It would be desirable to devise a method which would take account of all important variables if only to prevent incongruities that may be implicit in assumptions. A fully articulated methodology would account for at least the following variables: completed fertility, age of mother, marital status, parity of mother, and birth interval. The cohort fertility projections of the Growth of American Families Study took account only of completed fertility, age, and marital status. The marriage-parity progression method does take account of parity and interval as well as marital status but at present disregards completed fertility and has only indirect control on age. The sheer magnitude of the computations has been a hindrance to complex models in the past, but the availability of computers and of the condensed languages for programming should now make them practicable.

Working out meaningful relationships among all five variables would require cross-tabulations of a large body of data to assure that the differences between cells are statistically significant. Anything less than the 5 percent sample of the 1960 census would be too small. To enhance the quality of population projections for the next decade, it is highly desirable that the program for tabulating fertility data from the 1960 census be carried out.

It has long been hoped that in making birth projections social and economic variables as well as the purely demographic ones might be taken into account. Projections of economic variables might well be included in the equation for birth projections, but at present there is no series suitable to the purpose. Economic projections today cover either only a year or two in the future or the long-term trends. The level of births is not well correlated with the long-range economic trend, and, although it does respond to annual changes in the level of economy, the fluctuations are too narrow to affect the size and composition of the population to any significant degree. The business cycles of 5 to 10 years' duration appear to be the ones that influence fertility. But the economists have no projections of the business cycle. George Stolnitz at the University of Indiana has proposed that several series of projections be prepared under alternative assumptions respecting the level of the economy for the next 10 years. These projections would be used only to assess the consequences of possible change in the level of the economy and would not be given general circulation.

Social variables are even less amenable to quantitative treatment than are economic variables. But since the relationship between the level of fertility and such factors as urbanization, educational level, and the rationalization of family planning have been established from census data and from studies like the Indianapolis, Growth of American Families, and Family Growth in Metropolitan America projects, trends in these factors might well be taken into account, at least subjectively, in establishing the assumptions regarding the ultimate level of fertility. More use should be made of the comparative fertility experience of other countries.

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## APPENDIX

### DEFINITIONS OF TERMS

The terms listed below are used in the present report. The list is divided into two broad categories, fertility concepts and fertility measures. Under concepts are included very general terms describing various aspects of fertility. The terms listed under measures are divided into two groups, measures of period fertility and measures of cohort fertility.

#### Fertility Concepts

*Birth cohort.*—A group of persons born in a given 12-month period. In this report the birth cohort of 1930, for example, refers to women born in the period July 1, 1929, to June 30, 1930.

*Cohort.*—In this report synonymous with birth cohort. See also marriage cohort.

*Cohort fertility.*—An approach to the study of fertility that concentrates attention on the childbearing history of a group of women as they live through the reproductive years of life. The average number of children ever born by a given age (for a birth cohort) or by a given duration of marriage (for a marriage cohort).

*Cohort fertility rates.*—Rates that relate to births that occur to a specified group of women born or married in the same year.

*Fecundity.*—The physiological *capacity* to participate in conception or reproduction.

*Fertility.*—The number of children *actually* born to a woman, couple, or group (in contrast to fecundity).

*Marriage cohort.*—A group of persons married during a given year.

*Parity.*—The number of children a woman has borne. For example, a zero-parity woman has borne no children, a one-parity woman has borne one child, and so on.

*Period fertility.*—Any measure of fertility relating to births in a given segment of time, most commonly a single calendar year or 5-year period.

*Period rates.*—Rates that relate to births which occur in a specified time interval (usually a calendar year) as distinguished from cohort rates.

*Spacing of births.*—Interval between marriage and first birth and between births of successive order.

*Timing of births.*—The time of birth as it relates to the mother's age, her duration of marriage, or the length of time since her preceding birth.

#### Fertility Measures

##### 1. MEASURES OF PERIOD FERTILITY

*Age-specific birth rate.*—The number of births occurring annually (or in a specified period) per 1,000 women of specific age (usually in terms of 5-year age group).

*Birth rate.*—Synonymous with crude birth rate.

*Crude birth rate.*—The number of births occurring in 1 year per 1,000 average or midyear population within a given area or population group. The rate is crude in that it relates to the total population without regard to age and sex.

*Fertility rate.*—A general term relating to any measure of the reproductive performance of women or men of reproductive age. (Sometimes used as a brief term for general fertility rate.)

*Fertility ratio.*—The number of children under 5 years of age per 1,000 women of childbearing age (usually 15-49 years). Also called child-woman ratio.

*General fertility rate.*—The number of births occurring annually per 1,000 women of childbearing ages (usually 15-44 years or 15-49 years).

*Gross reproduction rate.*—The average number of daughters that a hypothetical cohort of females starting life together would bear if they all survived from birth to the end of the childbearing period and if they experienced a given set of age-specific fertility rates. Usually this measure is computed from fertility rates observed in a single calendar year. It is often interpreted as showing the extent to which the generation of daughters would replace the preceding generation of females if fertility remained constant at a given level and if there were no deaths.

*Illegitimacy rate.*—The number of illegitimate births per 1,000 unmarried women of specified age (usually 15-19 years, 20-24 years, 15-44 years or 15-49 years).



*Illegitimacy ratio.*—The number of illegitimate births per 1,000 live births.

*Intrinsic birth rate.*—The crude birth rate that would eventually result if a population were to experience given sets of age-specific mortality and fertility rates over a long period of time. Under these hypothetical conditions the age distribution of the population would eventually become stable, that is, the percent distribution of the population by age and sex would become constant. The crude birth and death rates would also become constant because the same age-specific rates would be applied to a stable age distribution year after year. The intrinsic birth and death rates are often interpreted as showing the potential effects on population growth of given sets of mortality and fertility rates. These rates are usually computed from mortality and fertility rates observed in a given calendar year.

*Marital fertility rate.*—The number of births per married woman (or a given number of women) during a specified period of time. This may or may not be specific with reference to age of woman or duration of marriage.

*Net reproduction rate.*—The average number of daughters that a hypothetical cohort of females starting

life together would bear if they experienced given sets of age-specific mortality and fertility rates. Usually this measure is computed from mortality and fertility rates observed in a single calendar year. It is often interpreted as showing the extent to which a generation of daughters would replace the preceding generation of females if mortality and fertility remained constant at stated levels.

## 2. MEASURES OF COHORT FERTILITY

*Cumulative birth rate.*—The number of children ever born per 1,000 women, or married women, of specific age. This indicates the total past fertility of women up to a given age.

*Completed birth rate.*—The cumulative birth rate by the end of the childbearing period (usually ages 45-49 years).

*Completed fertility, completed fertility rate, final birth rate, or average family size.*—Synonymous with completed birth rate.

*Cumulative marriage rate.*—The number of first marriages occurring by a given age per 1,000 women in a cohort who live to that age.



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