Williams

OBSTETRICS

Fourteenth Edition

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This volume represents the Fourteenth Edition of *Williams Obstetrics*, the first six of which were written by the late J. Whitridge Williams, Professor of Obstetrics in Johns Hopkins University, and Obstetrician-in-Chief to the Johns Hopkins Hospital from 1896 to 1931; the seventh, eighth, and ninth editions were prepared by the late Henricus J. Stander, Professor of Obstetrics and Gynecology in Cornell University and Obstetrician and Gynecologist-in-Chief to the New York Hospital from 1931 to 1948; the tenth and eleventh were prepared by Nicholson J. Eastman; the twelfth and thirteenth by Nicholson J. Eastman and Louis M. Hellman.

TO THE MEN OF HIGH PURPOSE
WHO HAVE SOMETIMES JEOPARDIZED THEIR CAREERS
IN DEFENSE OF THE RIGHT OF ALL CHILDREN TO BE WELL BORN,
THIS TEXT IS RESPECTFULLY DEDICATED.

PREFACE

The five years since publication of the thirteenth edition of this textbook have witnessed a growing concern for the social aspects of maternity care. During this period continued interest in the physiology and pathology of reproduction has generated a vast body of knowledge of basic biologic importance and direct applicability. The base of obstetrics has thus broadened to include fetal medicine and human ecology as integral to the specialty in the 1970s.

We have endeavored to strike a balance in introducing new concepts and restating established principles, with the aim of maintaining clinical excellence. Chapters dealing primarily with management of obstetric problems incorporate new scientific information, while reflecting the effects of the social and economic status of women on their reproductive efficiency. To emphasize the importance of the patient's emotions on her reproductive behavior, we have replaced the single chapter on psychiatric aspects of pregnancy and childbirth with relevant comments in appropriate sections throughout the book.

The material on therapeutic abortion, sterilization, and contraception has been entirely rewritten in order to present significant technical information within the context of current social trends that influence practice in these areas. Here, where science and philosophy meet, a particular effort to minimize bias was exerted. The chapters dealing with coincidental diseases of pregnancy and with the fetus and newborn have incorporated current concepts in the clinical and basic scientific areas related to modern obstetrics.

Revision of the chapters on reproductive anatomy, physiology, and endocrinology summarizes the significant biochemical and ultrastructural findings of the last five years. An entirely rewritten chapter on the hypertensive disorders in pregnancy incorporates significant laboratory data as well as important new clinical findings that stress the influence of social and familial factors. The relation of preeclampsia to the ultimate development of persistent hypertension has received detailed attention.

Despite these extensive revisions and additions, we have by continued judicious deletion and economy of phrase not added substantially to the number of pages in the last edition.

In keeping with the concept of J. Whitridge Williams, the author of the first six editions of this textbook, we have eschewed undue emphasis of our special areas of interest and points of view. We have instead attempted to present the

current consensus in obstetric diagnosis and therapy. Where opinion remains divided, we have presented the rationale of each suggested form of management. Where our combined experience has been extensive and consistent, we have outlined our currently employed plans of treatment, with no implication that alternate methods are inapplicable.

Maintaining another tradition of this textbook, we have selected all references with great care in the belief that accurate documentation of scientific data is a prerequisite to scholarship. Each reference list has therefore been checked by a professional bibliographer.

The modern format for this text was established by Doctor Nicholson J. Eastman, Professor of Obstetrics at Johns Hopkins, with the publication of the tenth edition. Although each subsequent edition has been extensively revised the standards of scholarship and readability set by Dr. Eastman during the 20 years of his authorship have been scrupulously respected.

With the exception of Chapter 26, all the material has been written by the authors, each of whom edited and approved the entire text. We express deep appreciation to Dr. Leon C. Chesley, Professor of Obstetrics and Gynecology, State University of New York, Downstate Medical Center, for his scholarly monographic revision of the chapter on hypertensive disorders in pregnancy.

We are particularly grateful to Dr. Arthur Lesser, Director, Maternal and Child Health, HSMHA, Department of Health, Education, and Welfare for compilation of the data for the charts and tables in Chapter 1, and to Dr. Paul C. MacDonald, Professor of Obstetrics and Gynecology at the University of Texas (Southwestern) Medical School at Dallas, for valuable help with the sections on endocrinology. We are also grateful to Dr. Rita Harper, Assistant Professor of Pediatrics, State University of New York, Downstate Medical Center, for her help with the chapters on the Newborn and Diseases of the Newborn. In addition, we owe gratitude to Doctors Hall, Jones, Kobayashi, Kohl, Nelson, Solish, Tricomi, and Valenti of Dr. Hellman's staff, Dr. Peggy Whalley of Dr. Pritchard's staff, and Doctors Kernis and Savage of Dr. Wynn's staff for their help and advice in their special areas of competence.

Special mention must be made of our debt to Doctors Hall and MacDonald who assumed our administrative chores during the writing of this text.

We are indebted to our secretaries for typing the manuscript and to Mrs. Edith Gelfand who supervised the preparation of figures. We owe a special debt of gratitude to Mrs. Florence Gubitz for supervision and direction of flow of the manuscript. Miss Madeleine Steele has checked each reference for accuracy. For this arduous task we are grateful.

Finally, it is our pleasure to thank Appleton-Century-Crofts for the meticulous attention they have devoted to the preparation of this volume.

Louis M. Hellman

Jack A. Pritchard

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1

OBSTETRICS IN BROAD PERSPECTIVE

Definition. *Obstetrics* is the branch of medicine that deals with parturition, its antecedents, and its sequels. It is concerned principally, therefore, with the phenomena and management of pregnancy, labor, and the puerperium, in both normal and abnormal circumstances.

In a broader sense obstetrics is concerned with reproduction of a society. Maternity care aims to promote health and well-being, both physical and mental, among young people and to help them develop healthy attitudes toward sex, family life, and the place of the family in society. Obstetrics is concerned with all of the social factors that greatly influence both the quantity and the quality of human reproduction. The problems of population growth are obstetrics' natural heritage. The vital statistics of the nation, published monthly by the National Center for Health Statistics, attest society's concern with the charge of this specialty.

The word *obstetrics* is derived from the Latin term *obstetrix,* meaning *midwife.* The etymology of obstetrix, however, is obscure. Most dictionaries connect it with the verb *obstare,* which means *to stand by* or *in front of.* The rationale of this derivation is that the midwife stands by or in front of the parturient. This etymology has long been attacked by Seligmann, who believed that the word was originally *adstetrix* and that the *ad* had been changed to *ob.* In that case, obstetrix would mean *the woman assisting the parturient.* The fact that on certain inscriptions *obstetrix* is also spelled *opstetrix* has led to the conjecture that it was derived from *ops* (*aid*) and *stare,* meaning *the woman rendering aid.* According to Temkin, the most likely interpretation is that obstetrix meant *the woman who stood by the* parturient. Whether it alluded merely to the midwife's standing in front of or near the parturient or whether it carried the additional connotation of rendering aid is not clear.

The term *obstetrics* is of relatively recent usage. The Oxford English Dictionary gives the earliest example from a book published in 1819, indicating that in 1828 it was necessary to apologize for the use of the word *obstetrician.* Kindred terms, however, are much older. For example, *obstetricate* occurs in English works published as early as 1623; *obstetricatory,* in 1640; *obstetricious,* in 1645; and *obstetrical,* in 1775. These terms were often used figuratively. As an example of such usage the adjective *obstetric* appears in Pope's *Dunciad* (1742) in the famous couplet:

> There all the Learn'd shall at the labour stand,
> and Douglas lend his soft, obstetric hand.

The much older term *midwifery* was used instead of *obstetrics* until the latter part of the nineteenth century in both the United States and Great Britain. It is derived from the Middle English *mid*, meaning *with*, and *wif*, meaning wife in the sense of a *woman*. The term *midwife* was used as early as 1303, and *midwifery*, in 1483. In England today the term midwifery carries the same connotation as obstetrics, and the two words are used synonymously.

Aims of Obstetrics. The transcendent objective of obstetrics is that every pregnancy culminate in a healthy mother and a healthy baby. Obstetrics strives to minimize the number of women and infants who die as a result of the reproductive process or who are left injured therefrom. It aims further to minimize the discomforts and hazards of pregnancy, labor, and puerperium, so that both mother and child will conclude the experience in physical and mental health. Obstetrics is concerned further with the number and spacing of children so that both mother and offspring may enjoy optimal physical and emotional well-being. Finally, obstetrics strives to analyze and influence the social factors that impinge on reproductive efficiency.

Vital Statistics: Definitions. To aid in the reduction of the number of mothers and infants that die as the result of pregnancy and labor, it is important to know how many such deaths occur in this country each year and in what circumstances. To evaluate these data intelligently, it is essential to know the following standard definitions:

Birth rate. The number of births per 1,000 population.

Fertility rate. The number of live births per 1,000 female population aged 15–44 years.

Marriage rate. The number of marriages per 1,000 population.

Neonatal death. Death of a newborn infant within the first four weeks of life. This definition is used chiefly in the United States; the World Health Organization defines the neonatal period as the first seven days of life.

Neonatal death rate. The number of neonatal deaths per 1,000 live births.

Infant mortality rate. Infant deaths (under 1 year of age) per 1,000 live births.

Stillbirth. An infant with no heartbeat who neither breathes nor cries nor shows any other sign of movement.

Fetal death. Death in utero of a fetus weighing 500 g or more. This weight corresponds roughly with a fetus of 20 weeks or more gestational age, that is, with a "viable" fetus. (Note: this term is often used loosely and *incorrectly* to designate the sum of fetal and neonatal loss. The term is also used by the National Center for Health Statistics to include fetal deaths irrespective of the duration of pregnancy. These divergent practices lead to lack of statistical precision. Death is defined in the following context: after expulsion the fetus does not breathe or show any other evidence of life, such as the beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles.)

Fetal death rate. The number of fetal deaths per 1,000 births (live births and stillbirths).

Perinatal death rate. The sum of fetal and neonatal death rates (theoretically, the denominator for both these rates should be the total number of births).

Maternal death rate or mortality. The number of maternal deaths that occur as the direct result of the reproductive process per 100,000 live births. (Note: this rate is calculated per *one hundred* thousand live births and not per *one* thousand.)

The Birth Rate and Fertility Rate. One index of the need for obstetric personnel is the number of births each year. Additional indices are the crude birth rate and the general fertility rate. From these data, particularly the fertility rate, the expected number of births in future years can be estimated. In 1968 there were 3,470,000 live births registered in the United States, a decline of 6 per cent from the number in 1966. It was also the tenth year in which the number of births continued to decline since the peak of approximately 4,300,000 in 1957. This decline is about 20 per cent from the peak value (Fig. 1).

There were approximately 2,965,000 births in the United States when the birth registration area was established in 1915. The number rose steadily except for a slight decline during World War I. It declined again during the depression,

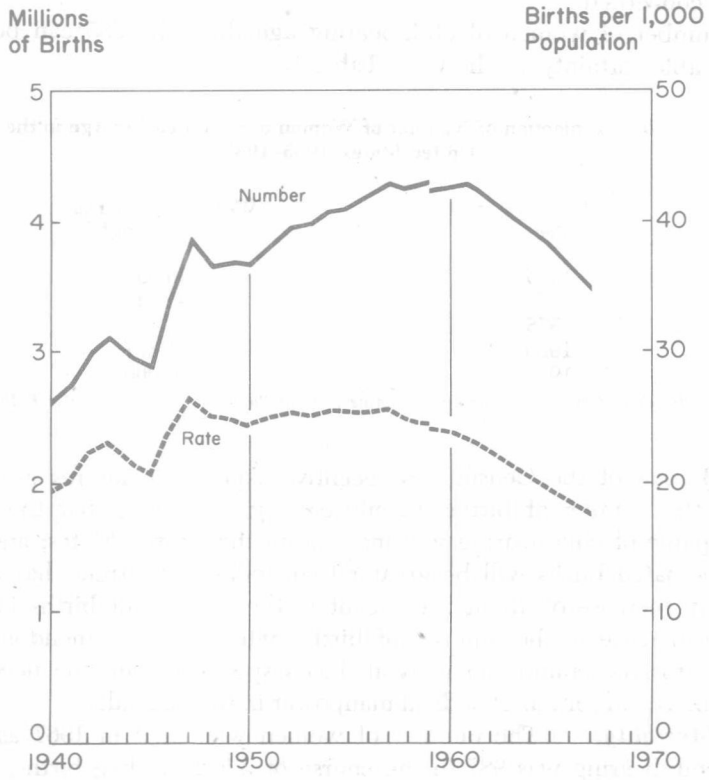

Fig. 1. Live births and birth rates, 1940-1968. (Monthly Vital Statistics Report, Provisional Statistics Annual Summary for the United States, 1968, National Center for Health Statistics, HSMHA, U.S. Department of Health, Education, and Welfare.)

reaching a low of 2,307,000 per year in 1933. Although there was another decline related to movements of military personnel overseas in the Second World War, it was followed by the "baby boom," which continued almost uninterrupted until 1957. Since then, the declining trend in births has been reflected in almost all measures of fertility. The crude birth rate declined from 25.3 per 1,000 population

in 1957 to 17.4 in 1968. The general fertility rate, which is a much more sensitive indicator of births and trends because it takes into account the population at risk (women between the ages of 15 and 44), dropped about 30 per cent during this period. The declines have been somewhat faster for white women, but the difference in trends at most ages is not great. At higher birth orders, however, the rates for nonwhites have been falling faster than those for whites.

Projections of Live Births. Nothing could be of greater concern to obstetricians and to obstetric practice than the future number of live births. The course of fertility in the United States depends on a number of factors, including future migration, mortality, marriage, and patterns of childbearing, as well as the composition by age and sex of the future population. Although the number of children born to any population at a projected date in the future cannot be calculated with precision, reasonable projections can be based upon explicit assumptions regarding the future effect of these factors. The precision of these predictions depends on how closely the projected economic and demographic factors apply to the population concerned.

The number of women of childbearing age through 1985 can be projected with reasonable certainty, as shown in Table 1.

Table 1. **Projection of Number of Women of Childbearing Age in the United States, 1965–1985**

Year	*Women 15–44 Years (in thousands)*
1965	38,939
1970	42,336
1975	46,881
1980	51,887
1985	56,000

From Department of Commerce, Bureau of Census Current Population Reports, Series P-25, Nos. 381 and 388, 1968.

The Bureau of the Census has recently taken these figures as a basis for projecting the number of births. In any case, it is evident that the number of women capable of childbearing will increase in the United States, and the number of anticipated births will be greater than today. This trend has already begun with an increase of about 2 per cent in the number of births in 1969 over 1968. This increase in the number of births, which is of tremendous economic importance for the country in general, bears specifically on the need for more maternity beds and for more medical manpower in this specialty.

Maternal Mortality. The number of women who died in 1967 as the direct result of childbearing was 987 in the course of 3,512,000 live births, a mortality rate of 28 per 100,000 live births. Figure 2 shows the dramatic reduction in the maternal mortality rate during the past three decades, from a plateau above 600 in white women before 1930 to a level of less than one twentieth that rate in 1967, in which year the rate in white women was 19.5. The corresponding figures for the nonwhite were 1,170 in 1930 and 69.5 in 1967. Whereas the overall decline has been spectacular, there is a persistent differential between the white and nonwhite maternal mortality rates. This differential appears to be increasing as the rates fall. In 1930 the rate for nonwhites was about twice that for white women, and by 1967, about three and a half times.

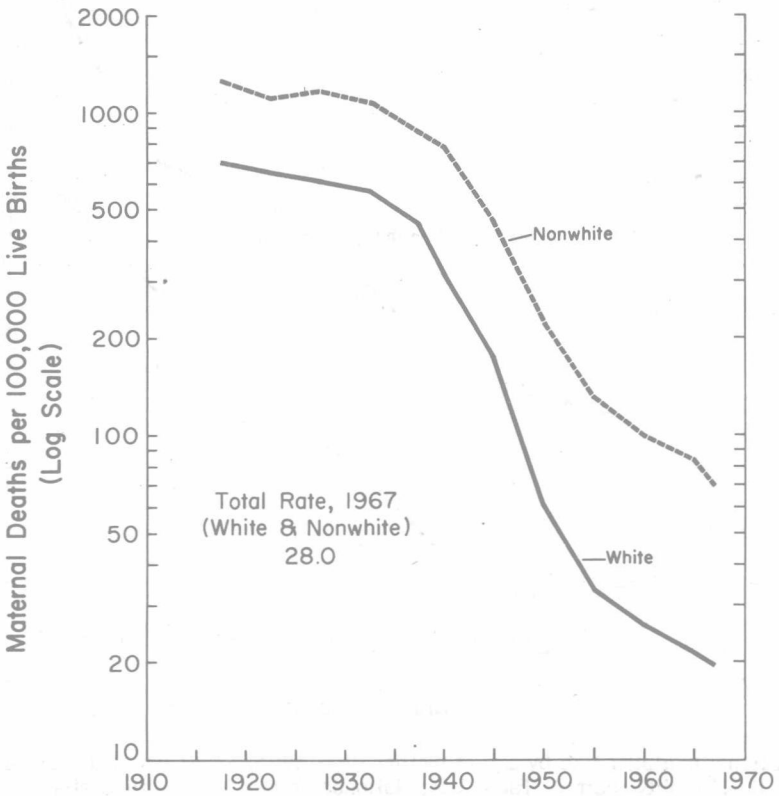

Fig. 2. Maternal mortality, 1915–1967, United States Birth Registration Area. (Vital Statistics of the United States, 1967, Vol. II—Mortality, Part A, Table 1-16, National Center for Health Statistics HSMHA, U.S. Department of Health, Education,and Welfare.)

These differences in maternal mortality rates result primarily from social and economic factors, such as lack of a medical attendant at delivery, lack of antepartum care, dietary deficiencies, poor hygiene, lack of contraceptive services, and faulty health education. As these unfavorable social and economic conditions are improved, the racial difference in the maternal death rates will doubtless decrease.

The maternal mortality rate varies also with the age of the mother, as plainly shown in Figure 3. In all races the tremendous increase in mortality with advancing age can be explained only on the basis of an intrinsic maternal factor. The increasing frequency of hypertension with advancing years and the greater tendency to uterine hemorrhage contribute significantly to the elevation of mortality. Advanced age and high parity act independently to increase the risk of childbearing, but their effects are usually additive. In the actual analysis of cases, it is difficult to dissociate these two factors. Figure 3 must therefore be interpreted as showing, for the most part, the additive effects of age and parity. It shows in addition that the lowest maternal mortality rates occur in mothers between 20 and 30 years of age, the reproductive period when the outlook for the baby also is best.

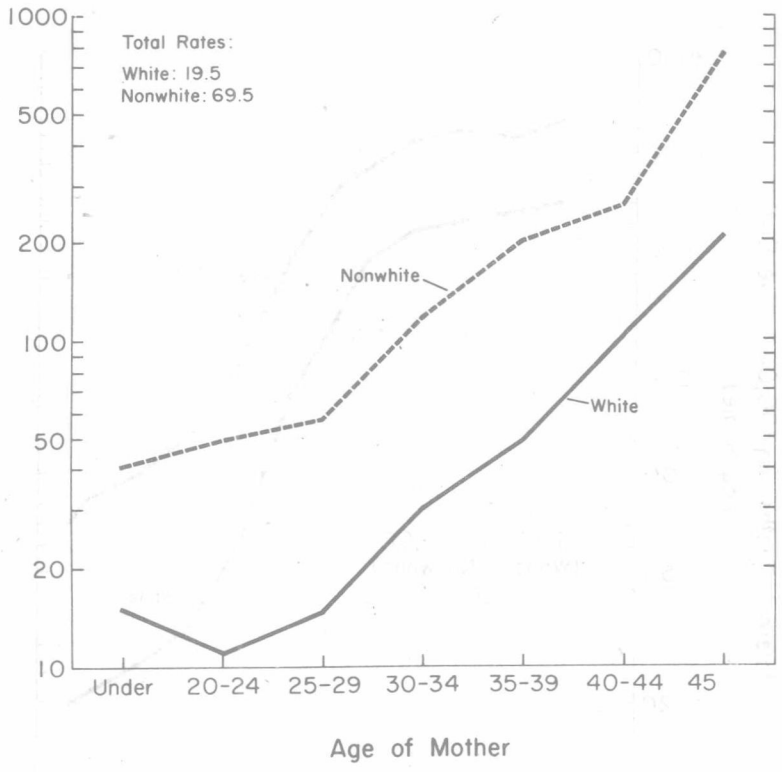

Fig. 3. Maternal mortality rate by age of mother, 1967. (Vital Statistics of the United States, 1967, Vol. II—Mortality, Part A, Table 1-16, National Center for Health Statistics, HSMHA, U.S. Department of Health, Education and Welfare.)

Geographic Distribution. Maternal mortality shows a large geographic variability, reflecting the social and economic status of the population as well as the distribution of medical care and facilities. In general, the mortality rates are lower in metropolitan areas. Deaths from hemorrhage and toxemia predominate in rural areas. This generalization may no longer be valid when the central metropolitan areas become filled with a nonwhite population.

As a result of improvements in obstetric care, ready access to blood for transfusion, and antibiotics, the death rates from toxemia, hemorrhage, and sepsis have fallen to the point that this classic triad no longer accounts for the overwhelming majority of maternal deaths. Figure 4 presents the national picture rather than that of well-equipped and properly manned metropolitan centers, where hemorrhagic death is a rarity, and deaths from illegal abortion rather than from the classic triad are likely to predominate.

Abortion has assumed a prominent place among causes of maternal mortality. These cases may well be underreported, for although sepsis in general causes deaths among the white and nonwhite populations with equal frequency, abortion with sepsis accounts for twice as many deaths among nonwhite as it does among white women. It is possible that white women can buy safer abortions; if so, it remains to be explained why the importance of sepsis in general among the causes of death is equal for white and nonwhite women.

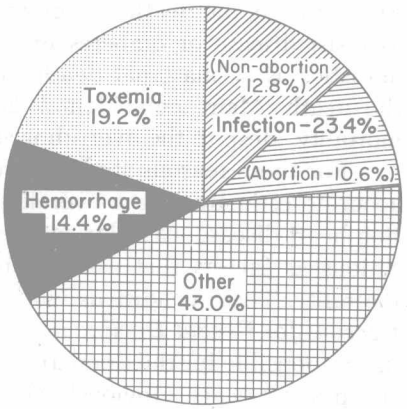

Fig. 4. The relative frequency of the most common causes of maternal death, based on 987 deaths in the United States in 1967, as tabulated by the National Center for Health Statistics. Hemorrhage includes deaths from ectopic pregnancy and abortion without sepsis or toxemia as well as deaths from other types of obstetric hemorrhage. As explained in the text, deaths associated with maternal heart disease and other coincidental conditions are not included. (Vital Statistics of the United States, 1967, Vol. II—Mortality, Part A, Table 1-15, National Center for Health Statistics, HSMHA, U.S. Department of Health, Education, and Welfare.)

Common Causes of Maternal Mortality. Hemorrhage, toxemias of pregnancy, and infection still account for nearly 60 per cent of reported maternal deaths for the United States. The official reports differ from those of individual hospitals, which include deaths not strictly related to pregnancy, such as those from cardiac disease. The individual institutional reports, based on findings at autopsy rather than the death certificate alone, often provide a more accurate diagnosis. The causes of obstetric hemorrhage are multiple: uterine bleeding immediately after birth (postpartum hemorrhage); shock and bleeding in association with abortion; bleeding from rupture of the fallopian tube (extrauterine or ectopic pregnancy); bleeding as the result of abnormal placental location or separation (placenta previa and abruptio placentae); and bleeding from rupture of the uterus. The toxemias of pregnancy, occurring in about 6 or 7 per cent of gravid women, are characterized by various combinations of hypertension, edema, and proteinuria, and in some severe cases by convulsions and coma. Puerperal infection of the genital tract usually originates in endometritis, which sometimes undergoes extension to cause peritonitis, thrombophlebitis, bacteremia, and other distant foci of infection. Details of the origin, prevention, and treatment of these conditions form a large portion of the subject matter of obstetrics.

Hemorrhage is probably a relatively more important cause of maternal death than is apparent from Figure 4 and from the national vital statistics. In official classifications of causes of death, it is customary to list only the *direct* cause; predisposing factors are necessarily ignored. For example, if the final and direct cause of death is puerperal infection, it is so classified. A common sequence of events in fatalities from puerperal infection, however, is as follows: the patient suffers a serious hemorrhage and her resistance to infection is thereby weakened; operative attempts to correct the cause of the hemorrhage may traumatize tissues and introduce infection; death occurs days or weeks later from puerperal infection. Hemorrhage thus acts as a most important predisposing factor, but it does not appear as the cause of death in the official statistics. Only if a woman actually bleeds to death is the fatality classified as hemorrhagic.

As the number of maternal deaths declines, the data from the death certificates become less informative. For example, in Figure 4 deaths classified as "other" (no specified complication mentioned) account for over 40 per cent of the deaths.

Furthermore, the death of a gravid or puerperal woman with a complication such as heart disease or diabetes is not classified by the National Center for Health Statistics as a "maternal death," but appears under the direct medical cause of the death. Many coincidental diseases are therefore excluded from "maternal mortality" despite the overriding influence of the pregnancy on the fetal outcome.

For these reasons studies based on hospital experience often provide a more accurate estimate of the overall toll of pregnancy. Currently these studies mention heart disease, vascular accidents, anesthesia, and a host of other medical conditions as factors that assume an increasingly important role in total maternal mortality. These conditions will be discussed in detail in Chapter 27.

Reasons for Recent Decline in Maternal Mortality. Many factors and agencies are responsible for the dramatic fall in the maternal death rate in this country over the past 20 years. Obviously there has been a general improvement in medical practice. The widespread use of blood transfusion and antibiotics and the maintenance of fluid, electrolyte, and acid-base balance in the serious complications of pregnancy and labor have materially changed obstetric practice. Equally important is the development of widespread obstetric training and educational programs, which have provided more and better qualified specialists and, at the same time, more competent general practitioners. The American Board of Obstetrics and Gynecology has been especially instrumental in this advance. Although lacking legal authority, it is the generally endorsed body that certifies specialists in this field. Approximately 8,000 specialists whom the board has certified have established high levels of obstetric care in their own practices and, by example and precept, have provided tutelage of high caliber for thousands of medical students, interns, and residents.

Obstetrics is unique in that no other branch of medicine is subject to such careful public scrutiny. Not only are births a matter of public record, but maternal and perinatal deaths are examined by municipal and state health authorities. In many areas, local medical or obstetric and gynecologic societies also examine such deaths, and mortality conferences are frequently conducted as part of the continuing medical education of the obstetrician.

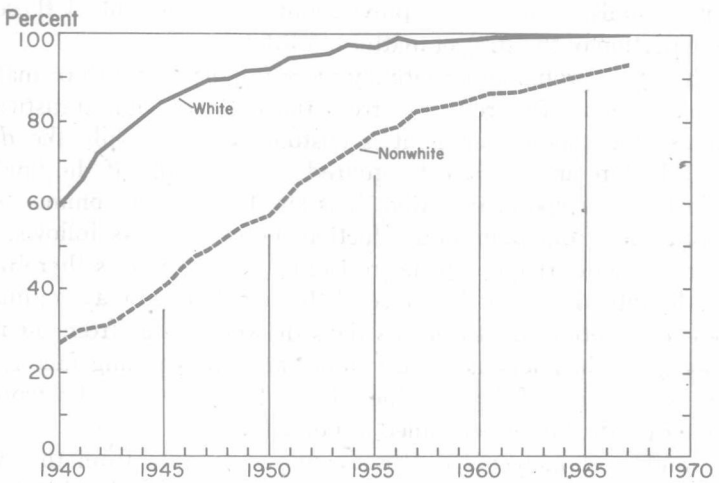

Fig. 5. Percentage of live births occurring in hospitals, by color, 1940–1967. (Vital Statistics of the United States, 1967, Vol. I—Natality, Table 1-23, National Center for Health Statistics, HSMHA, U.S. Department of Health, Education, and Welfare.)