

ANSLEY J. COALE
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New Estimates of Fertility and Population in the United States



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*A Study of Annual White Births from 1855 to 1960
and of Completeness of Enumeration in
the Censuses from 1880 to 1960*

BY

ANSLEY J. COALE AND MELVIN ZELNIK

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Preface

This book is the consequence of a suggestion that Coale made to Zelnik in 1956 when the latter was a graduate student in sociology at Princeton University. Each student was required to complete a research project—a second-year paper—and Coale suggested that Zelnik analyze single-year age heaping in the decennial censuses of the United States since 1880 in a manner analogous to Coale's work on 5-year age heaping in an article he had published in 1955.¹ Zelnik's analysis showed conclusively that there had been a very nearly linear trend in age heaping at almost every age, for males and females alike, in the censuses from 1880 to 1950.² The existence of these linear trends made it feasible to estimate single-year age distributions of the native white populations in each census from 1880 to 1950—age distributions nearly free of the effects of age heaping.

The success of this early research led to a second suggestion by Coale—that Zelnik project these single-year age distributions (for females) back to birth to form estimates of white births and birth rates for years prior to the completion of the Birth Registration Area. This expanded research project became Zelnik's doctoral dissertation, written under Coale's supervision. Upon the completion of Zelnik's thesis in 1958, it was apparent that two types of extension should be attempted—births should be estimated from enumerated males as well as females, and the final adjusted birth estimates should be used to determine the approximate completeness of enumeration of each native white age group in each decennial census. In 1958–59, Wang Nai Chi, who was then a research aide at the Office of Population Research, calculated preliminary birth estimates from the male age distributions. In 1960–61, Marion O'Connor, also a research aide, made preliminary estimates of completeness of enumera-

¹ Ansley J. Coale, "The Population of the United States in 1950 Classified by Age, Sex, and Color—A Revision of Census Figures," *Journal of the American Statistical Association*, Vol. L (March 1955), pp. 16–54.

² This analysis was described in Melvin Zelnik, "Age Heaping in the United States Census: 1880–1950," *Milbank Memorial Fund Quarterly*, Vol. XXXIX, No. 3 (July 1961), pp. 540–573, as well as in Chapter 7 below.

tion. During the academic year 1961-62 Zelnik returned to the Office of Population Research as a research associate to collaborate with Coale in completing the analysis and composing the manuscript of this book.

We wish to express our gratitude to Mr. Wang and Mrs. O'Connor for the high quality of their work, and to Erna Härm, who restored to unified order a large volume of unverified calculations which had been made by divers persons over a period of several years. Mrs. Härm (a research aide at the Office) has also contributed to our research and analysis during the past year. The figures were drawn by Maria Martin and Daphne Notestein. The various drafts of the manuscript were edited and proofread by Margaret MacDonald. We gratefully acknowledge the helpful comments and suggestions made by Simon Kuznets, P. K. Whelpton, and Irene Taeuber.

A subvention from the National Science Foundation (G-17680) defrayed many of the extra expenses entailed in completing this project during the past year. In addition, the general support the Office of Population Research enjoys from the Rockefeller Foundation and the Milbank Memorial Fund was essential to its completion. We wish also to thank the Fund for permission to use, in its present form, the material contained in Chapter 7. The final responsibility for errors and shortcomings in this book rests with the authors.

MELVIN ZELNIK
ANSLEY J. COALE

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PART I

INTRODUCTION AND OUTLINE OF METHODS

Chapter 1. Introduction

Anyone interested in the demographic history of the United States, or in using its demographic data, is faced with many gaps and shortcomings in the published population records. One of the most prominent gaps is the lack of an annual series of births and birth rates covering the nineteenth century and the early part of the twentieth. A conspicuous shortcoming is inaccuracy in the decennial censuses of population, including incomplete enumeration and inaccurate reporting of age. These two deficiencies in the data are, in fact, intimately related—an annual series of births for some years in the past plus appropriate estimates of mortality would make it possible to determine the numbers of people who should have been enumerated at various ages in the censuses, since the censuses record the native population by single years of age from 1880 to 1950. Conversely, complete and accurate census age distributions, again with the appropriate estimates of mortality, would make it possible to estimate the number of births in the years preceding the census, because the enumerated native population consists of the survivors of these births.

Birth statistics purporting to cover the total United States did not become available until 1933, when the Birth Registration Area first included all states. Before that date there are statistics for some states, a few having data extending back to the early and mid-1800's. "Generalizing" these data to apply to the total United States requires the solution of two major problems: (1) that of representativeness—the statistics of these states may not reflect the fertility experience of other states and areas—and (2) the problem of unknown and changing degrees of under-registration in those states where records of registered births are available. For reasons which need not be detailed here, it is extremely doubtful that the fertility behavior in the states for which early data are available was in fact representative of the fertility behavior of the total population of the United States; nor does there seem to be any way of estimating the magnitude or pattern of differences between the fertility in those areas for which data are available and the fertility in those areas for which such data are not available.

Under-registration in the nineteenth century has been stud-

ied for one state, Massachusetts, where the estimated under-registration ranged from 18 per cent in 1850 to 3.3 per cent in 1890.¹ Although there is no direct evidence, it is highly probable that the birth registration completeness was similarly variable in other states. Even if the data available for these states were representative of the entire population, the large and inconstant incompleteness of registration would make birth estimates based on such registration of little value.²

Errors in the reported numbers of persons at each age in the censuses are of two types, logically, but not necessarily empirically, identifiable and distinguishable. One type of error is under- (or over-) reporting of the entire population or of persons of a particular age; the other is age misreporting. Under-enumeration appears to occur at all ages and to change gradually from one age to the next. "Age heaping"—the most conspicuous form of age misreporting—occurs positively at some ages, negatively at others immediately adjacent, resulting in sharp peaks and dips in the age distribution. Births estimated from these saw-toothed age distributions would exhibit the same spurious sharp rises and falls.

The absence of birth statistics has prevented a close analysis of the interrelationships between demographic and various social, economic, and political factors. An annual series of births and birth rates would not only reveal the past course of fertility in the United States, but it would make possible the testing of certain previously untestable hypotheses. The inaccuracy of census enumerations has meant that conclusions based on census data, including per capita rates such as death rates, have been erroneous, and to an unknown degree. In some instances, the size of the error involved is small and of only minor significance;

¹ Robert Gutman, "The Birth Statistics of Massachusetts During the Nineteenth Century," *Population Studies*, Vol. X, No. 1 (July 1956), p. 76, Table 2.

² The annual series of total United States births extending back to 1909 prepared for the National Office of Vital Statistics by P. K. Whelpton is essentially an attempt at using the birth statistics for various states. Although Whelpton's methods are highly sophisticated and ingenious, there is reason to believe his estimates are, as Whelpton himself recognized, subject to an increasing degree of error for the earlier years in this interval; and he attempted no estimates for years prior to 1909. For a detailed discussion of Whelpton's methods, see U.S. National Office of Vital Statistics, "Births and Birth Rates in the Entire United States 1909-1948," prepared by P. K. Whelpton, *Vital Statistics—Special Reports*, Vol. 33, No. 8 (1950).