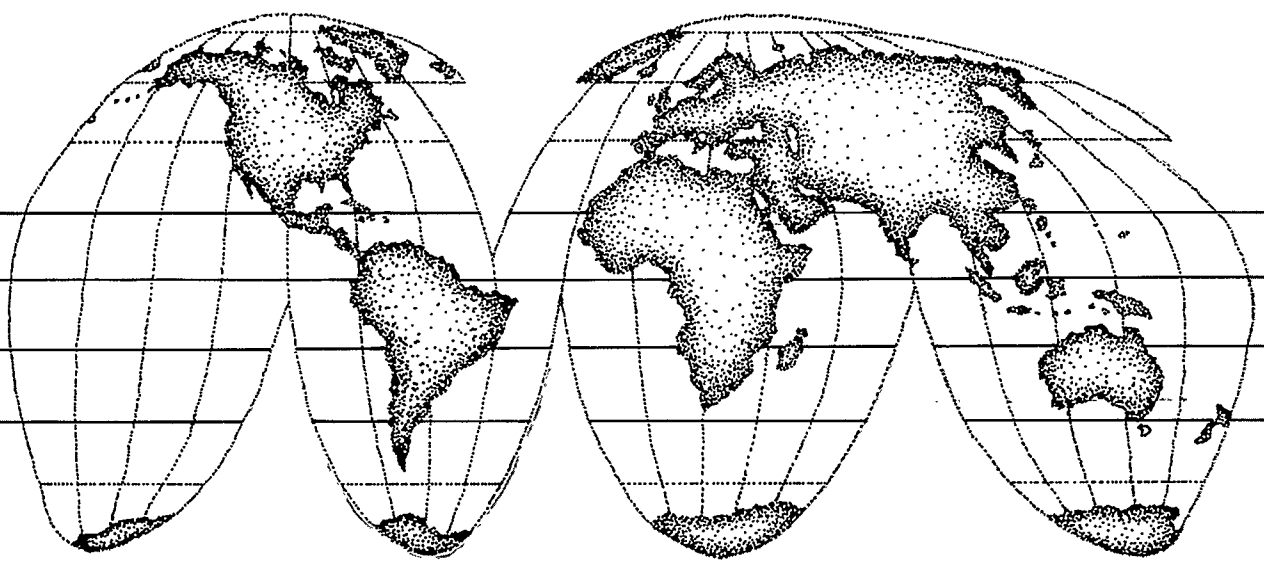
Proceedings of the International Collaborative Effort on Perinatal and Infant Mortality, Volume II

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES • Public Health Service • Centers for Disease Control • National Center for Health Statistics



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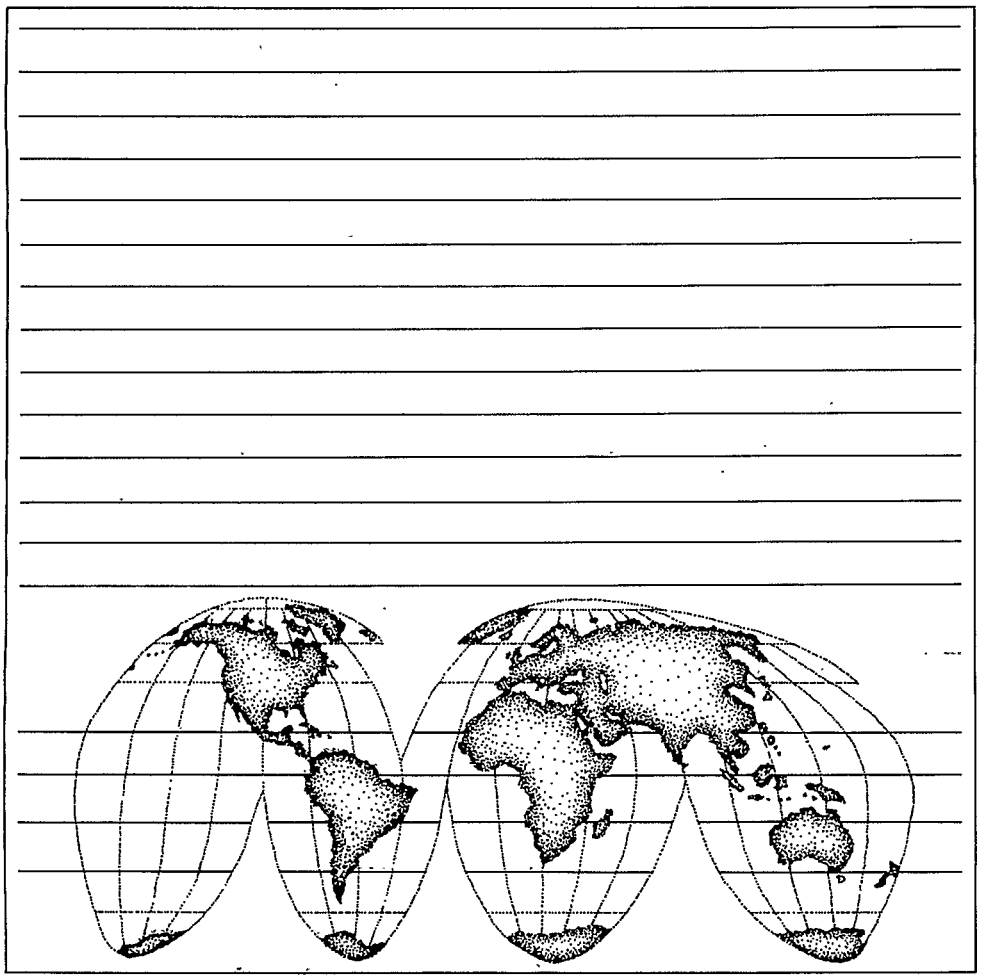
Papers presented at the American Public Health Association, 1985, Washington, D.C., sponsored by the National Center for Health Statistics



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control
National Center for Health Statistics

Hyattsville, Maryland
October 1988

National Center for Health Statistics

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PREFACE

On November 18, 1985, members of the International Collaborative Effort (ICE) on Perinatal and Infant Mortality participated in an American Public Health Association (APHA) session (at the request of the National Center for Health Statistics) for the purpose of presenting papers reflecting the status of their research. Subsequent to the APHA conference, the members convened a seminar to detail their various research perspectives and to discuss their current methodologies.

The ICE is a continuing effort. Through these shared activities of the members, the ICE is providing knowledge and valuable insight into perinatal and infant mortality. Through this dialogue, it is possible to examine international comparisons, to follow trends, and to gain insight into successful interventions, as well as to recognize national gains that have been realized. The goals of this effort are to identify risk factors, to enhance knowledge gained from experiences in intervention programs, and to disseminate data in order to reduce perinatal and infant mortality. In the United States, special attention is directed to the differences in infant mortality rates among various ethnic, racial, and socioeconomic groups in the population.

The ICE Planning Group is comprised of two eminent researchers from each of nine countries: Denmark, England, the Federal Republic of Germany, Israel, Japan, Norway, Scotland, Sweden, and Wales. This group also includes representatives from the National Center for Health Statistics and the Center for Environmental Health and Injury Control of the Centers for Disease Control; the Division of Maternal and Child Health of the Health Resources and Services Administration; the National Institute of Child Health and Human Development of the National Institutes of Health; and the Association for Vital Records and Health Statistics. The participants in this effort represent a diversity of scientific disciplines: physicians, epidemiologists, medical researchers, biostatisticians, and health planners.

The Planning Group's papers and discussions entailed a review of the complex and comprehensive issues in the health field which are critical with respect to perinatal and infant mortality. The presentations are grouped into four general categories:

Risk Factor/Outcome Assessment
Methodology
Comparisons of Trends and Data on Perinatal and Infant Mortality
Comparative Health Care Systems

The presentations published in this volume demonstrate the continuing collaboration which was initiated when this group of individuals first met in August 1984. The material included in this publication may be viewed as a mechanism for concentrating attention on certain methodologies, models, and schemata, which may be of great value in terms of helping the group focus on future areas of interest and in facilitating the process of comparison from one country to another. Eventually, a number of models may evolve from this process, which will then be adopted with appropriate variation by a number of nations in an effort to reduce their perinatal and infant mortality rates.

This volume offers a number of insights and approaches for enhancing perinatal and infant health. The research, the methodologies, the risk assessment, and the prevention efforts suggest certain strategies that, if utilized, may reduce perinatal and infant mortality. A number of the papers in this report offer evidence of successful interventions which certainly hold promise for other nations to emulate.

The Japanese experience with respect to infant mortality is significant. The Japanese attribute their success in this area of health to a concerted national effort of providing both prevention and education programs, as well as maternal and infant health care services. The population appears to have historically embraced the government's goals, and it continues to support these efforts by active participation in and by compliance with the required health practices. The outcome assessment from the Japanese Government indicates that their innovative and far-reaching approach has achieved the goal of reducing maternal and infant mortality.

The methodology undertaken in Sweden appears to have also been successful in achieving a low perinatal and infant mortality rate. As with the Japanese concept, the methodology employed in Sweden is comprehensive and national in nature. Both nations have not only ensured that the population accepts the critical importance of infant and maternal health care but have also succeeded in instilling in the population the conviction that this type of health care is reasonable, necessary, and obligatory. These two nations with their diverse history, customs, and lifestyle have managed to encourage a policy of reasonable and sound maternal and infant health that has become inherent in the culture itself.

Their programs suggest that their accomplishments can be applied to maternal and child health in other countries. In a similar manner, other papers included in this volume offer perspectives that can help guide, foster an awareness, and establish a foundation for implementing various innovations and programs which meet the needs of the population in many different nations.

These papers have been prepared and included in this volume as evidence of the progress of the continuous cooperation of the International Collaborative Effort on Perinatal and Infant Mortality. We look forward to further participation in this project and to the ensuing research rewards of this shared endeavor.

ACKNOWLEDGMENTS

Overall responsibility for planning and coordinating the content of this report rested with the International Statistics Staff, Office of Planning and Extramural Programs, National Center for Health Statistics, under the supervision of Jane Anne Mehargue.

Special appreciation is expressed to Katherine Taylor Jones who typed the manuscripts for publication.

Publications management and editorial review were provided by Klaudia M. Cox. Graphics were produced under the supervision of Steven L. Sloan; the cover was designed by Sarah Hinkle. Final production was accomplished by Sharon L. Saylor, and printing coordination was managed by Naomi M. Forester.

The substantial contributions made by the authors of the papers, printed in this publication, are gratefully acknowledged.

Symbols	
---	Data not available
...	Category not applicable
-	Quantity zero
0.0	Quantity more than zero but less than 0.05
Z	Quantity more than zero but less than 500 where numbers are rounded to thousands
*	Figure does not meet standard of reliability or precision (more than 30-percent relative standard error in numerator of percent or rate)
#	Figure suppressed to comply with confidentiality requirements

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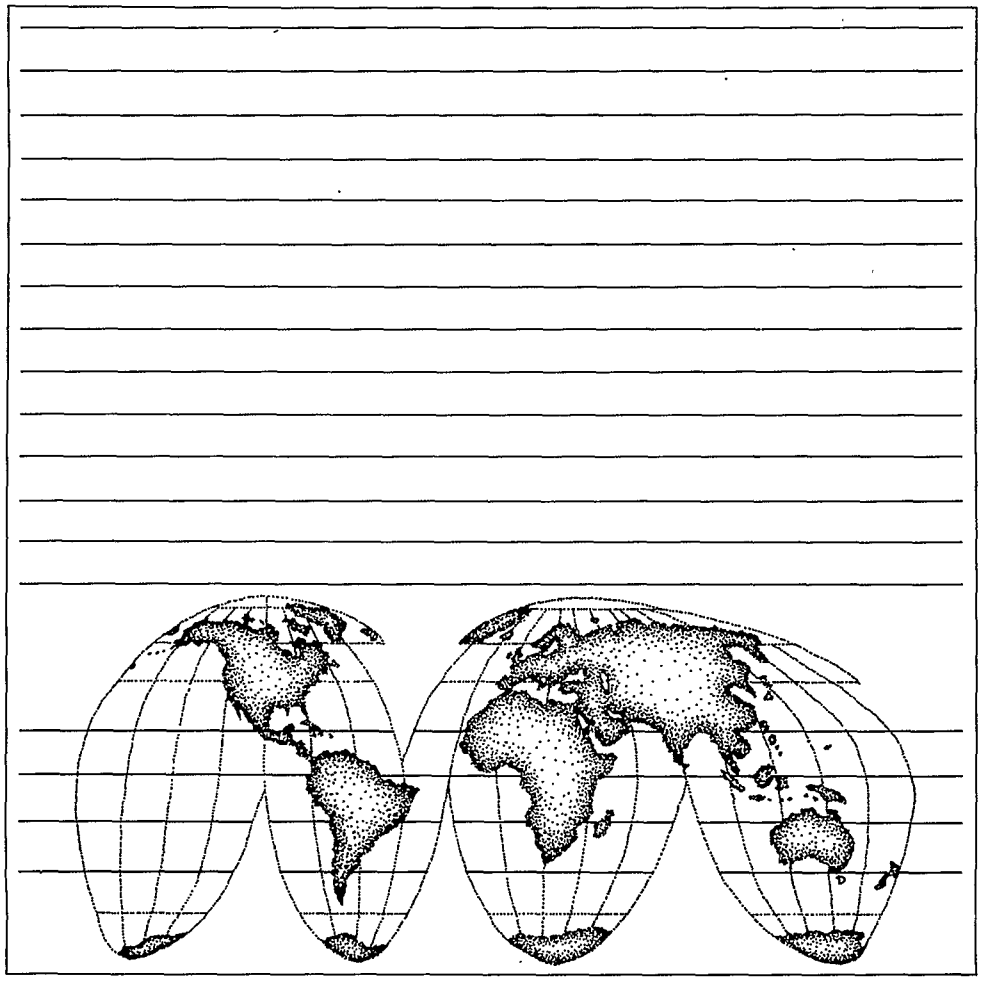

Chapter I: Risk Factor/Outcome Assessment

Recent Progress of Maternal and Child Health in Japan

by Takefumi Kondo, M.D., and Eikichi Matsuyama, M.D.

Since the end of the Second World War, maternal and child health (MCH) has been advanced considerably in Japan. In the time period from 1982 to the present time, Japan has become one of the leading countries of the world in this field as far as vital statistical figures are concerned.

Many factors might have directly influenced the improvement. We will show some statistical figures among these factors and explain how MCH has been developed in our country.

The live birth rate and total fertility rate are shown in table 1. Since the Second World War, most parents have wanted to have only one or two children, at the most three. Both live births and total fertility rates have been decreasing in a pattern similar to that in the other developed countries. The size of each family, therefore, has become much smaller. In 1985, the live birth rate per 1,000 population was 11.9, and the total fertility rate was 1.76. These rates are about one-third of those 50 years ago.

The annual changes of the infant and neonatal mortality rates are shown in figure 1 for 1965-85. In these 20 years, the rates have decreased year by year, and the declining trend was remarkable. In 1985, the infant and neonatal mortality rates were 5.5 and 3.4 per 1,000 live births, respectively.

Figure 2 shows the perinatal mortality rate (calculated per 1,000 live births) in 1985 by mother's age. The rate for the age group 25-29 years was the lowest, 6.9. The rates for the age groups 20-24 and 30-34 years were in the next lowest category. The mortality rates of the age groups under 20 years and 35 years and over, especially the rates for the groups aged 40 years and over, were much higher.

From these results, it can be said that newborns of mothers aged 25-29 years seem to be the most healthy, and those born to mothers aged 20-24 or 30-34 years are next. In other words, the mothers in the age group 20-34, especially those aged 25-29, are in a very favorable age group for childbearing.

Figure 3 shows the age distribution at first marriage in 1975 and 1984. Among men, the mean age at marriage was 28.1 years; among women, it was 25.4 years in 1984. This age at first marriage of Japanese women (around age 25) is very favorable in terms of giving birth within the period of ages 25-29, which appears to be the period with the healthiest outcome for infant morbidity and mortality.

Figure 4 shows the live birth rate by mother's age in 1950, 1970, and 1984, which indicates the age distribution of childbearing by mothers. In 1950, the distribution was spread between the 17 year and 45 year age groups. In 1970, however, it was almost limited to the age group 18-40 years and concentrated particularly from ages 25 through 29. This tendency had not changed in 1984. Recently, it has been observed that many women over the age of 30 do not want any more children. Also, it has been noted that almost all children were born to the group of mothers aged 20-34 years. This distribution corresponds very well with a favorable childbearing age.

The perinatal mortality rate (calculated per 1,000 live births) for 1960 to 1985 is shown in figure 5. The perinatal mortality rate has declined remarkably year by year, and it was 8.0 in 1985. The late fetal death rate has been much higher than the early neonatal death rate every year. The rates were 5.4 and 2.6, respectively, in 1985. To reduce this rate further, it is necessary to decrease late fetal deaths.

To analyze the causes of perinatal deaths, the causes are classified by birth weight or gestational age. Figure 6 shows the perinatal deaths by birth weight and cause in 1984. It should be noted that 17.1 percent of perinatal deaths were less than 1,000 grams, 48.9 percent were 1,000-2,499 grams, 32.3 percent were 2,500-3,999 grams, and 1.7 percent were 4,000 grams or more. Of the perinatal deaths, 80.3 percent were caused by certain conditions originating in the perinatal period and 17.9 percent by congenital anomalies.

Infant mortality rates per 100,000 live births from 1980 to 1985 are shown by leading causes in figure 7. Two main causes of death were (1) hypoxia, asphyxia, and respiratory disorders and (2) congenital anomalies. These two causes have recently accounted for a majority of infant deaths. Other causes--such as injury and poisoning; accident, adverse effect; premature infant of unknown details; and pneumonia--were not very significant.

Since 1983, congenital anomalies, which are considered to be very difficult to reduce, have ranked first among causes of death. To decrease the infant mortality rate further, it is necessary to reduce hypoxia, asphyxia, and respiratory disorders by improvement of the perinatal care system.

Figure 8 shows the annual change in the percentage of live births from 1950 to 1984 by whether they occurred in a hospital. Before 1950, most deliveries were carried out at home and were attended by midwives. Since 1950, deliveries in hospitals or in private clinics attended by physicians have increased year by year. In 1960, hospitalized deliveries exceeded nonhospitalized ones, and at present, almost all deliveries are carried out in hospitals or private clinics and a few are done in midwifery centers. In our country, hospitalization for 7 days after delivery is routine even in a case of normal labor and puerperium with healthy newborn. This length of hospitalization is considered to be very favorable--not only for the mother but also for the newborn.

In our country, we have a "Maternal and Child Health Handbook" (MCH) system, that was started in 1942 by the Ministry of Health and Welfare. Originally, it imitated the "Mutterpass (Mother Handbook)" of Germany. (See exhibit A.) The MCH Handbook has been revised several times in the ensuing 40 years. Exhibit A shows both the present MCH Handbook, which is 15 by 10.5 centimeters in

size and contains 56 pages, and the English version. When a woman becomes pregnant, she can get this handbook free of charge from the local governmental office. The pregnant woman then takes it to the hospital for each medical examination. Results of prenatal and postnatal examinations of the mother, status of labor, and growth conditions, as well as vaccinations for infants, are recorded in this handbook.

This MCH Handbook system has been useful in improving the level of MCH care. It is valued highly both at home and abroad. In addition to administrative organs, many private organizations, such as the Japan Medical Association, Japan Association for Maternal Welfare, Japan Family Planning Association for Maternal Welfare, Japan Family Planning Association, and the MCH Association, have cooperated with the government on both the central and local level. Their activities have been very effective for motivation, information, and promotion of MCH.

In the future, we will make efforts to reduce maternal deaths, late fetal deaths, and congenital anomalies. Because we have found the Maternal and Child Health Handbook to be so useful in our pursuit of the reduction of perinatal and infant mortality, we have attached this document for your review.

Table 1. Live birth rate and total fertility rate, by year: Japan, 1930–85

Year	*Live birth rate per 1,000 population*	*Total fertility rate*
1930	32.4	4.71
1950	28.1	3.65
1955	19.1	2.37
1960	17.3	2.00
1965	18.7	2.14
1970	18.8	2.13
1975	17.1	1.91
1978	14.9	1.79
1979	14.2	1.77
1980	13.6	1.75
1981	13.0	1.74
1982	12.8	1.77
1983	12.7	1.80
1984	12.5	1.81
1985	11.9	1.76

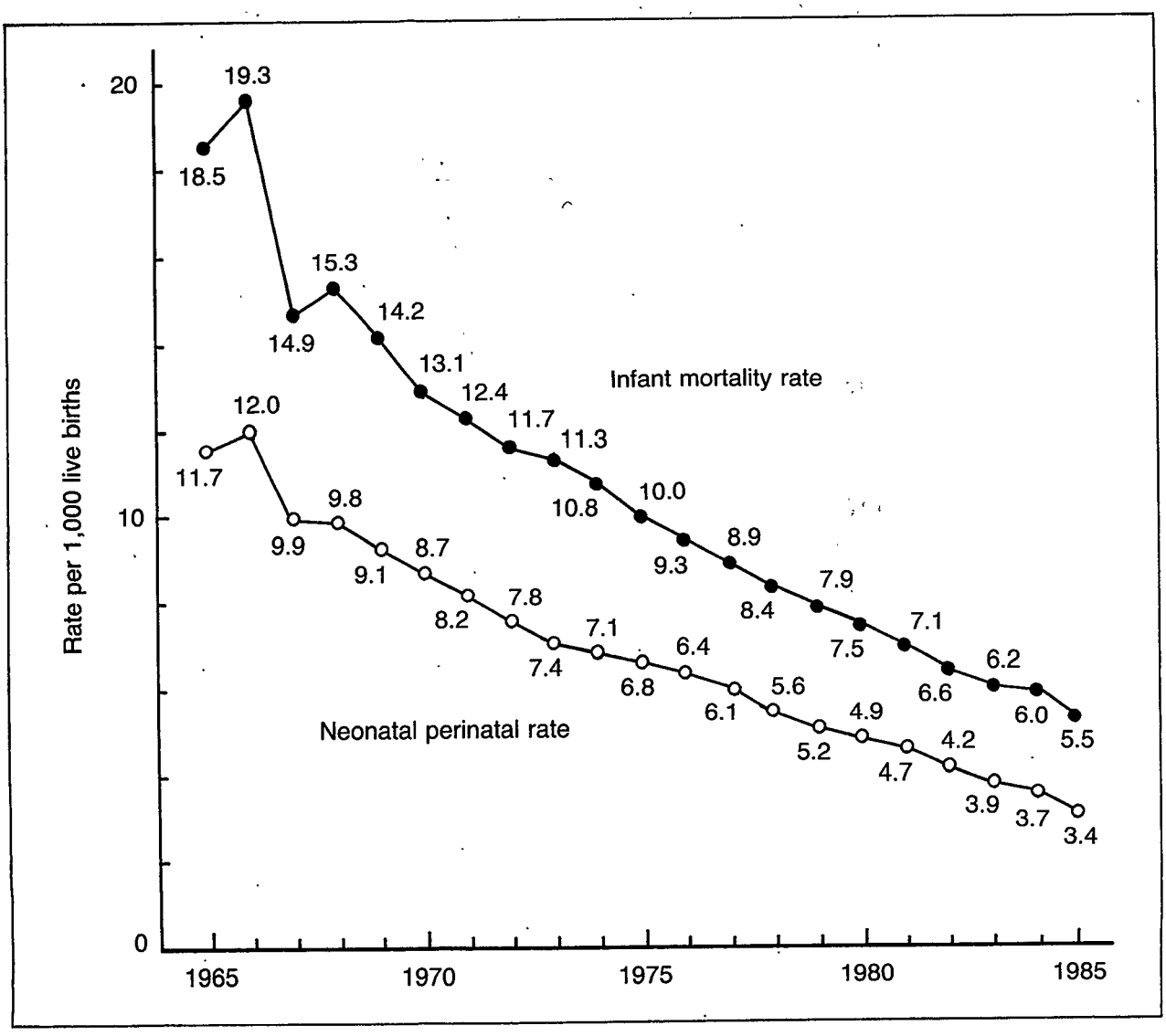

Figure 1. Trends in infant and neonatal mortality rates, by year: Japan, 1965–85

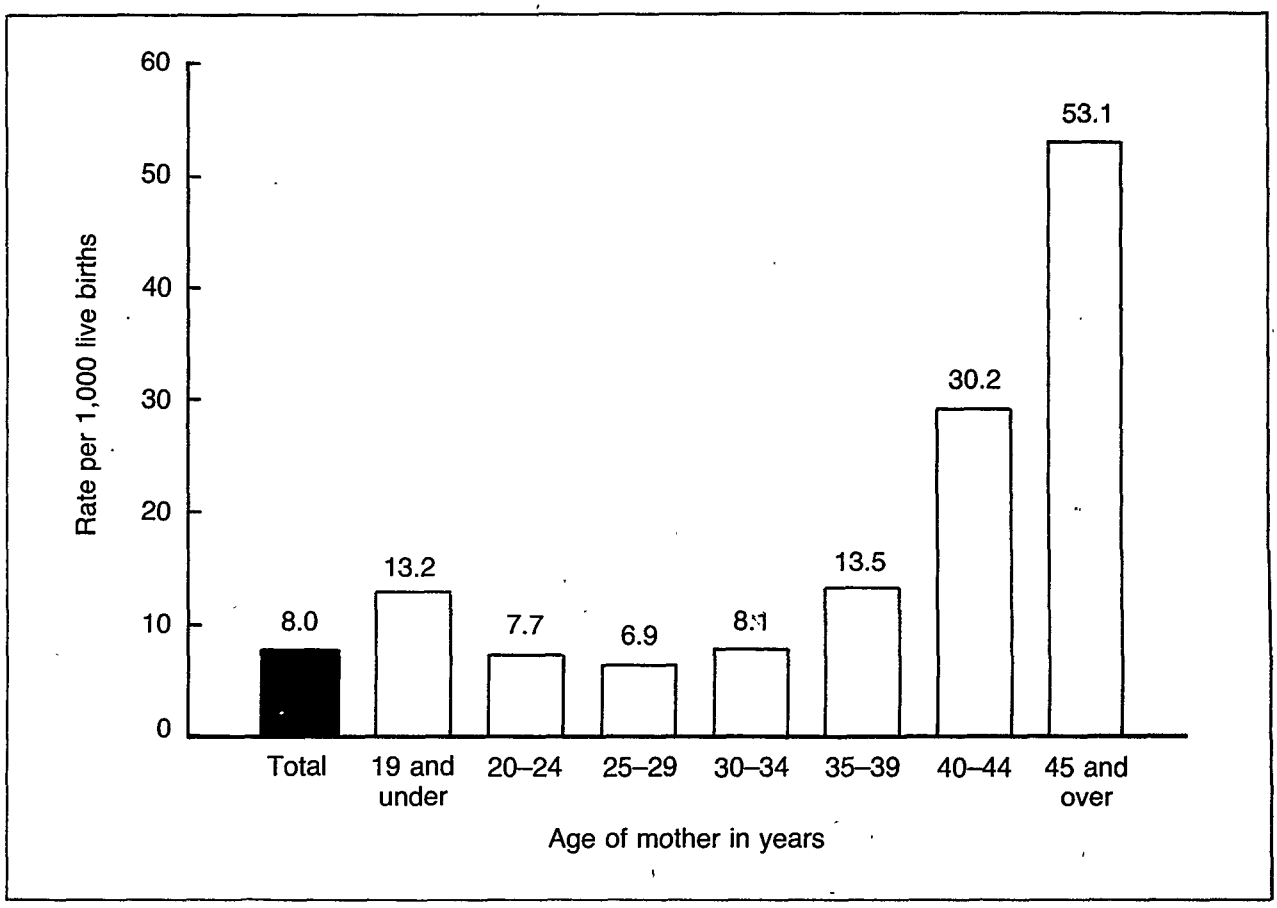

Figure 2. Perinatal mortality rate, by mother's age: Japan, 1985

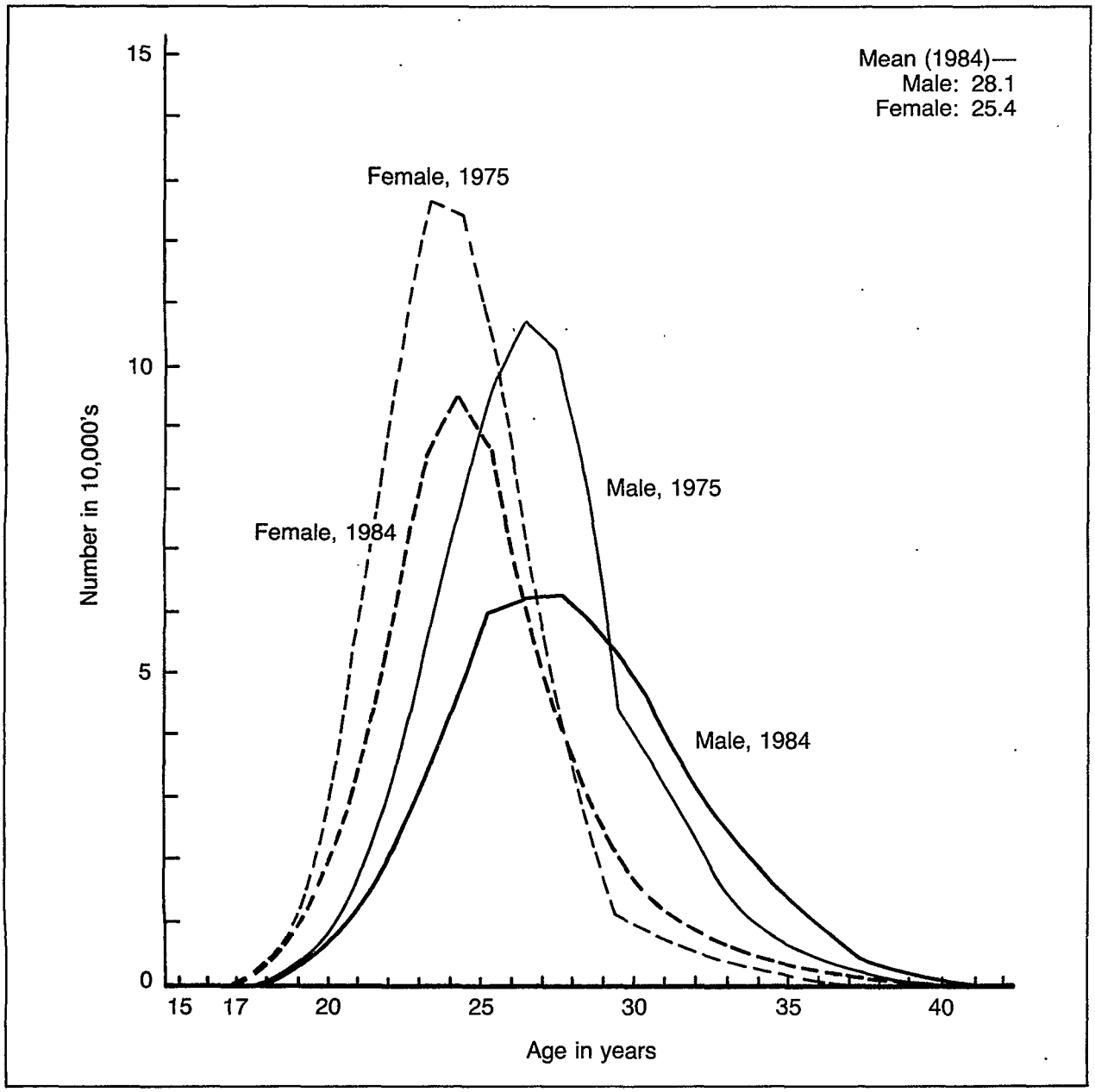

Figure 3. Age at first marriage for males and females: Japan, 1975 and 1984

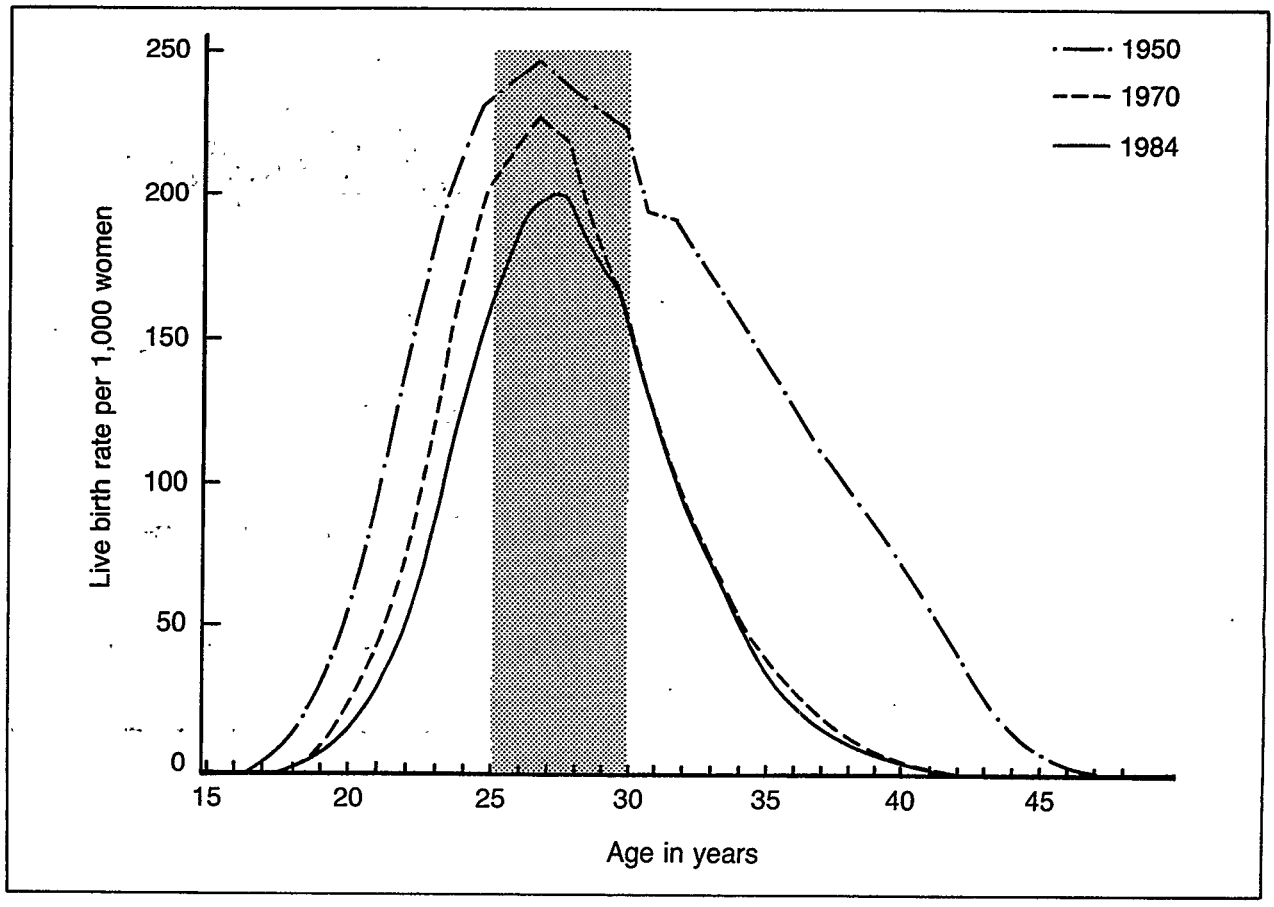

Figure 4. Live birth rate, by mother's age: Japan, 1950, 1970, and 1984

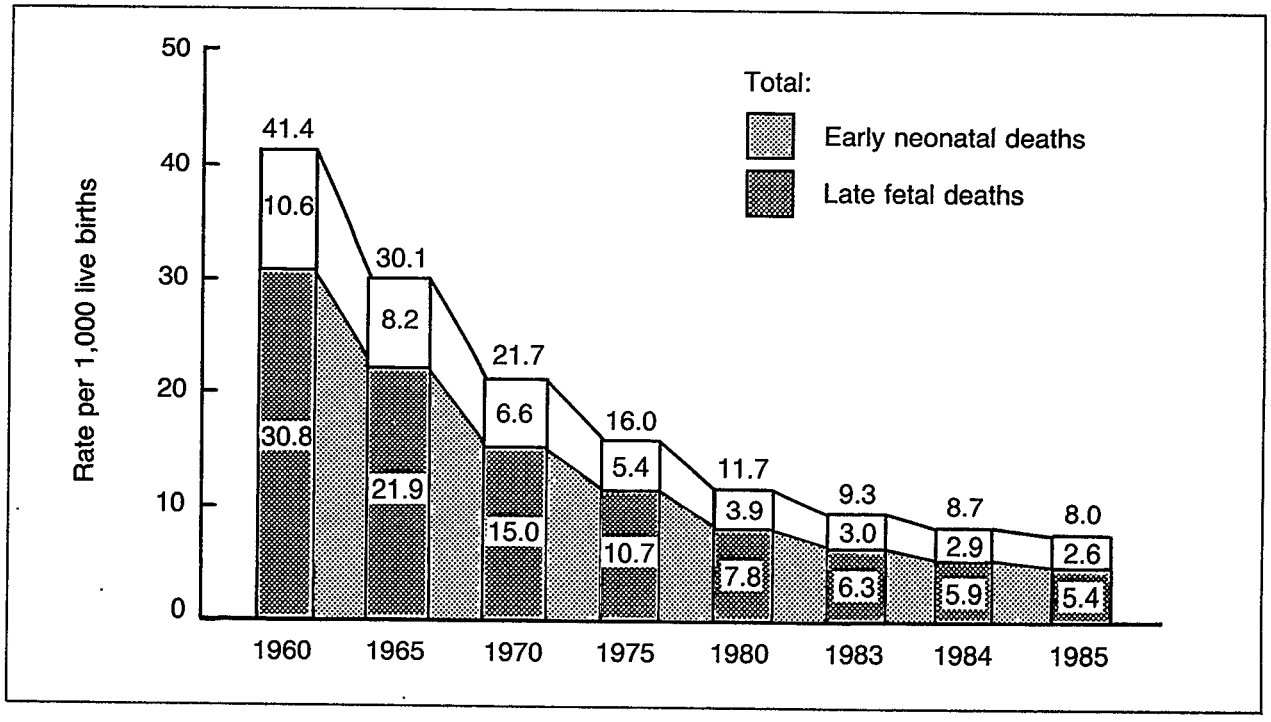

Figure 5. Perinatal mortality rate: Japan, 1960–85

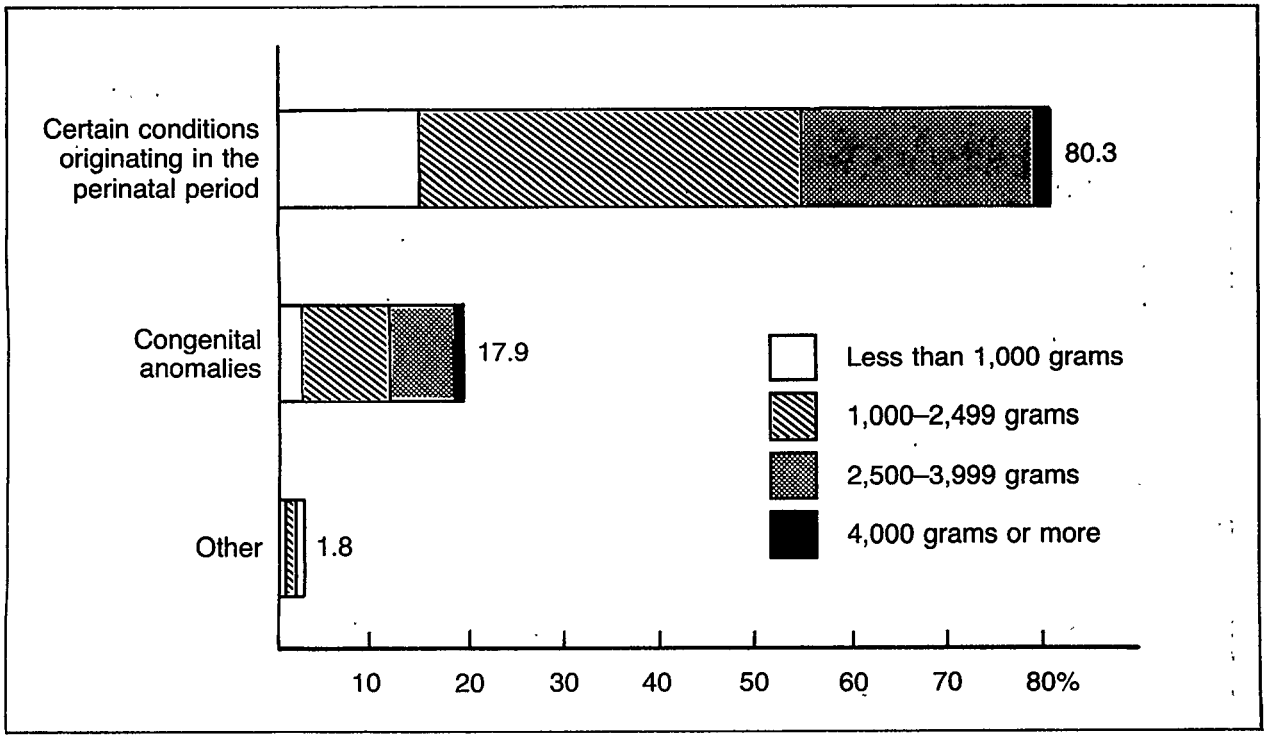

Figure 6. Perinatal deaths, by cause and birth weight: Japan, 1984

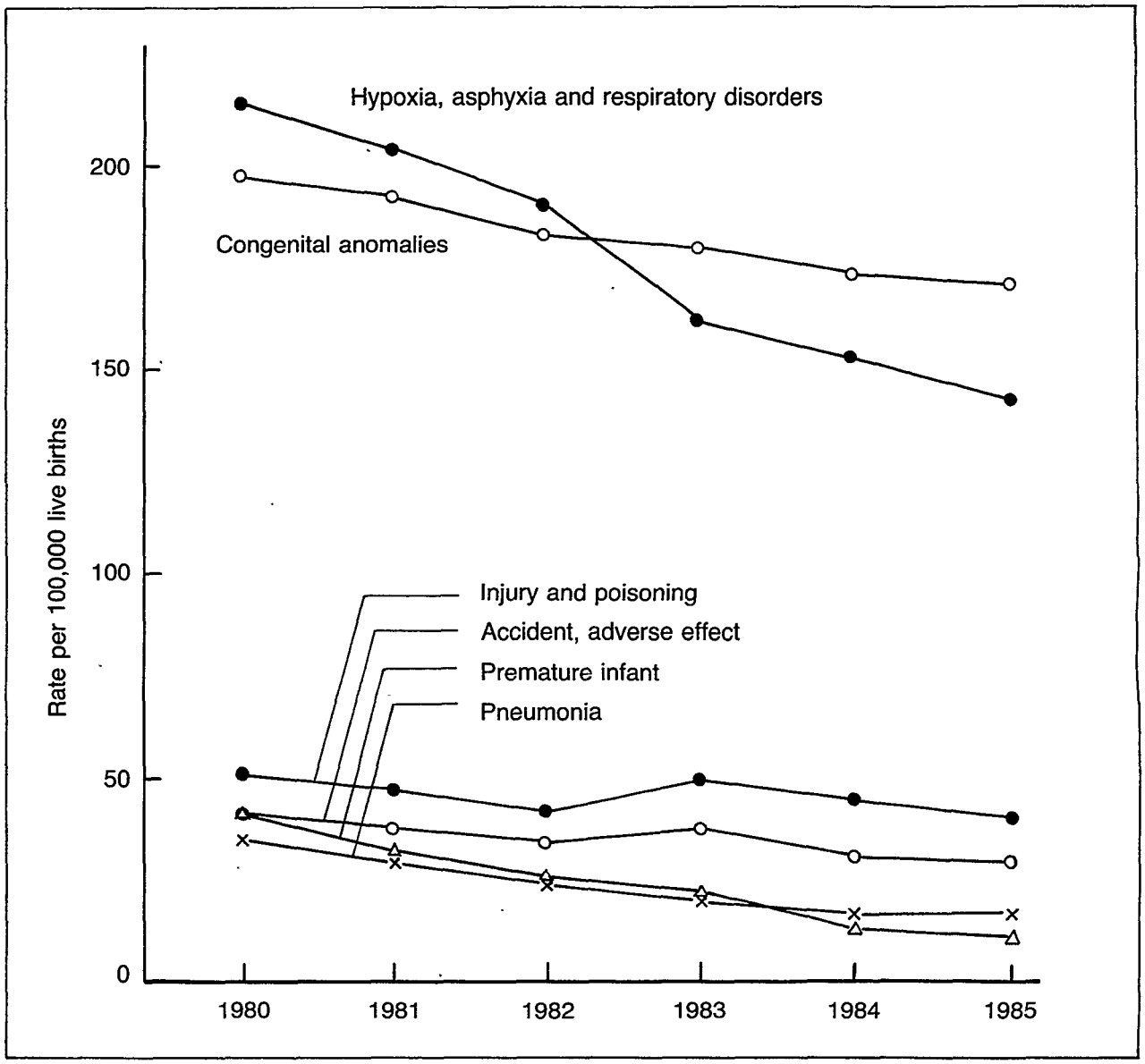

Figure 7. Infant mortality rate, by leading causes: Japan, 1980–85

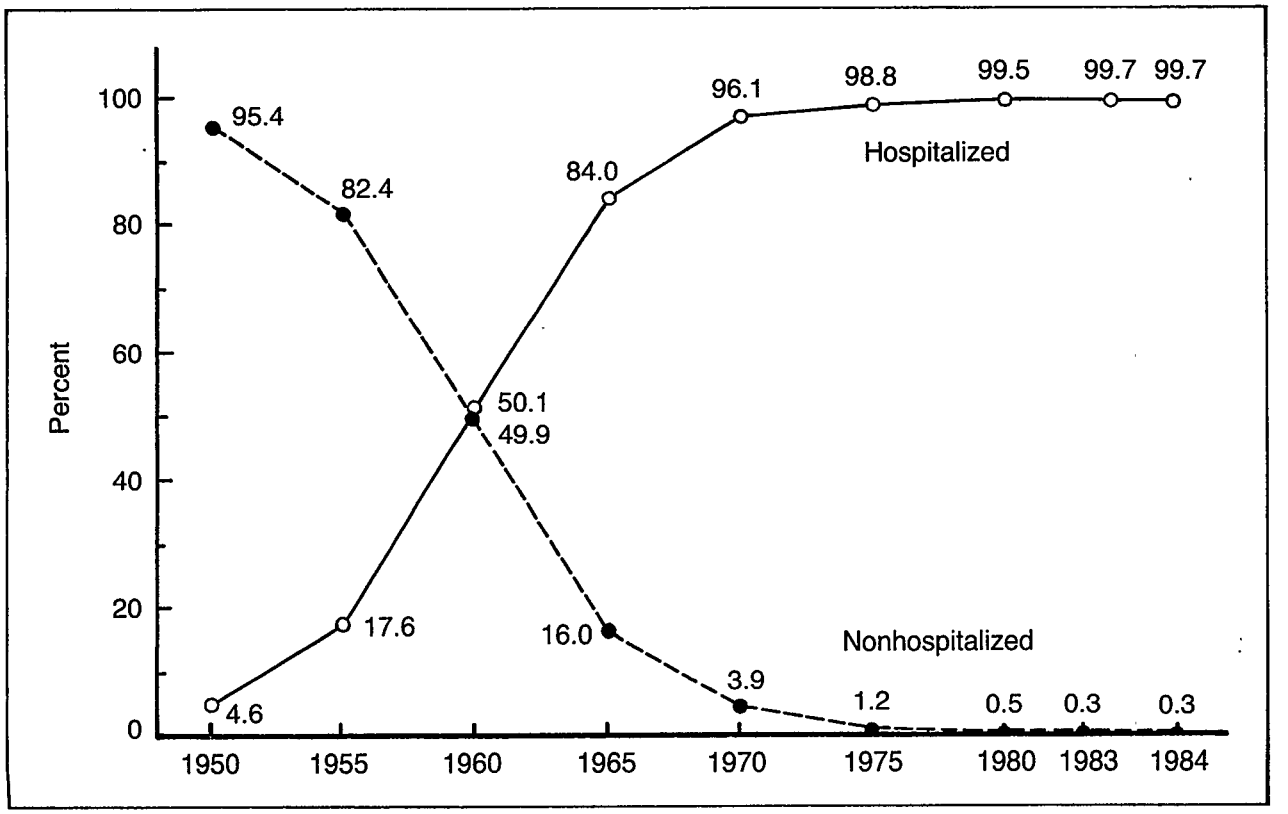

Figure 8. Percent of live births, by hospitalization status: Japan, 1950–84

Maternal and Child Health Handbook

Issued on:	
Name of mother:	
Name of child:	(order of birth:)
Name of municipality:	
No.	

Japanese Organization for International Cooperation in Family Planning, Inc. (JOICFP)

Exhibit A: Maternal and Child Health Handbook (English version)

Contents

Fill in the blanks below as soon as you receive this handbook.

	Relationship	Name	Date of birth (age)	Occupation
Guardians of the Child	Mother (Pregnant Woman)		___ month ___ day ___ year (years old)	
	Father		___ month ___ day ___ year (years old)	
			___ month ___ day ___ year (years old)	
	Permanent Domicile	Prefecture		
	Present Address	Phone:		
		Phone:		
		Phone:		

Certificate of Birth Registration

Name of child		Male/Female
Place of birth	Prefecture	City/Ward/Town/Village
Date of birth	___ month	___ day ___ year

I herewith certify that the birth of the above child was registered on ___ month ___ day ___ year.

Official Seal of the Mayor:

When your child is born, please register his/her birth immediately and, at the same time, get the certificate of birth registration above.

We sincerely hope that this handbook can become a useful reference to many countries in the world and help all the children in the world to have healthy and happy lives.

April 1, 1987

Takefumi Kondo

Takefumi Kondo M.D.
Director
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Government of Japan

母子健康手帳

昭和　　年　　月　　日交付

母の氏名

子の氏名（ふりがな）　　（第　　子）

市区町村名

No.

The picture above shows the actual size of the "Boshi Kenko Techo."

Note: Translated from the Japanese version of the "Boshi Kenko Techo" (Maternal and Child Health Handbook) which is published by the Ministry of Health and Welfare.

Preface for English version

Everybody, particularly family of a newborn baby, hopes that a baby will grow up healthy and strong.

The maternal and child health programs in Japan have made steady progress, having overcome the chaotic periods after World War II when there was a serious food shortage and communicable diseases were rampant.

The "Maternal and Child Health Handbook" has been a great driving force in the progress of our maternal and child health programs. Its provision is stipulated in the Maternal and Child Health Law.

The handbook is issued by the prefectural governor to a pregnant woman when she submits a report to the municipal office, who, in turn, reports to the governor.

The handbook is made in a compact size, convenient to carry. It is used to fill in the results of health check-ups and health guidance which the pregnant woman/mother and baby receives from doctors, dentists, midwives, or public health nurses. The mother's observations on the growth of the baby can be also freely recorded. When used faithfully, it can be a complete digest of all the necessary items on the health of a mother and baby.

The system of distributing the Maternal and Child Health Handbook to all pregnant women was begun in 1942.

The contents of the handbook have been updated several times including the most recent made in April 1987, although its objectives remain unchanged: to maintain and promote the health of a mother and baby. Continuing efforts will be made to keep it up-to-date in the future.

Protect the Health of Both Mother and Child and Build a Happy Family

About the Maternal and Child Health Handbook

- The purpose of this handbook is to help protect the health of both mother and child. As soon as it is issued to you, read through it carefully, and then fill in the necessary items in the blank spaces as required.

- This handbook is important as a health record for both mother and child. Please bring this handbook with you whenever you and/or your child receive any kind of health check-up or guidance, and ask the medical doctor or health workers to fill in the necessary items. Please also use this handbook for your own notes about you and your baby, the results of check-ups, etc.

- Because this handbook will be used in the future as a reference for medical history when your child enters nursery, kindergarten, and primary school, please be careful not to lose it.

- If you are pregnant with twins or multiple fetuses, please ask your municipal office to issue a handbook for each baby.

- If this handbook is torn, soiled or lost, please ask your municipal office to re-issue it.

- If you have any questions about this handbook, please inquire at the health center or municipal office where you received it.

Maternal and Child Health Handbook

Edited by
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&
English Translation by
JOICFP

Becoming a Good Mother to Your Baby

- **Daily life during pregnancy**
  As the fetus in your body develops, various changes will occur in your body. Your physical condition is subject to changes, particularly during the periods around 11 weeks, and after 28 weeks of pregnancy. Therefore, take especially good care of yourself, paying attention to your work, rest, and diet. It is good to rest even for a short time both in the morning and in the afternoon.

- **Health guidance**
  Please consult a doctor, midwife, public health nurse, or nutritionist for guidance concerning your daily life, nutrition and environment to maintain good health during pregnancy and to have a safe delivery. It is also important to attend a mothers' class.

- **Importance of health check-ups**
  You should pay more attention to your health during pregnancy. Please visit the health center or medical institutions to receive general health check-ups to monitor the growth of the fetus, blood pressure, urine, etc., at least once a month, at least twice monthly after 28 weeks of pregnancy and once a week after 36 weeks.

- **Warning symptoms**
  If you notice any of the following symptoms, please consult your doctor immediately; edema (swelling of hands, face or legs), general bleeding, abdominal pain, fever, diarrhea, constipation, unusual vaginal discharge, severe headache, dizziness, nausea, vomiting, fatigue caused by severe morning sickness, or lack of fetal movement.

- **Dental hygiene**
  Dental problems such as decay and bleeding of the gums tend to become more serious during pregnancy. It is important to receive regular professional dental care. Brush your teeth after each meal. If you have any problems, visit the dentist promptly.

- **Precautions in the second half of pregnancy (after 20 weeks)**
  Among the complications which may occur in the second half of pregnancy, one should be careful of anemia and toxemia as they may affect the growth of the fetus and the mother's body. However, with proper medical care and treatment at an early stage, the health of mother and baby is rarely effected.

- **Postpartum precautions**
  After the delivery of a baby, the mother tends to be absorbed in the health of her baby and to neglect her own health. Even though you feel normal in the post-partum period, please have a health check-ups one or two months after delivery. If you had any complications during pregnancy or delivery, please follow the advice of your physician carefully.

Nutrition during Pregnancy

○ **Eat well-balanced meals**
Your meals should be nutritionally well-balanced, combining the six basic food groups listed on the opposite page.

○ **To prevent anemia**
Intake of good quality protein, iron and vitamins helps to prevent anemia. The foods which contain plenty of these nutrients are eggs, meat, liver, soybeans, green and yellow vegetables, fruits and seaweed.

○ **To prevent toxemia**
For the prevention of toxemia in pregnancy, eat foods such as lean meats and fish, dairy products, soybean products, vegetables and fruits. Avoid excessive intake of carbohydrates (e.g., rice), sugar, sweets, and salt.

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Six Basic Food Groups

Groups		Examples
1	fish, meats, eggs soybeans	fish, shellfish, squid, octopus, crab, etc. beef, pork, chicken, ham, sausage, etc. chicken eggs, quail eggs, etc. soybeans, bean curd, etc.
2	milk, dairy products small fish	milk, skimmed milk, cheese, yoghurt, etc. dried sardines, pond smelt, dried whitebait, etc. (including various seaweeds)
3	green and yellow vegetables	carrots, spinach, squash, tomatoes, *komatsuna* (a kind of Chinese mustard), etc.
4	other vegetables fruits	radishes, chinese cabbage, cabbage, cucumbers, etc. tangerines, apples, pears, grapes, strawberries, etc.
5	rice, bread, noodles, potatoes	rice, bread, noodles, buckwheat, spaghetti, etc. sweet potatoes, potatoes, taros, etc. (includes sugar and foods which contain sugar such as confectioneries)
6	oils and fats	vegetable oil, salad oil, lard, butter, margarine, etc. (including foods which contain a lot of oil such as mayonnaise and dressing)

• It is desirable to drink 200 to 300 ml of milk daily during the first half of pregnancy (until 19 weeks) and 400 ml of milk daily during the second half of pregnancy (after 20 weeks).

This page should be filled in by the pregnant woman.

Record of Pregnant Woman

Pregnant woman	Height cm	Usual weight kg	
Age at marriage years old		Married to a close relative	no / yes ( )
Major diseases or operations you have had			
Date of recent vaccinations or X-ray exam			
Husband	general condition: healthy/sick (name of disease:		blood type ( ))

Record of Past Pregnancies

Date of delivery	Condition of pregnancy, delivery & puerperium	Baby's weight at birth (gram) and sex	Present condition of the child
month, year	normal / abnormal (weeks of pregnancy)	g male / female	healthy / not healthy / deceased

This page should be filled in by the pregnant woman.

Occupation and Environment of Pregnant Woman

Occupation		none/employed / part-time job / household work / side job at home / others ( )		
Conditions of work when pregnancy was noticed.	Job description			
	Working hours per day	about hours / rest: minutes		
	Means of transportation to work			
	Commuting time/one way	minutes	degree of congestion	heavy/normal
Conditions of work after pregnancy		leave (weeks of pregnancy) change of work (weeks of pregnancy) resignation (weeks of pregnancy) others ( )		
Prepartum leave		from ____ month ____ day days		
Postpartum leave		from ____ month ____ day days		
Type of residence		independent house/condominium/apartment/ rented room/others ( ) : (storied: floor)		
Noise		quiet / normal / noisy		
Sunlight		sunny / normal / dark		
Cohabitants		husband / no. of children (persons) father / mother / father-in-law / mother-in-law / brothers & sisters (persons) brothers- & sisters-in-law (persons) others (persons)		

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Whenever you receive a medical examination, please bring this handbook with you as this page becomes a reference if and when you must change doctors.

Development of Pregnancy I

Date of exam	Weeks of pregnancy (th month)	Height of uterine fundus	Abdominal circumference	Blood pressure	Edema	Urine protein	Urine sugar	Other exams (incl. hemoglobin)	Weight	Doctor's advice (rest, leave, etc.)	Name of medical institution or doctor
		cm	cm	/	- + ++	- + ++	- + ++		kg		
				/	- + ++	- + ++	- + ++				
				/	- + ++	- + ++	- + ++				
				/	- + ++	- + ++	- + ++				
				/	- + ++	- + ++	- + ++				
				/	- + ++	- + ++	- + ++				
				/	- + ++	- + ++	- + ++				

Serological test for syphilis	conducted on: ___ month ___ day ___ year		
Test for antigen against hepatitis type B	conducted on: ___ month ___ day ___ year		
Blood type exam	conducted on ___ month ___ day ___ year	ABO	Rh

Personal Record of Pregnant Woman

First day of last menstruation	___ month	___ day	___ year
First medical exam for pregnancy	___ month	___ day	___ year
First quickening	___ month	___ day	___ year
Expected date of confinement	___ month	___ day	___ year

Memo of Items to Ask the Doctor

• When you feel quickening, please begin care of breasts and nipples.

Whenever you receive a medical examination, please bring this handbook with you as this page becomes a reference if and when you must change doctors.

Development of Pregnancy II

Date of exam	Weeks of pregnancy (th month)	Height of uterine fundus	Abdominal circum-ference	Blood pressure	Edema	Urine protein	Urine sugar	Other exams (incl. hemoglobin)	Weight	Doctor's advice (rest, leave, etc.)	Name of medical institution or doctor
		cm	cm	/	– + ++	– + ++	– + ++		kg		
				/	– + ++	– + ++	– + ++				
				/	– + ++	– + ++	– + ++				
				/	– + ++	– + ++	– + ++				
				/	– + ++	– + ++	– + ++				
				/	– + ++	– + ++	– + ++				
				/	– + ++	– + ++	– + ++				
				/	– + ++	– + ++	– + ++				

Personal Record of Pregnant Woman

Residence in perinatal period	phone:
Person to be contacted in perinatal period	phone:
Means of transportation to the hospital	own car / taxi / on foot / others ( )
Time required for arrival	( ) hours ( ) minutes

Memo of Items to Ask the Doctor

If you have vaginal bleeding, rupture of membrane or abdominal contractions, please contact the doctor immediately.

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This page should be filled in as soon as the baby is born.

Record of Delivery

Duration of pregnancy	weeks (th month)		
Date of delivery	____ month ___ day ____ year Time: ___ : ___ a.m. p.m.		
Progress of delivery (condition of the mother and baby)	cephalic / breech presentation, others ( ) particular notes:		
Time required for delivery		Amount of bleeding	little/normal/excessive (ml)

Condition of the baby at birth	Sex/Number	male/female/unidentified : single/twin/more	
	Measurement	weight g	height • cm
		chest circumference • cm	head circumference • cm
	Special symptoms and treatment by the doctor	asphyxia → (dead/resuscitated)/stillbirth	

Certificate	certificate of birth certificate of stillbirth (certificate of postpartum examination) certificate of birth and death	
Place of delivery		
Names of birth attendants	doctor:	others:
	midwife:	

This page should be filed in when you leave the hospital or receive postpartum examinations.

Postpartum Condition of the Mother

Days/Months after delivery	Involution of the puerperal uterus	Lochia	Conditions of breasts	Blood pressure	Urine protein	Others
	good not good	normal abnormal			– + ++	
	good not good	normal abnormal			– + ++	
	good not good	normal abnormal			– + ++	
	good not good	normal abnormal			– + ++	

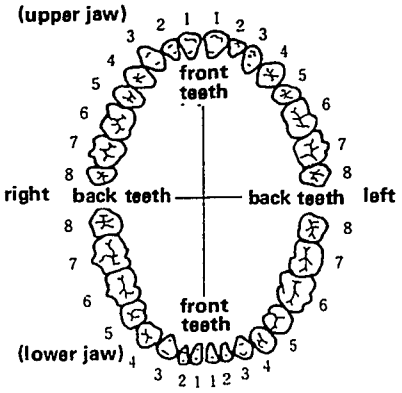
Personal Notes of the Mother

o Do you ever feel depressed, cry easily, or feel like doing nothing?
Yes No

o Please record if you have felt or noticed anything unusual since delivery.

Bathing	days after delivery (____ month ___ day)	Start of house work	days after delivery (____ month ___ day)
Start of outside work	days after delivery (____ month ___ day)	Start of menstruation	(____ month ___ day ____ year)
Family planning guidance received	none/yes (by doctor/family planning worker) ____ month ___ day ____ year		

Dental Hygiene during Pregnancy & Puerperium



Tooth conditions:

Untreated decayed teeth	:	C
Present teeth	:	/
Lost teeth	:	△
Treated teeth	:	○

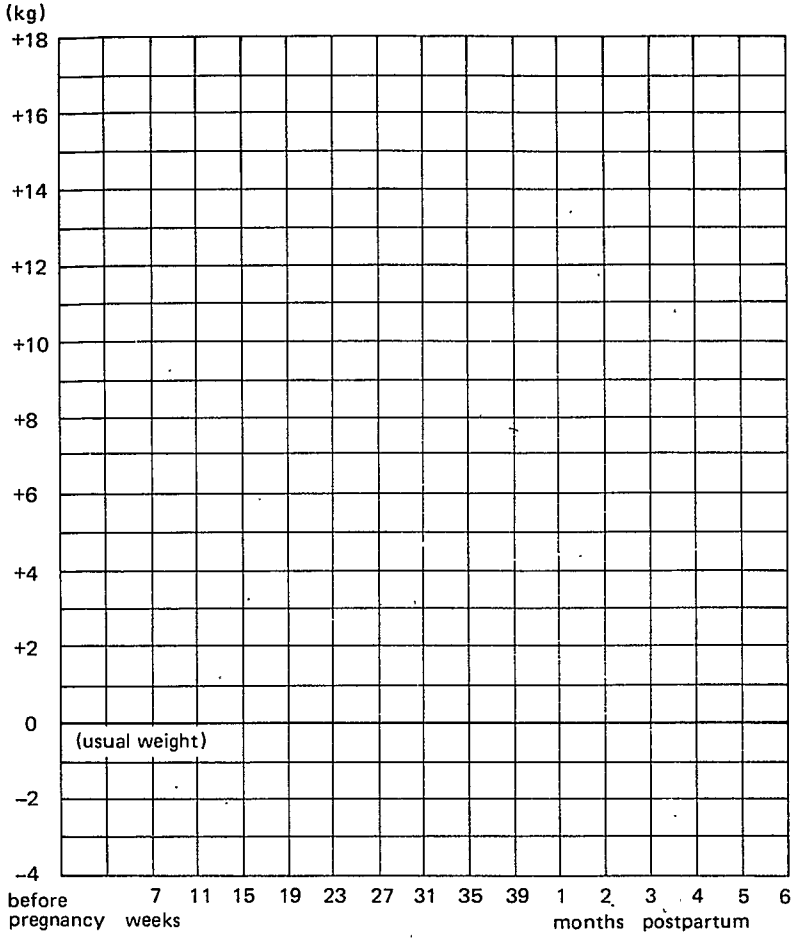
Date of first examination:	
Weeks of pregnancy:	th week
Decayed teeth	treated: no.
	untreated: no.
Paradentosis	none / yes
Others	
Guidance memo	healthy/need caution/ need treatment
Name of medical institution or dentist	

teeth	Date of examination:	
8 7 6 5 4 3 2 1 1 2 3 4 5 6 7 8	___ weeks of pregnancy/ ___ weeks after delivery	
8 7 6 5 4 3 2 1 1 2 3 4 5 6 7 8	Paradentosis	none / yes
	Name of medical institution or dentist	

teeth	Date of examination:	
8 7 6 5 4 3 2 1 1 2 3 4 5 6 7 8	___weeks of pregnancy/ ___weeks after delivery	
8 7 6 5 4 3 2 1 1 2 3 4 5 6 7 8	Paradentosis	none / yes
	Name of medical institution or dentist	

Record of Weight Change during Pregnancy and the Postpartum Period

Your weight is a good indicator of the state of your health. Unusual changes of weight can identify complications, especially during pregnancy and the postpartum period. Please mark this record yourself.



Mark your weight before pregnancy or in very early pregnancy at zero and make a graph of the weight increase/decrease. It is desirable to return to your original pre-pregnancy weight level about six months after delivery.

Record of Attendance at Mother's Classes

Date of class	Subject	Remarks
month day year		
month day year		
month day year		
month day year		
month day year		
month day year		
month day year		
month day year		
month day year		
month day year		
month day year		

Care of the Newborn Baby

(within 4 Weeks after Birth)

The first four weeks, especially the first two weeks after the birth, is a very important period for a baby to become adapted to living and growing in a new environment which is quite different from the one inside the mother's uterus.

Therefore, please pay special care to the following points so that your baby can naturally adapt to a new life, and start out his/her life feeling secure.

o. **Rest**

A baby sleeps most of the time except when he/she sucks milk. Let your baby sleep peacefully in a clean and quiet place.

o **Temperature**

A baby cannot control his/her own body temperature well, so try to keep the temperature of the baby's room not below 20°C. Do not forget to air the room out regularly.

o **Nutrition**

Breastfeeding provides the best nutrition for your baby. Breastfeeding prevents your baby from getting sick and strengthens the bond between the baby and mother. The initial breast milk, colostrum, is very important for the baby's health and nutrition, so by all means, please breast feed your baby. Even though you may feel that your breast milk is not abundant, it will flow freely if you let your baby suck as much as he/she likes. It is also important for the mother to have sufficient nutrition and rest in order to produce abundant milk.

○ **Prevention of disease**

Wash your hands clean before you care for your baby, and always keep the bed clothes, baby clothes and diapers sanitary. Do not let others approach or hold the baby unless necessary.

○ **In case of emergency**

If your baby suffers from fever, diarrhea, difficult breathing, convulsion, jaundice, etc., please consult a doctor immediately. If the baby's weight at birth is below 2,500 grams or if any abnormality of the body is found, contact the health center to get health guidance, or guidance on public subsidy of the medical fees.

Guardian's Record for the Baby (within 4 Weeks after Birth)

Condition of the baby at birth	weight g	height cm
	chest circumference cm	head circumference cm

- Did your baby receive examinations for inborn errors of metabolism? (yes / no)
- The first time you gave milk to your baby was ( ) hours after the birth.
- That milk was (breast milk / formula milk).
- Please write down freely whatever worries you have about baby care, what you want to keep as a record, your impressions on baby care, etc.

Development of the Newborn Baby (within 1 Week after Birth)

Age in days*	Weight (g)	Sucking Ability	Jaundice	Others
		weak normal	none/ normal/heavy	
		weak normal	none/ normal/heavy	

Abnormality at Birth: none/ yes (treatment:)

Abnormality after Birth: none/ yes (treatment:)

Record at the Time of Discharge from Hospital

(__month__day__year /__days after birth)

Weight g	Feeding: breast milk / mixed / formula milk
Items for observation:	
Name of the medical institution or doctor:	

Development of the Newborn Baby

(from 1 to 4 Weeks after Birth)

Observations	Age in days*	Weight (g)	Sucking ability	Feeding	Name of the medical institution or doctor
			weak normal	breast milk mixed formula milk	
			weak normal	breast milk mixed formula milk	
			weak normal	breast milk mixed formula milk	
			weak normal	breast milk mixed formula milk	

Health guidance:

*Birth day is 0 day.

Guardian's Record for 1 Month Old Baby

(Recorded on ____ month ____ day ____ year)

My baby became one month old ____ month ____ day ____ year

- ○ Does your baby suck milk well?
  Yes No
- ○ Does your baby move his/her hands and legs actively when he/she is undressed?
  Yes No
- ○ Does your baby sometimes stare at your eyes?
  Yes No
- ○ Does your baby stop crying when you talk to him/her?
  Yes No
- ○ Is your baby's navel dry?
  Yes No
- ○ What color are your baby's stools?* ( )
- ○ Has your baby ever suffered from any disease?
  Yes (name of disease:) No
- ○ Please write down freely whatever worries you have about baby care, what you want to keep as a record, your impressions of baby care, etc.

* If your baby's stools become grayish white to white or if your baby's skin becomes jaundiced (yellowish), it may indicate congenital biliary obstruction. In that case, please consult your pediatrician immediately.

Health Check-up for 1 Month Old Baby

(Conducted on ____ month ____ day ____ year at the age of__months__days old)

Weight	. kg	Height	. cm
Chest circumference	. cm	Head circumference	. cm
Nutritional condition:	good/normal/ malnourished	Feeding:	breast milk/mixed/ formula milk
Developing normally or observation needed			
Health guidance			

Name of: Doctor Public health nurse Midwife

Record until the Next Health Check-up

(Fill in the height and weight measured at home.)

Date	Age in months	Weight	Height	Guidance	Name of the medical institution or doctor
		. kg	. cm		

Guardian's Record for 3 – 4 Months Old Baby

(Recorded on ____ month ____ day ____ year)

- o Can your baby hold his/her head up alone?
  Yes No
- o Do you feel there is anything strange about the movement or expression of your baby's eyes?
  Yes No
- o Does your baby smile when you dandle him/her?
  Yes No
- o Does your baby turn his/her face in the direction of your voice when you speak to him or her from out of baby's view?
  Yes No
- o Do you let your baby out in the fresh air and the sun?
  Yes No
- o Has your baby suffered from any disease recently?
  Yes (name of disease:) No
- o Please write down freely whatever worries you have about baby care, what you want to leave as a record, or your impressions of baby care, etc.

● Baby foods, bottled milk, and juices can be started from 4 – 5 months of age.

Health Check-up for 3 – 4 Months Old Baby

(Conducted on ____ month ____ day ____ year at the age of ___ months ___ days old)

Weight . kg		Height . cm	
Chest circumference . cm		Head circumference . cm	
Nutritional condition:	good/normal/ malnourished	Feeding:	breast milk/mixed/ formula milk
Weaning:	started/ not yet	Limitation to spreading hip joint:	none / yes
Developing normally or observation needed			
Health guidance			

Name of: Doctor Public health nurse Midwife

Record until the Next Health Check-up

(Fill in the height and weight measured at home.)

Date	Age in months	Weight	Height	Guidance	Name of the medical institution or doctor
		kg	cm		

Guardian's Record for 6 – 7 Months Old Baby

(Recorded on ____ month ____ day ____ year)

- o Did your baby receive the examination for neuroblastoma?
  Yes No
- o Does your baby turn over?
  Yes No
- o (For the 7-month old baby) Can your baby sit up?
  Yes No
- o Does your baby try to grasp a toy put near him/her?
  Yes No
- o When your baby is with the family, does he/she make sounds as if he/she is speaking to them?
  Yes No
- o Has the first tooth erupted?
  Yes No
- o Have the pupils of your baby's eyes ever looked white or had a yellow-green glisten?
  Yes No
- o Does your baby like baby foods?
  Yes No
- o Has your baby suffered from any disease recently?
  Yes (name of disease:) No
- o Please write down freely whatever worries you have about baby care, what you want to keep as a record, your impressions of baby care, etc.

Health Check-up for 6 – 7 Months Old Baby

(Conducted on ____ month ____ day ____ year at the age of__months__days old)

Weight	. kg	Height	. cm
Chest circumference	. cm	Head circumference	. cm
Nutritional condition:	good/normal/ malnourished	Feeding:	breast milk/mixed/ formula milk
Weaning:	started/not yet	No. of teeth	____
Diseases or abnormalities of the mouth:	none / yes ( ) a . b , c .*		
Developing normally or observation needed			
Health guidance			

Name of: Doctor Public health nurse Midwife

Record until the Next Health Check-up

(Fill in the height and weight measured at home.)

Date	Age in months	Weight	Height	Guidance	Name of the medical institution or doctor
		. kg	. cm		

*These include tooth decay, gums diseases, and malocclusion. The marks for the condition of the teeth are as follows:
a: healthy b: attention needed c: treatment needed

Guardian's Record for 9 – 10 Months Old Baby

(Recorded on ____ month ____ day ____ year)

- ○ Does your baby crawl?
  Yes No
- ○ Can your baby stand with support?
  Yes No
- ○ Can your baby seize a small object with his/her fingers?
  Yes No
- ○ Is your baby shy with strangers? Does he/she cry when they approach?
  Yes No
- ○ Does the baby take baby foods well?
  Yes No
- ○ Is there anything that worries you about the baby's teeth, such as their growth, shape or color?
  Yes No
- ○ Does your baby react to various noises?
  Yes No
- ○ Does your baby play alone happily?
  Yes No
- ○ Has your baby suffered from any disease recently?
  Yes (name of disease:) No
- ○ Please write down freely whatever worries you have about baby care, what you want to keep as a record, your impressions of baby care, etc.

- Please examine your baby's teeth regularly.

Health Check-up for 9 – 10 Months Old Baby

(Conducted on ____ month ____ day ____ year at the age of ____ months ____ days old)

Weight	. kg	Height	. cm
Chest circumference	. cm	Head circumference	. cm
Nutritional condition:	good/normal/ malnourished	Baby foods	given times a day
No. of teeth:		Diseases or abnormalities of the mouth:	none / yes ( ) a . b . c .*
Developing normally or observation needed			
Health guidance			

Name of: Doctor Public health nurse Midwife

Record until the Next Health Check-up

(Fill in the height and weight measured at home.)

Date	Age in months	Weight	Height	Guidance	Name of the medical institution or doctor
		. kg	. cm		

* a: healthy b: attention needed c: treatment needed

Guardian's Record for 1 Year Old Baby

(Recorded on ____ month ____ day ____ year)

My baby became one year old on ____ month ____ day ____ year.

- ○ Does your baby walk with support?
  Yes No
- ○ Does your baby move his/her body in response to music on TV or records?
  Yes No
- ○ Does your baby understand simple adult words such as "come on", or "give me"?
  Yes No
- ○ Is your baby happy when an adult plays with him/her?
  Yes No
- ○ What are your baby's favorite toys? ( )
- ○ Has your baby suffered from any disease recently?
  Yes (name of disease:) No
- ○ Please write down freely whatever worries you have about baby care, what you want to keep as a record, your impressions of baby care, etc.

- To prevent loss of appetite and tooth decay, be careful to avoid foods and drinks which are too sugary.

Health Check-up for 1 Year Old Baby

(Conducted on ____ month ____ day ____ year at the age of__ year___months old)

Weight . kg		Height . cm	
Chest circumference . cm		Head circumference . cm	
Nutritional condition:	good/normal/ malnourished	Breast feeding:	completely stopped/ not yet
Weaning:	completed/ not yet	No. of teeth:	No. of decayed teeth: none yes ( )
Diseases or abnormalities of the mouth:	none / yes ( ) a . b . c .*		
Developing normally or observation needed			
Health guidance			

Name of: Doctor Public health nurse Midwife

Record until the Next Health Check-up

(Fill in the height and weight measured at home.)

Date	Age	Weight	Height	Guidance	Name of the medical institution or doctor
		. kg	. cm		

* a: healthy b: attention needed c: treatment needed

Guardian's Record for 18 Months Old Child

(Recorded on _____ month ____ day ____ year)

- ○ Does your baby walk without help?
  Yes No
- ○ Does your baby appear overly sensitive to light or have any strange eye movement? Yes No
- ○ Can your baby drink water using a cup?
  Yes No
- ○ Does your baby use a bottle when he/she drinks juice or milk?
  Yes No
- ○ Can your baby say some words?
  Yes (No. of vocabulary) No
- ○ When you show a picture book to your baby and ask the names of animals or objects, does he/she point to them?
  Yes No
- ○ Does your baby understand simple orders from adults?
  Yes No
- ○ Does your baby look around when someone calls his/her name from behind? Yes No
- ○ Is your child happy when an adult plays with him/her?
  Yes No
- ○ What games does your baby especially like? ( )
- ○ Are you training your baby to discontinue the use of diapers?
  Yes No
- ○ Has your baby suffered from any disease recently?
  Yes (name of disease:) No
- ○ Write down freely whatever worries you have about child care, what you want to keep as a record, your impressions of child care, etc.

- Please clean your child's teeth after meals.
- Don't forget the 18 month health check-up.

Health Check-up for 18 Months Old Child

(Conducted on _____ month ____ day ____ year at the age of ____ year ____ months old)

Weight . kg	Height . cm
Nutritional condition: good/normal/malnourished	Breast feeding: completely stopped/not yet
Developing normally or observation needed	

Eye abnormality. (eye position, eyesight etc.): none / yes / suspected

Condition** of teeth	E	D	C	B	A	A	B	C	D	E
	E	D	C	B	A	A	B	C	D	E

Decayed tooth: a . b . c
Inflammation of the gums, etc.: a . b . c
Dental cleanliness: a . b . c
Malocclusion: a . b . c
(examined on ____ month ____ day ____ year)

Health guidance

Name of: Doctor Dentist Public health nurse

Record until the Next Health Check-up

(Fill in the height and weight measured at home.)

Date	Age	Weight	Height	Guidance	Name of the medical institution or doctor
		. kg	. cm		

*Please refer to page 50 for explanation regarding the child's teeth.
** a: healthy b: attention needed c: treatment needed

Guardian's Record for 2 Years Old Child

(Recorded on ____ month ____ day ____ year)

My child became two years old on ____ month ____ day ____ year.

- ○ Can your child run?
  Yes No
- ○ Does your child eat meals using a spoon?
  Yes No
- ○ Does your child scribble with crayons?
  Yes No
- ○ Does your child imitate TV and the manners of adults?
  Yes No
- ○ Can your child make a two-word sentence such as "I go", "See doggie"?
  Yes No
- ○ Does your child eat high-fiber vegetables and meat?
  Yes No
- ○ Are you careful about the dental hygiene of your child after meals?
  Yes No
- ○ Has your child suffered from any disease recently?
  Yes (name of disease:) No
- ○ Please write down whatever worries you have about child care, what you want to keep as a record, your impressions of child care, etc.

- At this age, your child is apt to have tooth decay, so please take care to produce good oral hygeine.

Health Check-up for 2 Years Old Child

(Conducted on ____ month ____ day ____ year at the age of ____ years ____ months old)

Weight . kg	Height . cm

Developing normally or observation needed

Eye abnormality (eye position, eyesight, etc.): none / yes / suspected

Condition** of teeth	E	D	C	B	A	A	B	C	D	E	Decayed tooth: a . b . c Inflammation of the gums, etc.: a . b . c Dental cleanliness: a . b . c Malocclusion: a . b . c (examined on ____month ____day ____ year)
	E	D	C	B	A	A	B	C	D	E	

Health guidance

Name of: Doctor Dentist Public health nurse

Record until the Next Health Check-up

(Fill in the height and weight measured at home.)

Date	Age	Weight	Height	Guidance	Name of the medical institution or doctor
		. kg	. cm		

*Please refer to page 50 for explanation regarding the child's teeth.
** a: healthy b: attention needed c: treatment needed

Guardian's Record for 3 Years Old Child

(Recorded on ____ month ____ day ____ year)

My child became three years old on ____ month ____ day ____ year

- o Does your child have crossed eyes?
  Yes No
- o Does your child narrow his/her eyes or get extremely close to an object, when he/she looks at something?
  Yes No
- o Have you ever felt your child could not hear well?
  Yes No
- o Can your child go up the stairs by himself/herself without using his/her hands? Yes No
- o Can your child draw circles using a crayon or a pencil?
  Yes No
- o Does your child want to put on and take off clothes by himself/herself?
  Yes No
- o Can your child tell his/her own name?
  Yes No
- o Does your child have friends to play with?
  Yes No
- o Does your child eat foods that need to be chewed well? (e.g. meat)
  Yes No
- o Does your child brush his/her teeth?
  Yes No
- o What are the favorite games of your child? ( )
- o What are your child's favorite toys and play things (e.g. swing)?
  ( )
- o Has your child suffered from any disease recently?
  Yes (name of disease:) No
- o Please write down freely whatever worries you have about child care, what you want to keep as a record, or your impressions of child care, etc.

- o Now is the time for your child to receive the 3-year health check-up.

Health Check-up for 3 Years Old Child

(Conducted on ____ month ____ day ____ year at the age of ___ years ___ months old)

Weight . kg	Height . cm

Developing normally or observation needed

Eye abnormality (eye position, eyesight, etc.): none / yes / suspected

Condition** of teeth	E	D	C	B	A	A	B	C	D	E
	E	D	C	B	A	A	B	C	D	E

Decayed tooth: a . b . c
Inflammation of the gums, etc.: a . b . c
Dental cleanliness: a . b . c
Malocclusion: a . b . c
(examined on ___ month ___ day ___ year)

Health guidance

Name of: Doctor . Dentist Public health nurse

Record until the Next Health Check-up

(Fill in the height and weight measured at home.)

Date	Age	Weight	Height	Guidance	Name of the medical institution or doctor
		. kg	. cm		

*Please refer to page 50 for explanation regarding the child's teeth.
** a: healthy b: attention needed c: treatment needed

Guardian's Record for 4 Years Old Child

(Recorded on ____ month ____ day ____ year)

My child became four years old on ____ month ____ day ____ year.

- Can your child jump down from the second or third step of the stairs?
  Yes No
- Can your child hop on one foot?
  Yes No
- Does your child tell you what he/she has experienced?
  Yes No
- Does your child enjoy children's games with friends?
  Yes No
- Does your child brush his/her teeth or gargle?
  Yes No
- Does your child go to the toilet and urinate without any assistance?
  Yes No
- What are the favorite playthings and songs of your child?
  ( )
- Has your child suffered from any disease recently?
  Yes (name of disease:) No
- Please write down freely whatever worries you have about child care, what you want to keep as a record, your impressions of child care, etc.

Health Check-up for 4 Years Old Child

(Conducted on ____ month ____ day ____ year at the age of ____ years ____ months old)

Weight . kg	Height . cm

Developing normally or observation needed

Eye abnormality (eye position, eyesight: right ( ). left ( ), etc.): none / yes / suspected

Condition** of teeth	E	D	C	B	A	A	B	C	D	E
	E	D	C	B	A	A	B	C	D	E

Decayed tooth: a . b . c
Inflammation of the gums, etc.: a . b . c
Dental cleanliness: a . b . c
Malocclusion: a . b . c
(examined on ____month ____day ____year)

Health guidance

Name of: Doctor Dentist Public health nurse

Record until the Next Health Check-up

(Fill in the height and weight measured at home.)

Date	Age	Weight	Height	Guidance	Name of the medical institution or doctor
		. kg	. cm		

*Please refer to page 50 for explanation regarding the child's teeth.
** a: healthy b: attention needed c: treatment needed

Guardian's Record for 5 Years Old Child

(Recorded on ____ month ____ day ____ year)

My child became five years old on ____ month ____ day ____ year.

- o Can your child turn a somersault?
  Yes No
- o Does your child draw pictures from thoughts in his/her own mind? Yes No
- o Does your child enjoy group activities?
  Yes No
- o In case of bowel movements, does your child go to the toilet without assistance?
  Yes (from years months old) No
- o Can your child identify colors (red, yellow, green and blue)? Yes No
- o Does your child speak with accurate pronunciation?
  Yes No
- o Does your child seem to love animals or appreciate flowers?
  Yes No
- o Does your child have meals and snacks at fixed hours?
  Yes No
- o Has your child suffered from any disease recently?
  Yes (name of disease:) No
- o Please write down freely whatever worries you have about child care, what you want to keep as a record, your impressions of child care, etc.

Health Check-up for 5 Years Old Child

(Conducted on ____ month ____ day ____ year at the age of ___ years ___ months old)

Weight . kg	Height . cm

Developing normally or observation needed

Eye abnormality (eye position, eyesight: right ( ). left ( ), etc.): none / yes / suspected

Condition** of teeth

6	5	4	3	2	1	1	2	3	4	5	6
	E	D	C	B	A	A	B	C	D	E	
	E	D	C	B	A	A	B	C	D	E	
6	5	4	3	2	1	1	2	3	4	5	6

Decayed tooth: a . b . c
Inflammation of the gums, etc.: a . b . c
Dental cleanliness: a . b . c
Malocclusion: a . b . c
(examined on ____ month ___ day ___ year)

Health guidance

Name of: Doctor Dentist Public health nurse

Record until the Next Health Check-up

(Fill in the height and weight measured at home.)

Date	Age	Weight	Height	Guidance	Name of the medical institution or doctor
		. kg	. cm		

*Please refer to page 50 for explanation regarding the child's teeth.

**a: healthy b: attention needed c: treatment needed

Guardian's Record for 6 Years Old Child

(Recorded on ____ month ____ day ____ year)

My child became six years old on ____ month ____ day ____ year.

- o Can your child stand on one foot for about ten seconds?
  Yes No
- o Can your child put on or take off his/her clothes by himself/herself?
  Yes No
- o Does your child put away things he/she has used?
  Yes No
- o Does your child understand which is his/her right and left?
  Yes No
- o Can your child read and write his/her name?
  Yes No
- o Can your child play a game, abiding by the rules?
  Yes No
- o Have the molars (permanent teeth which grow behind the milk teeth) grown in?
  Yes No
- o Has your child suffered from any disease recently?
  Yes (name of disease:) No
- o Please write down freely whatever worries you have about child care, what you want to keep as a record, your impressions of child care, etc.

Health Check-up for 6 Years Old Child

(Conducted on ____ month ____ day ____ year at the age of ____ years ____ months old)

Weight . kg	Height . cm

Developing normally or observation needed

Eye abnormality (eye position, eyesight: right ( ), left ( ), etc.): none / yes / suspected

Condition** of teeth

6	5	4	3	2	1	1	2	3	4	5	6
	E	D	C	B	A	A	B	C	D	E	
	E	D	C	B	A	A	B	C	D	E	
6	5	4	3	2	1	1	2	3	4	5	6

Decayed tooth: a . b . c
Inflammation of the gums, etc.: a . b . c
Dental cleanliness: a . b . c
Malocclusion: a . b . c
(examined on ____ month ____ day ____ year)

Health guidance

Name of: Doctor Dentist Public health nurse

Record until the Next Health Check-up

(Fill in the height and weight measured at home.)

Date	Age	Weight	Height	Guidance	Name of the medical institution or doctor
		. kg	. cm		

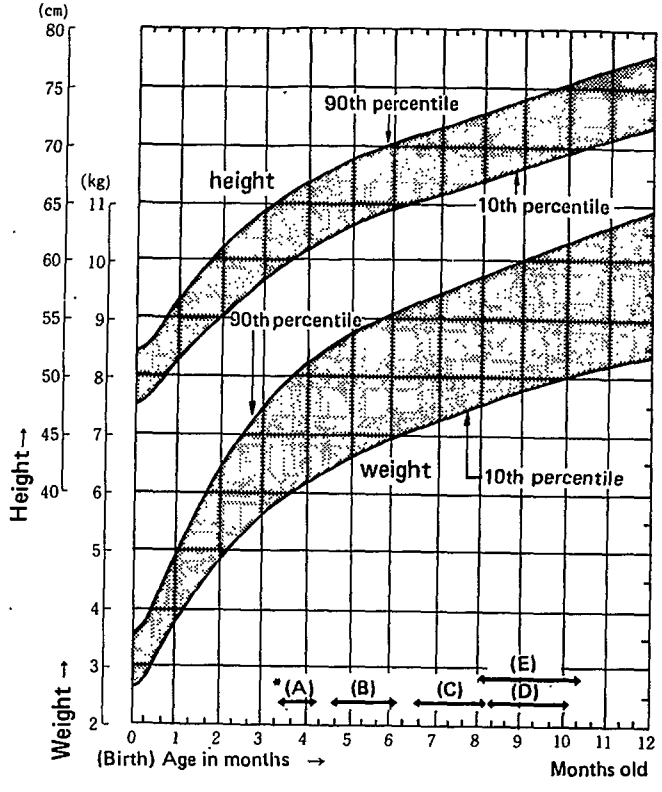
*Please refer to page 50 for explanation regarding the child's teeth.

**a: healthy b: attention needed c: treatment needed

Infant's Physical Growth Curve (as of 1980)

(boy)

Fill in weight and height of your baby in this graph.



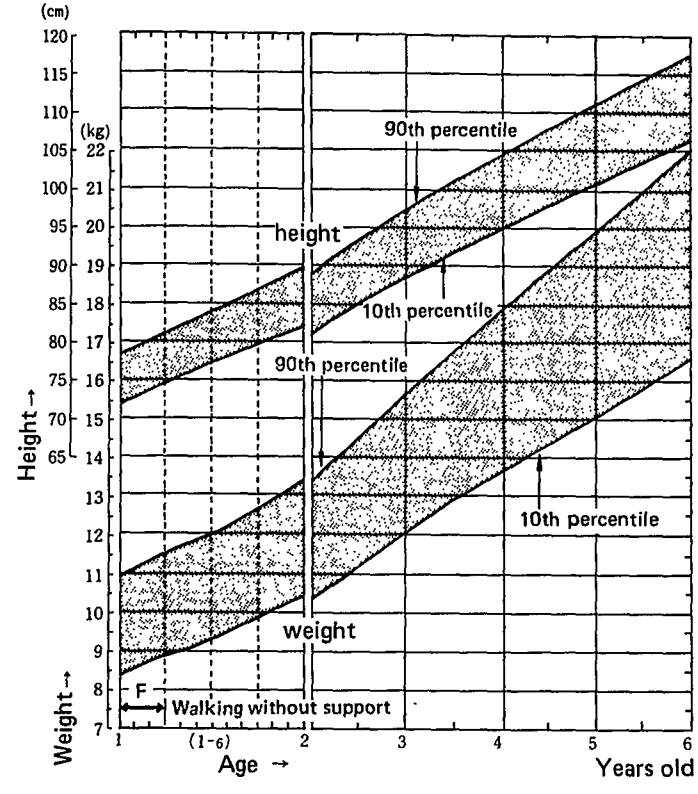
* (A) Stabilization of neck
(B) Turning over in sleep
(C) Sitting
(D) Standing with support
(E) Crawling

Arrows of (A), (B), (C), (D), and (E) express the periods from the age in months when 50% of infants are able to do each item, to the age in months when 90% of them are able to do so. Please mark the age at which your child was first able to do items. A through E on the arrows on this graph and F on the following page.

Child's Physical Growth Curve (as of 1980)

(boy)

Fill in weight and height of your child in this graph.



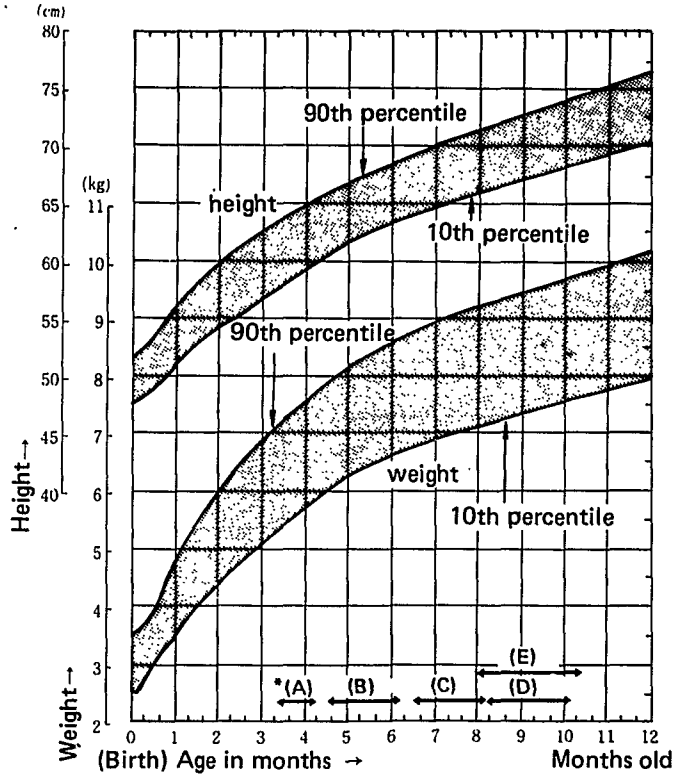
(F) Walking without support

The graphs of height and weight show the figures of the 10th percentile and 90th percentile of children beginning from the smallest of each age. The height was measured in a lying position for the children below 2 years old, and in a standing position for the children over 2 years old.

Infant's Physical Growth Curve (as of 1980)

(girl)

Fill in weight and height of your baby in this graph.



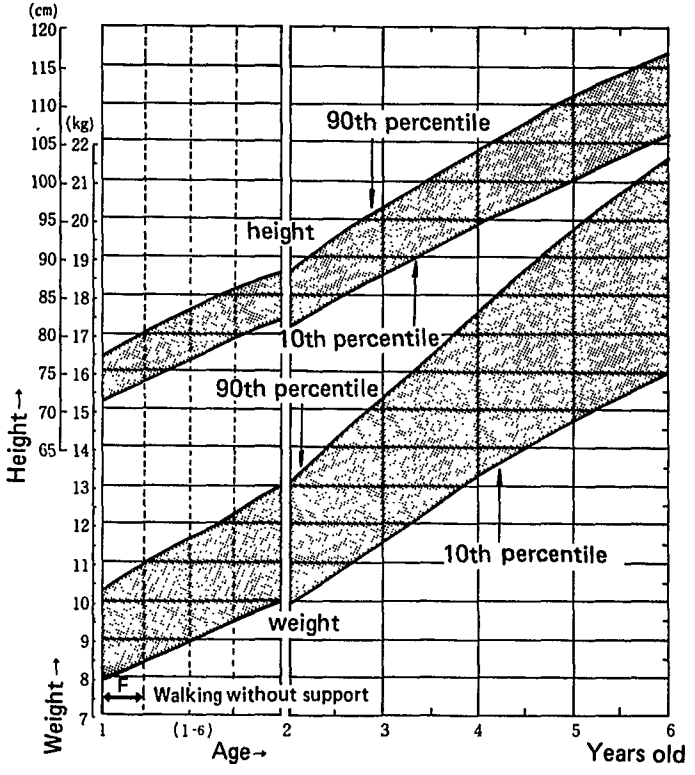
*(A) Stabilization of neck
(B) Turning over in sleep
(C) Sitting
(D) Standing with support
(E) Crawling

Arrows of (A), (B), (C), (D), and (E) express the periods from the age in months when 50% of infants are able to do each item, to the age in months when 90% of them are able to do so. Please mark the age at which your child was first able to do items. A through E on the arrows on this graph and F on the following page.

Child's Physical Growth Curve (as of 1980)

(girl)

Fill in weight and height of your child in this graph.



(F) Walking without support

The graphs of height and weight show the figures of the 10th percentile and 90th percentile of children beginning from the smallest of each age. The height was measured in a lying position for the children below 2 years old, and in a standing position for the children over 2 years old.

Vaccinations

The prevention of disease is even more important than the treatment of disease. There is as yet no specific medicine for some viruses, in spite of the developments in medicine. Because the risk of dangerous communicable diseases still exists, it is important for your child to receive vaccinations.

Vaccinations, on the basis of the Vaccinations Law and Tuberculosis Prevention Law, are implemented under the responsibility of the National Government and Local Governments in order to protect society from communicable diseases.

- **Before receiving a vaccination:**
  Vaccinations should be administered only when your child is in good health. So, please pay full attention to the state of health of your child before receiving vaccinations, and read the information bulletins on vaccinations carefully.

- **On the day of a vaccination**
  Please take your child's temperature before going to get a vaccination. Please also read carefully the questionnaire distributed to you beforehand, and fill in the necessary items. Bring it with you together with this handbook. It is useful to judge whether or not the vaccination can be given to your child. If you find any problem in the health condition of your child, please consult a doctor. For this reason, the person who takes the child to receive a vaccination should be the guardian of the child who is most familiar with the state of his/her health.

- **A child who should not receive vaccinations**
  If a child with any of the following physical problems receives a vaccination, it may worsen the disease or intensify the side effects of the vaccination. So, such a child should not receive a vaccination.

  1. Fever.
  2. Abnormally retarded growth.
  3. Serious heart or kidney disease.
  4. Problems with past vaccinations.
  5. Convulsions within the past year.

  In addition to the above-mentioned cases, there may be other cases in which vaccination is inappropriate. Please pay strict attention to the health of your child and discuss the matter thoroughly with the doctor before he/she receives a vaccination.

- **After receiving a vaccination**
  After receiving a vaccination, please take your child back home and let him/her rest. Refrain from taking a bath. If the child develops a high fever, has convulsions, or any other unusual symptoms, take him/her to a doctor immediately. Report the matter to the health center or municipal office.

- **If your child could not receive the vaccination on the designated date**
  There are some vaccinations which are given in a series, and none of the vaccinations should be missed. If your child could not receive them on the designated dates, be sure to make arrangements to receive them at another time.

Tuberculin Skin Test and BCG Vaccination

Date of test	Site of test	Name of tester	Size of reaction	Judgement	Name of Judge	Date of BCG vaccination	Name of vaccinator
	Left: upper/middle /lower Right: upper/middle /lower						
	Left: upper/ middle/lower Right: upper/ middle/lower						

Pertussis, Diphtheria and Tetanus

Time		Date of vaccination	Kind of vaccine used	Lot. No. (The amount of vaccine, when reduced to the regular amount)	Especially strong local or all-body reaction	Name of vaccinator
Initial series	I			Lot. No. ( )		
	II			Lot. No. ( )		
	III			Lot. No. ( )		
Repeat "Booster"				Lot. No. ( )		

• Record of allergies to drugs or other allergies.

Poliomyelitis

Inoculation	Date of vaccination	Lot. No.	Remarks	Name of vaccinator
1st	• •			
2nd	• •			

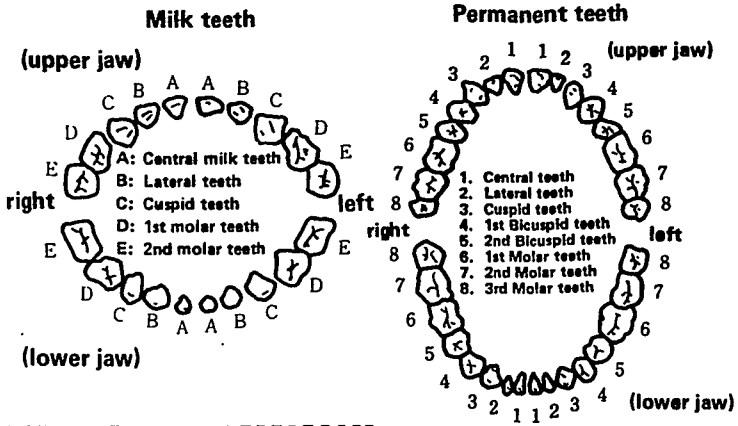
Measles

Date of vaccination	Lot. No.	Remarks	Name of vaccinator
• •			

Other Vaccinations

Kind	Date of vaccination	Lot. No.	Amount of vaccine	Remarks	Name of vaccinator
	• •				
	• •				
	• •				
	• •				
	• •				
	• •				
	• •				
	• •				

Names and Erupting Periods of Teeth



Marks for conditions of teeth

Untreated decayed tooth: C
Present tooth: / Lost tooth: △
Treated tooth: ○

There are 20 milk teeth in total; 10 each for the upper and lower jaws (see illustration on left). The front teeth of the lower jaw (A) begin to erupt first at 6 to 7 months after birth. The 20 milk teeth should all be in when your child becomes 2½ to 3 years old. There are differences among individuals in the ages and order of tooth eruption.

Since the milk teeth play an important role when the permanent teeth start to erupt, it is important to prevent their decay and loss.

There are 32 permanent teeth in total, 16 each for the upper and the lower jaws (see illustration on the right). Some individuals never cut the third molar teeth (wisdom teeth) (8). The permanent tooth which starts to grow first is the 1st molar tooth (6-year molar tooth) (6) which has strong biting power. It starts to erupt when your child becomes 5 to 6 years old. By 12 to 13 years of age, all the permanent teeth except the wisdom teeth should come in.

Record of Major Diseases

Name of the disease	Date of onset	Remarks
	month day year	
	month day year	
	month day year	
	month day year	
	month day year	
	month day year	
	month day year	
	month day year	
	month day year	
	month day year	
	month day year	
	month day year	
	month day year	
	month day year	

Major Subsidies by the Government for Medical Costs to Mothers and Children

- **For toxemia of pregnancy and others**
  If the pregnant or post-partum woman is affected by the following diseases and needs to be hospitalized, medical costs are subsidized by the government:
  toxemia of pregnancy, diabetes, anemia, excessive bleeding or heart diseases

- **For premature babies**
  When a premature baby needs continued hospitalization, medical costs are subsidized by the government.

- **For designated chronic diseases of infants**
  If a child is affected by any of the following diseases, medical costs are subsidized by the government:
  malignant neoplasms, chronic renal diseases, asthma, chronic heart diseases, endocrine diseases, collagen diseases, diabetes, inborn errors of metabolism, and blood diseases such as hemophilia

- **For physically handicapped children**
  Costs for medical treatment and equipment for physically handicapped children are subsidized by the government.

The above subsidies are awarded by criteria based on the degree of the disease or the income of the guardian. Please consult the health center for details.

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Notes

THE CHILDREN'S CHARTER

(Proclaimed on May 5, 1951)

Preamble

We, the people of Japan, in accordance with the spirit of the Constitution, do adopt this Charter to establish proper ideas toward children and thus bring about the well-being of all children.

General Principles

The child shall be respected as a human being.
The child shall be given due regard as a member of society.
The child shall be brought up in a good environment.

Text

1. All children shall be assured of healthy minds and bodies and shall be guaranteed freedom from want.
2. All children shall be entitled to be brought up in their own homes with proper love, knowledge and skill. Those children not having homes shall be brought up in an environment having similar advantages.
3. All children shall be provided with adequate nourishment, housing and clothing and shall be protected against disease and injury.
4. All children shall be educated in accordance with their individuality and capacity and so guided that they will honestly and independently discharge their responsibilities as members of society.
5. All children shall be so guided that they may love nature, respect science and art, and accept the virtues of morality.
6. All children shall be assured access to schooling and be provided with complete educational facilities.
7. All children shall be provided with opportunity to receive vocational guidance and training.
8. All children shall be fully protected against exploitation in labour that their mental and physical development shall not be retarded, their opportunities to receive education not be lost and that their lives as children not be hampered.
9. All children shall be assured access to wholesome recreational and cultural resources and be protected against evil environments.
10. All children shall be protected against abuse, exploitation, neglect and other harmful treatment. Children who have committed wrongful acts shall be provided with adequate protection and guidance.
11. All children who are mentally or physically handicapped shall be provided with appropriate medical care, education and protection.
12. All children shall be so guided that they may be united with one another in the spirit of love and sincerity and as good citizens devote themselves to the peace and culture of mankind.

Important Names and Address

Planned Facility for Delivery	Name Address	Phone
Health Center	Name Address	Phone
Doctor	Name Address	Phone
Doctor	Name Address	Phone
Dentist	Name Address	Phone
Midwife	Name Address	Phone
	Name Address	Phone
	Name Address	Phone
	Name Address	Phone

JOICFP

The Japanese Organization for International Cooperation in Family Planning (JOICFP) is a private, non-profit organization approved by the Japanese Ministry of Foreign Affairs and Ministry of Health and Welfare, providing cooperation and assistance for promoting family planning and maternal and child health programs in developing countries.

Its major activities are to implement the integrated family planning, nutrition and parasite control project (IP) in Asia, Africa, the South Pacific, and Latin America in cooperation with IPPF (International Planned Parenthood Federation), UNFPA (United Nations Fund for Population Activities), UNICEF, WHO and other international organizations. To meet this aim, JOICFP also conducts regular international meetings, seminars and training programs, and provides commodities, information, and publication services in Japan and other countries in the world.

JOICFP
Hoken Kaikan Bekkan, 1-1, Sadohara-cho, Ichigaya,
Shinjuku-ku, Tokyo 162, Japan
Tel: 03-268-5875
Cable: JOICFPJAPAN TOKYO,
Telex: 2324584 JOICFP J

JICA

In order to contribute to the social and economic development of the developing world, the Japan International Cooperation Agency (JICA), an executing agency of the aid programmes of the Government of Japan, extends international cooperation mainly in the field of technical cooperation to developing countries on the basis of agreements concluded between the Japanese Government and the governments of these countries.

From the viewpoint that the development of human resources enables a wide range of people to participate in the development process and share the fruit of growth, JICA is putting increasing emphasis on technical cooperation for human resources development.

JICA
Shinjuku Mitsui Bldg.,
2-1-1, Nishi-Shinjuku, Shinjuku-ku, Tokyo 163, Japan
Tel: 03-345-5311 Telex: J22271

Israel: The National Program for Reduction of Infant Mortality

by Vita Barell

The national infant mortality rate (IMR) in Israel in 1984 was 14.0 per 1,000 live births; among Jewish births the rate was 11.0 per 1,000 and among non-Jews the rate was 22.0 per 1,000. In that same year, there were areas in Israel in which infant mortality was lower than 10 per 1,000 and those with a rate more than twice the national level. These large differentials among population groups, regions, and communities are the target of the program presented here (figure 1). The Israel National Program on Infant Mortality Differentials attempts to identify problem areas among the regions and communities in Israel as the first phase in a multistaged endeavor which includes a comprehensive analysis to identify factors influencing the high mortality rate and to characterize the population groups at risk. Information is the basic tool, and involvement of decisionmakers and service managers in the process of information evaluation, plan development, and implementation is essential. Concomitantly, an attempt is being made to transmit to the regions the responsibility for developing feasible plans and intervention programs designed to reduce infant deaths and to decrease the differential among communities. Preset criteria for evaluation of the plan's success are being applied.

Method

In 1982, a national task force was established to guide the project in the analytic as well as the organizational aspects. It included authorities in pediatrics, obstetrics, maternal and child health, public health nursing, epidemiology, and statistics.

Regional work parties were set up with members selected by representatives of the different disciplines in the national committee and deputized by the Ministry of Health in cooperation with the Health Insurance Fund, the major insurer in Israel. Adequate representation of all levels and of all sponsors of care was assured. A concerted attempt was made to present aims, methodology, and results in a form suitable for service managers and clinicians at the field level. The organizational structure of this task force reflected the various regions of the country (figure 2).

Selection of comparison standards

The comparison standards for identification of problem areas were the national averages and the levels of the rest of the region rather than the levels attained in other countries, based on the principle that goals should be realistic and attainable.

Selection of appropriate standards met with a number of problems. One problem is that the mortality rate is not constant over time and there has been a consistent decrease within the last decade (figure 3). Data are presented separately here for Jews and for non-Jews because of the considerable differences in mortality rates and population characteristics between the two groups. The Jewish rate decreased by 7.1 per 1,000 (from 18.1 in 1973 to 11.0 in 1984), and the non-Jewish rate decreased by 15.1 per 1,000 (from 37.1 to 22.0), each about a 40-percent decrease. However, the non-Jewish rate has remained close to double the Jewish level throughout the period.

There are about 70,000 Jewish births and 23,000 non-Jewish births yearly. The latter group is composed of Moslem and Christian Arabs as well as a sizable Druse population. The Jewish population is also heterogeneous, comprising four major ethnic groups--European, North African, Mid-Eastern, and Yemenite. Intragroup differences among both Jews and non-Jews are smaller than the differences between them.

The data base

Analysis of national infant mortality patterns was based on the matched birth and infant death record file for the period 1977-80, obtained from the Central Bureau of Statistics. Fetal deaths have not yet been included for technical reasons but will be added to the data base. In order to base comparison of different population groups and different regions on stable rates and have sufficient numbers for analysis of relevant risk factors, data for the 4-year period were combined. More recently, data through 1983 have been added.

National rates by age at death

Age at death

The average infant mortality rate during the study period, 1977-80, was 13.1 per 1,000 for Jewish births and 26.6 per 1,000 for non-Jewish births. The difference between the two groups is particularly striking in the post-neonatal period (figure 4), when the average Jewish rate was 3.7 per 1,000 and the average non-Jewish rate 12.7 (a relative risk of 3.4). Post-neonatal deaths are the primary component of infant mortality among non-Jews, while among Jews the early neonatal rate represents nearly 60 percent of all infant deaths (figure 5).

Cause of death

Inspection of the main causes of infant death in the two national groups shows significant differences in all categories except for maternal and obstetric causes and prematurity (table 1). The latter category is a combination of low birth weight-related causes and respiratory distress syndrome.

Congenital malformations (28 percent) and prematurity (27 percent) are the major causes of death among Jewish infants; infections (28 percent) and malformations (24 percent) are the major causes among non-Jews. The relative risk of death from a malformation among all live births is 1.7 times greater among non-Jews. The largest disparity between the two national populations is in infectious disease mortality (7.3 per 1,000 among non-Jews, 5.6 times greater than the

comparable rate among Jews--1.3 per 1,000). This excess is mainly due to gastrointestinal infections.

Maternal age at delivery, maternal education and parity, and differences in urban-rural residence all contribute to the differential between national groups. Multivariate analyses are being performed for evaluation of the contribution of these factors to the differences in infant mortality.

Regional Analysis

Israel has about 4 million inhabitants: 3,400,000 Jews and 670,000 non-Jews. The country is divided into 23 health regions with 100,000-300,000 persons each. These regions have only recently been defined and do not represent functioning administrative entities.

The current project is limited to six of these regions situated throughout the country. The six regions under investigation include about 31 percent of all the births in the nation among Jews and non-Jews alike. The combined IMR for all regions is similar to the national rate during the study period. Our analysis shows considerable differences in crude rates among the different regions (figure 6), with the Ramat Gan region the lowest. For example, among non-Jews in the Nahariya area, the infectious disease mortality rate was particularly disturbing. In the Beer Sheva southern region, deaths associated with low birth weight were the highest ranking cause of death among Jews, with excess respiratory deaths as well.

Statistical Methods

In order to obtain relatively stable rates within the regions and in communities of only a few hundred births, data for a number of years were combined. Communities with very few deaths were grouped together with others in the same regional council or combined with communities of similar characteristics (kibbutzim, rural villages). A community is considered to have excess mortality if at least one of the following conditions exists:

1. There is an excess in crude IMR.

2. There is an excess in the early neonatal, late neonatal, or post-neonatal rate.

3. There is an excess rate in one or more specific causes of death.

The community rates were compared to the comparable rates in the rest of the region and to the national standards. The quantitative basis for definition of a community with excess infant mortality was the level of significance of the difference between its rate and the national or regional rates, a measure of distance from the standard. The definition was chosen with the approach that it is preferable to obtain false positives (communities identified as having excess mortality, while their deviation from the standard is a chance deviation) than false negatives (communities with excess mortality which are not identified).

A Local Intervention Program

The Ramat Gan region (figure 7) has the lowest IMR of all areas presented, yet not all communities within this area are similar. Of the five communities in the area, four are low, while one community stands out with considerable excess infant mortality--Or Yehuda.

In 1977-80, the infant mortality rate in Or Yehuda, the lowest socioeconomic community in the area, was almost twice as high as the rate in the rest of the district. There was about a twofold difference in the early neonatal and in the post-neonatal periods (table 2).

Or Yehuda is a community of 18,000 in the center of the country, composed of immigrants from Iraq and Libya and their descendants with a recent addition of newcomers from Asian Russia. It is situated only a few kilometers from two major teaching hospitals and has a comprehensive network of primary medical services. These findings stimulated an investigation into the causes of the excess mortality in Or Yehuda. The project team included the Health Insurance Fund director responsible for primary services and the head of pediatrics in the Regional Medical Center, a 1,100-bed government teaching hospital. This group worked jointly on the data and their implication for area medical services. Clinical records were accessed, and an intrinsic problem was uncovered: the breakdown in transmission of clinical information from one treatment site to another.

Epidemiological analysis showed large disparities in population risk characteristics between Or Yehuda and the rest of the region (table 3) such as low maternal education, many teenage mothers, high birth order, and low birth weight. The excess mortality, however, was not limited to the known risk groups, and it was concentrated in a subset of the population with multiple risk factors (table 4): 60 percent with four or more risk factors in Or Yehuda as compared with 19 percent in the rest of the region. More than 80 percent of the Or Yehuda deaths among babies with good birth weight came from this group.

The pattern, however, did hint at potentially preventable deaths, with severe social deficiencies that might influence behavior during pregnancy and child rearing contributing to the high infant mortality. There are limitations to the influence of medical care systems, optimal as they may be, in the face of these deficiencies. While it is unlikely that health system intervention will remove these problems, it may be able to ameliorate their effects. The Ramat Gan area was the model for the entire project, and an active intervention program has been in place since 1982. The Or Yehuda program aims and strategies, as well as some of the implementation elements, are shown in figures 8-10.

An overview of the current situation reveals yearly infant mortality rates in Or Yehuda to date and is presented in figure 11. The yearly rates are unstable, based as they are on only 500 births. The intervention program began at the end of 1981. In 1982, the rate in Or Yehuda decreased. Last year, there was only one infant death among the live births in the community, and there has been only one death to date in 1985. The comparison standard rates for the rest of the region are as yet unavailable, and these must be used to properly evaluate change. The mortality rates are not the only criteria for program evaluation, and other outcome and process indices are being developed.

Application of Demonstration Project

The Or Yehuda program serves as a model for the national program. The data processing and statistical techniques developed in the analysis of the Ramat Gan regional prototype are being applied for all six regions. Analysis of population risk characteristics and characteristic-specific mortality rates are currently underway and will be used for targeting intervention.

Thirty-six other communities among the study regions have been identified as having excess infant mortality according to one or more of the predefined criteria. The regional working parties have developed their own situation analyses on the basis of data provided and local information. They have prepared tentative intervention programs according to local problems, priorities, and feasibility.

The central working party is responsible for standard setting in data analysis and for coordination and guidance of the regional committees. The locally developed planning program in Or Yehuda, using epidemiological techniques to identify public health problems and target populations, has become the model for the National Infant Mortality Differential Project, and both are developing along the lines of a planning cycle. Change takes place in a real-world environment, with different sponsors of medical care, different levels of proficiency among medical and nursing care givers, and very different population needs within each region.

Table 1. Infant mortality rate, by cause of death, for Jews and non-Jews: 1977-80

Cause of death	Jews	Non-Jews	Relative risk
Total births	282,364	93,584	---
All causes	13.1	26.3	*2.0
All infections	1.3	7.3	*5.6
Congenital anomalies	3.7	6.2	*1.7
Maternal and obstetric causes	1.9	2.0	1.1
Prematurity index	3.5	4.1	1.2
Other perinatal conditions	0.9	1.5	*1.7
Other diseases	0.7	1.7	*2.4
Accidents and adverse effects	0.2	0.7	*3.5
Ill-defined conditions	0.9	2.8	*3.1

NOTE: * = $p \leq 0.05$

Table 2. Infant mortality rate per 1,000 live births: 1977-80 average

Age at death	Or Yehuda	Rest of region	Rate ratio
Number of births	2,037	24,675	---
Total infant mortality	19.1	10.3	1.85
Early neonatal	10.3	5.9	1.74
Late neonatal	1.4	1.3	1.08
Post-neonatal	7.4	3.1	2.39

Table 3. Risk factors (percent of all births): 1977-80

Risk factor	Or Yehuda	Rest of region
Maternal education 0-8 years	41.3	8.1
Maternal age 19 years and under	8.7	1.7
Birth order 4 or higher	17.1	17.7[1]
Birth weight less than 2,500 grams	7.5	6.1

[1]Not including Bnei Brak, an ultra-orthodox area with 36 percent birth order of 4 or higher.

Table 4. Infant mortality rate, by number of risk factors: 1977-80

Number of risk factors	Or Yehuda		Rest of region	
	Percent	IMR	Percent	IMR
All births	100	19.1	100	10.3
0	0.5	0.0	3.6	3.1
1	4.5		19.9	
2	12.4	4.3	32.0	4.5
3	22.9	4.7	25.3	4.6
4	28.9	9.2	13.3	6.5
5	22.5	11.9	5.0	7.7
6 or more	8.3	25.8	0.8	10.4

NOTES: Live births of 2,500 grams or more. N = 2,037 for Or Yehuda. N = 24,675 for rest of region. IMR = infant mortality rate.

Identification of communities/regions with excess infant mortality
Description of high-rate communities
Identification of target populations
Analysis of factors contributing to excess mortality

Development and implementation of intervention programs
Evaluation of intervention outcome

Figure 1. National program aims

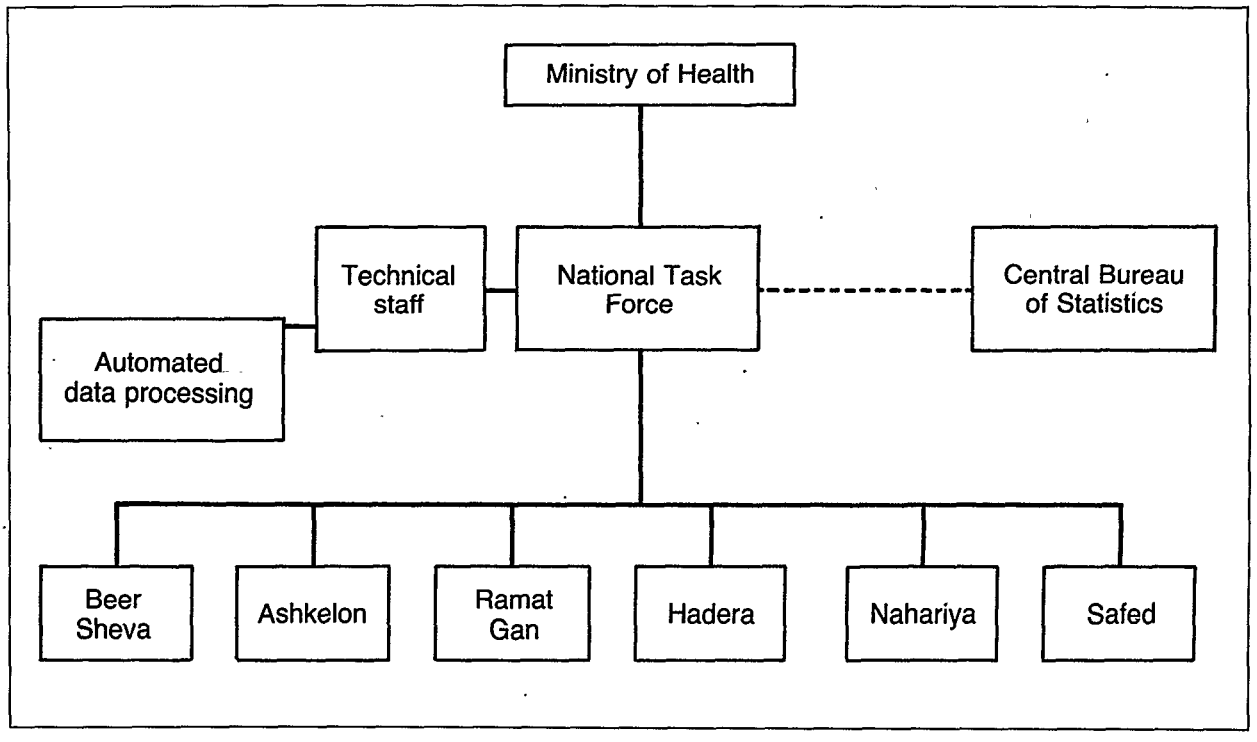


Figure 2. Organizational chart: Israel National Program on Infant Mortality Differentials

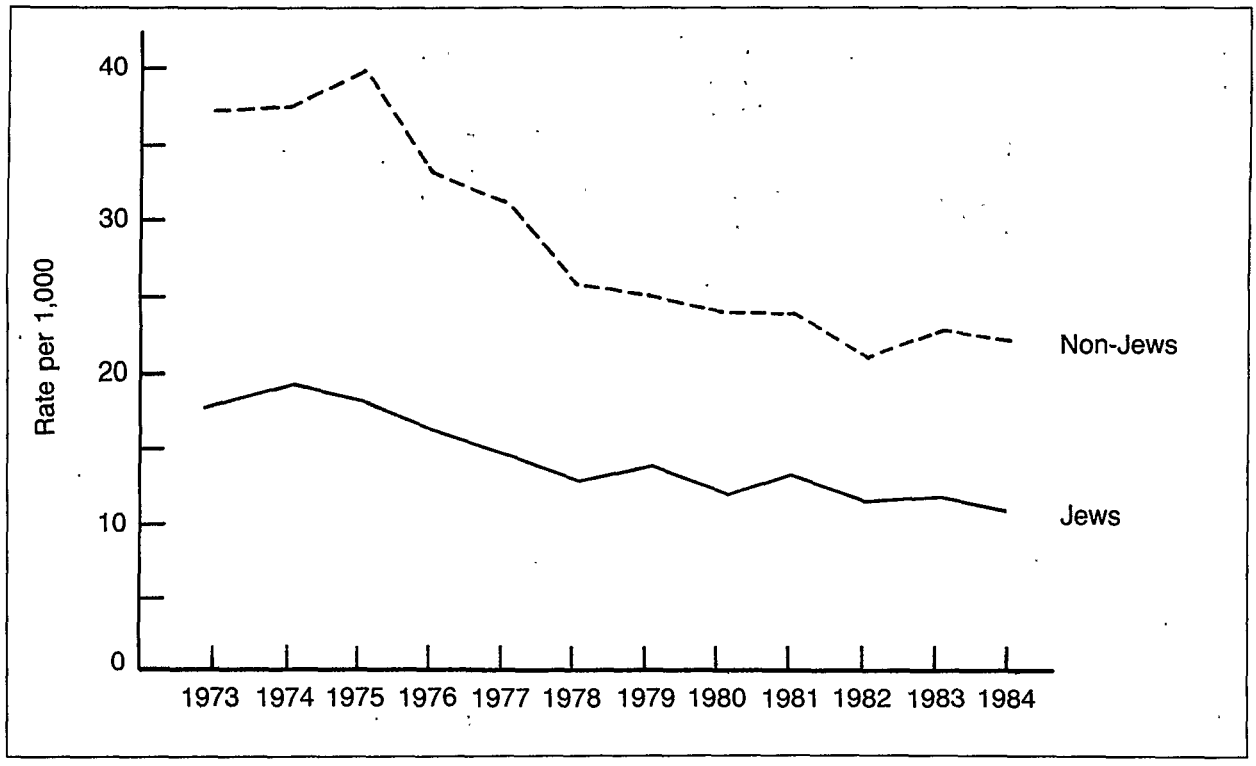


Figure 3. Infant mortality rate in Israel: 1973–84

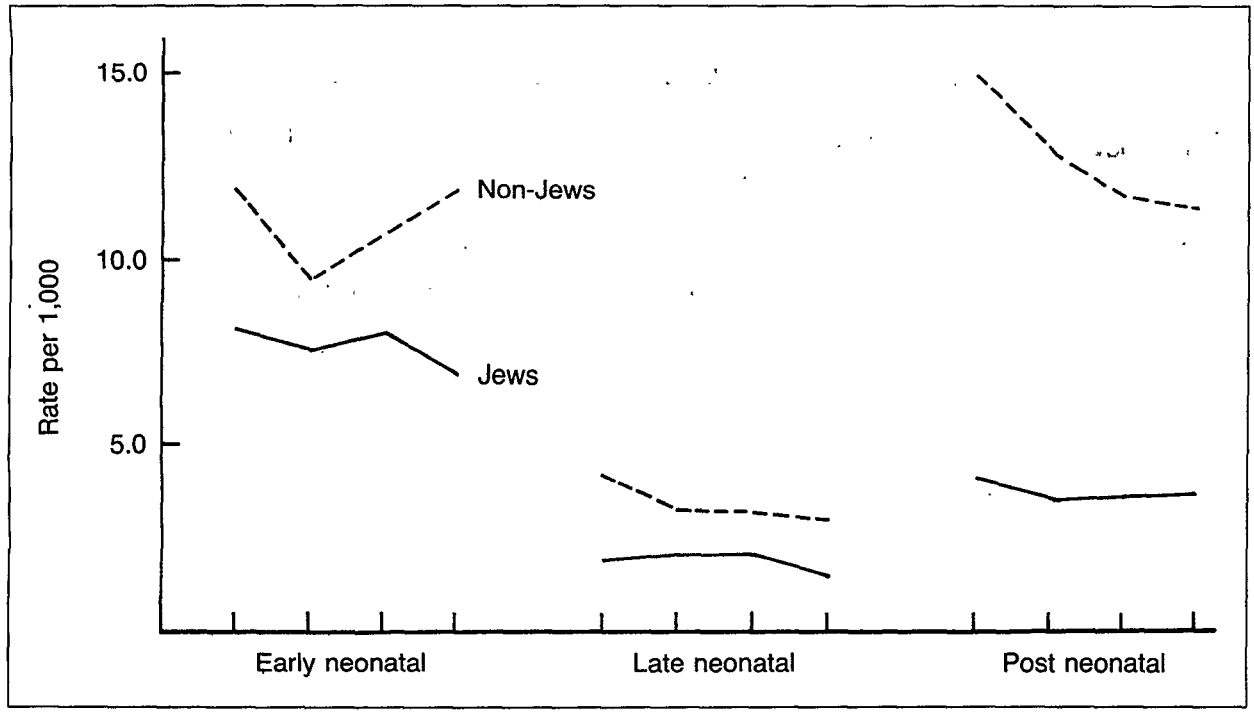


Figure 4. Infant mortality rate by age for Jews and non-Jews in Israel: 1977–80

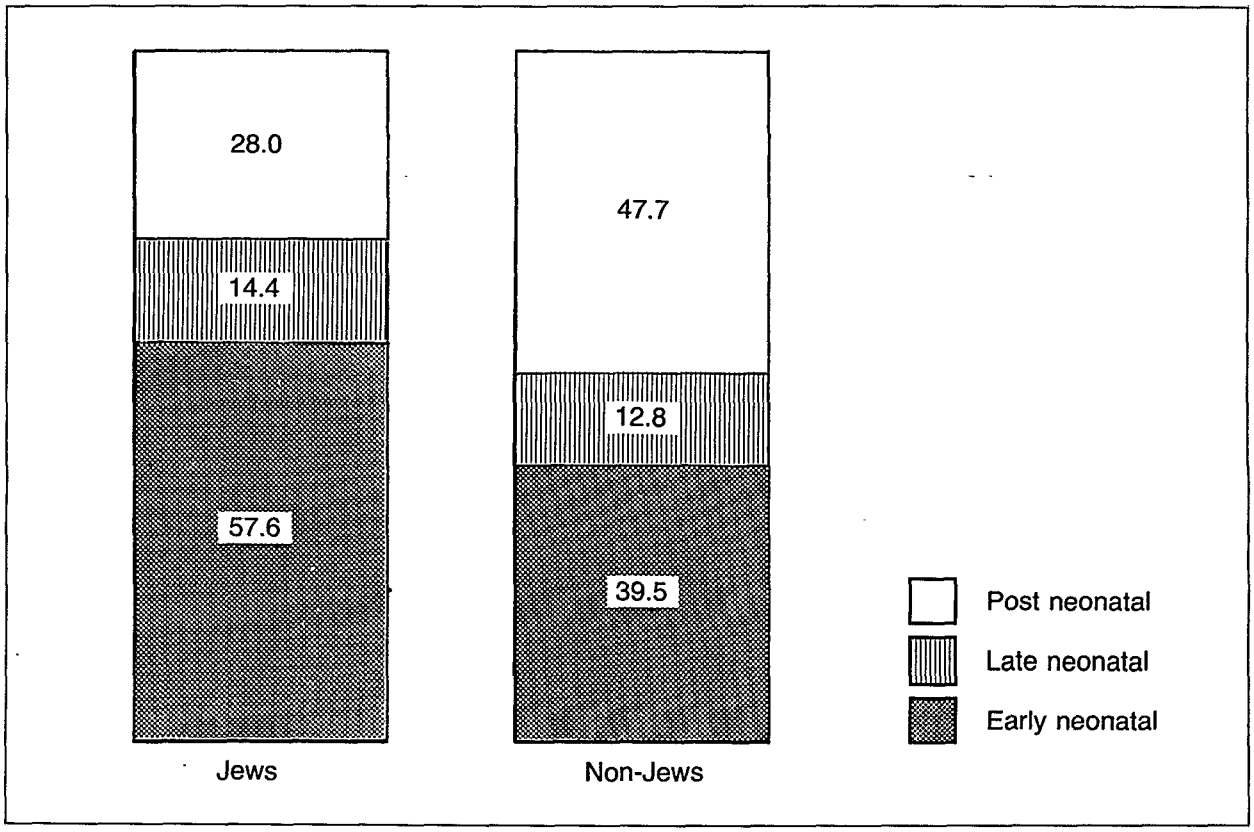


Figure 5. Percent of all infant deaths in Israel: 1977–80

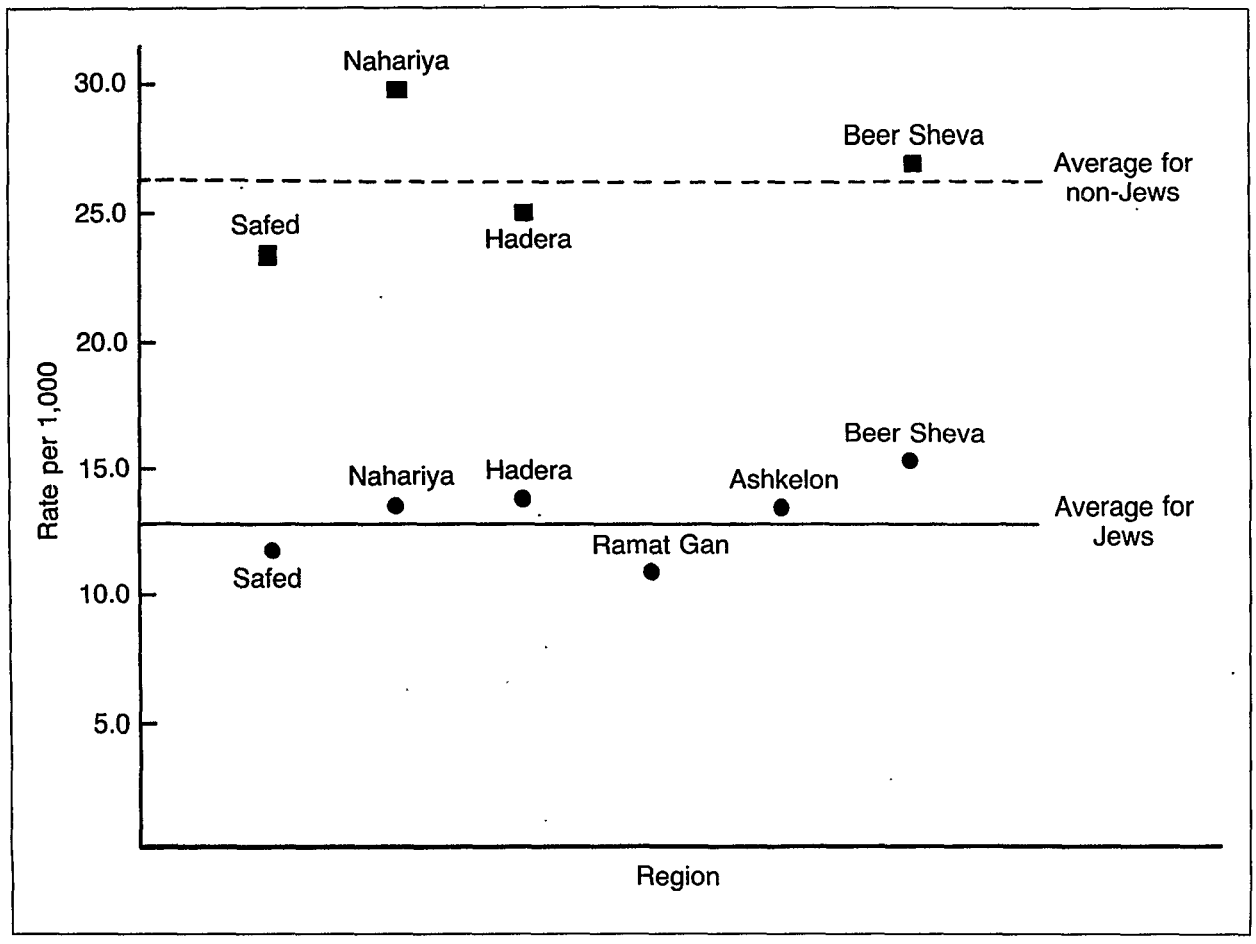


Figure 6. Infant mortality rate, by region: Israel, 1977–80

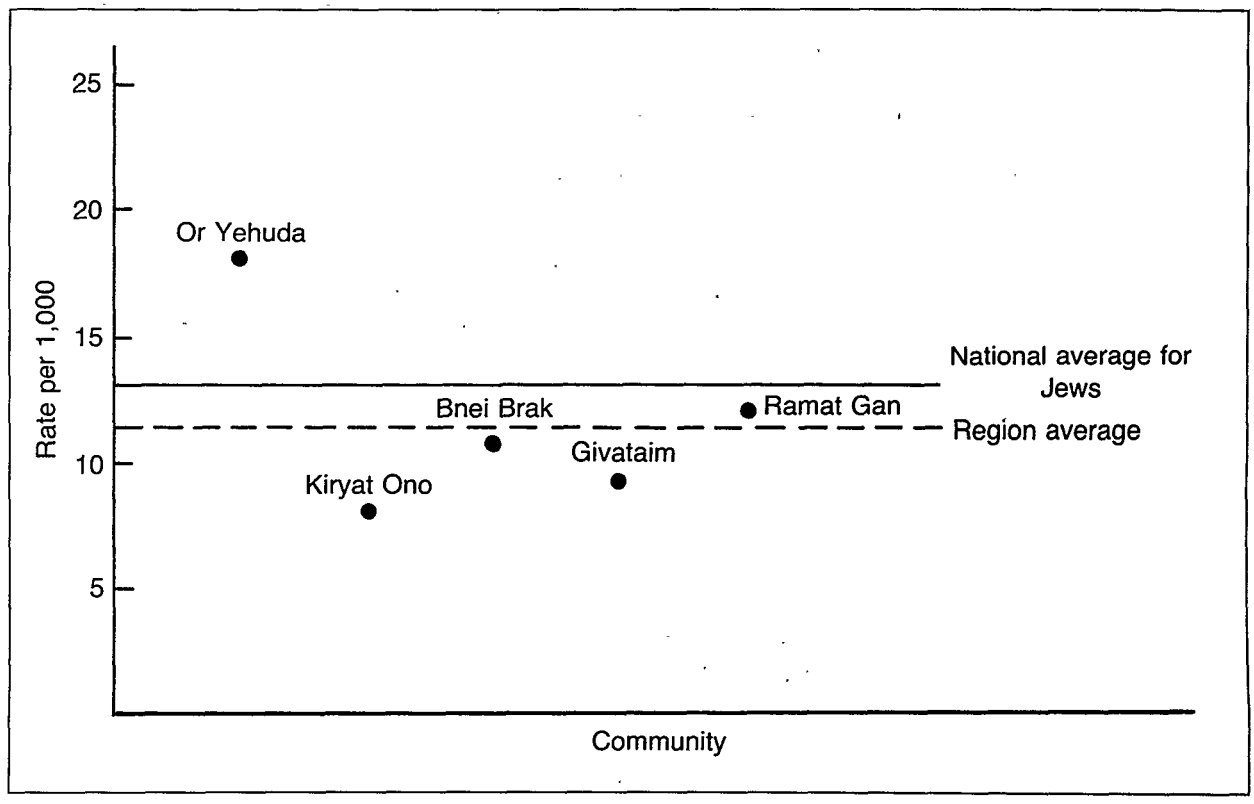


Figure 7. Infant mortality rate in Ramat Gan region: 1977–80

Situation analysis:

- Statistical analysis of births and deaths
- Epidemiological investigation of deaths
- Joint infant mortality conference

Intervention program:

- Reduction of Or Yehuda infant mortality rate
- Promotion of continuity of care and appropriate medical management

Figure 8. Or Yehuda program aims

Increase primary care capabilities:

- Monitoring mother and child care
- Accessibility of all relevant patient data
- Identification of population risk factors
- Identification and followup of high-risk cases

Integration of health systems:

- Increase in transfer of information
- Integration of hospital with primary clinics
- Coordination between pediatric and obstetric services

Figure 9. Or Yehuda program strategy

Increase in local autonomy in resource allocation
Joint forum for program management
Catalyst—service sponsors outside health sector

Hospital obstetric staff—community gynecology clinics
Board-certified pediatric—half-time hospital and community
Public Health nurses added—direct community service

Fetal monitor in community clinic
Access to ultrasound
Serum alpha fetoprotein

Psychologist
Particularized health education programs

Figure 10. Or Yehuda implementation elements

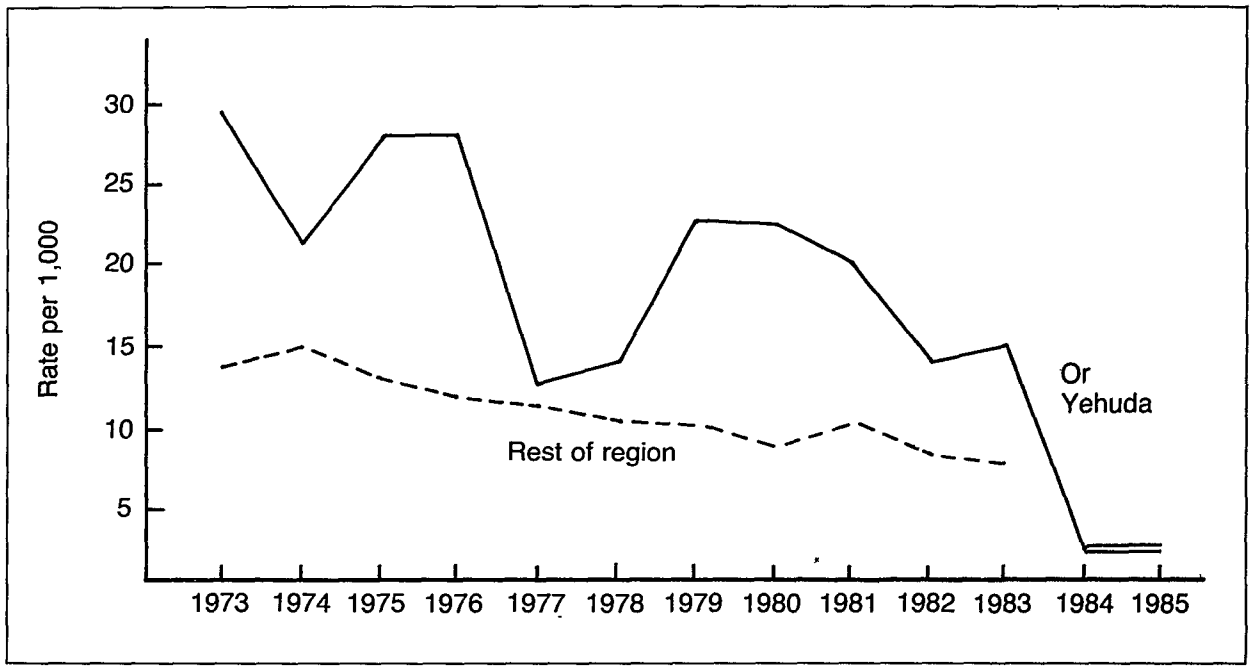
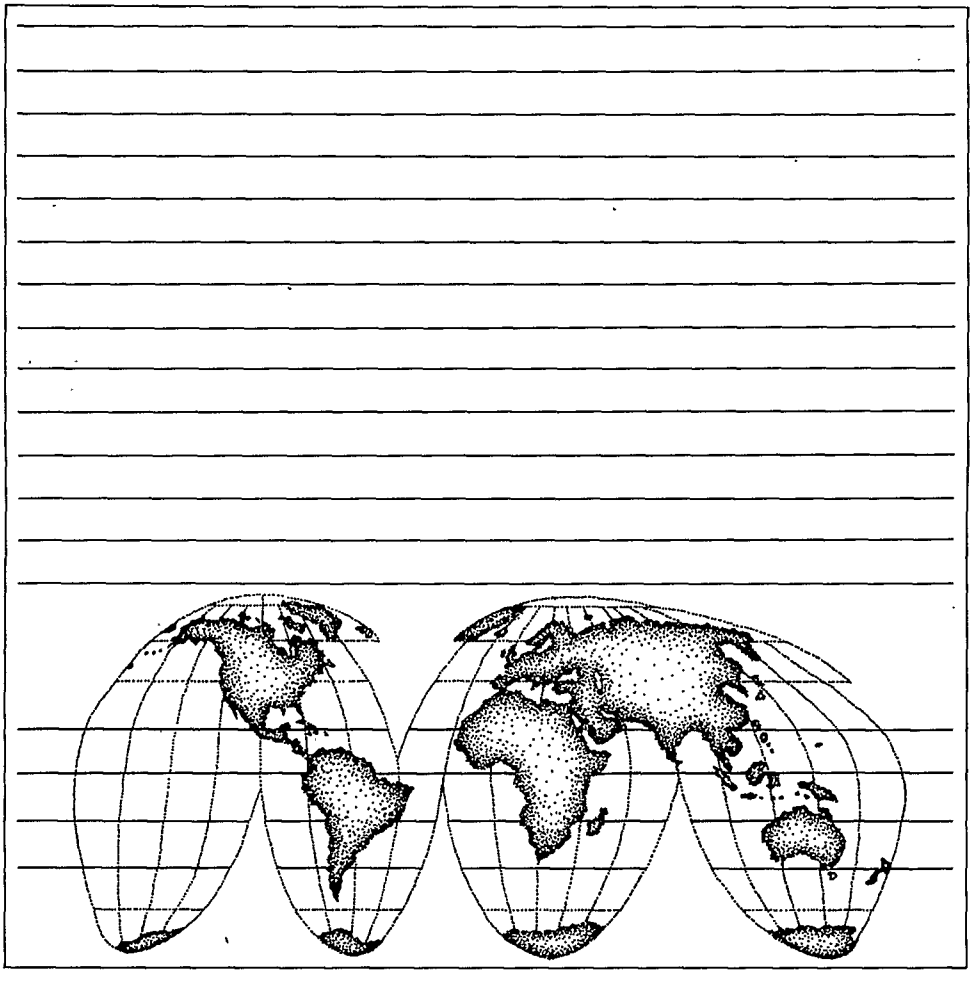


Figure 11. Infant mortality rate per 1,000 live births: 1973–85



Chapter II: Methodology

Perinatal Audit Experience in Norway: A Model for International Application

by Leiv S. Bakketeig, M.D., Per Bergsjø, M.D., and Karl-Erik Larssen, M.D.

The Scandinavian countries have a record for having some of the lowest perinatal mortality rates. Among the three Scandinavian countries--Denmark, Norway, and Sweden--Norway has the least favorable rates. The development of perinatal mortality rates over the last decade or so is shown in table 1. Sweden shows the most favorable rates over the whole period and even has the most impressive decline during this period. In 1983, the perinatal mortality was more than 30 percent lower in Sweden as compared to Norway.

Comparisons of birth weight-specific perinatal mortality rates among these three countries are shown in figure 1. The rates are shown for the year 1982 for Denmark, Norway, and Sweden. It appears that mortality is consistently higher in Norway than in the two other countries for each of the weight categories. For example, for average-sized births (weighing more than 3,000 grams), the perinatal mortality is 50 percent higher in Norway than in Sweden. These differences in perinatal mortality rates are mainly due to differences in the stillbirth rates among the three countries, as shown in figure 2. In these comparisons, the standard definition of stillbirth has been used (fetal death aged 28 weeks or more). It should also be mentioned that birth weight-specific comparisons are justified and valid among the Scandinavian countries, since the underlying birth weight distributions are very similar indeed.

If we accept that the shown differences in mortality in these three countries are most likely due to real differences, what then could account for them? Well, in principle, the differences could be explained in three different ways or through a combination of these three:

- The childbearing population could differ biologically among the three countries;
- The habits of living, the psychosocial environment, or the environment at large could differ; or finally,
- The perinatal care which is being offered and being utilized by the women and their newborns could also differ.

We do not have reason to believe that there exist any important biological differences among the fertile female populations in the three countries. We do not know enough about differences in habits of living, but from what is known--for example, about smoking habits--we have little evidence of any considerable differences of this kind among the three populations. Finally, we come to the

medical or perinatal care available in the three countries. There has been and continues to be much speculation as to whether the organization and content of perinatal care can explain the mortality differences, at least partly.

Attention has been focused, in particular, on two features of perinatal care. The first feature to be examined is the organization and context of antenatal care. This care has, until now, been rather loosely organized in Norway. The general practitioners have been in charge of the care, and until recently no real attempt to standardize the content of care has been made. In contrast, in Sweden and also to some extent in Denmark, the antenatal care is organized through maternity centers where the midwives play a key role as care providers, assisted by general practitioners, obstetricians, and other specialized personnel, with strict guidelines for the content of care, including guidelines for referrals among different levels of care.

The second feature to be discussed is the delivery services and the neonatal services, which have been examined in an attempt to explain the differences in mortality. These parts of perinatal care are more centralized in Sweden. In Denmark, due to geography, even though the deliveries do not necessarily occur in the larger hospitals, the distance to the nearest more specialized obstetrical and neonatal services is less crucial.

In Norway, even though practically all births occur in maternity institutions and even though considerable centralization of deliveries has occurred over the last two decades, as shown in table 2, 50 percent of all low birth weight births still take place in institutions without an available neonatal intensive care unit. Referral of high-risk mothers to specialized institutions has become more effective. However, one-third of all low weight births (less than 2,500 grams) and one-fourth of all very low weight births (less than 1,500 grams) still occur in hospitals without a neonatal intensive care unit.

In order to explore the reasons for the relatively poorer perinatal statistics in Norway, the medical audit method has been applied to perinatal care. A perinatal audit was conducted in 1980 based on 1980 perinatal deaths in 5 (of 19) selected counties in Norway (Larssen et al., 1982). For each of the perinatal deaths, all available information was collected for the different levels of care (antenatal, intrapartum, and neonatal care). Additional information on all fetal deaths with gestational age 24 weeks or more and all deaths during the first month after birth was collected using a specially designed form. In each of the participating counties, the data collection was coordinated by a senior pediatrician located at the pediatric department at the central county hospital. A panel of experts reviewed all the available information together with the local coordinating pediatrician. The panel of experts consisted of an obstetrician, a midwife, a pediatrician, and a child pathologist. The panel was chaired by an epidemiologist. A study pediatrician prepared and organized the information and the panel meetings.

The panel members thoroughly reviewed the records and all available documents prior to each panel meeting. The main purpose of the review was to classify the deaths into unavoidable and potentially avoidable deaths. Certain criteria for unavoidable deaths were agreed upon initially, such as lethal malformations, birth weight less than 700 grams, and gestational age less than 26 weeks.

Potentially avoidable deaths were sought and were subgrouped into whether the deaths were potentially avoidable given the available resources (meaning personnel and equipment) or whether the avoidability required additional resources or delivery in a better equipped clinic. The panel reviewed 270 perinatal deaths, which could be shown by linkage with the information in the Medical Birth Registry of Norway to be a complete coverage of all perinatal deaths in the five counties during the actual 12-month period. Of the deaths, 190 (70 percent) were classified as unavoidable. A majority of the remaining 80 deaths were classified as potentially avoidable given the actual setting and the available resources at the place of delivery (65 deaths). Only slightly more than 5 percent of the deaths (or 15 deaths) were considered to be potentially avoidable given more optimal resources or a more appropriate place of delivery. The panel of experts tried to locate the avoidable factors. These avoidable factors were mostly associated with either the antenatal or the neonatal care.

Later, the same Norwegian panel of experts applied the same method to a sample of Swedish perinatal deaths (Eksmyr et al., 1986). Deaths from one average Swedish county were examined, and the deaths were selected from two time periods, one in the first half and one in the latter half of the 1970's. The panel members were not told in which period the deaths occurred. In this way, one could get a closer look at which deaths disappear as the mortality drops, as it certainly did in Sweden during the 1970's. Also, this audit made it possible to compare perinatal deaths between the two countries.

The main findings are illustrated in table 3. Of the deaths in the first time period, 47 percent were considered potentially avoidable, while this proportion in the latter period had dropped to 14 percent. As shown in table 3, the rate of unavoidable deaths did not change very much (as expected) from the first period to the latter. The unavoidable stillbirths became somewhat fewer, but this could be ascribed to prenatal diagnoses and the use of induced abortions. The rate of unavoidable perinatal deaths was moderately reduced from 7.3 per 1,000 to 6.2 per 1,000. The potentially avoidable stillbirths and early neonatal deaths, however, were dramatically reduced, and the rate of such deaths dropped significantly from 6.4 to 1.0 per 1,000 from the first to the latter period.

The reduction in potentially avoidable deaths occurred in all weight groups, and deaths weighing more than 2,500 grams had nearly disappeared completely. The deaths that particularly had disappeared were deaths which might be due to insufficient followup during antenatal care, deaths associated with delayed transfers, and deaths due to inadequately performed ventilatory treatment. These also were the deaths that were observed in the Norwegian audit, but which in comparison had disappeared in the latest period in the Swedish county.

In conclusion, we believe one can learn from comparative studies of this type. International comparisons of perinatal outcomes might be enhanced by the use of similar medical audit approaches. An international perinatal audit could be organized in a manner similar to the Norwegian/Swedish one presented here or, for example, through an internationally composed panel of experts or some combination of these approaches. Based on new available data sets, international comparisons of perinatal outcome statistics obviously will become more sophisticated. However, in order to enhance our understanding of the differences and their explanations, we will need to get beyond statistical

comparisons, and here the audit method has an interesting potential. In addition, we have devised a model for descriptive comparisons that we also believe would be useful in improving our knowledge of international differences and the reasons for these variations (exhibit A).

References

Eksmyr, R., K.-E. Larssen, L. S. Bakketeig, et al. 1986. Perinatal mortality in a Swedish county, 1973-1978, Time trends revealed by Perinatal Audit. Acta Pediatr. Scand. 75:17-23.

Larssen, K.-E., L. S. Bakketeig, P. Bergsjø, et al. 1982. Perinatal Audit in Norway, 1980. NIS Report 7/82. Trondheim, Norway.

Table 1. Perinatal mortality rates in the Scandinavian countries: 1971-83

Time period	Perinatal deaths per 1,000 births		
	Denmark	Norway	Sweden
1971-75	14.9	16.4	13.7
1976-80	10.6	12.0	9.7
1981	9.0	9.6	7.7
1982	8.7	9.8	7.8
1983	9.0	9.6	7.3
Percent reduction	40	41	47

SOURCE: NOMESCO. 1985. Health Statistics in the Nordic Countires. No. 22. Copenhagen.

Table 2. Changes over time in the proportion of low birth weight births born at maternity institutions, by level of neonatal care available: Norway, 1973-81

Neonatal care	Proportion of births					
	1973-75			1979-81		
	Total	<1,250 grams	1,250-2,499 grams	Total	<1,250 grams	1,250-2,499 grams
	Percent					
None	38	38	29	22	8	14
Pediatrician daytime	22	17	22	15	7	11
Pediatric department without intensive care unit	28	36	32	13	9	12
Pediatric department with intensive care unit	13	19	17	50	76	64

Table 3. Potentially avoidable perinatal deaths in a Swedish county in two time periods: 1973-75 and 1976-78

Item	1973-75	1976-78
	Percent	
Potentially avoidable deaths	47	14
	Rate	
Rate of unavoidable deaths per 1,000	7.3	6.2
Rate of potentially avoidable deaths per 1,000	6.4	1.0

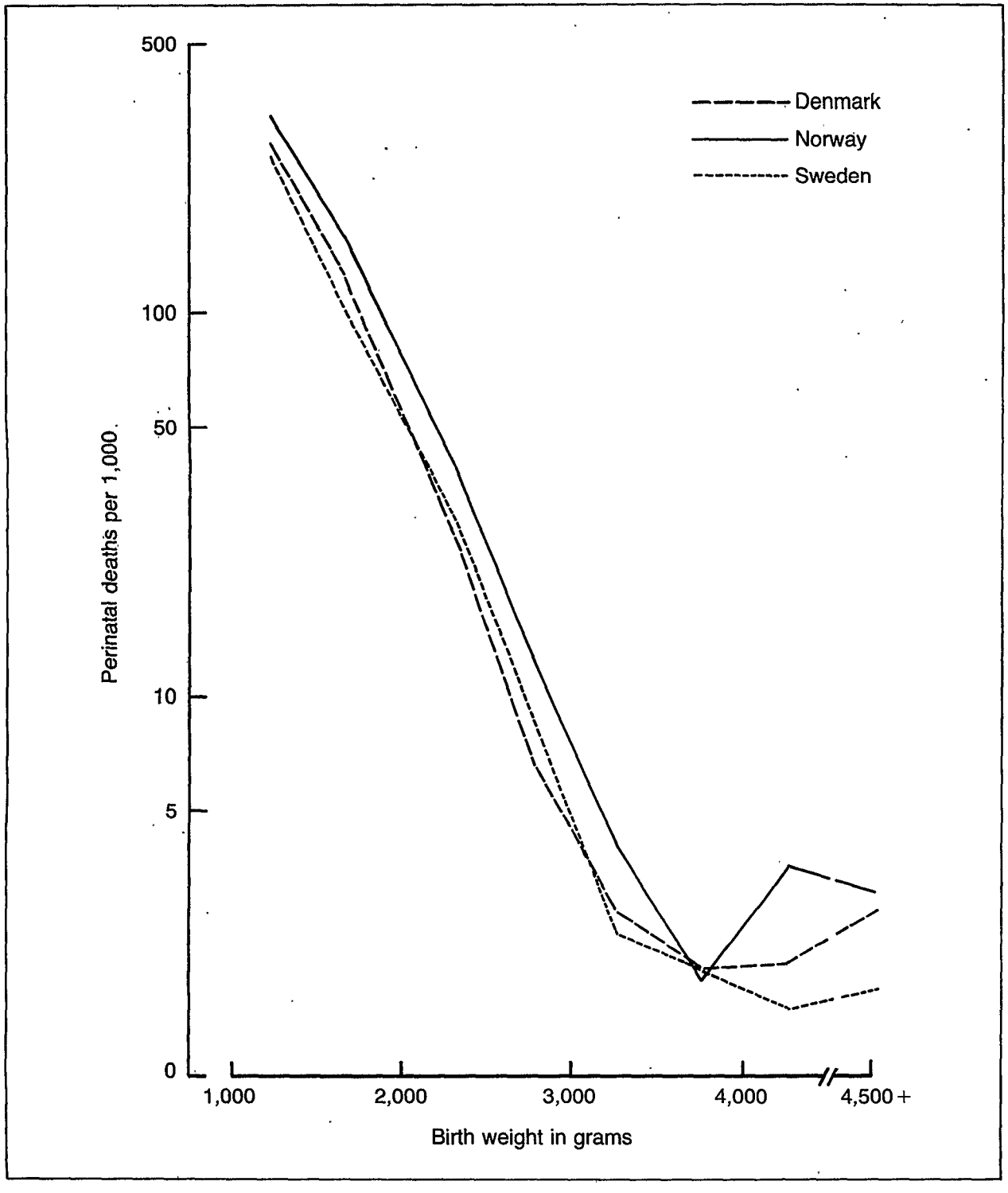


Figure 1. Birth weight-specific perinatal mortality rates in the Scandinavian countries: 1982

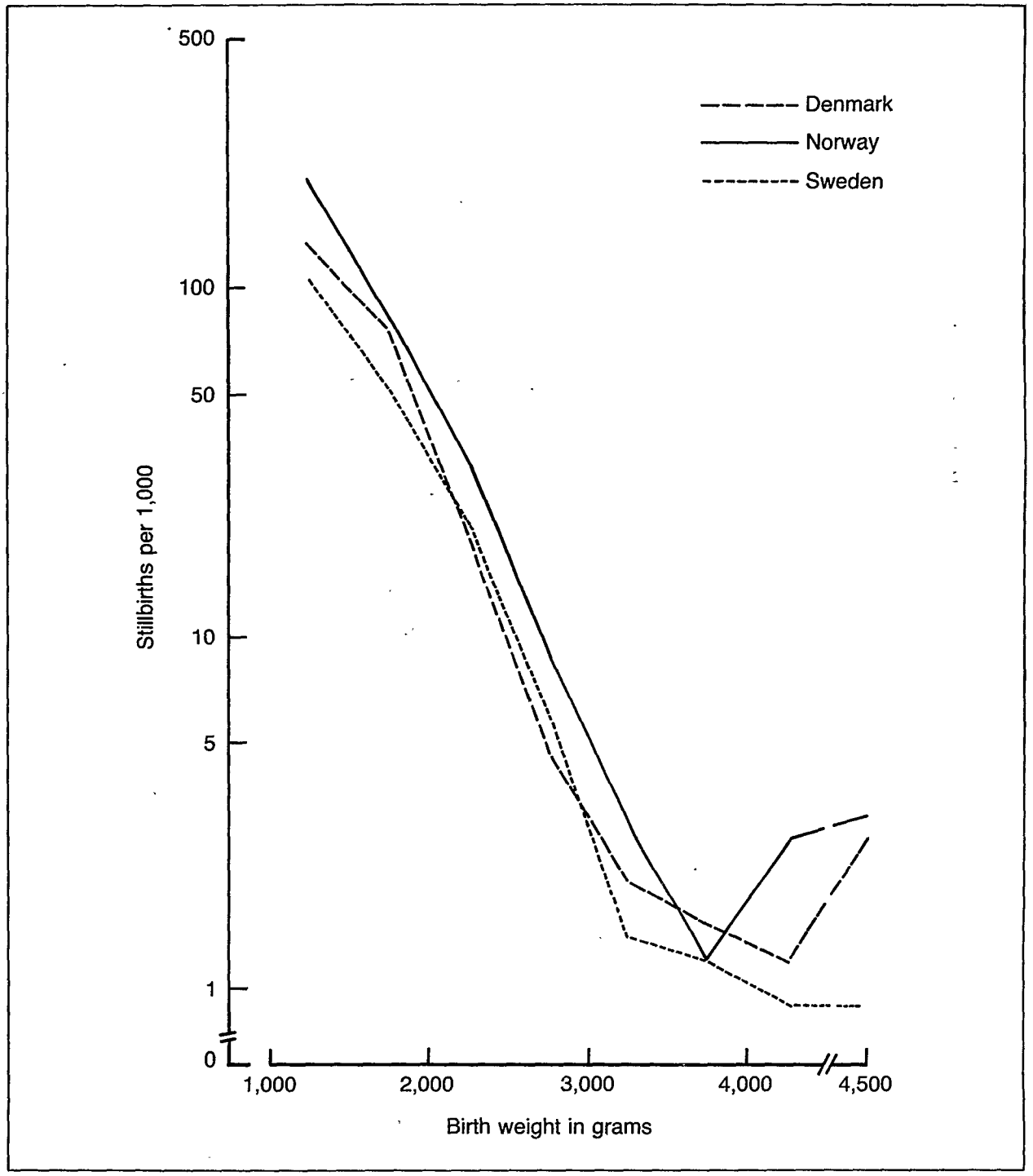


Figure 2. Birth weight-specific stillbirth rates in the Scandinavian countries: 1982

Exhibit A

Suggested Model for Descriptive Comparison of National (or State) Perinatal Care Systems

1. HISTORICAL OUTLINE

Brief description of transition of maternal and child care, with advent of antenatal care, change from home to hospital birth, and increasing emphasis on neonatal intensive care. Changing roles of birth attendants, midwives, doctors to present day structure. Key names, years, time periods, statistics as appropriate.

2. FORMAL ORGANIZATIONAL FRAME

2.1 Laws and regulations

Laws, paragraphs, rules and regulations concerning pregnancy, birth and the neonatal period possibly including infancy. Is there a collective law covering the whole perinatal period, or are the pertinent rules scattered in the national legal code?

2.1.1 Pre-pregnancy

Restrictions on marriage: Consanguinity, venereal disease, artificial insemination by donor, IVF-embryo transfer, other.

2.1.2 Pregnancy

Law on abortion, blood tests (venereal disease), genetic fetal diagnostics. Legal rights on employment and work conditions. Antenatal care: organizational content. Law on midwives, doctors (if perinatal care is specified).

2.1.3 Birth

Organization, right to hospital birth, right to proper care in home birth. Formal advice, responsibility for structure.

Women's right to professional help in labor, right to pain relief, right to presence of husband/father, others.

Other rights of choice

Guidelines for size, staffing and equipment of birth institutions: Official or professional?

2.1.4 Post partum

Newborn eye prophylaxis (silver nitrate). Vital measurement registration, by decree or medical tradition?

Parents' responsibility for their children. Regulations on newborn intensive care, in particular for very low birth weight babies.

Professional home visits (nurses).

Prophylactic measure on newborns and infants: Clinical examination, vaccination, other.

2.1.5 Obligatory notifications

Brief outline only. See also 3.1.5, 4.2.3, 5.2.5, 5.3.4 and 6.
Describe forms and systems: to whom?
Birth notification: civic/medical
Special notification of out-of-wedlock birth, special
Conditions of newborn
Acknowledgment of paternity

2.2 Economic and other support

2.2.1 Pregnancy and post partum leave (see also 2.1.2)

2.2.2 Sick insurance coverage

Rules for sick leave
Coverage of antenatal care
National or private systems

2.2.3 Economic support during pregnancy and birth

To all, to groups in special need (single mothers, other), to none. Forms of support.

2.2.4 Other parents' rights

Right for pregnant women to be transferred to other (non-risk) work. Right to return to previous work-places after birth. Right to breaks for nursing child during working hours? Fathers' work leave at and after birth?

2.3 Official steering and supervision

Responsibility of governing bodies on all levels by law or decree. Person(s) or office (ministry) responsible.

2.3.1 On national (Federal) level

2.3.2 On county or state (U.S., FRG) level

2.3.3 On lower administrative levels: commune, county (U.S.).
(See comment on administrative subdivisions.)

2.3.4 Personal responsibility
Law enforcement of maintenance of professional competence

2.3.5 Official bodies, other than governmental

Social security system
Work supervision system
Trade or labor unions

2.3.6 Official supervision of medical (technical) equipment

2.4 Personnel categories

With brief outline of educational requirement.

Relative distribution (availability) in antenatal, birth, post partum and neonatal care.

Supply population-related figures, if possible.

2.4.1 Doctors

General practitioners
Obstetricians/gynecologists
Pediatricians/neonatologists
Anesthesiologists

2.4.2 Midwives

2.4.3 Others

Infant nurses, intensive care nurses, anesthesiology nurses, traditional birth attendants, others

3. ANTENATAL CARE

3.1 Medical care

3.1.1 Organization

Rigid framework based on a formalized system (monopolistic), loose structure (pluralistic) or intermediate (see Comment)

Localization: private (M.D.) offices, hospital outpatient clinics, special care centers

Personnel

Assignment, relative shares (elaboration of 2.4 with regard to antenatal care)

Obstetrician/gynecologist specialists
Other specialists
General practitioners
Midwives
Other

Shared care - continuity of care

3.1.2 Referral systems

Risk evaluation, formalized or based on individual judgement
Referral system - cooperative or competitive

Laboratory facilities and use

3.1.3 Examination schedule and attendance

Uniform or based on risk evaluation
Parity differences?

Basis for schedule:

Government rule or advice
Medical advice - learned society, medical school, textbook?

Attendance rates

Economic incentive for attendance?

Systems for increasing attendance?
Person-oriented?
Media - recommendations?

3.1.4 Medical content

a. Initial visit: Civil status, education, employment

Consanguinity, genetic risks
Medical history. Past pregnancies.
Present pregnancy. Life style (habits)
Medication
Particulars about spouse/partner
Examination: General, local (gyn)
Lab tests (routine)
Advice - information: Life style, food, iron intake, other prophylactics

b. Later visits: History
Examination
Lab tests

c. Genetic counselling: Policy, diagnostics (availability), coverage, cost

d. Screening procedures
Syphilis
Ultrasound
Rubella

Diabetes
Cytology (Pap smear)
Blood groups - antibodies
Sickle cell, Thalassemia
Neural tube defects
Others

e. Planning for delivery

Normal cases - risk cases
Continuity of care from antenatal to birth situation

f. Special policies

Extent of AID - artificial insemination by donor
Extent of IVF - in vitro fertilization and embryo transfer

3.1.5 Antenatal record form

National standard/local standards
Attach copy (copies) as Appendix

3.2 Other antenatal preparatory activities

Content, attendance, personnel involved

3.2.1 Antenatal classes

3.2.2 Other

Conversation groups
Guidance by psychologist, social workers, others

4. BIRTH

4.1 Organization

Implementation of 2.1.3
Distribution of hospital (institution) versus home births
Special group pressure towards alternative birthing

4.1.1 Birth institutions

Numbers, sizes, classification (degree of specialization)

4.1.2 Capacity

Beds per population unit, or by reproduction index

4.1.3 Personnel, equipment, availability
Personnel categories, by size of institution

Doctors - Obstetricians/residents
Anesthesiologists
Pediatricians (neonatologists)
Other specialists

Midwives, nurses, special care nurses

Equipment for surveillance, delivery, analgesia/anesthesia, laboratory services

Availability: round the clock/daytime only/occasionally/never

Outline responsibilities and relative share of work of the different personnel categories (elaboration of 2.4 with regard to delivery services), i.e., who conducts normal labor and delivery? Are midwives permitted to perform operative deliveries? Whose presence is required in normal/complicated cases?

4.1.4 Policy and work routines

Person(s) of mother's choice permitted to be present at normal/complicated (operative) birth? Official or local rules?
Choice of birth position?
Policy concerning pubic shaving, enema
Labor rooms and delivery rooms separated?
Single or multiple bed labor/delivery rooms?
Continuous presence of other person (lay or professional) during labor required?
Continuity of care - labor, delivery, post partum?
Policy for mother-child bonding

4.2 Medical content

4.2.1 Extent of use of intensive electronic monitoring

Policy for:
breech presentation
twin births
previous Cesarean section
handling of post term pregnancy
induction by oxytocics
Preference for vacuum extraction/forceps delivery
Frequency of vaginal examinations
Use of anesthesia/analgesia
Episiotomy, stitching
Delivery of the placenta
Immediate care of newborn - washing/eye prophylaxis

4.2.2 Transfer of mothers in labor

Policy and systems for transfer to hospital/between hospitals

4.2.3 Birth record form

National standard/local standard
Attach copy (copies) as Appendix

5. POST PARTUM - MOTHER AND CHILD

5.1 Organization in obstetrical department

Some items will be covered in 4.1
Organization of neonatal intensive care - see 5.3.1

5.1.1 Duration of post partum stay

Uncomplicated cases: Parity considerations?
Complicated cases - well babies
Cesarean section
Other

5.1.2 Work routines

Rooming-in for mothers and newborns
Round the clock/daytime only
Newborn feeding schedules - by clock/by demand?

5.1.3 Visiting hours

Restricted or flexible?
Special policy for fathers/siblings?

5.1.4 Policy for care of newborns

Mother's participation
Father's participation
Instruction of parents

5.2 Content

5.2.1 Breast-feeding

Policy, compliance (statistics?)

5.2.2 Preparation for homecoming

On care of child
On contraception
Individual/class preparation

5.2.3 Physiotherapy

5.2.4 Medical content

Diet, medication, other

5.2.5 Record form

Discharge record form, information on mother and child not covered by 4.2.3
Attach copy as Appendix

5.3 Neonatal intensive care

5.3.1 Organization

Separate pediatric units or units within obstetrical department
Proximity to obstetrical department
Policy for transfer
Mode of transfer
Frequency of transfer

5.3.2 Bonding policy

Contact parents-child during intensive care
Mother's milk

5.3.3 Medical decision, content

Rules for application of resuscitation and intensive care
by weight
length of gestation
malformations
other

5.3.4 Neonatal intensive care form

Examination and treatment form
Transfer form
Attach copy (copies) as Appendix

6. INFORMATION AND EVALUATION SYSTEMS

6.1 Notification of birth (see also 2.1.5)

6.1.1 Legal requirements for notification

6.1.2 Civil registration systems

To which authorities at which level(s)
a. live births
b. stillbirths
c. neonatal deaths

State definitions concerning required notifications, particularly concerning length of gestation, birth weight, life and death

6.1.3 Medical registration

Medical birth registry, if separate from civil notification authority. Outline scope and content of information.

6.1.4 Other registration systems

If separate from 6.1.2 and 6.1.3
On congenital malformations/all or separate entities
On cerebral palsy
On blindness
On other/at risk cases
State whether central or local administration

6.1.5 Utilization of data from registration systems

Stated objective of 6.1.2, 6.1.3, 6.1.4
Implementation of objectives
Surveillance
Issuing of statistical information, dissemination
Specific feedback to information providers
Scientific use
Ad hoc studies on causation, risk factors, etc.

Educational use
Supply tables and publications if possible

6.2 Notification forms

Describe and attach obligatory forms required by systems 6.1.2, 6.1.3, and 6.1.4, if not already covered by 3.1.5, 4.2.3, 5.2.5 and 5.3.4

6.3 Evaluation of perinatal services

6.3.1 Periodic updates on

Personnel and equipment at birth institutions at neonatal intensive care units

Noninstitutional births

Home births
Transportational births
Other

6.3.2 Perinatal audit

Organized audit systems? Describe data collection, committee structure, work routines, criteria for conclusions, mode of feedback

7. CURRENT CHANGES

Outline specific (government or professional) plans for legal, or care changes. Pressure from political or other groups?

8. ATTACHMENTS

Forms
Key statistical tabulations
Explanatory information (brochures, leaflets, instructions)

9. LITERATURE

List of publications pertaining to national perinatal care systems

COMMENT

I. On administrative subdivisions: Denominations vary from state to state, and furthermore, similar denominations may signify different levels. Suggested guideline for corresponding levels:

a) Federal Republic (U.S., FRG) - Peoples Republic (China) - State (sovereign nation, country)
b) State (U.S., FRG), Province, Semi-autonomous Region (China), no corresponding level in many countries
c) County (U.S., Scandinavia), Commune (China), City commune, Shire (Great Britain)
d) Commune (Scandinavia), Township (U.S., Canada), Work Brigade, City Neighborhood (China)

II. On framework of antenatal care systems: In monopolistic systems, as one extreme, pregnancy care is offered exclusively through health centers and hospital outpatient clinics. In these institutions all personnel are employed by the state or county, antenatal services are not offered by private practitioners on any level. In this system the woman has little or no chance to choose, her place of residence determines which center she will attend. In pluralistic systems, care during pregnancy is offered by doctors and midwives in private practice, and to some extent by institutions. The woman is relatively free to choose the kind of care, and the care provider, she wants. Intermediate systems denote a combination of these two extremes.

III. It is realized that much of the information which this proposed index asks for will be absent or incomplete at the national (or state) level. Clinical routines will vary from place to place within states, but there may be prevailing trends. Furthermore, the desired information will generally not be available from one single source but may require considerable detective work for collection. However, it is felt that such effort will be infinitely rewarding.

Scottish Perinatal Mortality Survey: Results From 1984

by Susan K. Cole, M.D.

The Scottish Perinatal Mortality Survey started as a research project in 1977 (McIlwaine et al., 1979, 1984) and has continued annually since 1979. Its value was formally recognized, and in 1983, when the research grant ended, its continuation was made a service commitment (McIlwaine et al., 1985). Data collection has continued with the cooperation of obstetricians and pediatricians in the 25 specialist obstetrical hospitals or units in Scotland.

When a stillbirth or first-week death is registered, we receive a photocopy of the forms completed by the local registrar of births and deaths. The information allows us to identify the place of stillbirth or death, and a request for further information is sent to the appropriate coordinator. The coordinators are asked to classify all perinatal deaths to an obstetrical classification modified from Baird, Walker, and Thomson (1954) and shown in table 1. The classification is hierarchical, with conditions at the head of the list taking precedence over conditions further down. The clinician is asked to select the underlying event that was responsible for starting the train of events leading to death. The pediatricians are asked in addition to assign a pediatric cause of death (table 2) to the first-week deaths. This classification is based on one devised by Butler and Bonham (1963) and was used in the British Birth Surveys. This classification is also hierarchical.

We request and receive copies of the post mortem report and background histories, case summaries, or copies of discharge letters. These are invaluable for assessing the assignment to the classifications and allow further coding, using International Classification of Diseases codes, within the office. The other essential items of information include birth weight, best estimate of gestation, plurality, and whether stillbirth occurred antepartum or intrapartum.

The perinatal mortality rate (PNMR) in 1984 in Scotland was 10.9 per 1,000 total births, with a singleton PNMR of 9.8 per 1,000 and a multiple PNMR of 64.7 per 1,000.

Using the obstetric classification, it can be seen that 70 percent of all the deaths are accounted for in three groups--fetal abnormality, antepartum hemmorrhage, and the unknown cause low birth weight group (table 3). This latter group consists of pregnancies ending in unexplained intrauterine deaths or in unexplained premature labor. The antepartum hemorrhage and low birth weight groups contain more or less equal numbers of stillbirths and first-week deaths; the fetal abnormality group contains almost three times more first-week deaths than stillbirths, whereas the other groups have more still births than first-week deaths.

There was considerable difficulty in achieving a standard definition that differentiated between the anoxia/trauma and immaturity groups. This was a result of the difficulties in classifying babies who were both immature and asphyxiated at birth. Experience in subsequent years has led to a reduction in the proportion assigned to the asphyxial group and a corresponding increase in the immaturity group.

Of the babies who are born alive, 32.7 percent die of a lethal malformation; 29.7 percent die of problems arising during labor--namely, anoxia or birth trauma; 27.6 percent die of problems associated with immaturity; and about 10 percent are associated with other pediatric factors (table 4). Figure 1 shows how these pediatric groups fit into the obstetric classification.

Birth weight is probably as important a factor in perinatal deaths as congenital anomaly (table 5).

Figure 2 shows the percent distribution of all births compared with the percent distribution of normally formed perinatal deaths. Stillbirths are not particularly associated with birth weight, but the first-week deaths show a high degree of correlation with birth weight.

This survey has demonstrated the significance of data collection efforts and the utilization of data in revealing specific health and risk-related factors.

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Butler, N. R., and D. G. Bonham. 1963. Perinatal Mortality: The First Report of the 1958 British Perinatal Mortality Survey. Edinburgh: Livingstone.

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Table 1. Obstetric classification

Code	Category
(1-7)	CONGENITAL ANOMALY--Any structural or genetic defect incompatible with life or potentially treatable but causing death
1	Central nervous system
2	Cardiovascular system
3	Renal
4	Alimentary
5	Chromosomal
6	Biochemical
7	Other (including multiple)
(8-9)	ISOIMMUNIZATION--Death ascribable to blood group imcompatibility
8	Blood group incompatibility
9	Hydrops unexplained
(10-11)	PREGNANCY HYPERTENSION--In deaths with antepartum hemorrhage (APH) secondary to toxemia, classify toxemia first and APH second
10	Severe--diastolic of 90 mm Hg or more on two or more occasions after 20 weeks with proteinuria of 2 g per liter or more
11	Other toxemia (increased blood pressure without or with only a trace of proteinuria)
(12-14)	ANTEPARTUM HEMORRHAGE--(See note on hypertension)
12	Abruptio placentae
13	Placenta praevia
14	Other APH (with evidence of recurrent bleeding after the first trimester)
(15-17)	TRAUMA--Any death from uterine rupture, cord compression, birth trauma, or intrapartum asphyxia that is associated with disproportion, malpresentation, or breech delivery in babies of $\geq$ 1800 g. Deaths from anoxia or cerebral trauma should be classified as "unexplained" (codes 24-27) if there is no evidence of difficulty in labor. Antepartum deaths associated with cord entanglement in the absence of strong circumstantial evidence that cord compression caused death (e.g., fetal death soon after external version) should be classified to "unexplained" (codes 24-27)
15	Breech
16	Cord prolapse
17	Other trauma

(18-22)	MATERNAL DISORDER
18	Maternal trauma
19	Essential hypertension
20	Diabetes
21	Abdominal operations in pregnancy
22	Other
(23)	OTHER OBSTETRIC FACTORS
23	(Specify)
(24-27)	UNEXPLAINED
24	Birth weight $<$ 2,500 g before 37 weeks
25	Birth weight $<$ 2,500 g at 37 weeks or over
26	Birth weight $\geq$ 2,500 g before 37 weeks
27	Birth weight $\geq$ 2,500 g at 37 weeks or over
(28)	POSTNATAL CAUSE ONLY
28	

Table 2. Pediatric classification

Code	Category
(1-7)	CONGENITAL ANOMALY (See obstetric classification)
1	Central nervous system
2	Cerebrovascular system
3	Renal
4	Alimentary
5	Chromosomal
6	Biochemical
7	Other (including multiple)
(8-9)	ISOIMMUNIZATION
8	Rhesus
9	Hydrops unexplained
(10-11)	INTRAUTERINE ANOXIA
10	Antepartum
11	Intrapartum
12	Not known whether 10 or 11
(13)	BIRTH TRAUMA--e.g., serious damage to falx, great cerebral vein, or cervical spine in the absence of clinical or post mortem evidence of severe fetal anoxia.
13	(Specify)
(14)	IMMATURITY < 24 WEEKS
14	Structural lung immaturity sufficient to render ventilation impossible
(15-17)	HYALINE MEMBRANE DISEASE (HMD)
15	With significant intraventricular hemorrhage (IVH) (grade III or IV)
16	With infection
17	HMD without significant IVH or infection
(18-25)	HEMORRHAGE
18	IVH (in the absence of potentially lethal HMD)
19	IVH (in a baby who never had HMD)
20	Subarachnoid hemorrhage
21	Subdural hemorrhage
22	Intracerebral hemorrhage (If 20-22 are thought to be due to birth trauma or anoxia, code these first and 20-22, as appropriate, second)

23	DIC	In the absence of infection
24	Pulmonary-massive intra-alveolar	
25	Other hemorrhage	
(26-29)	INFECTION	
26	Antenatal	With or without DIC or pulmonary hemorrhage
27	Intranatal	
28	Necrotizing entercolitis	
29	Other postnatal infection	
(30)	OTHER PEDIATRIC FACTORS	
30	(Specify)	
(31)	UNEXPLAINED	
31	(Specify)	

Table 3. Perinatal deaths, by obstetric classification: Scotland, 1984

Obstetric classification	Percent	Stillbirths	Early neonatal deaths
Congenital abnormality	20.6	37	108
Pregnancy hypertension	7.1	37	13
Antepartum hemorrhage	20.6	76	69
Other	9.5	43	24
Unknown:			
Less than 2,500 grams	29.6	108	101
2,500 grams or more	12.6	74	15

Table 4. First-week deaths, by pediatric classification: Scotland, 1984

Pediatric classification	Number	Percent
Fetal abnormality	108	32.7
Anoxia/trauma	98	29.7
Immaturity/hyaline membrane disease	91	27.6
Other	33	10.0

Table 5. Percent distributions of all births and all perinatal deaths by birth weight: Scotland, 1984

Item	Birth weight		
	Less than 2,500 grams	2,500 grams or more	Unknown
All births	6.6	93.2	0.2
All perinatal deaths	70.0	28.7	1.3

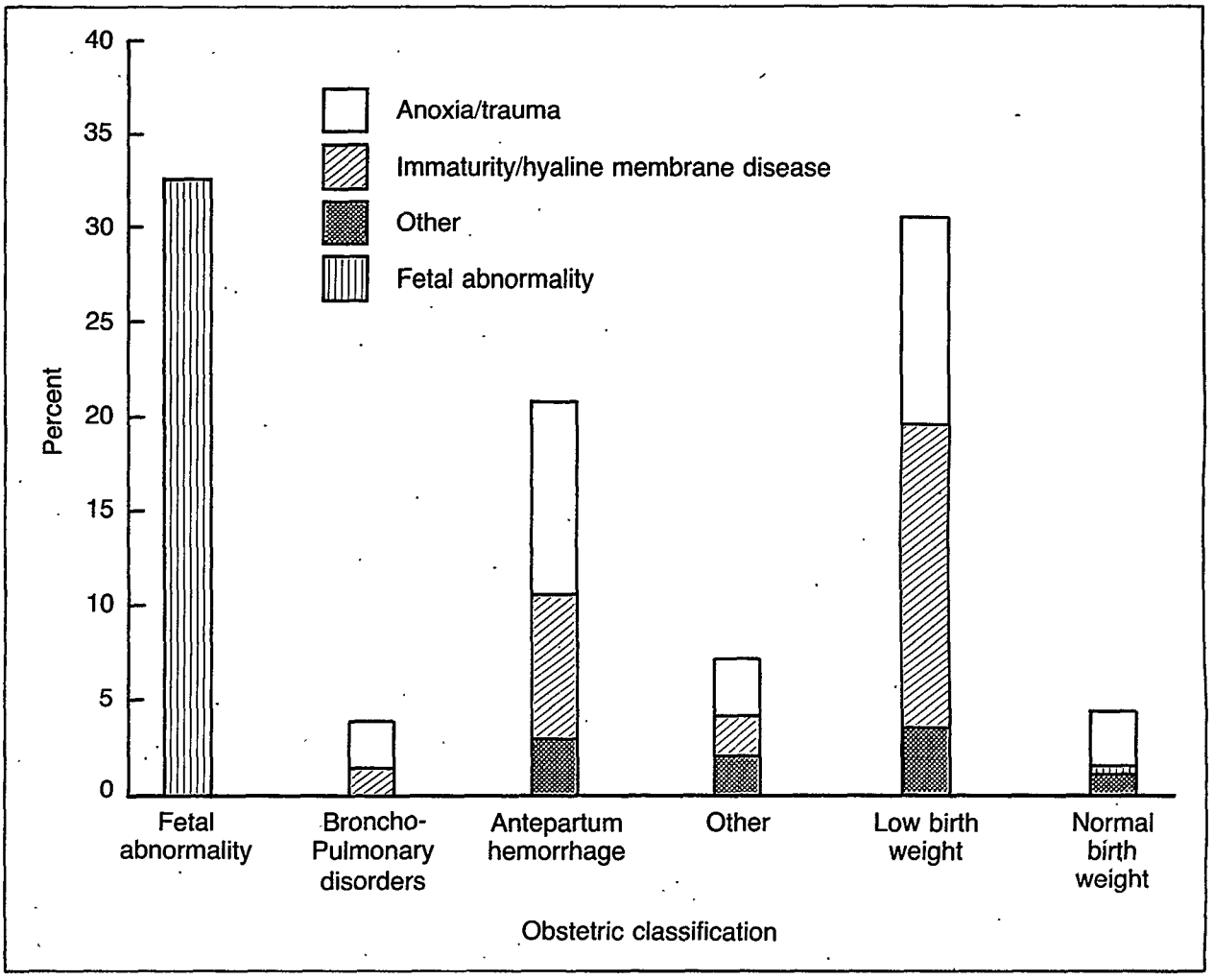

Figure 1. Percent distribution of first-week deaths by obstetric classification: Scotland, 1984

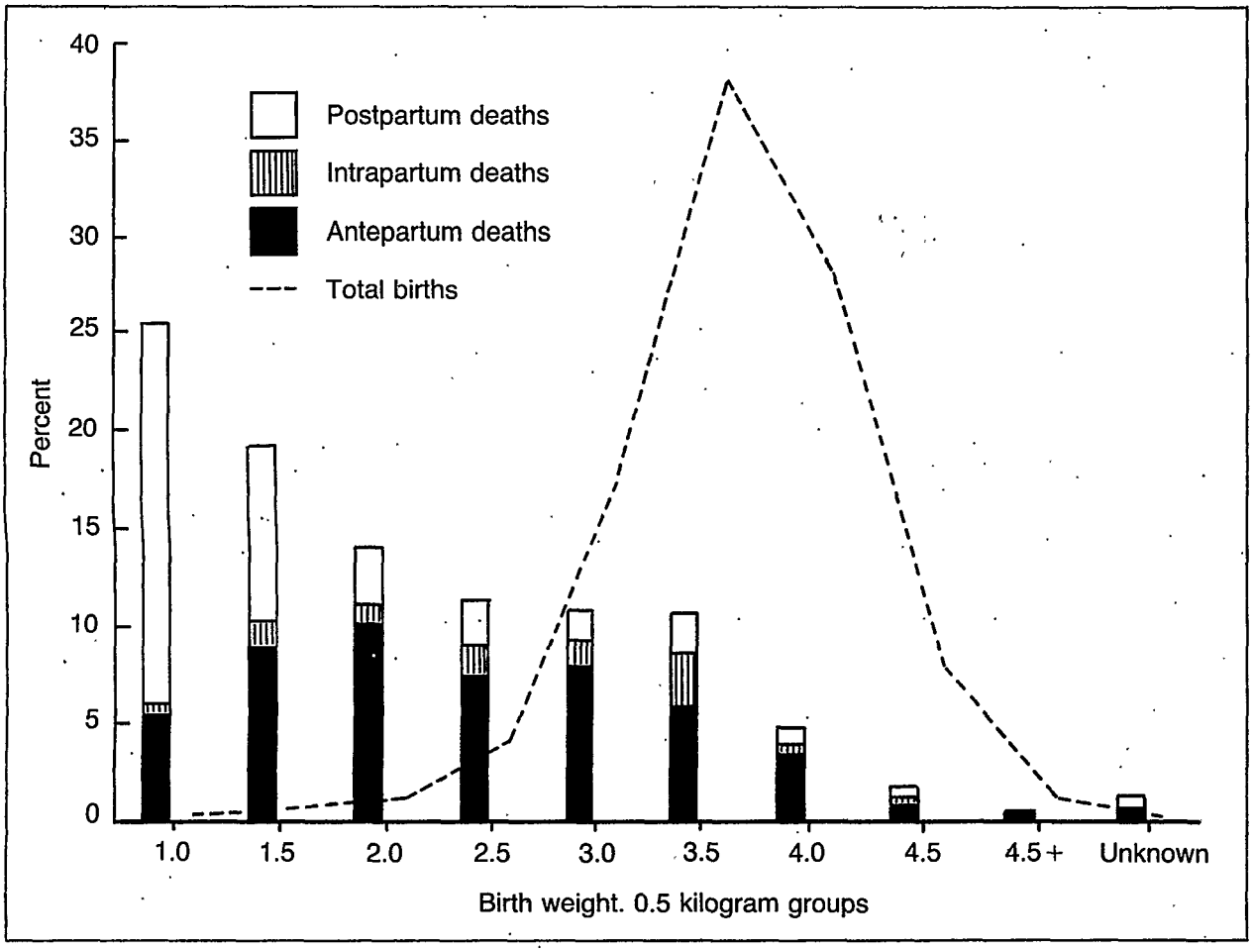

Figure 2. Percent distributions of normally formed perinatal deaths and total births, by birth weight: Scotland, 1984

A Methodology for Evaluating Size at Birth

by P. Karlberg, M.D.; A. Niklasson, M.D.; A. Ericson, M.Sc.;
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Introduction

The outcome of a pregnancy is closely related both to the maturity of the baby and to its size. Because these two measures are correlated, they are even more informative when viewed as a pair. Their evaluation either in an individual newborn baby or in groups of newborns requires reference to what is considered to be a reasonably "normal" situation. By this, we mean undisturbed intrauterine development of the fetus. The main purpose of this paper is to describe a method of obtaining reference values for the relationship between size at birth and gestational age. Swedish data that include clinical information on individual infants are used to illustrate the approach. They were taken from the Swedish Medical Birth Registration and cover all "healthy" live-born singletons of estimated gestational age 28-42 weeks born in Sweden during the years 1977-78. Comparisons are made later between these results for Sweden and those reported in the literature for other countries. The question of how to proceed when less information on individual infants is available is considered in the discussion at the end of the paper.

Defining Gestational Age and Undisturbed Growth

In general, two separate assessments of the gestational age (GA) of each infant are included in the Swedish material. First, the time that elapses between the first day of the mother's last menstrual period and the baby's delivery (LMP-GA) is recorded in completed weeks. In addition, there is a comparable obstetric assessment (OB-GA) in practice, which is estimated to the nearest week. The difference between the statistical distributions of the two are illustrated in figure 1. Both histograms in figure 1(a), where frequencies are given in percents, show the expected skewness toward the lower GA weeks. There is a clear tendency for the OB-GA estimate to be more concentrated in the commonly occurring weeks. Miscalculations may well account for the heavier tails of the the LMP-GA.

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The corresponding cumulative distributions are also displayed on the usual linear scale in figure 1(b). They show the median for OB-GA to be some 2 or 3 days longer than that for LMP-GA. This simply reflects the difference between the recording conventions used, that is, the nearest and completed weeks. The cumulative plot becomes rather more informative when the probability scale is used instead, as shown in figure 1(b). On this special nonlinear scale, the cumulative distribution of a pure Gaussian distribution appears as a line, and the strong linearity exhibited from 37 through 42 weeks might well indicate the presence of a dominant Gaussian component, possibly representing "normal" full-term development.

In view of the suspected inaccuracies of LMP-GA and a preference for the use of completed weeks, a combined method for estimating GA (COM-GA) has been adopted here. LMP-GA is used provided it differs from OB-GA by no more than 2 weeks. It might be argued in this case that the two assessments are probably referring to the same menstrual period. If they differ by more than 2 weeks, OB-GA is used instead. When either estimate is missing, GA is considered unknown. The distribution of COM-GA is evidently somewhat more concentrated than that of LMP-GA in the "full-term" range but has consequentially lighter tails.

Our definition of infants showing undisturbed growth is relatively straightforward. This "healthy" subgroup is taken to be the total population of liveborn singletons, excluding both those babies whose mothers experienced complications in pregnancy with potential effect on fetal growth and those with identified malformations. Shortened or prolonged gestational age alone is not taken to be a reason for rejection. The clinical perinatal information on each infant given in its Medical Birth Registration was used to identify cases for exclusion. Factors taken to be relevant are as follows:

Factors potentially affecting intrauterine growth

Maternal factors

- Infection (TBC, virus, cytomegalo-virus, syphilis, toxoplasmosis)
- Tumor
- Diabetes or other endocrine disturbance
- Alcohol abuse
- Narcotic addiction
- Hypertension
- Heart disease
- Asthma
- Enteritis, ulcerative colitis
- Kidney disease

Disorders related to the pregnancy

- Hemorrhage
- Anemia
- Cervical insufficiency
- Prolonged pregnancy (more than 42 weeks)
- Urinary infection
- Eclampsia, preeclampsia

Neonatal disorders

All malformations except:

Persistent ductus arteriosus
Single umbilical artery
Congenital dislocation of the hip
Undescended testicle

Information on maternal smoking was not available in 1977-78. Approximately 80 percent of the original births remained after the exclusions, and some details concerning the composition of this resulting "healthy" subgroup are set out in tables 1 and 2.

Construction of Reference Standards--The So-Called Perinatal Growth Chart

The individual relationships of birth weight (BW), birth length (BL), and birth head circumference (BHC) to GA concern us here. In probabilistic terminology, we are basically interested in the form taken by the conditional distribution of, say, BW, given GA, as GA is varied over its complete range. Because this distribution (like others) is in fact uniquely determined by the joint distribution of the two measures, it would appear to be the natural one to model. However, this has proven to be very difficult to do satisfactorily, so a simpler approach is adopted here. We model weekly conditional distributions one by one, as if they were entirely unrelated. After this basic step, they are linked through a smoothing device in order to emphasize and reflect the continuity of the underlying biological process.

For the modeling of most of the conditional distributions of BW, the individual weights were grouped in intervals of 250 grams (g) in the following manner: 375-624 g, 625-874 g, 875-1,124 g, and so on. Weights like 1,500 g, 2,000 g, and 2,500 g were therefore made the center points of groups rather than the end points, thereby reducing bias. In the lower GA's, we have used finer groups (width 50 g) for obvious reasons; however, this makes surprisingly little difference to the analyses for the lower ages and virtually none to the remainder. In a similar way, groups of 2 centimeters (cm) were used for both BL and BHC. Scrutinizing the frequency distributions of BW for each GA shows that anomalous observations have been retained despite the initial screening of the GA data. Consider, for instance, the distribution of BW at GA 30 weeks for males. Starting at the lowest 250 g group, 375-624 g, and ending at 4,125-4,374 g, the successive entries for the numbers of infants are

1 2 4 9 31 13 8 4 0 0 3 1 1 1 3 1 2.

Because we have no good reason a priori to expect other than a unimodal distribution, we are bound to suspect the last six figures. These seem very likely to be classification errors that have somehow survived our careful filtering of the data. Some of them may well be "4 week" errors for births having a true gestational age of 34 weeks and others even 8- or 12-week errors. Others may just be errors in the BW itself. Our way of dealing with the problem in this paper has been to truncate each distribution to a suitable BW range where the observations seem entirely plausible. The data within the restricted BW range have then been used to estimate the true distribution over that

interval and hence, by extrapolation, over the complete range. Including dubious observations in our estimation procedure could lead to considerable bias, whereas excluding them brings a little inefficiency at worst.

The modeling of the GA-specific distributions of BW would be a good deal easier if we could find a transformation for BW that moved the distributions to a well-known form. Because the Gaussian distribution is the natural focal point of probability and statistics, and conditional distributions are already roughly of this form, a normalizing transformation would be especially apposite. Accordingly, the Box-Cox power family of transformations (Box and Cox, 1964) was applied at each GA, with normality over the complete range as the aim. With this transform, the most appropriate power (say ρ) whether it be 2 (the square), 0.05 (the square root), or some other number, is to be determined by the data themselves. If the data point is to a power of 1, then we conclude that the data are already as close to normality as they can be brought by a simple power. Figure 2 displays the individual powers found for BW for the two sexes at each GA. Although these are only estimates (and so are subject to sampling fluctuation), the pattern for males is quite clear. In the lowest GA's, the data are already near normal; at term, the square roots are called for; and in between, a logarithmic transformation is required. The last is unsurprising; in periods of steady growth, physical measures often follow a lognormal distribution (Karlsberg et al., 1976). There is a tendency for females to follow a similar pattern, but the results are more diffuse. After the data are normalized, fiducial points of the distribution are readily determined. With the Gaussian distribution, it is natural to work in terms of the mean (μ) plus or minus multiples of the standard deviation (σ), $\mu \pm k\sigma$). The constant k is chosen to match the desired probability levels. In this paper, we use k = 2 (corresponding to percentage levels of 2.28 and 97.72), but this is purely arbitrary. Having assessed the percentage points on the transformed scale, it is a simple matter to "invert" them to recover the same percentage points on the original scale of grams. We denote these by μ^* and $(\mu \pm 2\sigma)^*$. In the case of BW, plots of the μ^* and $(\mu \pm 2\sigma)^*$ are seen to follow somewhat irregular sigmoid-shaped patterns. Because we would expect values of these percentage points, when not subject to error of any sort, to vary in a systematic fashion, we have applied smoothing procedures (cubic splines) to the raw estimates to bring them into line. The results are given in tabular form in table 3 and displayed pictorially in figure 3 (together with some raw estimates). Plots of the ratios

$$R_+ = \frac{(\mu + 2\sigma)^*}{\mu^*} \quad \text{and} \quad R_- = \frac{(\mu - 2\sigma)^*}{\mu^*}$$

for BW show these to be far from constant as GA is varied. Values are more extreme among the lower GA's than at term.

Corresponding results are given for both BL and BHC in table 3. Because of the generally higher percents of infants with unknown measurements in the preterm range, these figures must be regarded as more approximate. The pattern is particularly hard to gauge in the lowest GA's, where unknown percents are at their highest. All median values (μ^*) given are based on the directly relevant observations alone. However, the values of $(\mu \pm 2\sigma)^*$ for preterm ages are obtained indirectly through use of the R values for full-term infants, using the simple formula $(\mu \pm 2\sigma)^* = R\,\mu^*$.

Comparison With Other Results

Our results were compared with those of the Engström-Falconer material of 1956-57 (Engström and Falconer, 1960), which formed the basis for the Swedish Perinatal Growth Chart of 1971 (Karlberg and Priolisi, 1977). The median growth curve of BW for 1977-78 exceeds the 1971 Chart figure by some 100 g at term. On the other hand, taken literally, the results show a reduction in median length of some 0.5-1.0 cm. These findings indicate a secular trend over the past 20 years, but the reality of this is currently being carefully assessed and will be discussed elsewhere.

In view of the genetic differences in populations and the environments in which they live and the different ways in which material may be classified, collected, and analyzed, we would expect a priori to find wider differences when our 1977-78 Swedish figures are compared with those reported for the inhabitants of other countries. Figure 4, in which five commonly quoted data sets (Bjerkedahl and Skjaerven, 1980; Hoffman et al., 1974; Lubchenko et al., 1963; Thomson, Billewicz, and Hytten, 1968; Usher and Mac-Lean, 1969) are displayed, shows more similarity of pattern for median BW at 28-36 weeks GA, where the curves are fairly well parallel, than afterwards, when they begin to show different rates of deceleration and relative positions change. Swedish males seem to show the least deceleration in the full-term region. At 40 weeks, there is a 400g difference among medians of the six sets of standards. The ranges of the distributions are more difficult to assess because of the different distributional assumptions and percent levels used. The latter vary from 2.5 percent, or ($\mu - 2\sigma$) at the lower end, through 5-10 percent, possibly because of the clinician adjusting the limit to reflect similar clinical experiences. Two of the standards, Bjerkedahl and Skjaerven (1980) and Hoffman et al. (1974), show very much higher levels of ($\mu + k\sigma$)* than the others prior to 37 weeks. These authors appear to have included certain extreme observations that, in our data, have been taken to be misclassifications of GA.

Discussion

A knowledge of the GA of an infant is essential for an evaluation of its size; because infants of the same weight can have very different levels of maturity, the use of BW (or BL) alone provides much reduced information. Given both, the infant needs to be referred to established growth standards for the "healthy," by which we mean those infants who experienced undisturbed fetal growth. Inclusion of all live born infants in such standards merely widens the range and so obscures the issue. Stillbirths should certainly be excluded.

A universally acceptable definition of undisturbed intrauterine growth is desirable; but to establish this further, analyses and debate are required. What matters in practice is that at least all deviations of a nontrivial nature be excluded. In the case of Swedish infants, it is possible to construct a variety of plausible "healthy" groups from the information contained in the national Medical Birth Registration. Naturally, any such definition is constrained by the items available. For our own definition, we would have liked to have excluded infants of mothers who smoked, for example, but this was not feasible in 1977-78. In fact, when the record was first discussed prior to 1973, it was feared that requesting information about a smoking habit might be viewed as an insult to a mother's personal integrity. Nowadays (1982 onwards), a

smoking habit is recorded in Sweden and, together with other items, has recently been used by Rooth, Meirek, and Karlberg (1985) in an alternative definition of the "healthy." This more restrictive definition retains only some 10 percent of the total material, compared with our own 80 percent. However, values of median BW at term have been found to be practically identical to ours. Because we have not explicitly excluded infants of heavy smokers, for instance, some difference might have been anticipated. However, it is likely that such infants have largely been rejected on other grounds, for smoking in particular is associated with certain other negative factors. It is our intention to pursue various definitions of "healthy" in a forthcoming comprehensive analysis of the Swedish data for 1977-84, although the principal aim is to fix probability levels more securely among the lowest GA's, for which data for only two years generate insufficient numbers of infants.

The numerical approach used in this paper seems to us to have highlighted a number of points which may be worth noting.

First, even if initial filtering of the data fails to eliminate all suspect GA's, it is still possible to use a relatively simple and efficient model-based approach based on the truncation of the underlying distributions to derive standards. Other approaches involving the modeling of the complete distribution (after filtering) are possible too, but they require many more infants in the lowest GA's than are commonly available.

Second, the proposition that BW data follow a Gaussian (or even symmetric) distribution for each gestational week appears to be distinctly unrealistic. Our analyses indicate that some transformation of the original scale is needed at most GA's to bring the data into line, at least for Swedish material. A key feature of our approach is that the data are required to transform themselves to the Gaussian form as a matter of course if deviant. Because this procedure is easily inverted to recover the original scale, even in probabilistic terms, we are offered the flexibility of two scales of measurement with merit, the original grams and the power of it producing Gaussian frequency; and we can move from one to the other with ease. On the transformed symmetric scale, we can work in terms of standard deviation scores, as advocated for postnatal growth (Karlberg, Engstrom, and Karlberg, 1981); and on the original asymmetric scale, we can work in terms of the corresponding levels of probability. Note that the use of sample percentiles is ruled out if any nontrivial truncation of the distribution takes place; even without it, this somewhat naive approach would be rejected by many on the grounds of statistical inefficiency alone.

Third, the assumption that the coefficient of variation of the BW distribution is constant throughout the GA range appears to be untenable, for noticeably larger values are recorded in the lower GA's than at term. If term values are applied at 28-36 weeks, then unduly restricted limits result naturally.

Although the corresponding results for BL and BHC mimic those for BW to a considerable extent, there are some points of difference too. Because fetal growth is not a uniform phenomenon in the sense that different organs and parts of the body develop at different rates, this is hardly surprising.

Both BL and BHC appear to be more normally distributed at term than does BW. The fact that BL and BHC are one-dimensional measures and that BW, if considered

as a volume, is three-dimensional would lead us to anticipate rather different forms. After all, both X and X^3 cannot be normally distributed. The fact that we need to use the square root or cube root of BW to convert it to normality at term lends support to this dimensional argument.

We find the median growth curve to be more clearly sigmoid in shape for BW than it is for the other two over the range explored (28 weeks onward). Presumably, BL and BHC would show a clearer tendency to conform to this shape if we were able to extend the range to cover, say, 12-28 weeks as well. All of this emphasizes that charts for the various measures should be studied simultaneously for they are related aspects of the same phenomenon. A natural sequel to noting that the BW of an infant is low for its GA is to check BL and BHC too. This action might indicate a simple measurement or recording error in BW, confirm a significant clinical deviation, or support doubts about the accuracy of the GA assessment, for example.

Many paths exist for extending customary analysis. Some clinicians might consider appropriately constructed standards for BW given GA and BL, as helpful ancillary information. Again, perinatal growth charts could be drawn for BW, after adjusting it for the influence of BL and BHC (via regression), or for a simple combination of BW, BL, and BHC optimally representing physical development in some sense. If a decision is to be made concerning the normality or otherwise of the physical state of an infant for its level of GA, then all worthwhile available measures should be used. The basic ingredient for this procedure would be the joint distribution of the measures involved (conditional on GA)--let us say, BW, BL, and BHC. Given that the infant is judged "unusual," some explanation will be sought, and naturally charts for the individual measures will be consulted. Therefore, we conclude that, even in more extensive decision analyses, basic univariate standards have a role to play.

In order to construct "perinatal growth charts" similar to the ones displayed here, a considerable amount of information is required. The question naturally arises as to what can be done when a full set is not available. Presume in the first place that there is little clinical information at hand and that we are limited in effect to BW and GA. Given that stillbirths are identified, then their elimination from the data could well be the only practical step toward forming a "healthy" group if the approach pursued in this paper is adopted. In this instance, a change of approach might be more fruitful; the one we have in mind does not actually require the identification of stillbirths. Because the total material is the aggregation of the "healthy" and the "less healthy," we may argue that at any particular GA we could easily find that the "healthy" form one statistical subpopulation and the remainder another. If we could disentangle the two, probability levels for the "healthy" could be determined. Some plausible assumptions about the forms of the components are called for initially; these can be checked later using the data in aggregate form. Gaussian subpopulations seemed reasonable a priori here and were later found to be quite consistent with the data (Fryer et al., in press). Because of the presence of misclassifications, it was necessary to postulate further the existence of a third component in the lower GA's.

The results of some tentative analyses in which the sexes are combined are displayed in figure 3 along with the standard derived earlier. The term "primary" is used to denote the alternative "healthy" subpopulation. Median

values of the two seem to be close but the upper limits less so. It is possible that the application of the Box-Cox transform (Box and Cox, 1964) to the original scale might make normal components on the transformed scale more plausible still; in this case, the limits produced would be asymmetric. This approach does seem to us to be worth pursuing further.

Finally, we come to the case in which BW alone is available. Current practice might tempt us to use some arbitrary cutoff point such as 2,500 g to define the low weight and, by further inference, the "less healthy." Apart from the crudity of the latter step, it is difficult to see how a fixed point like 2,500 g could be justified for all populations. If boundaries are related to probability when we have a full set of information, then why should we deviate from this reasoning when the set is reduced? Following this approach, we would adopt probability-based limits among both the low weights and the high, although percents in the two tails might be quite different. A more ambitious statistical approach would be to attempt to isolate a "healthy" group using the subcomponent or mixture method outlined in the last paragraph. This has already been explored by several authors. Fryer et al. (in press) claim to have found a primary "healthy" Gaussian component in Swedish data that accounts for some 90 percent of infants, with a mean of 3,500 g and standard deviation rather less than 500 g. Obviously, this distribution would provide the base reference for probability calculations. Tables 4 and 5 give precise parameter values of the mixture for seven of the countries participating in a 1973 perinatal study sponsored by the World Health Organization (World Health Organization, 1979), and this seems to support the interpretation of the major component. It is also argued in Fryer et al. (in press) that standardizing this primary subpopulation provides a sensible basis for making international comparisons of BW. In Figure 5, the cumulative distributions of BW for three of the participating countries (Hungary, Japan, and Sweden) are presented, first in absolute form and then in standardized form. We see that, although the levels for Japan and Sweden are quite different in figure 5(a), the plots are virtually coincident in figure 5(b), although Hungary still shows a heavier lower tail.

BW-specific early neonatal mortality rates can be standardized in the same way, and these are also displayed in figure 5. The parallel courses of the standardized BW-specific mortalities in figure 5(b) indicate an improved description of the biological events.

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Table 1. Numbers of births, in reducing subgroups: Sweden, 1977-78

Subgroup	Male	Female	Total	Percent
Total births	---	---	189,228	---
Liveborn singletons			188,305	100.00
"Healthy"	78,531	75,848	154,379	81.98
Known birth weight and gestational age	77,310	74,648	151,958	80.70
Gestational age 28-44 weeks	77,182	74,525	151,707	80.56

Table 2. Distribution of gestational age for "healthy" liveborn singletons

Gestation	Male	Female	Total	Number and percent
28 weeks	68	39	107	
29 weeks	61	36	97	
30 weeks	83	57	140	
31 weeks	96	86	182	Preterms-- 5,695 = 3.8 percent
32 weeks	143	108	251	
33 weeks	199	158	357	
34 weeks	357	294	651	
35 weeks	669	555	1,224	
36 weeks	1,471	1,215	2,686	
37 weeks	3,150	2,662	5,812	
38 weeks	8,214	6,957	15,171	Full-terms-- 129,902 = 85.6 percent
39 weeks	16,892	15,699	32,591	
40 weeks	21,916	22,074	43,990	
41 weeks	15,764	16,574	32,338	
42 weeks	6,705	6,615	13,320	Postterms-- 16,110 = 10.6 percent
43 weeks	1,162	1,146	2,308	
44 weeks	232	250	482	
Total	77,182	74,525	151,707	100 percent

Table 3. Size by gestational age--mean and upper and lower probability limits for "healthy" subsample: Sweden, 1977-78

Week	Mean - 2 standard deviations		Mean		Mean + 2 standard deviations	
	Male	Female	Male	Female	Male	Female
			Birthweight			
28	690	---	1,230	---	1,780	---
29	850	860	1,360	1,290	1,920	1,710
30	1,020	930	1,530	1,420	2,220	1,860
31	1,210	1,050	1,730	1,610	2,370	2,100
32	1,410	1,210	1,950	1,820	2,650	2,400
33	1,620	1,400	2,190	2,060	2,950	2,740
34	1,830	1,620	2,440	2,310	3,250	3,090
35	2,030	1,840	2,690	2,560	3,550	3,420
36	2,240	2,060	2,930	2,800	3,830	3,720
37	2,430	2,280	3,150	3,030	4,080	3,960
38	2,600	2,470	3,350	3,220	4,290	4,150
39	2,740	2,620	3,520	3,390	4,470	4,300
40	2,850	2,740	3,650	3,510	4,610	4,420
41	2,910	2,790	3,750	3,600	4,730	4,520
42	2,910	2,780	3,800	3,630	4,810	4,610
			Birth length			
28	34.8	33.7	37.6	36.4	40.5	39.1
29	36.1	35.6	39.0	38.4	42.0	41.2
30	37.4	36.6	40.4	39.5	43.5	42.4
31	38.8	38.6	41.9	41.7	45.1	44.8
32	40.4	39.8	43.7	43.0	47.0	46.1
33	41.6	40.8	44.9	44.0	48.3	47.2
34	42.6	42.0	46.0	45.3	49.5	48.7
35	43.4	42.8	46.8	46.2	50.4	49.6
36	44.2	43.7	47.7	47.1	51.4	50.6
37	45.1	44.4	48.7	47.9	52.4	51.5
38	45.7	44.9	49.5	48.6	53.2	52.3
39	46.4	45.7	50.2	49.3	53.9	52.9
40	47.0	46.3	50.7	49.8	54.5	53.5
41	47.6	46.7	51.2	50.2	55.0	53.9
42	47.7	46.8	51.4	50.4	55.3	54.2

Table 3. Size by gestational age--mean and upper and lower probability limits for "healthy" subsample: Sweden, 1977-78--Con.

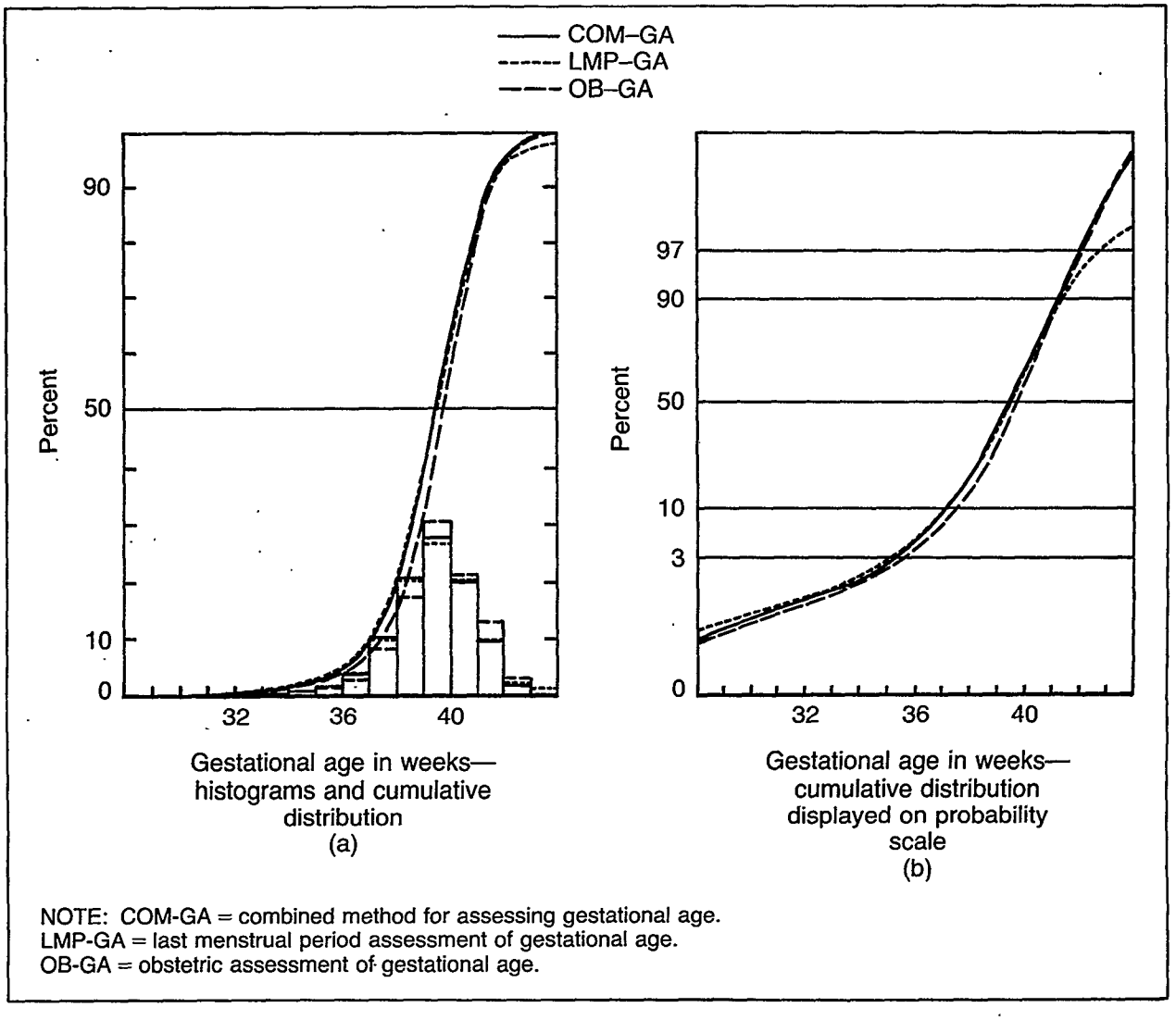
Week	Mean - 2 standard deviations		Mean		Mean + 2 standard deviations	
	Male	Female	Male	Female	Male	Female
			Head circumference			
28	25.2	24.5	27.4	26.4	29.6	28.6
29	26.3	25.8	28.6	28.0	30.8	30.7
30	27.0	26.6	29.3	28.8	31.6	31.0
31	28.0	27.4	30.3	29.7	32.7	32.0
32	28.9	28.6	31.4	31.0	33.9	33.4
33	29.7	29.1	32.3	31.6	34.8	34.0
34	30.3	30.0	32.9	32.5	35.5	35.0
35	30.8	30.5	33.4	33.1	36.1	35.7
36	31.4	31.1	34.1	33.7	36.8	36.3
37	31.9	31.4	34.7	34.1	37.4	36.7
38	32.2	31.7	35.0	34.5	37.9	37.3
39	32.6	32.1	35.3	34.6	38.1	37.5
40	32.8	32.3	35.6	35.0	38.4	37.6
41	33.1	32.5	35.9	35.2	38.6	37.9
42	33.1	32.7	36.1	35.4	38.9	38.1

Table 4. Distribution of absolute birth weight: Parameters from World Health Organization comparative perinatal study, 1973

Country	Primary subpopulation		Secondary subpopulation		Primary subpopulation as a percent of total population
	Mean	Standard deviation	Mean	Standard deviation	
Austria	3,384	427	2,747	1,012	90.1
Cuba	3,166	449	2,827	912	84.7
Hungary	3,213	452	2,616	920	84.2
Japan	3,175	383	2,845	853	90.9
New Zealand	3,427	467	2,994	1,013	89.9
Sweden	3,519	469	3,062	1,044	90.8
United States	3,375	459	2,939	1,075	90.0

Table 5. Distribution of standardized birth weight: Parameters from World Health Organization comparative perinatal study, 1973

Country	Primary Subpopulation		Secondary Subpopulation		Primary subpopulation as a percent of total population	Coefficient of variance of primary subpopulation
	Mean	Standard deviation	Mean	Standard deviation		
Austria	0	1	- 1.492	2.370	90.1	7.92
Cuba	0	1	- 0.755	2.031	84.7	7.05
Hungary	0	1	- 1.321	2.035	84.2	7.11
Japan	0	1	- 0.862	2.227	90.9	8.29
New Zealand	0	1	- 0.927	2.169	89.9	7.34
Sweden	0	1	- 0.974	2.226	90.8	7.50
United States	0	1	- 0.950	2.342	90.0	7.35



NOTE: COM-GA = combined method for assessing gestational age.
LMP-GA = last menstrual period assessment of gestational age.
OB-GA = obstetric assessment of gestational age.

Figure 1. Distribution of gestational age (GA): Sweden, 1977–78

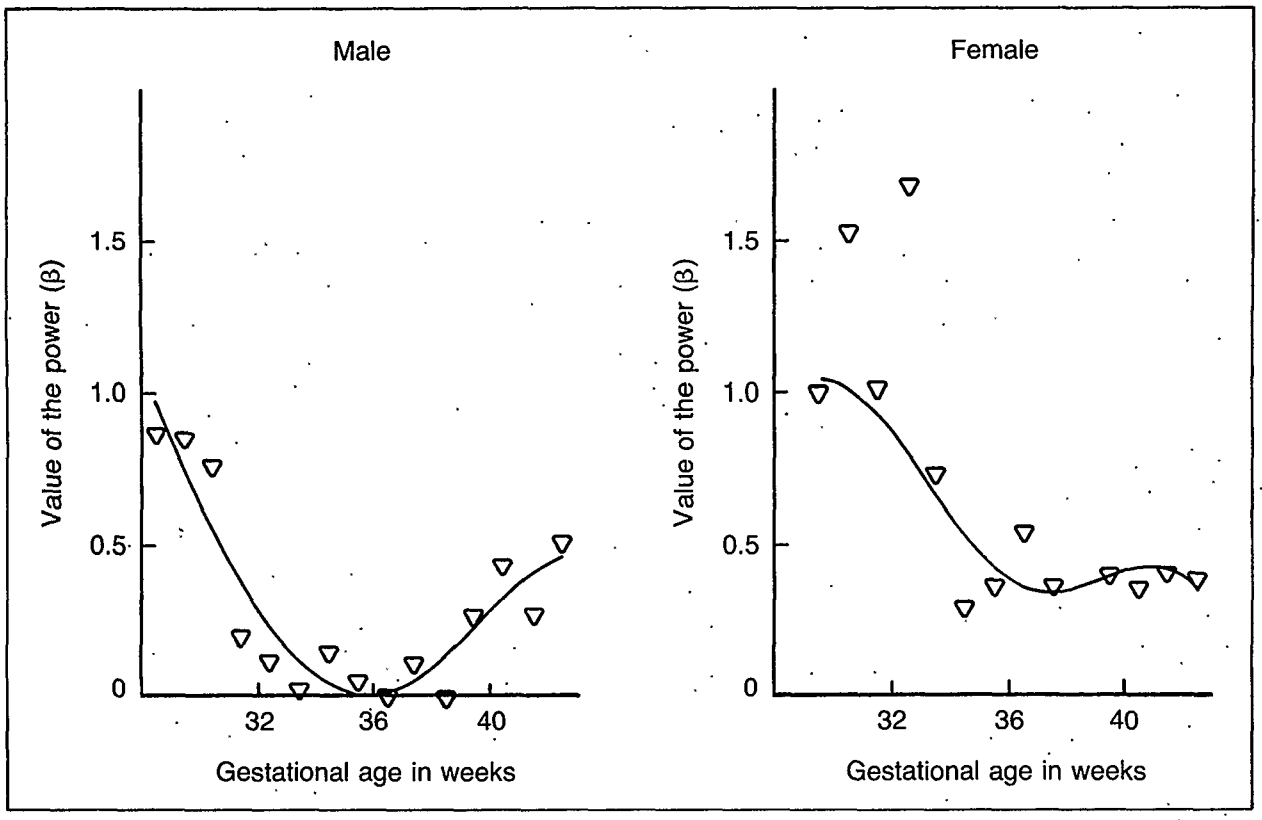


Figure 2. Values of the power (β) for each gestational age 28–42 weeks, by sex: Sweden, 1977–78

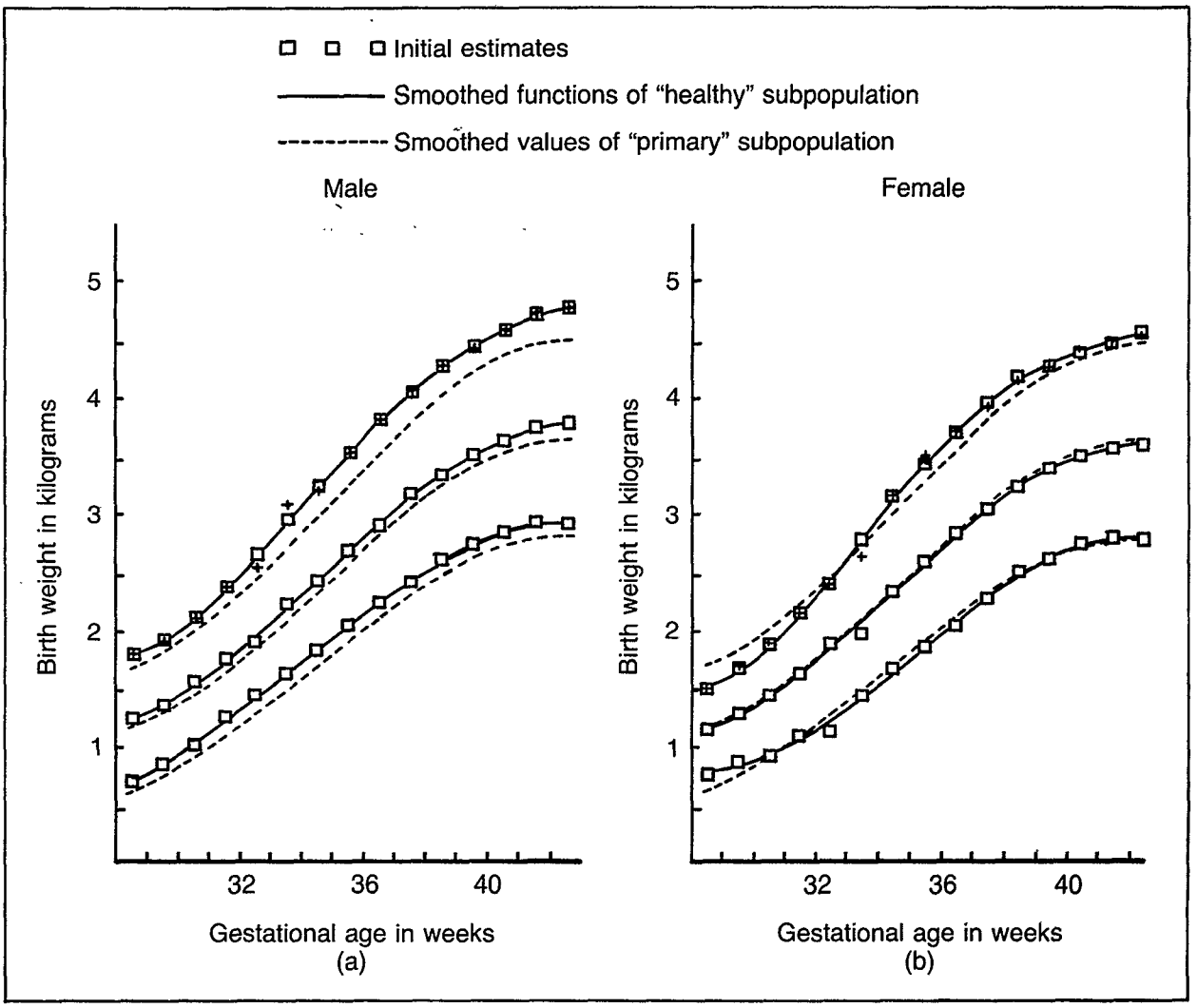


Figure 3. 1977–78 Swedish reference standard for birth weight given gestational age (in kilograms and completed weeks) by sex: Median, 2.28 and 97.72 percentage points (corresponding to ±2 standard deviations on the transformed scale)

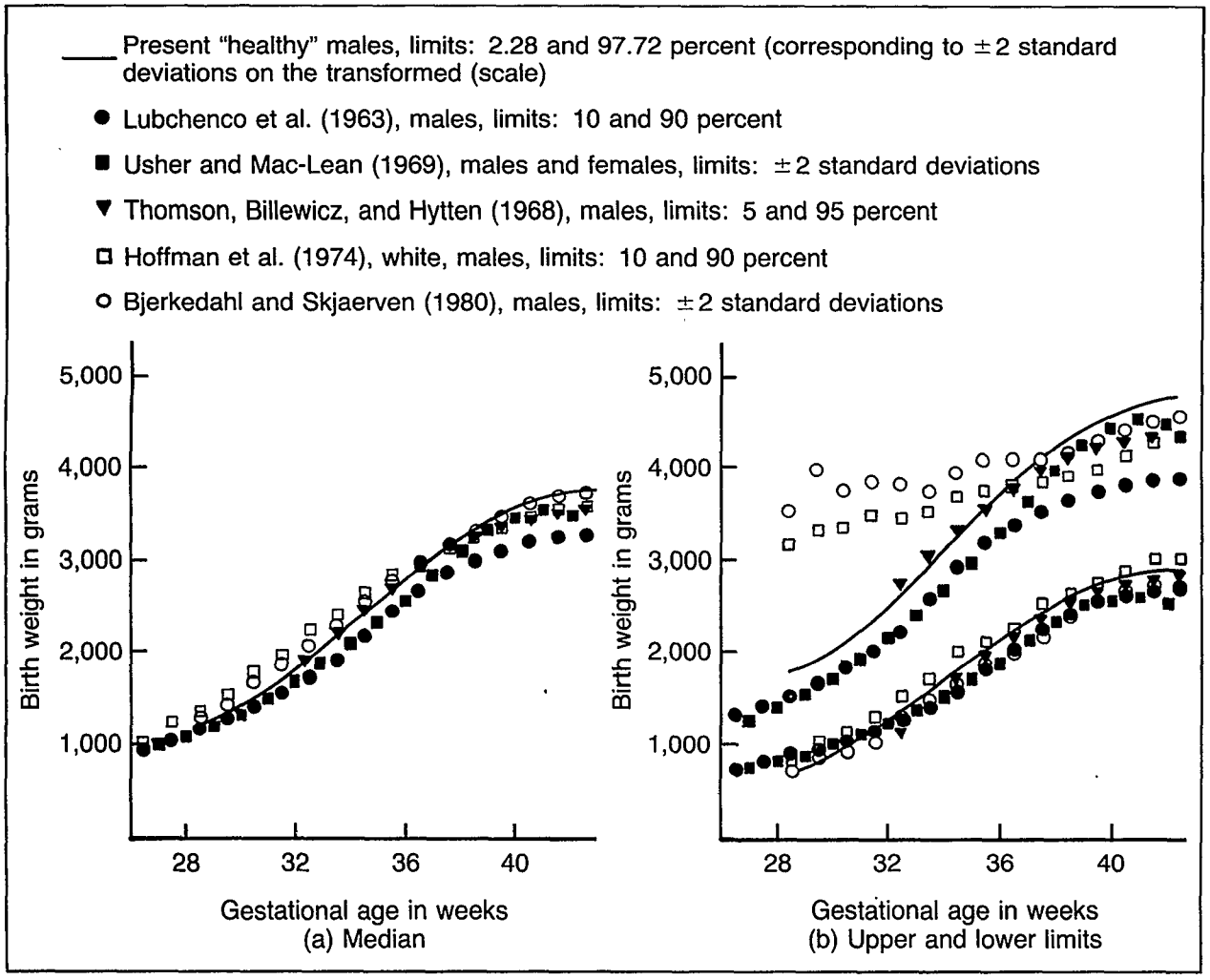
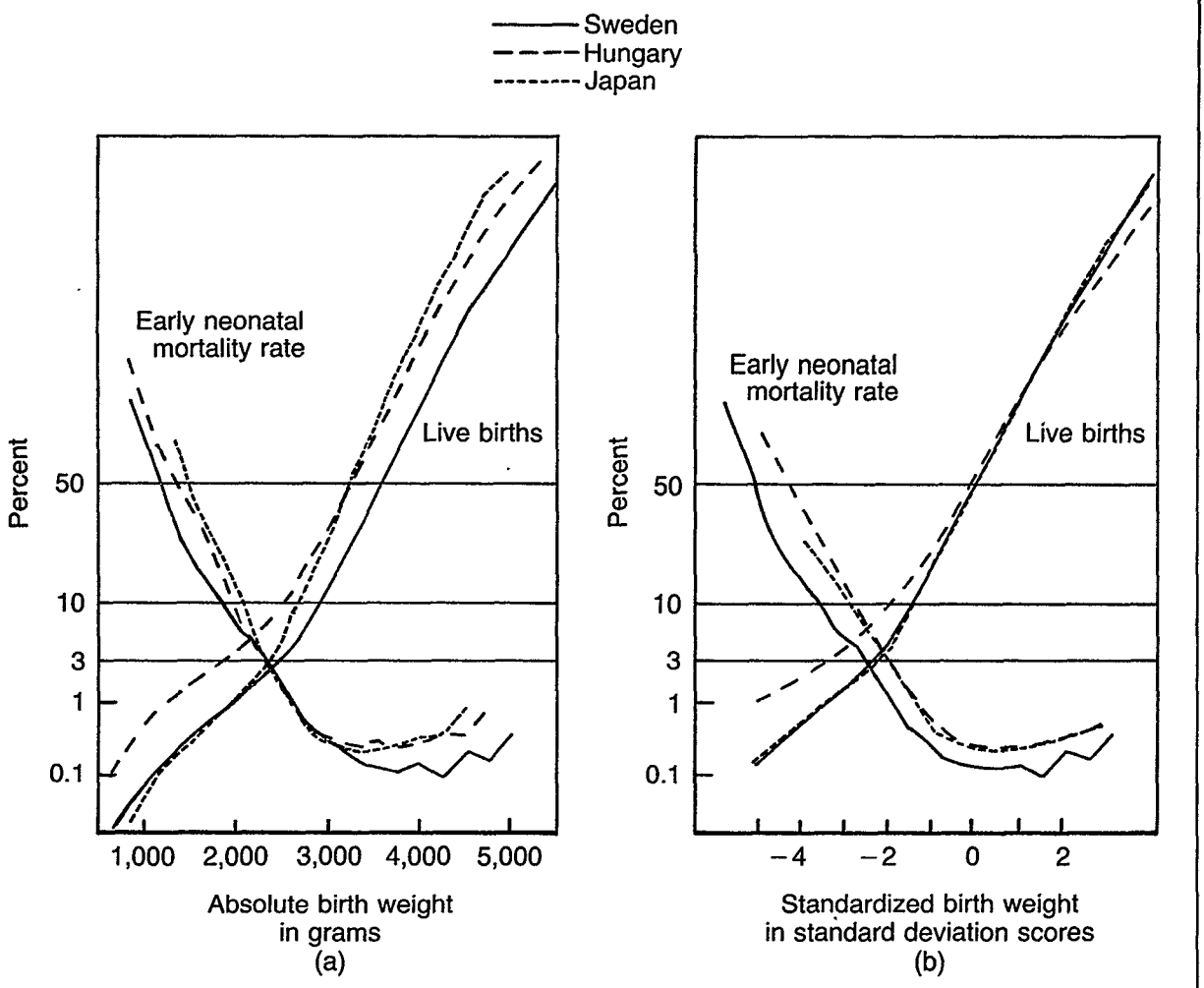
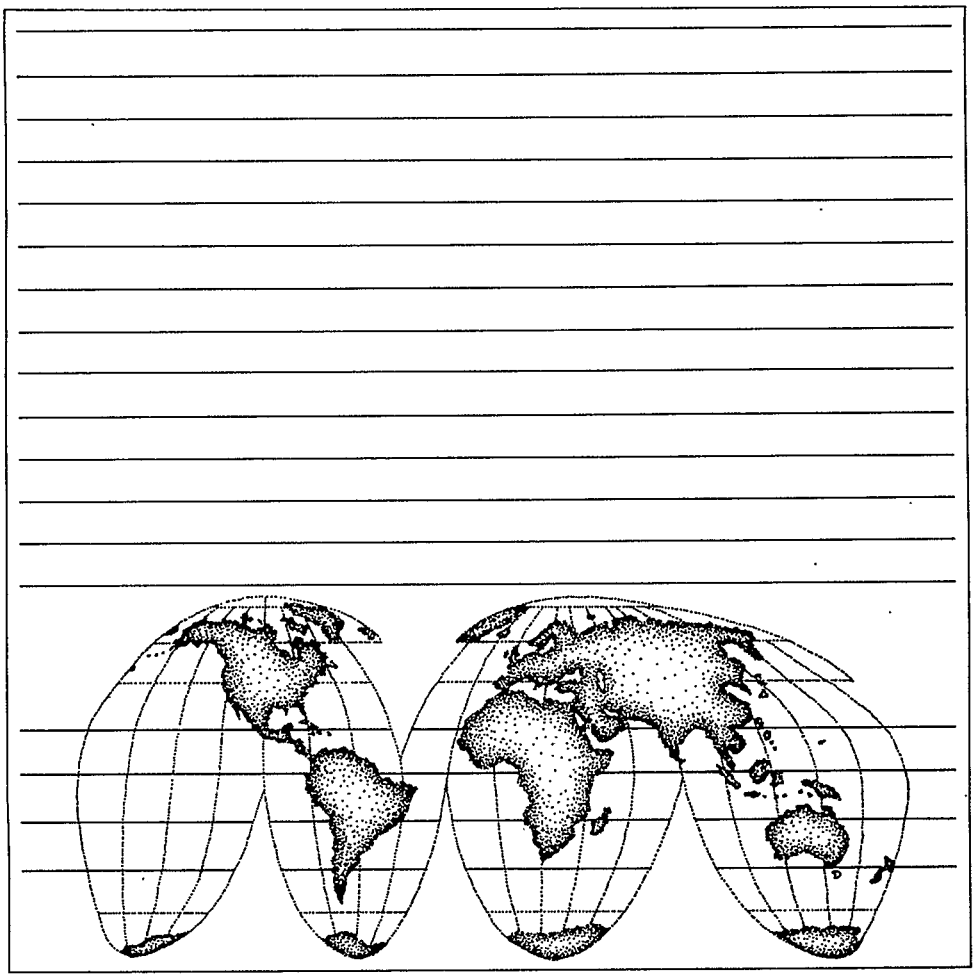


Figure 4. International comparison of birth weight and gestational age relationships (in grams and completed weeks)



SOURCE: World Health Organization, 1979.

Figure 5. World Health Organization international comparative study. Cumulative distribution of live births by birth weight; birth weight-specific early neonatal mortality rate



Chapter III: Comparisons of Trends and Data on Perinatal and Infant Mortality

Comparison of Cesarean Trends and Pregnancy Outcome in Selected States

by Patricia W. Potrzebowski, Ph.D.

The rate of cesarean section deliveries in the United States quadrupled from 1965 to 1983, from 4.5 per 100 hospital deliveries in 1965 to 20.3 in 1983, based on National Hospital Discharge Survey data from the National Center for Health Statistics. Cesarean section rates in 1981 were highest in the Northeast at 20.0 per 100 hospital deliveries and lowest in the North Central Region at 15.9 per 100. The South and West had intermediate rates in 1981 of 18.8 and 17.1, respectively.

Previous studies of cesarean deliveries in the United States have been based on national sample data from either the National Hospital Discharge Survey or the National Natality Survey, both conducted by the National Center for Health Statistics. While data from individual States have been reported, no State-by-State comparisons have been made. At present, 23, or almost half, of the States and other registration areas in the United States include information on method of delivery on birth certificates. These States are shown in Figure 1. (For simplicity, the registration areas of New York City and New York State, excluding New York City, are referred to as States throughout this paper.) This information is collected and coded in a variety of standard and nonstandard ways, including method, mode, or type of delivery; cesarean section; operation for delivery; and operative procedures.

In order to obtain the data for this study, letters were sent to the vital registrar or health statistician in each of the 23 States, requesting that 14 standardized table shells be completed with information for 1965, 1970, 1975, 1980, and 1983. Of these 23 States, 18 provided at least some of the requested data and are included in this study. They are listed in table 1. The five registration areas that, for a variety of reasons, were unable to provide data were Arkansas, the District of Columbia, Massachusetts, Oregon, and South Dakota. I would like to acknowledge the generous cooperation and support of participating States at this time, as they were asked to provide rather large amounts of data in a relatively short timeframe.

Table 1 also shows the year that method of delivery (or an equivalent data item) was added to the birth certificate in each of these States and the year that the data were first put into machine-readable form. We were interested to find that six States had been collecting this data item on the birth certificate since before 1950. Five of these six States were able to provide statistical information on cesarean section delivery rates back to 1965, the earliest year for which we requested data. Cesarean section delivery rates for those five

States in 1965 and 1983 are shown in figure 2. Cesarean section rates for all participating States are shown in table 2.

It should be noted that in all tables included in this study, rates are per 100 live births with unknown type of delivery excluded. Data from the National Hospital Discharge Survey published by NCHS are rates per 100 hospital deliveries. About 1.1 percent of all live births in the United States were nonhospital deliveries in 1983. Since we can assume that the vast majority of these nonhospital deliveries were not cesarean sections, the difference in denominators means that the U.S. rates based on hospital deliveries will be only slightly higher than if they had been computed on the basis of all live births.

In 1965, the U.S. rate of cesarean section deliveries was 4.5 per 100. Of the five States which provided data for 1965, only California, with 5.1 per 100 live births, had a rate that greatly exceeded the U.S. rate.

Figures 3 through 6 show the earliest year of data provided by each State in the study in comparison with their 1983 rates. Figure 7 shows the increase in rates for six selected States over time from 1965 to 1970. You can see some slight differences in trends among the States, most notably California and New York City, whose increases seem to have tapered off faster than the other States shown.

Table 3 shows the cesarean section rates in 1983 for the 18 States included in the study. The rate of 23.6 in Maryland was the highest in 1983, well above the U.S. rate of 20.3 per 100 hospital deliveries. However, it should be noted that the Maryland data are by residence of mother, not place of occurrence, so it is possible that this rate is higher than it would be if calculated by occurrence.

Preliminary analysis has shown that there appears to be a positive correlation between these cesarean section rates and per capita income in the State and also with the number of physicians per capita in the State.

Because of time limitations, I can only briefly summarize the remaining preliminary findings. More detailed analyses are planned to further investigate these findings.

In table 4 and figure 8, cesarean section rates by age of mother are shown. In all States studied, the incidence of cesarean section increased consistently with increasing maternal age (probably because, in the past, medical practice has been for the most part "once a section, always a section").

Table 5 shows cesarean section rates by race of mother. In figure 9, you can see that the cesarean section rates were higher for black women than white women in eight of the States, but higher for white women than black women in the other six States. This phenomenon may be related to age or to income and payment source but merits further study before any conclusions can be drawn.

Table 6 shows rates for 1970 and 1983 by mother's marital status. Married women generally show slightly higher rates, and this is probably related to age. The one exception is Maryland in 1970, where unmarried women had slightly more cesarean sections per 100 live births than did married women.

Table 7 shows cesarean section delivery rates by mother's education for 1980 and 1983, and figure 10 shows rates for 1983. The rates are consistently higher for women with at least a high school education, and again this may be related to age but may also be related to income.

The change in cesarean section rates by mother's education from 1980 to 1983 are shown in figure 11. Most States had a smaller increase for women with less than a high school education. Missouri and Vermont had a greater increase for those women.

Table 8 and figure 12 show cesarean section delivery rates in 1983 by birth order. In general, the cesarean section rates decreased with increasing birth order, but there are exceptions and this decrease does not appear to be consistent.

In figure 13, the cesarean section delivery rates in 1983 for infants of less than 1,500 grams, 1,500-2,499 grams, and 2,500 or more grams are shown. The rates were considerably higher for very low and low birth weight infants. For infants weighing less than 2,500 grams at birth, the cesarean section rates increased considerably from 1975 to 1983 (figure 14). The percent of increase was greater for these infants than for normal weight infants (figure 15) with the exception of Maryland, where the percent of increase was about the same.

In figure 16, a comparison of cesarean section delivery rates by State for very low birth weight babies is shown. In figure 17, the percent of increase from 1975 to 1983 by gestational age is shown. The inconsistency of these data may be due to the relatively poor quality of this information as reported on birth certificates.

Figure 18 shows cesarean section delivery rates for plural births in 1970 and 1983, and figure 19 shows rates for 1983. Figure 20 shows higher sex ratios for cesarean sections than for vaginal births in all States.

In figure 21, the percent of all cesarean section deliveries that were repeat procedures is given for those States that could provide this information.

Figure 22 shows the percent of increase in cesarean section rates for live births and neonatal deaths from 1975 to 1983. Without further study, it is difficult to interpret these results.

In summary, while many of the variables under study were consistent for all States, there were some interesting differences. Since the item "method of delivery" will be on the 1989 revision of the U.S. Standard Certificate of Live Birth, most, if not all, registration areas will begin to collect these data in 1989. With the implementation of standard wording and coding procedures and with the addition of information on primary and repeat cesarean section procedures and V-BAC's (vaginal births after cesarian) in all States, we will be able to study future trends in cesarean section deliveries in all States in greater detail. National sample data do not generally provide the specificity needed for State and local public health program managers and decisionmakers. There is considerable value to State and local users in State-specific data and in cross-State comparisons such as those shown in this presentation.

Table 1. Selected characteristics of cesarean section data provided by States participating in the study

State	Year data added to certificate	Year data first coded and entered	Type of data provided	
			Occurrence	Residence
California	1940	1968	x	
Connecticut	1956	1979	x	
Georgia	prior to 1980	prior to 1980	x	
Kansas	1958	1960	x	
Maine	1983	1983	x	
Maryland	prior to 1970	1970		x
Minnesota	1967	1967	x	
Missouri	1968	1968	x	
Montana	1939	1954	x	
New Hampshire	1978	1978	x	
New Mexico	1941	1980	x	x
New York City	1937	1937	x	
New York State (excluding New York City)	1949	1976	x	
Pennsylvania	1942	1960	x	
Utah	1978	1978	x	
Vermont	1978	1978	x	
Washington	1980	1980	x	
Wisconsin	1968	1968	x	x

Table 2. Cesarean section delivery rates,[1] by year: Selected States, 1965-83

State	1965	1967	1968	1970	1975	1978	1980	1983
California	5.1	N/A	N/A	6.9	12.8	N/A	17.1	19.8
Connecticut	N/A	N/A	N/A	N/A	N/A	N/A	18.7	20.7
Georgia	N/A	N/A	N/A	N/A	N/A	N/A	15.4	19.9
Kansas	4.0	N/A	N/A	4.3	9.0	N/A	16.1	20.7
Maine	N/A	N/A	N/A	N/A	N/A	N/A	N/A	17.9
Maryland	N/A	N/A	N/A	5.7	12.8	N/A	20.6	23.6
Minnesota	N/A	3.4	N/A	4.3	7.9	N/A	13.9	16.3
Missouri	N/A	N/A	N/A	4.7	9.2	N/A	15.1	19.0
Montana	3.6	N/A	N/A	5.0	7.4	N/A	12.6	15.5
New Hampshire	N/A	N/A	N/A	N/A	N/A	15.0	N/A	19.6
New Mexico	N/A	N/A	N/A	N/A	N/A	N/A	14.7	17.2
New York City	N/A	N/A	N/A	8.2	14.5	19.1	N/A	20.4
Upstate New York	4.6	N/A	N/A	5.7	10.3	N/A	18.9	21.8
Pennsylvania	4.6	N/A	N/A	5.6	10.0	N/A	16.0	19.3
Utah	N/A	N/A	N/A	N/A	N/A	10.1	11.7	13.9
Vermont	N/A	N/A	N/A	N/A	N/A	13.8	15.0	17.2
Washington	N/A	N/A	N/A	N/A	N/A	N/A	14.3	16.5
Wisconsin	N/A	N/A	4.2	5.0	8.3	N/A	13.6	15.8

[1]Rate per 100 live births; excludes unknown type of delivery.

NOTES: Maryland and Wisconsin data are by State of residence; all others are by State of occurrence. N/A = not available.

Table 3. Cesarean section delivery rates, by State and rank: Selected States, 1983

Rank	State	Rate[1]
1	Maryland	23.6
2	Upstate New York	21.8
3	Connecticut	20.7
3	Kansas	20.7
5	New York City	20.4
6	Georgia	19.9
7	California	19.8
8	New Hampshire	19.6
9	Pennsylvania	19.3
10	Missouri	19.0
11	Maine	17.9
12	New Mexico	17.2
12	Vermont	17.2
14	Washington	16.5
15	Minnesota	16.3
16	Wisconsin	15.8
17	Montana	15.5
18	Utah	13.9

[1]Rate per 100 live births; excludes unknown type of delivery.

NOTES: U.S. rate for 1983 is 20.3 per 100 hospital deliveries; 1.1 percent of all births in the United States were nonhospital deliveries. Maryland and Wisconsin data are by State of residence; all others are by State of occurrence.

Table 4. Cesarean section delivery rates,[1] by age of mother: Selected States, 1983

State	All ages	Age of mother				
		Under 20 years	20-24 years	25-29 years	30-34 years	35 years and over
Washington	14.3	10.4	13.3	14.9	16.2	18.1
Minnesota	14.8	11.5	13.5	14.9	16.9	17.9
Wisconsin	15.4	12.3	14.6	15.9	16.8	18.4
Montana	15.5	12.0	13.7	16.7	17.0	21.8
Vermont	17.1	14.8	15.8	16.7	19.6	23.1
Maine	17.9	13.7	17.6	18.3	20.2	21.7
Missouri	19.0	14.4	17.7	20.0	22.2	23.6
Pennsylvania	19.3	14.5	17.8	19.8	22.7	25.0
Connecticut	19.4	14.7	17.5	19.6	21.5	24.8
Georgia	19.6	15.4	18.9	20.8	23.3	26.1
New Hampshire	19.6	15.0	16.8	21.3	21.8	24.6
California	19.8	14.4	17.7	20.4	23.4	26.2
New York City	20.3	12.7	17.4	21.0	23.5	28.8
Maryland	23.2	17.4	21.4	23.8	26.8	29.5

[1]Rate per 100 live births; excludes unknown type of delivery.

NOTE: Maryland and Wisconsin data are by State of residence; all others are by State of occurrence.

Table 5. Cesarean section delivery rates,[1] by race: Selected States, 1983

State	All races	White	Black	All other
California	19.8	19.9	20.8	18.7
Connecticut	19.4	[2]19.6	18.0	19.2
Georgia	19.6	20.2	18.4	16.8
Maine	17.9	17.9	20.5	19.4
Maryland	23.2	22.8	23.8	23.9
Minnesota	14.8	15.1	17.1	12.4
Missouri	19.0	19.3	17.0	18.2
Montana	15.5	15.6	25.0	13.7
New Hampshire	19.6	19.7	11.5	16.8
New York City	20.3	21.2	18.8	20.8
Pennsylvania	19.3	18.8	20.0	19.0
Vermont	17.1	17.2	20.0	10.0
Washington	14.3	14.4	14.1	12.7
Wisconsin	15.4	15.4	16.6	12.5

[1]Rate per 100 live births; excludes unknown type of delivery.
[2]Includes unknown race.

NOTE: Maryland and Wisconsin data are by State of residence; all others are by State of occurrence.

Table 6. Cesarean section delivery rates,[1] by mother's marital status: Selected States, 1970 and 1983

State and year	All mothers	Marital status	
		Married	Not married
Minnesota			
1970	4.2	4.2	3.5
1983	14.8	14.9	13.8
Montana			
1970	5.0	5.1	3.6
1983	15.5	15.8	13.5
Pennsylvania			
1970	5.6	5.7	5.1
1983	19.3	19.9	17.3
Missouri			
1970	4.7	4.8	4.3
1983	19.0	19.7	17.1
Maryland			
1970	5.6	5.5	6.4
1983	23.3	23.9	21.2
New York City			
1970	8.1	8.6	6.3
1983	20.3	21.9	17.6
Wisconsin			
1970	4.9	5.1	3.7
1983	15.4	15.6	14.5

[1]Rate per 100 live births; excludes unknown type of delivery.

NOTE: Maryland and Wisconsin data are by State of residence; all others are by State of occurrence.

Table 7. Cesarean section delivery rates,[1] by years of education of mother: Selected States, 1980 and 1983

State and year	Years of education	
	Less than 12 years	12 years or more
Connecticut		
1980	16.3	18.1
1983	17.8	20.2
Georgia		
1980	12.1	15.1
1983	16.1	20.9
Maryland		
1980	17.2	20.4
1983	19.4	24.0
Minnesota		
1980	12.1	13.4
1983	13.6	15.6
Missouri		
1980	12.3	15.8
1983	15.9	19.6
Montana		
1980	11.5	12.8
1983	13.2	15.9
New Hampshire		
1980	16.5	16.6
1983	16.3	20.2
New York City		
1980	16.6	20.1
1983	17.9	21.3
Pennsylvania		
1980	13.4	16.3
1983	15.4	19.8

Table 7. Cesarean section delivery rates,[1] by years of education of mother: Selected States, 1980 and 1983--Con.

State and year	Years of education	
	Less than 12 years	12 years or more
Vermont		
1980	12.6	15.4
1983	16.2	17.3
Wisconsin		
1980	12.5	13.5
1983	13.6	15.7

[1]Rate per 100 live births.

NOTE: Maryland and Wisconsin data are by State of residence; all others are by State of occurrence.

Table 8. Cesarean section delivery rates,[1] by birth order: Selected States, 1983

State	All orders	Birth order				
		First	Second	Third	Fourth	Fifth and higher
Connecticut	19.4	21.5	20.3	18.1	14.3	17.9
Minnesota	14.8	15.6	15.7	13.9	12.4	8.5
Montana	15.5	16.4	16.0	14.2	12.0	12.1
Pennsylvania	19.3	20.6	19.8	17.6	14.5	13.1
Missouri	19.0	20.0	20.0	17.0	14.8	14.8
Washington	14.3	15.2	14.8	13.1	11.4	10.4
Vermont	17.1	16.9	18.1	17.4	13.1	13.1
California	19.8	21.3	20.1	18.6	16.2	14.3
Maryland	23.3	24.3	23.3	21.0	18.9	18.1
New York City	20.3	20.6	21.5	20.0	16.9	15.6
Wisconsin	15.4	16.4	15.4	14.5	13.3	11.4
Georgia	19.6	20.7	20.6	17.8	13.7	13.1

[1]Rate per 100 live births.

NOTE: Maryland and Wisconsin data are by State of residence; all others are by State of occurrence.

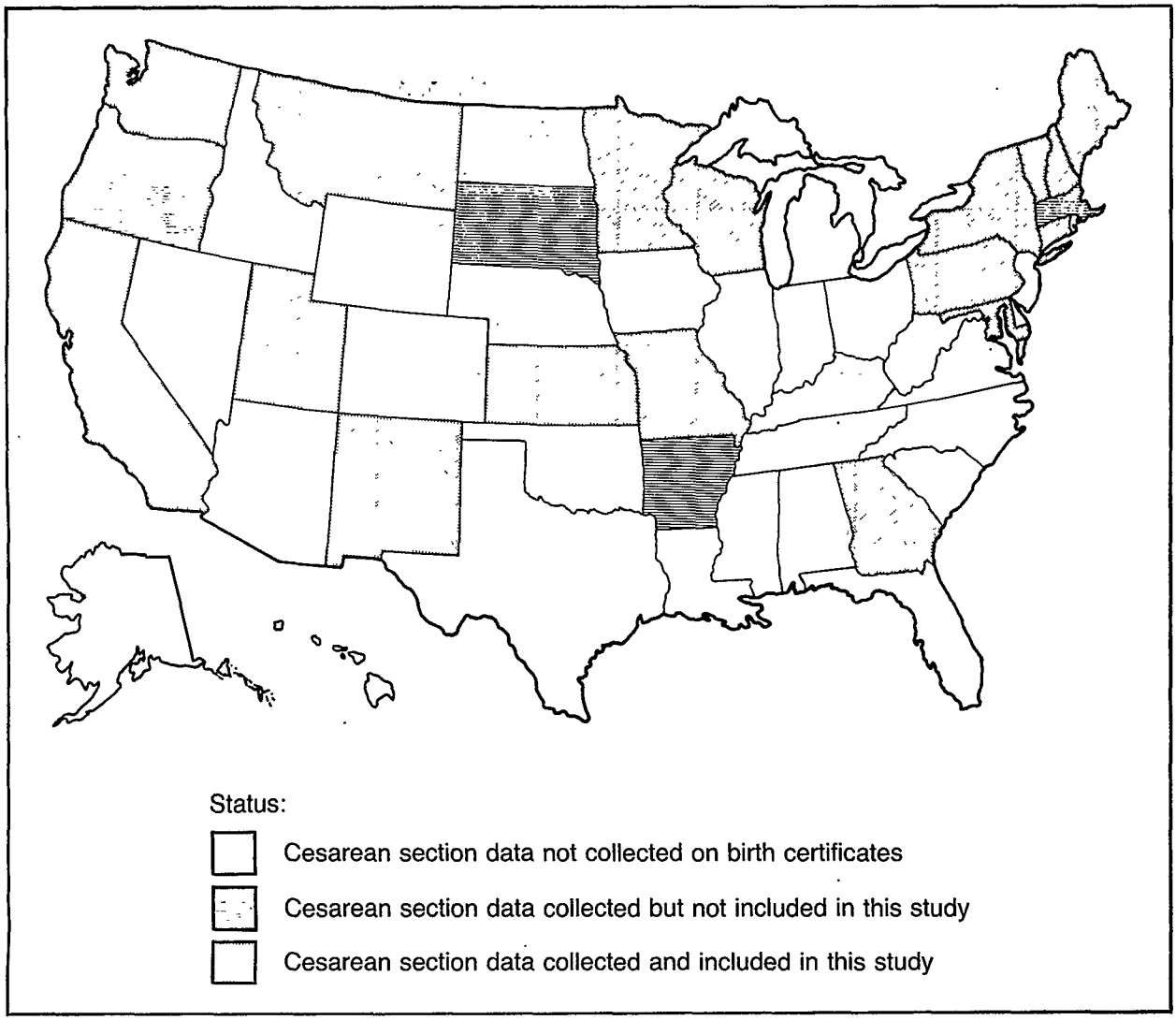
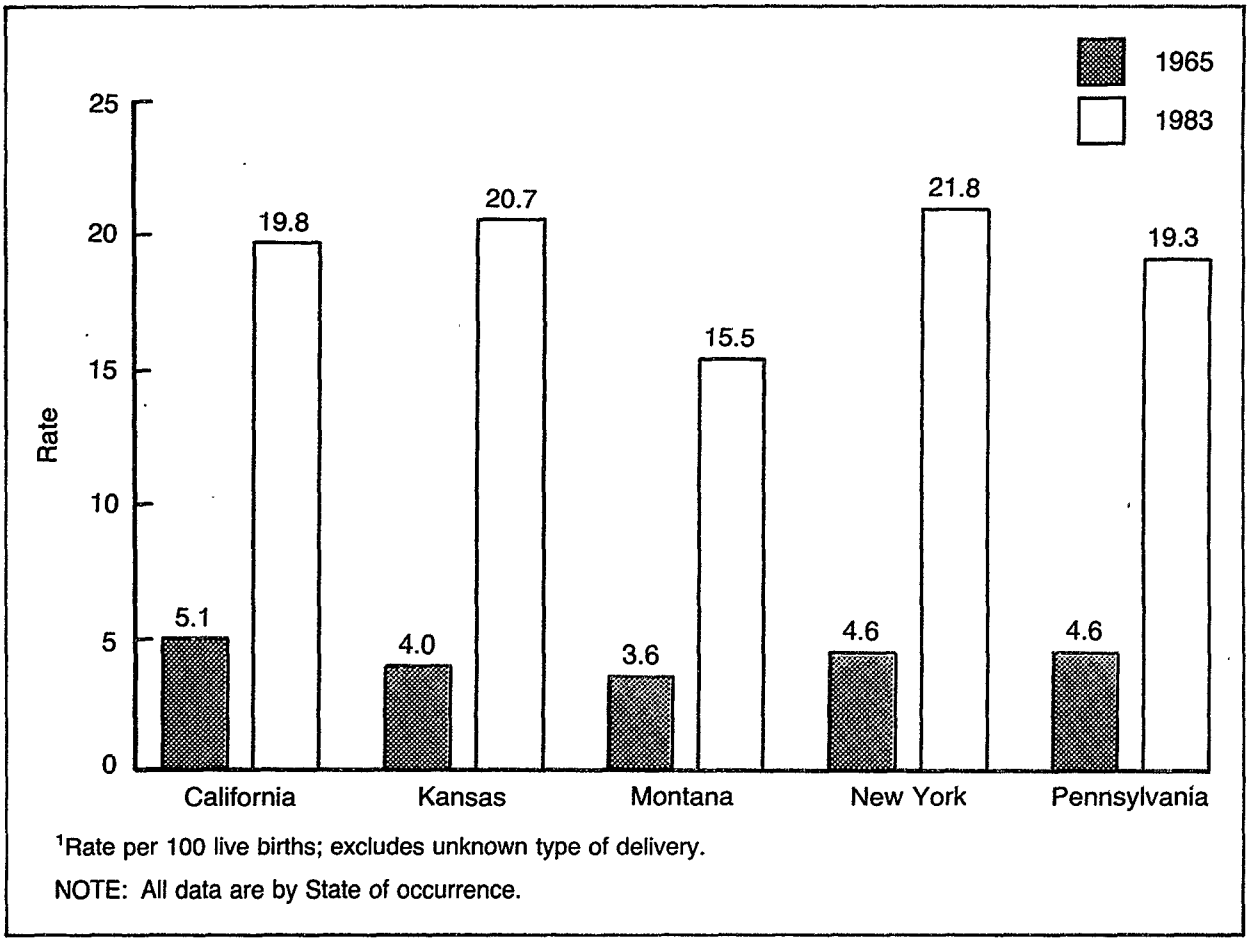


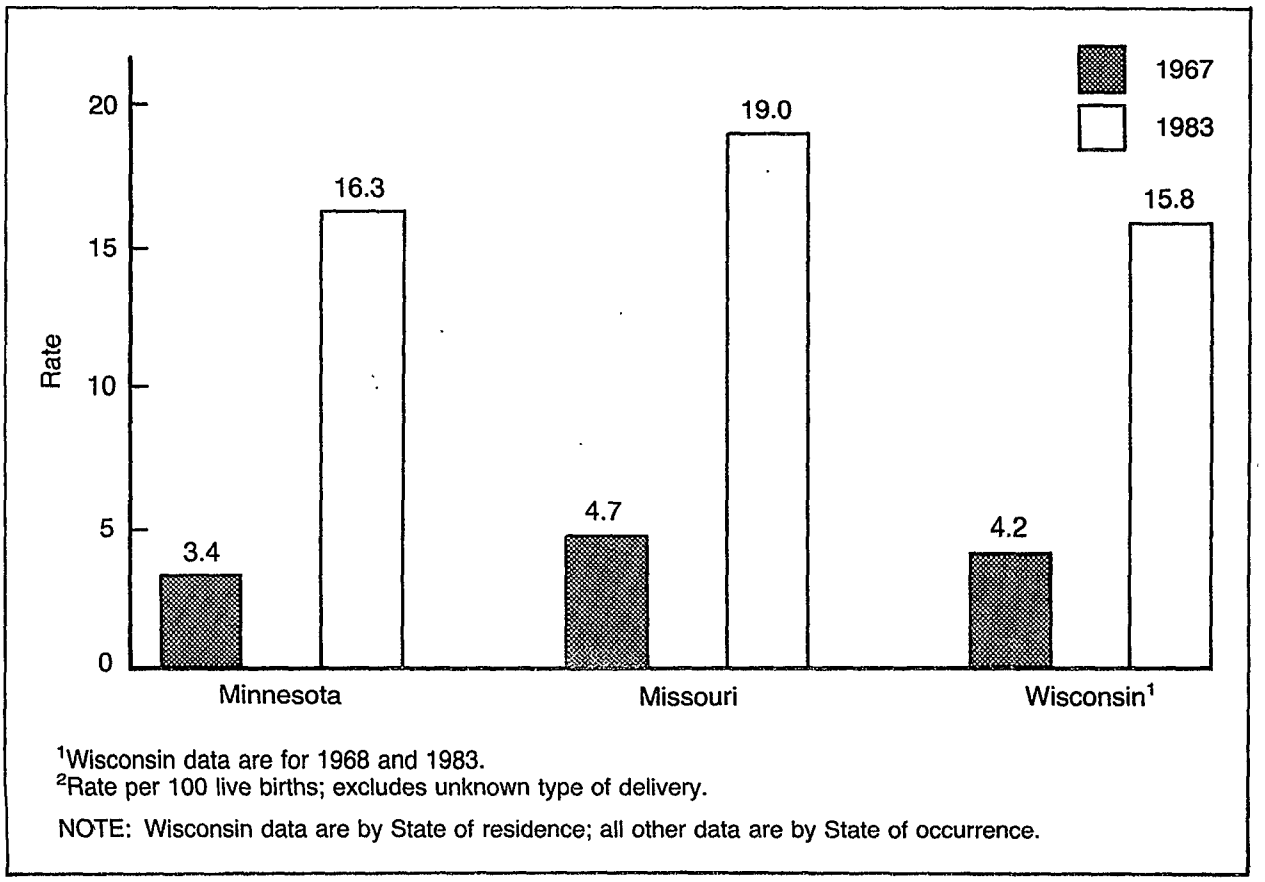
Figure 1. States by cesarean section data collection and study participation status



[1]Rate per 100 live births; excludes unknown type of delivery.

NOTE: All data are by State of occurrence.

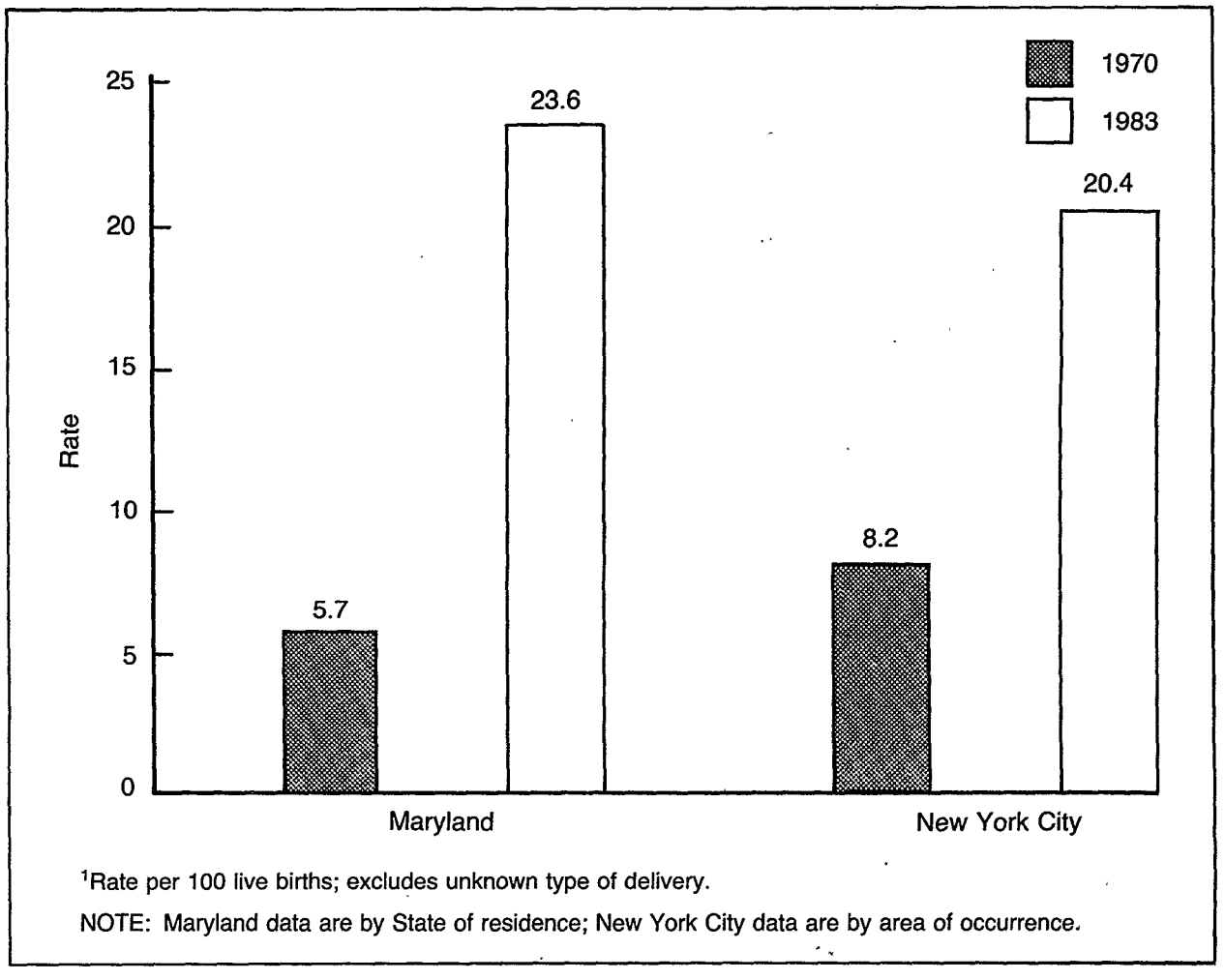
Figure 2. Cesarean section delivery rates:[1] Selected States, 1965 and 1983



[1]Wisconsin data are for 1968 and 1983.
[2]Rate per 100 live births; excludes unknown type of delivery.

NOTE: Wisconsin data are by State of residence; all other data are by State of occurrence.

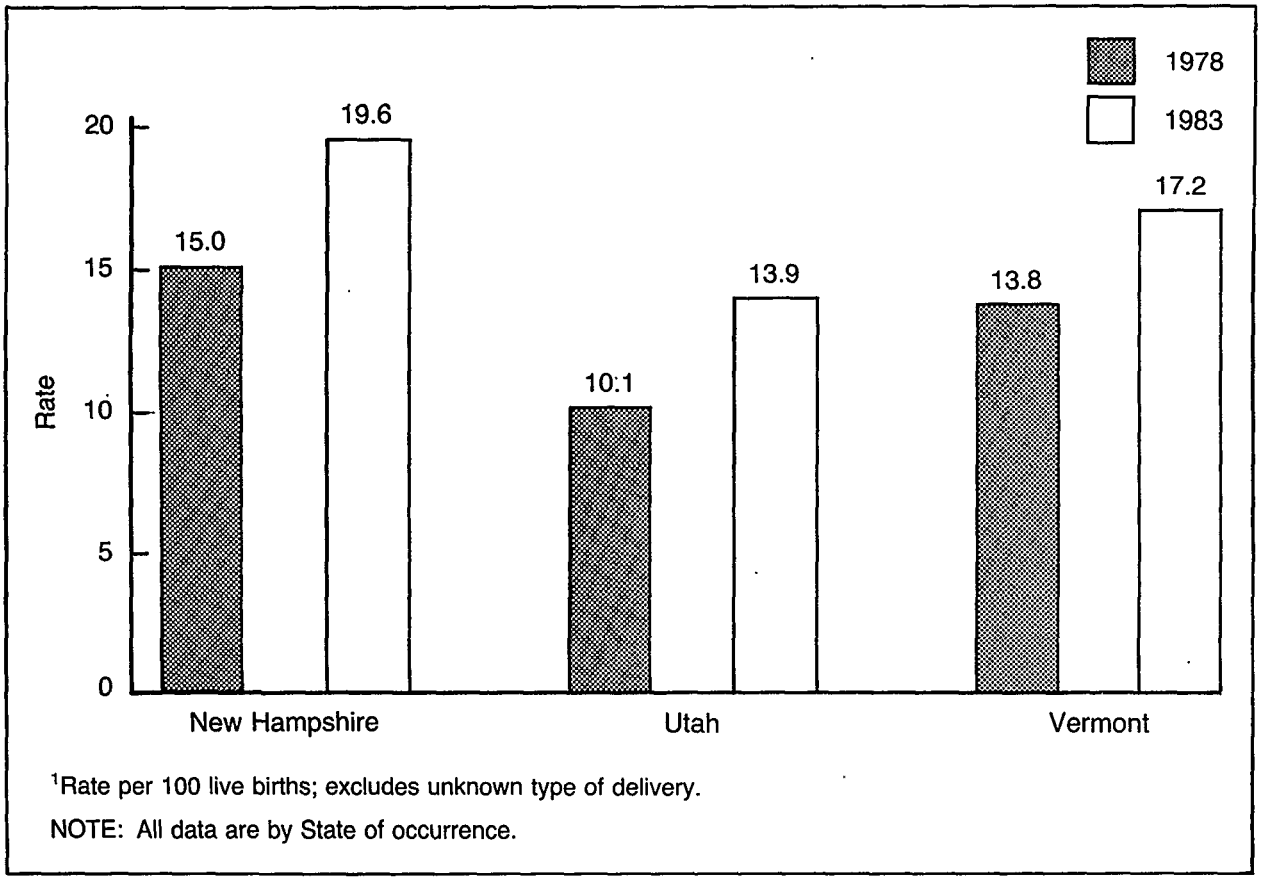
Figure 3. Cesarean section delivery rates:[2] Selected States, 1967 and 1983



[1]Rate per 100 live births; excludes unknown type of delivery.

NOTE: Maryland data are by State of residence; New York City data are by area of occurrence.

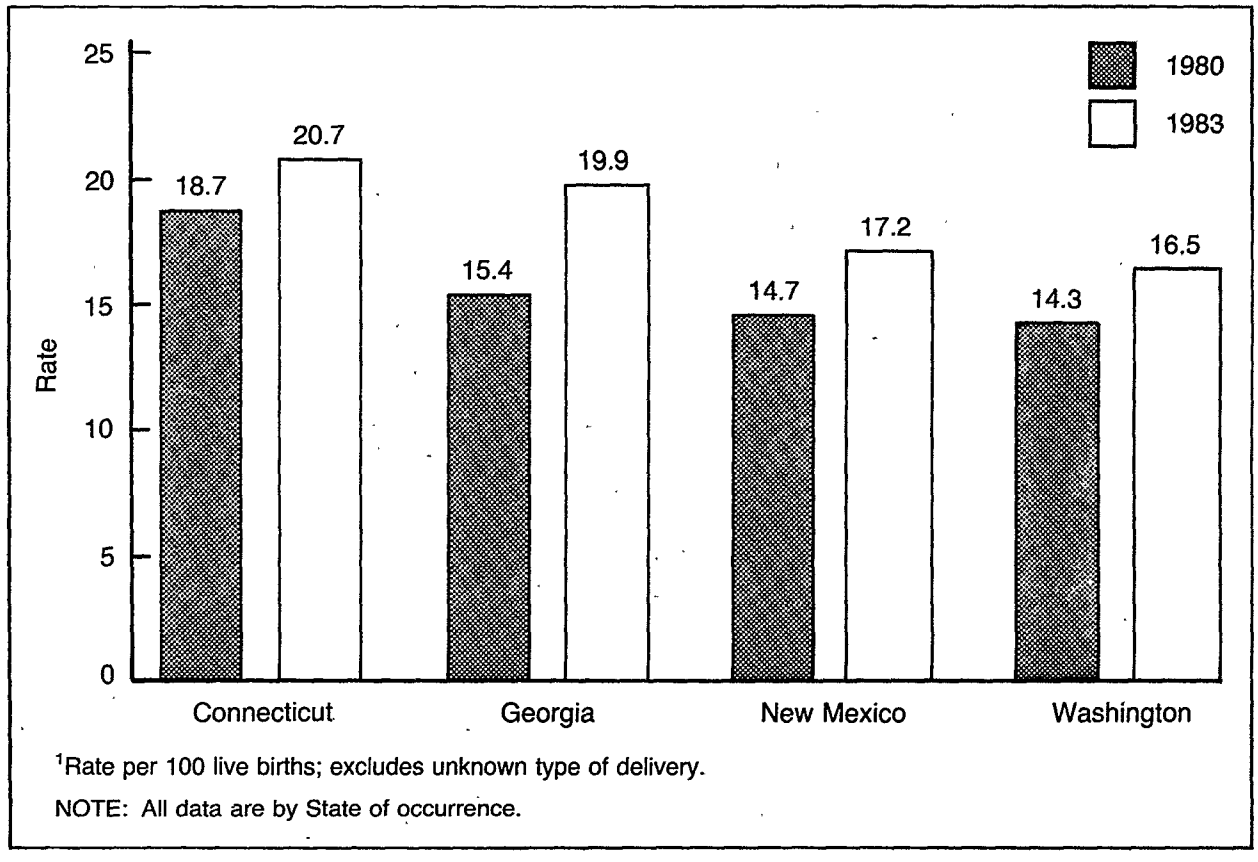
Figure 4. Cesarean section delivery rates:[1] Maryland and New York City, 1970 and 1983



[1]Rate per 100 live births; excludes unknown type of delivery.

NOTE: All data are by State of occurrence.

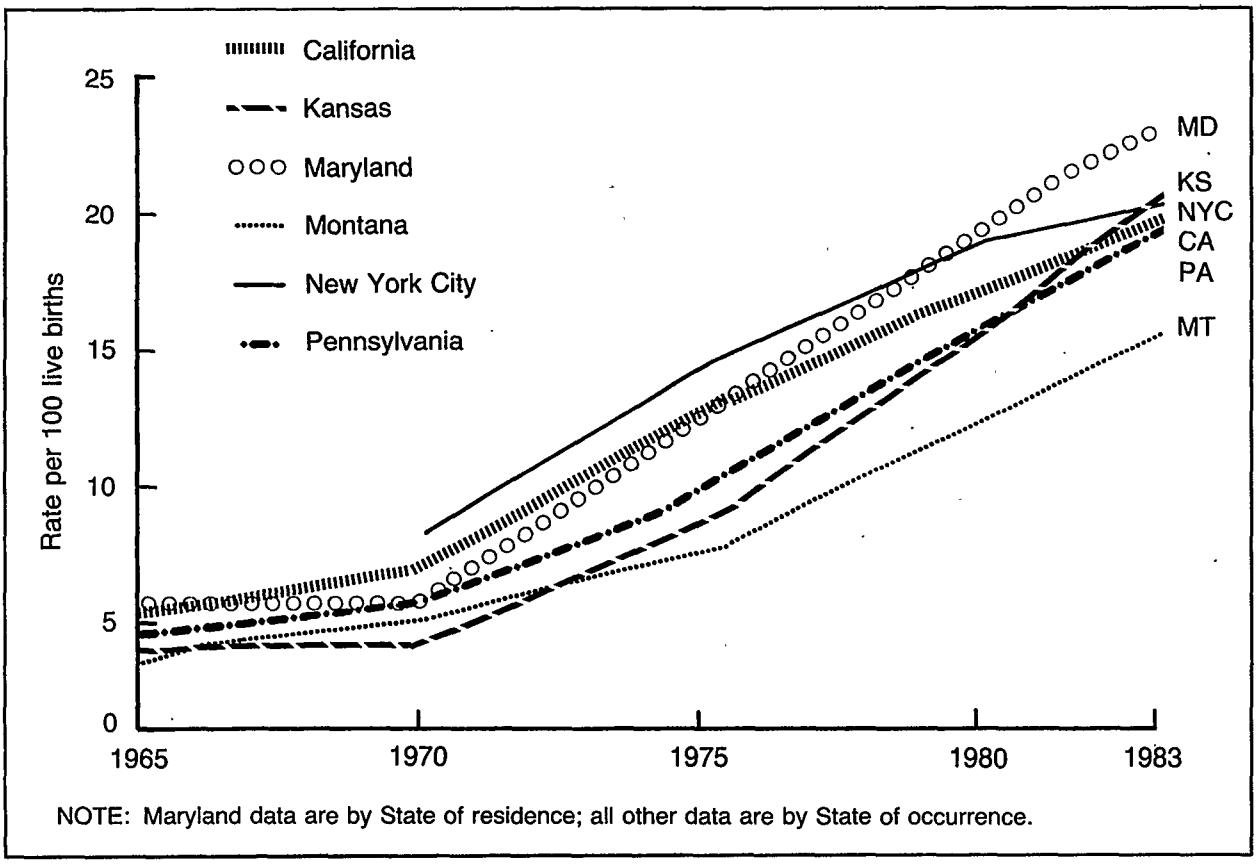
Figure 5. Cesarean section delivery rates:[1] Selected States, 1978 and 1983



[1]Rate per 100 live births; excludes unknown type of delivery.

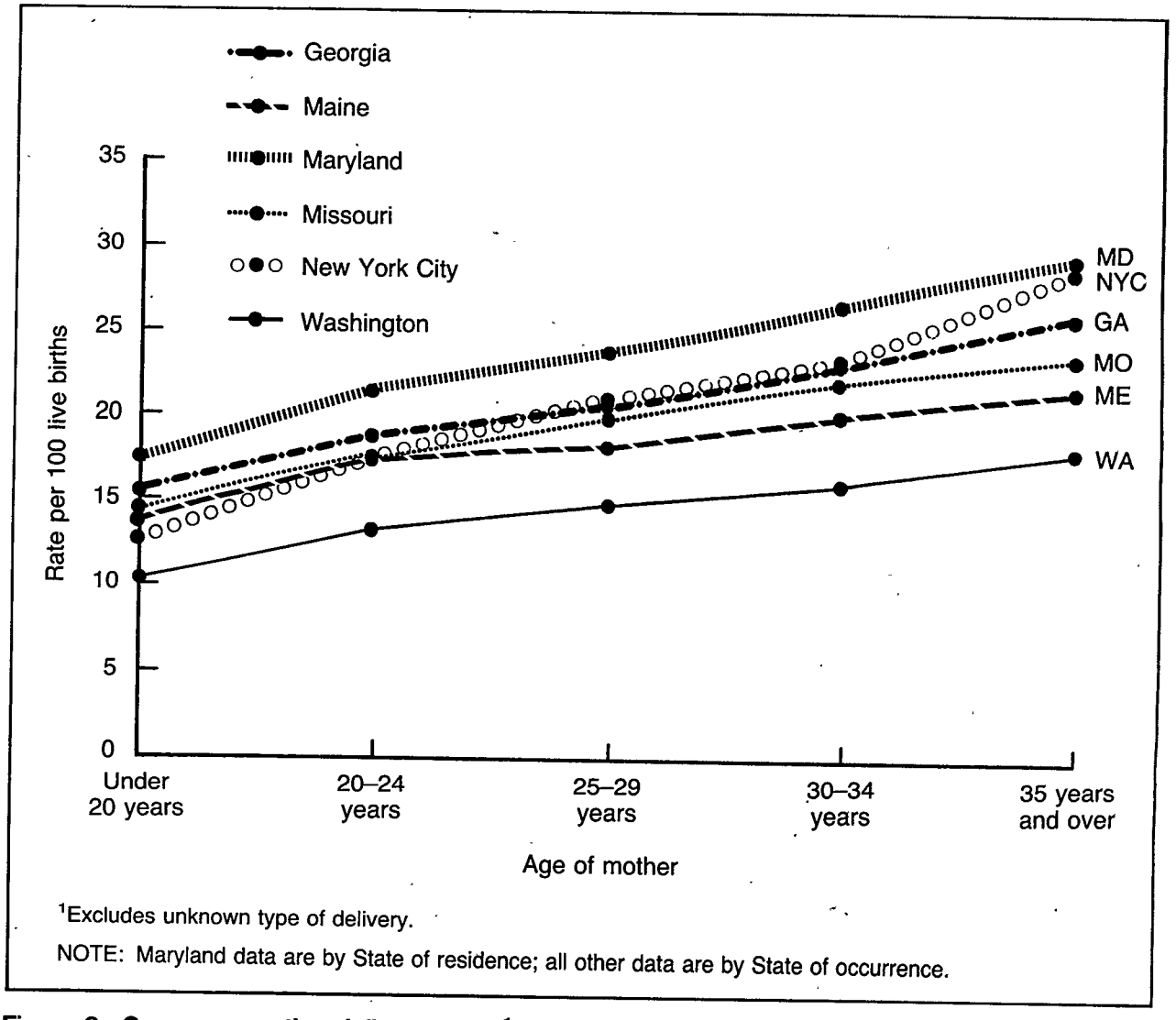
NOTE: All data are by State of occurrence.

Figure 6. Cesarean section delivery rates:[1] Selected States, 1980 and 1983



NOTE: Maryland data are by State of residence; all other data are by State of occurrence.

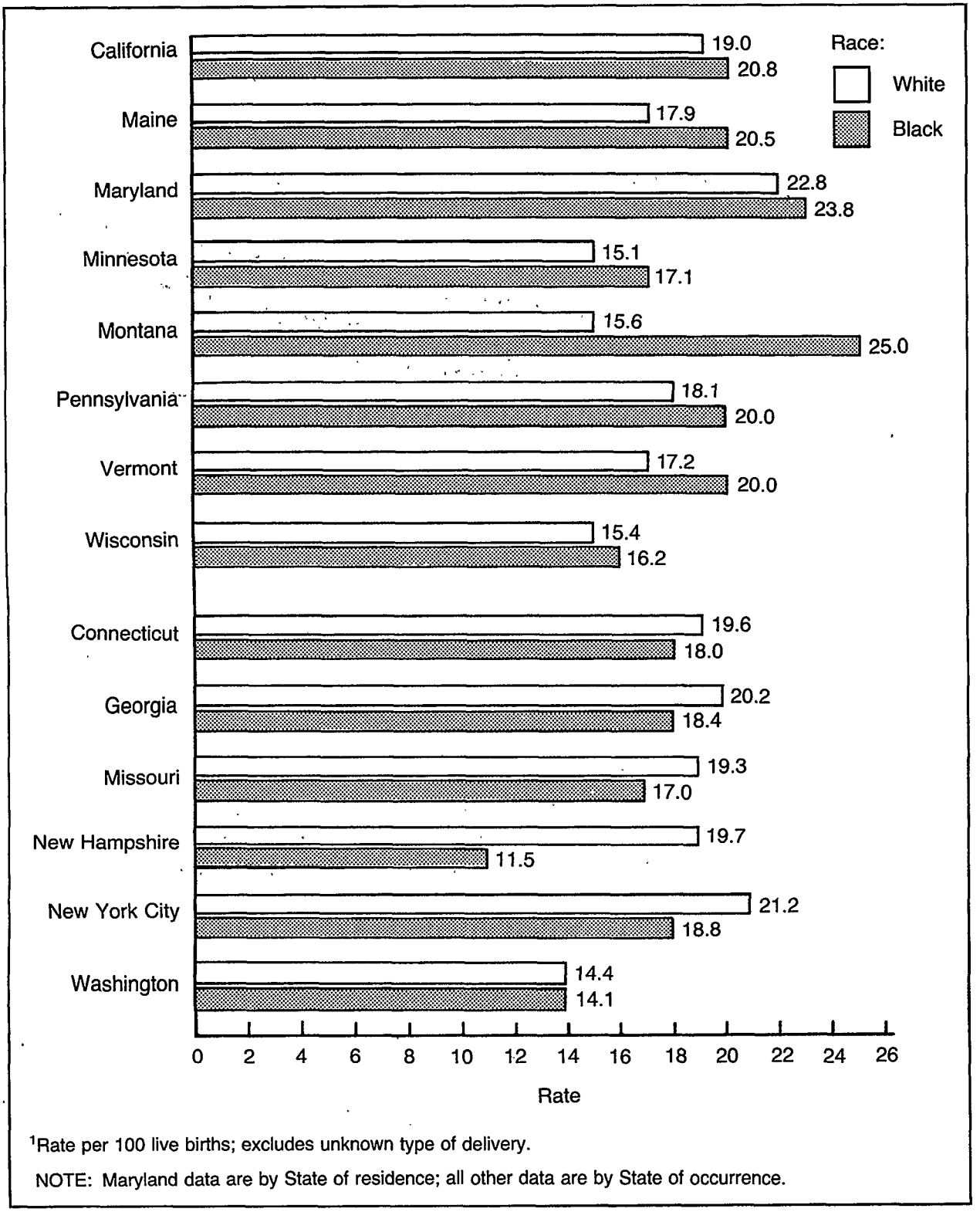
Figure 7. Cesarean section delivery rates per 100 live births: Selected States, 1965–83



[1]Excludes unknown type of delivery.

NOTE: Maryland data are by State of residence; all other data are by State of occurrence.

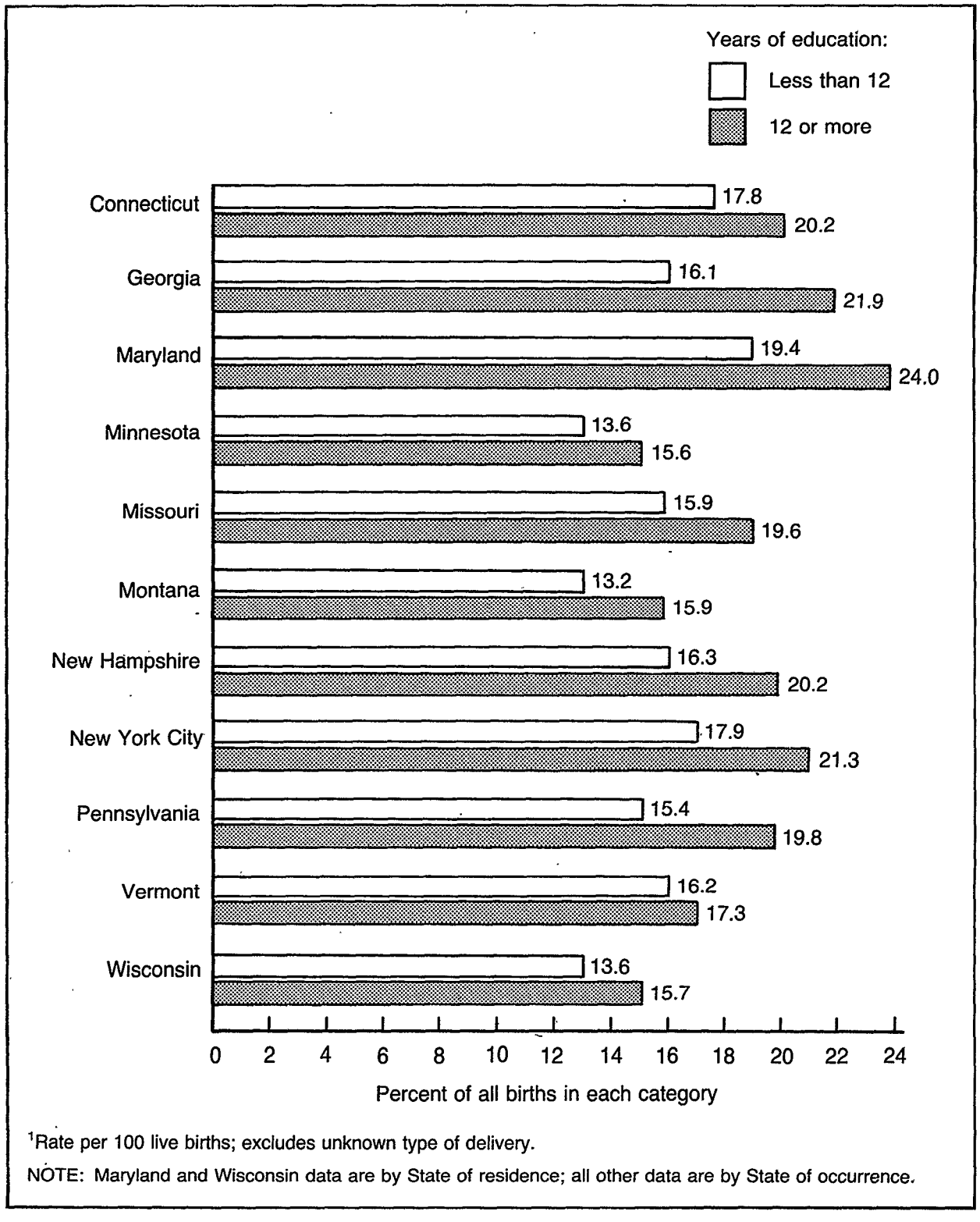
Figure 8. Cesarean section delivery rates,[1] by age of mother: Selected States, 1983



[1]Rate per 100 live births; excludes unknown type of delivery.

NOTE: Maryland data are by State of residence; all other data are by State of occurrence.

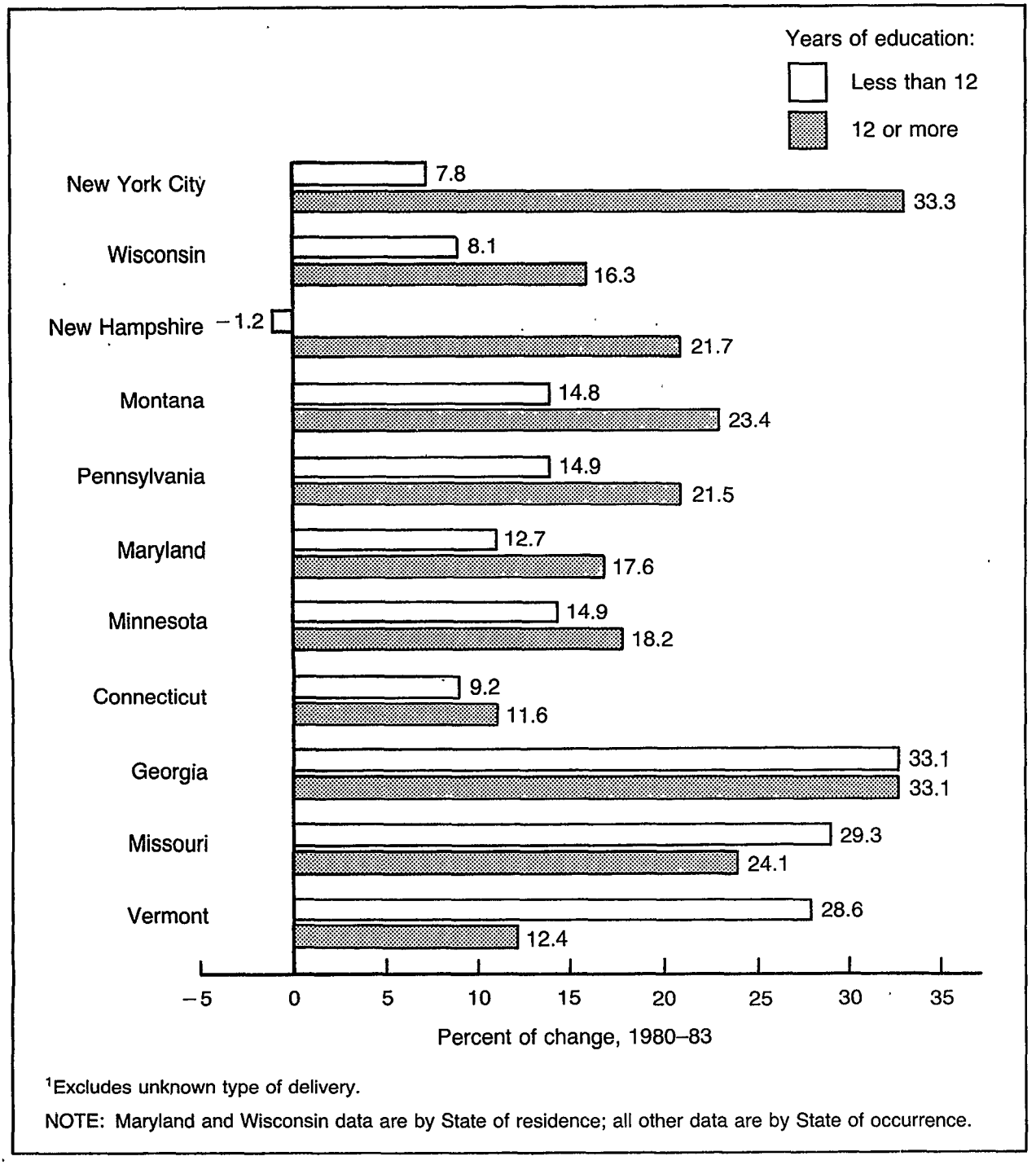
Figure 9. Cesarean section delivery rates,[1] by race: Selected States, 1983



[1]Rate per 100 live births; excludes unknown type of delivery.

NOTE: Maryland and Wisconsin data are by State of residence; all other data are by State of occurrence.

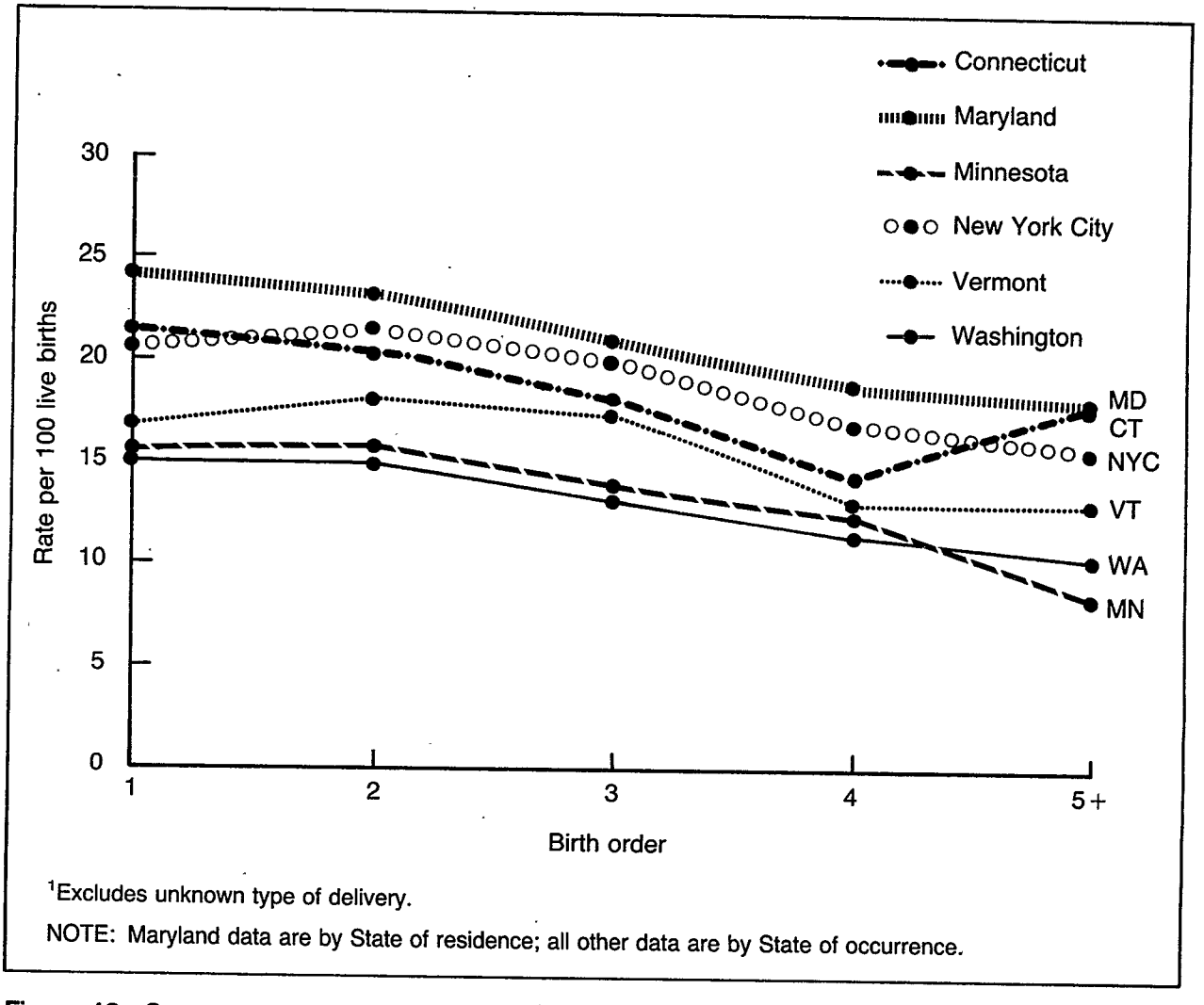
Figure 10. Cesarean section delivery rates,[1] by years of education of mother: Selected States, 1983



[1]Excludes unknown type of delivery.

NOTE: Maryland and Wisconsin data are by State of residence; all other data are by State of occurrence.

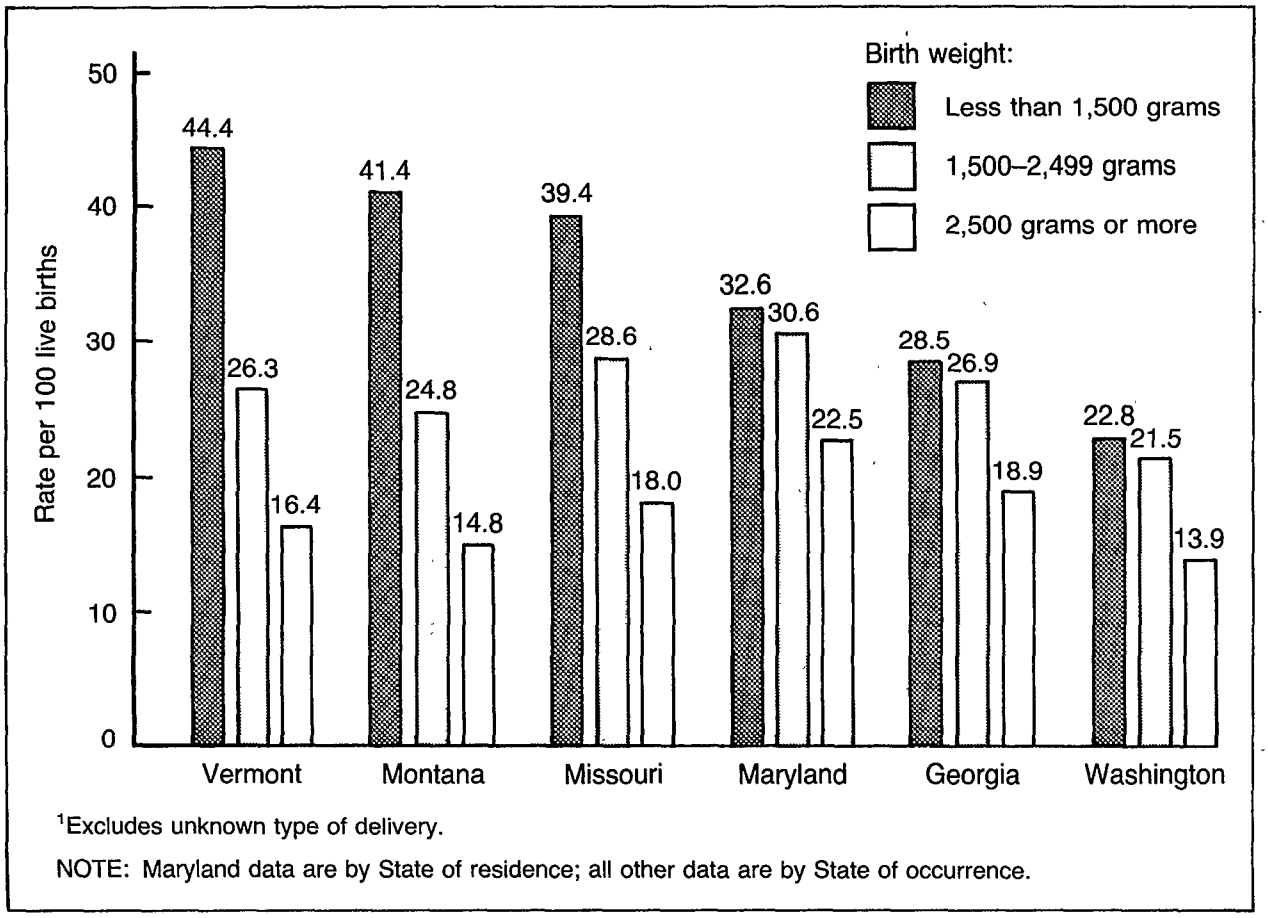
Figure 11. Percent of change for cesarean section delivery rates,[1] by years of education of mother: Selected States, 1980–83



[1]Excludes unknown type of delivery.

NOTE: Maryland data are by State of residence; all other data are by State of occurrence.

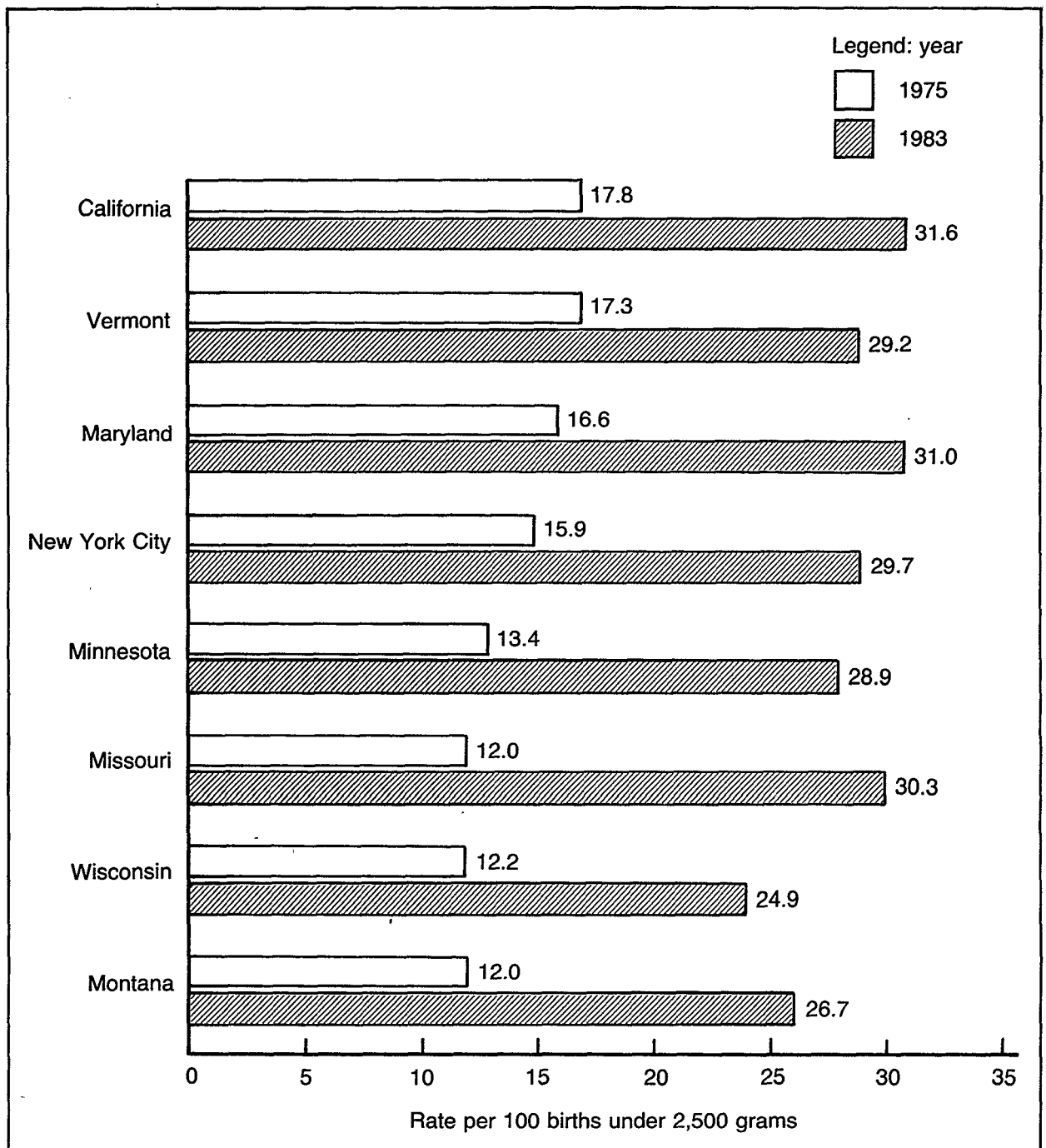
Figure 12. Cesarean section delivery rates,[1] by birth order: Selected States, 1983



[1]Excludes unknown type of delivery.

NOTE: Maryland data are by State of residence; all other data are by State of occurrence.

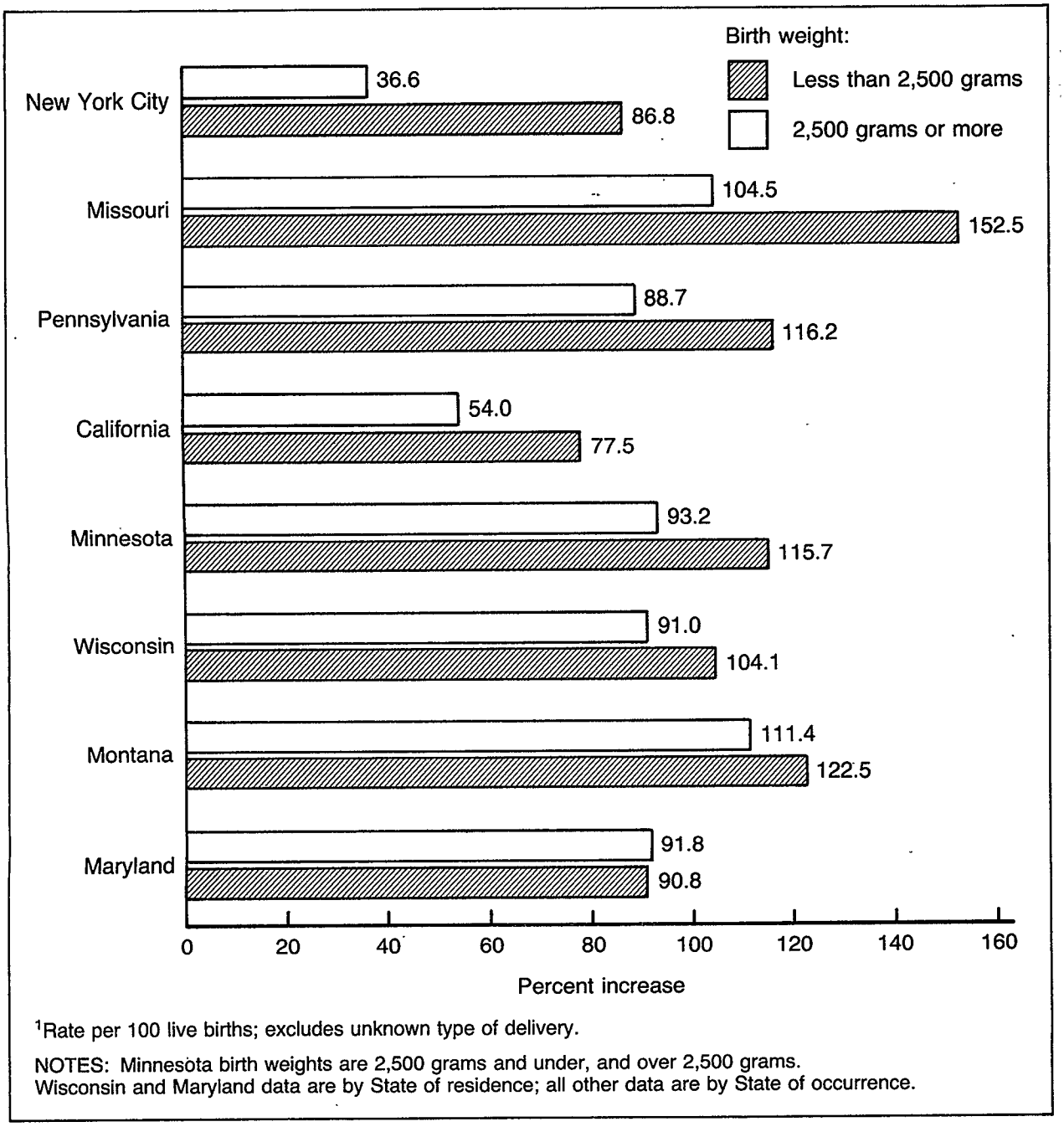
Figure 13. Cesarean section delivery rates,[1] by birth weight: Selected States, 1983



[1]Rate per 100 live births; excludes unknown type of delivery.

NOTES: Minnesota birth weight is 2,500 grams and under.
Wisconsin and Maryland data are by State of residence; all other data are by State of occurrence.

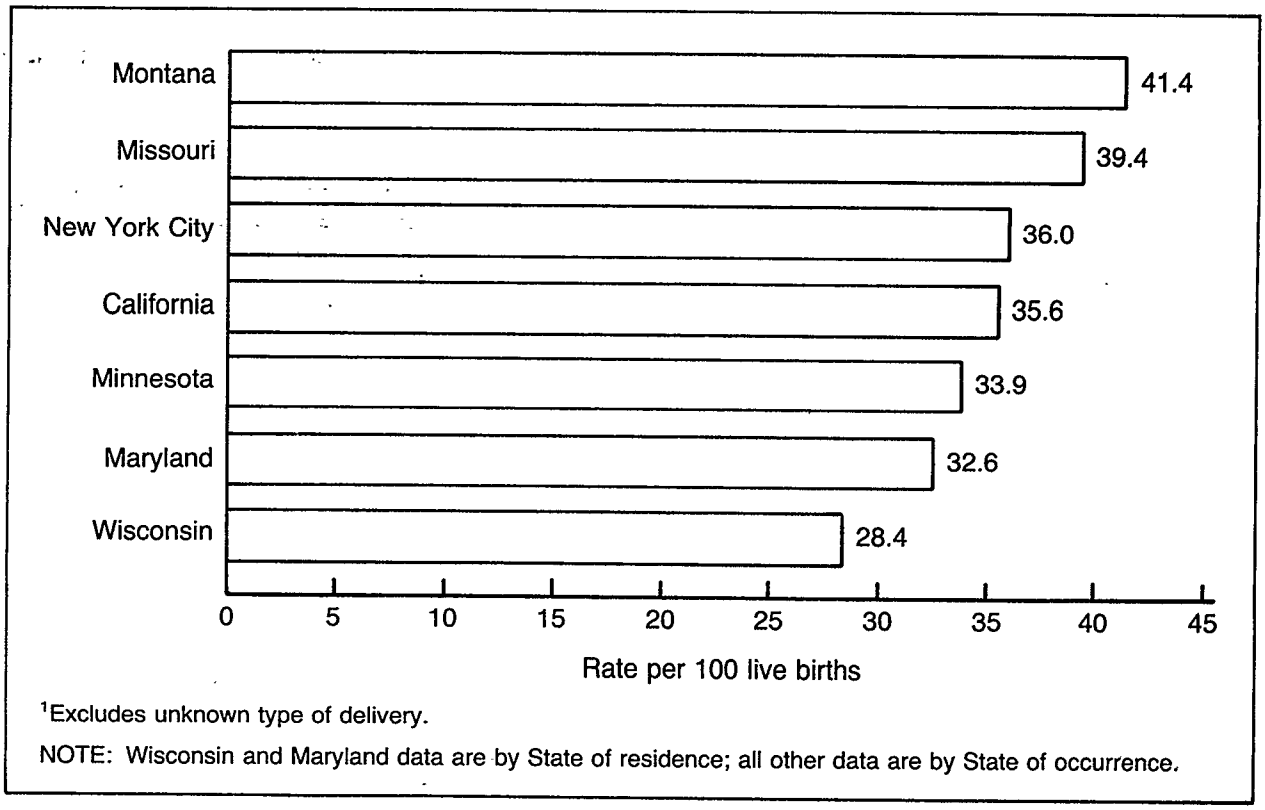
Figure 14. Cesarean section delivery rates[1] for births less than 2,500 grams: Selected States, 1975 and 1983



[1]Rate per 100 live births; excludes unknown type of delivery.

NOTES: Minnesota birth weights are 2,500 grams and under, and over 2,500 grams.
Wisconsin and Maryland data are by State of residence; all other data are by State of occurrence.

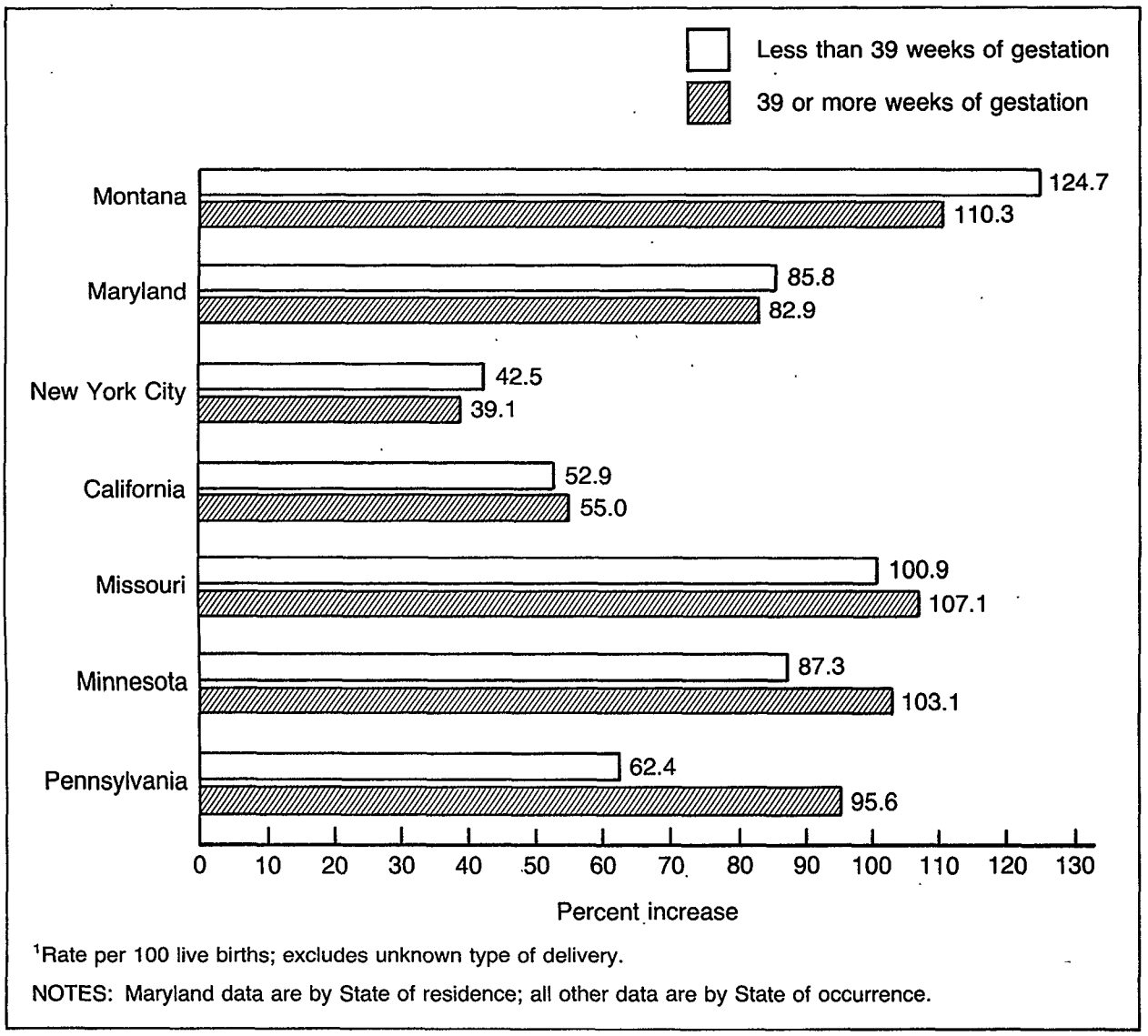
Figure 15. Percent increase for cesarean section deliveries,[1] by birth weight: Selected States, 1975–83



[1]Excludes unknown type of delivery.

NOTE: Wisconsin and Maryland data are by State of residence; all other data are by State of occurrence.

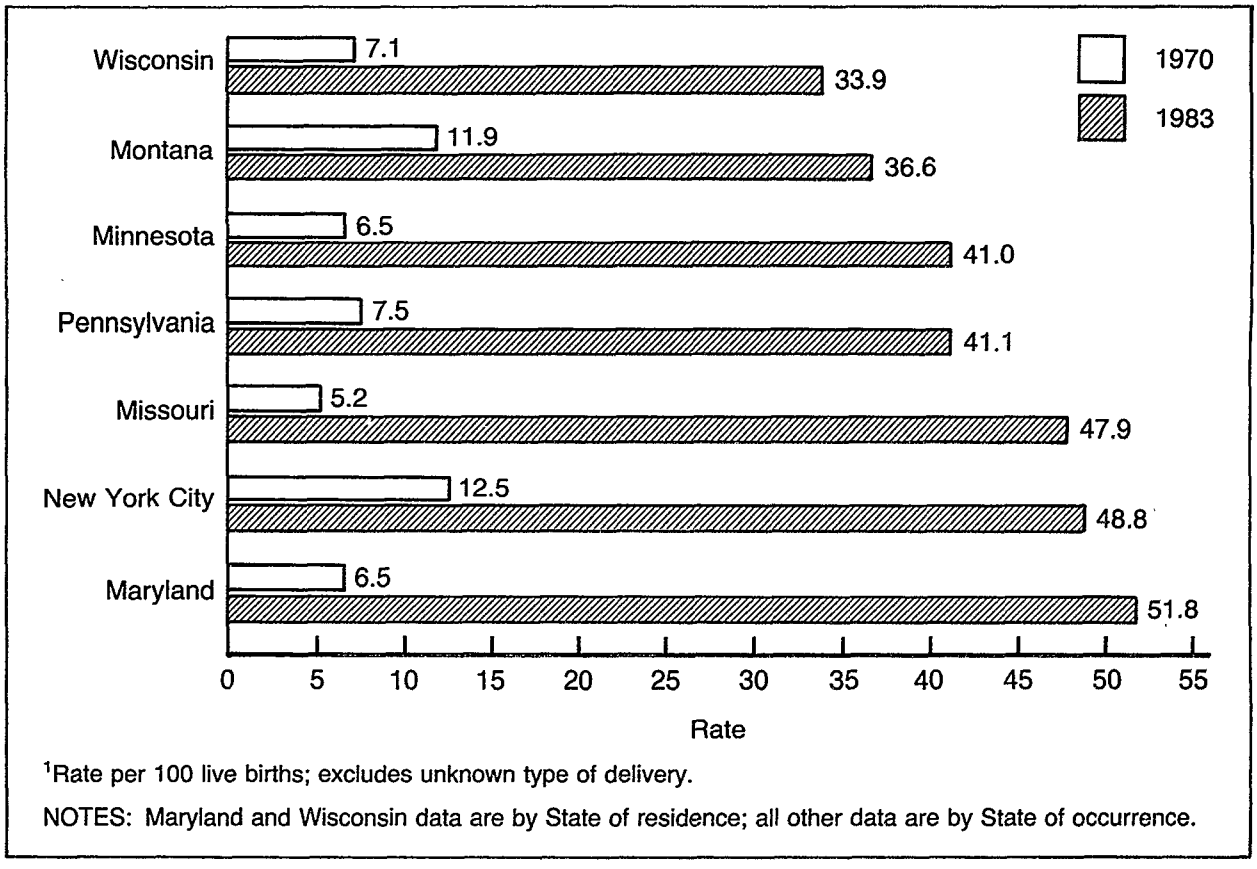
Figure 16. Cesarean section delivery rates[1] for birth weight less than 1,500 grams: Selected States, 1983



[1]Rate per 100 live births; excludes unknown type of delivery.

NOTES: Maryland data are by State of residence; all other data are by State of occurrence.

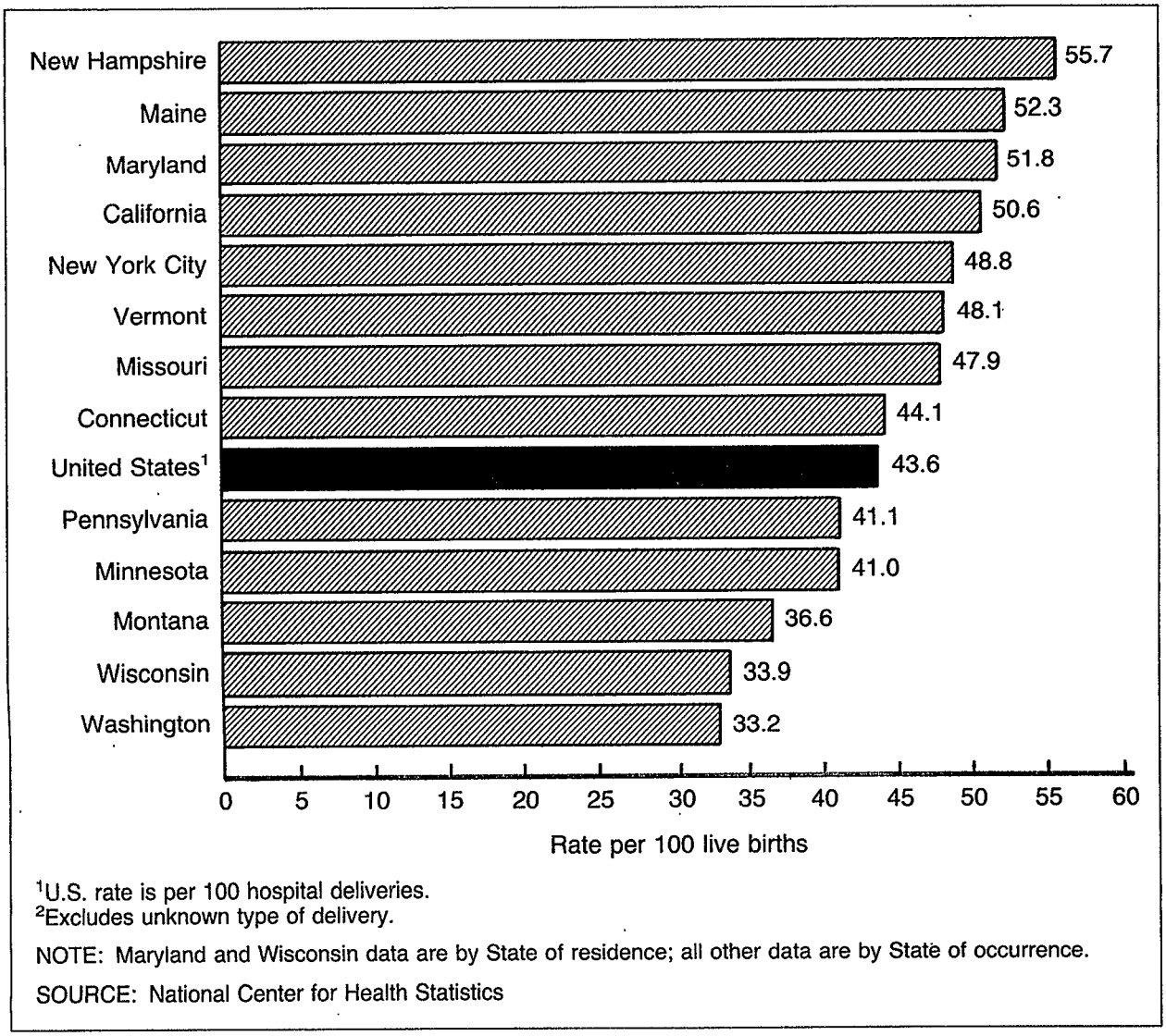
Figure 17. Percent increase in cesarean section delivery rates,[1] by gestational age: Selected States, 1975–83



[1]Rate per 100 live births; excludes unknown type of delivery.

NOTES: Maryland and Wisconsin data are by State of residence; all other data are by State of occurrence.

Figure 18. Cesarean section delivery rates[1] for plural births: Selected States, 1970 and 1983

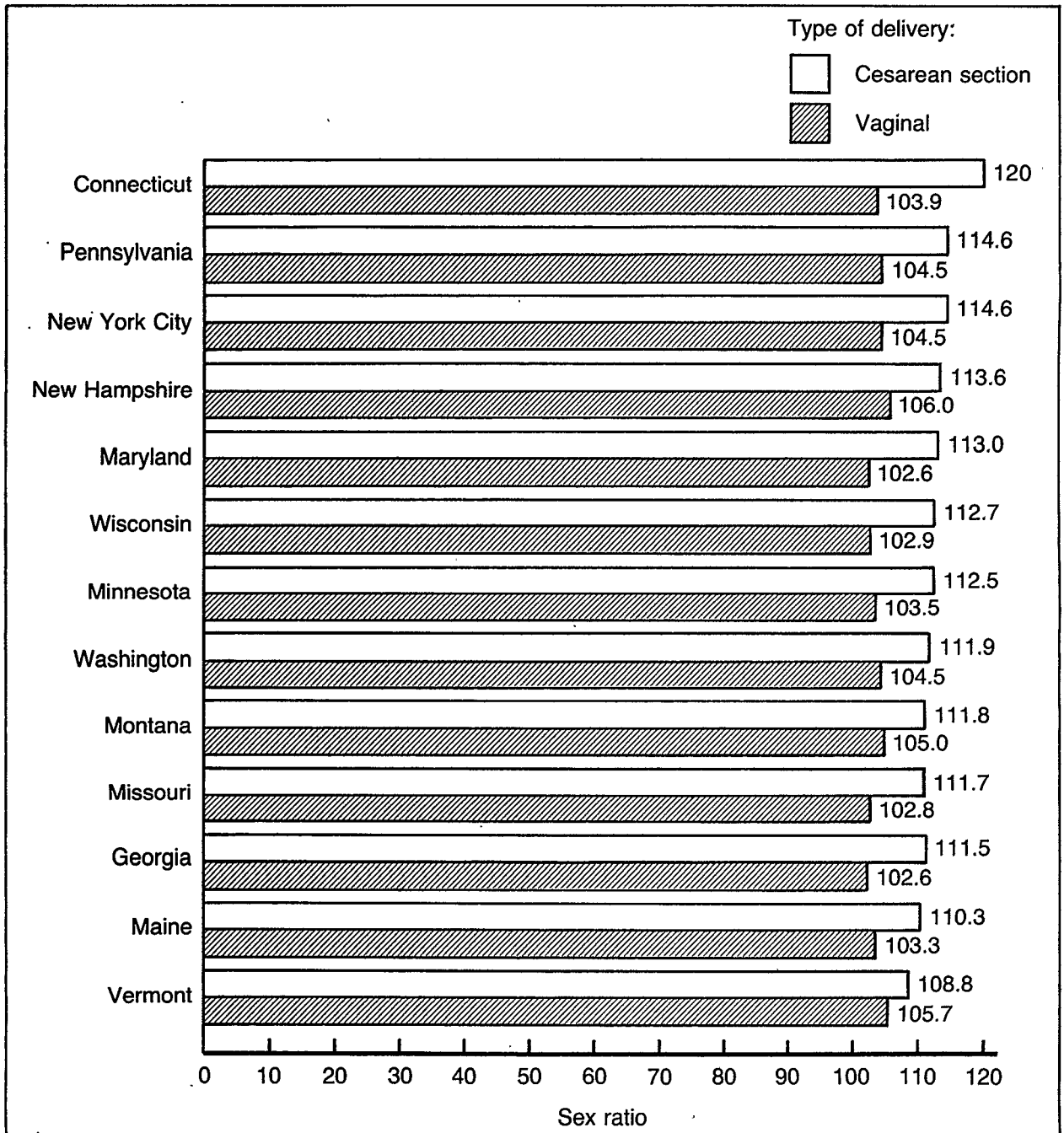


[1]U.S. rate is per 100 hospital deliveries.
[2]Excludes unknown type of delivery.

NOTE: Maryland and Wisconsin data are by State of residence; all other data are by State of occurrence.

SOURCE: National Center for Health Statistics

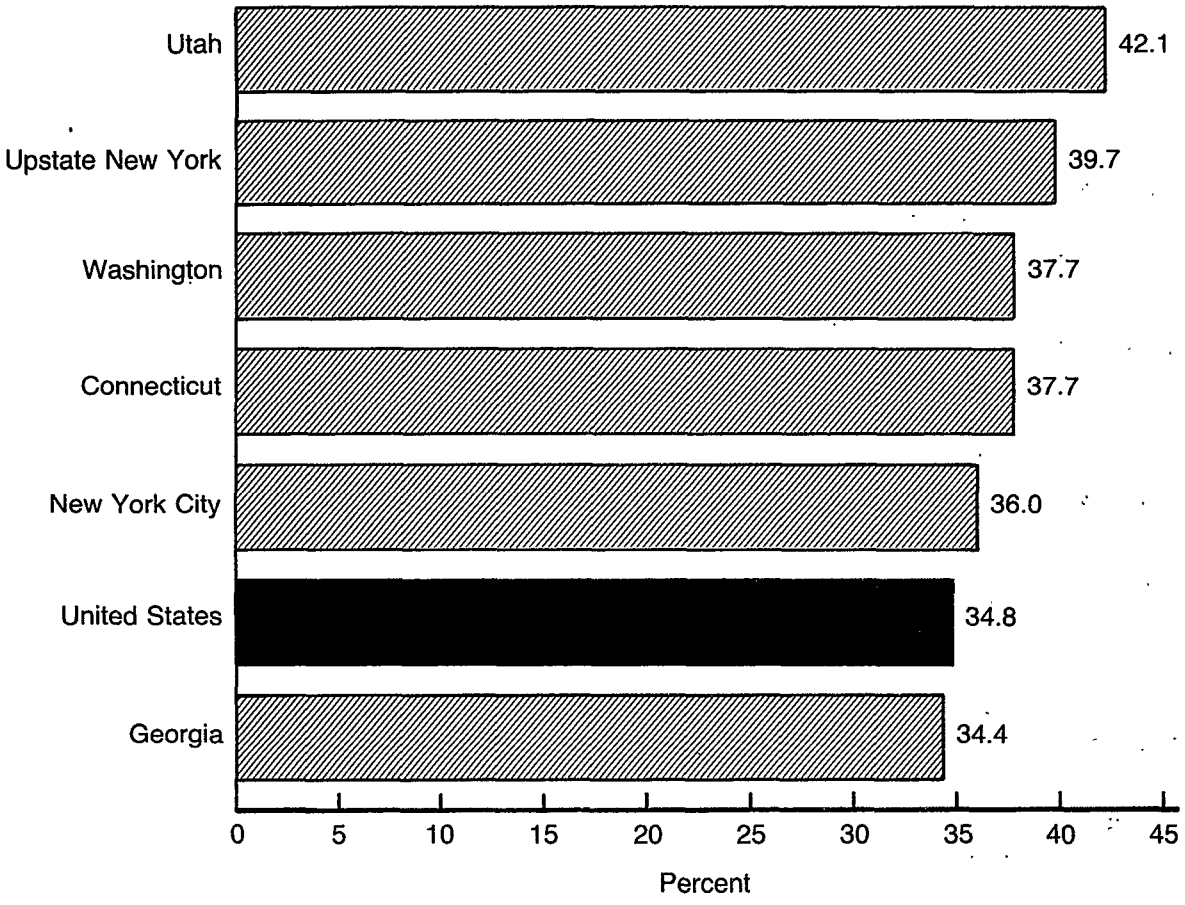
Figure 19. Cesarean section delivery rates[2] for plural births: Selected States and United States, 1983



[1]Number of males per 100 females.
[2]Excludes unknown type of delivery.

NOTE: Maryland and Wisconsin data are by State of residence; all other data are by State of occurrence.

Figure 20. Sex ratios[1] by method of delivery[2] for live births: Selected States, 1983

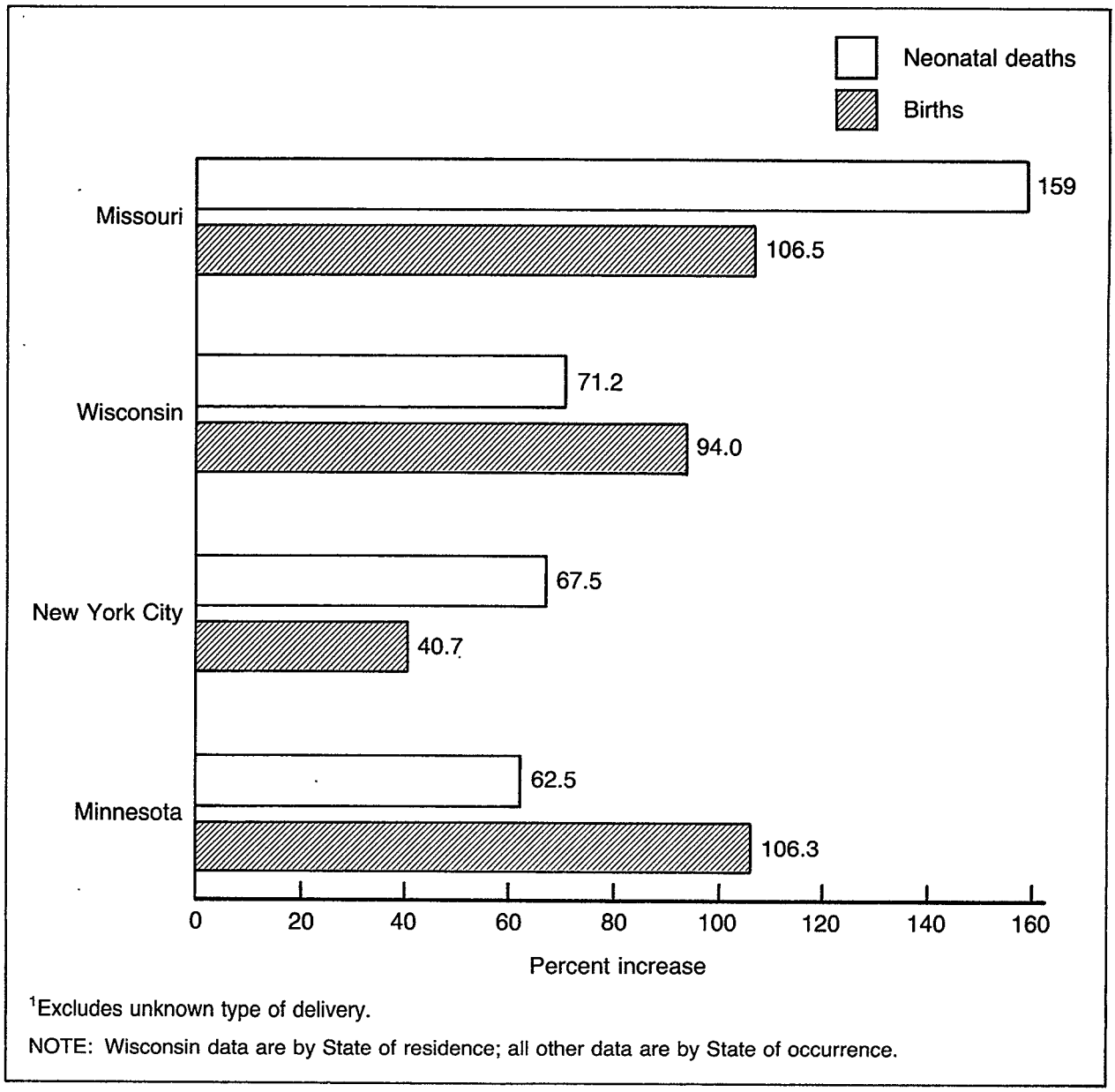


[1]Percent of all live birth cesarean section deliveries.

NOTE: All data are by State of occurrence.

SOURCE FOR U.S. DATA: National Center for Health Statistics.

Figure 21. Percent[1] of all cesarean section deliveries that were repeat procedures: Selected States and United States, 1983



[1]Excludes unknown type of delivery.

NOTE: Wisconsin data are by State of residence; all other data are by State of occurrence.

Figure 22. Percent increase in cesarean section delivery rates[1] for neonatal deaths and births, by State: Selected States, 1975–83

Trends in Birth Weight Distribution: 1970-83

by Eva D. Alberman, M.D., and Stephen J. W. Evans, M.S.

Introduction

The International Collaborative Effort (ICE) is beginning to collect and analyze data on birth weight distributions of early deaths and survivors from different countries. This is a preliminary report on the data. For many years, biologists, epidemiologists, and perinatologists have been concerned with differences in birth weight distribution among different populations or different subgroups of the same population. Interest has focused on the remarkable fall of neonatal mortality, in particular, with even small increases of birth weight, and on the numerous sociobiological factors known to be associated with the rate of intrauterine growth, including sex, plurality, paternal height, diet, social and educational advantage, and genetic factors. These have been fully reviewed in accounts by Thomson (1983), by Falkner and Tanner (1978), and by Reed and Stanley (1977).

There have been numerous cross-sectional studies of such associations across part or all of the birth weight distribution in many countries--sometimes on national, sometimes on institutional samples. Researchers whose names are particularly associated with previous international studies include Helen Chase from the United States, Neville Butler from the United Kingdom, and Petter Karlberg from Scandinavia.

However, until fairly recently there have been few routinely available national statistics to enable systematic comparisons of time trends of whole distributions. We are now beginning to be able to do this using routinely available data that many of the member countries of ICE have kindly made available and using computer packages that enable us to handle these fairly crude and somewhat inconsistent data sets.

Data

The data we have include national birth weight distributions for Japan, Norway, Sweden, Scotland, Bavaria, and Israel, as well as birth weight distributions for many States of the United States.

Grouping by birth weight

Birth weight is usually recorded in groups of 500 grams (g), but unfortunately there is some variation in the grouping used at the extremes of the distributions. Some data sets group down to less than 500 g; some start at less than 1,500 g. Some countries group together 4,000 g or more; some go up to 4,500 g or more. The proportion of unknown birth weight is variable but usually

relatively small. It is clear from the England and Wales data that babies of unknown weight include a disproportionate number of neonatal deaths, and these are often of very low birth weight (Alberman, 1985), so their exclusion can affect the lower end of the distribution. It is likely that this bias affects data from other countries also.

Birth weights of stillbirths and infant deaths

We have distributions for live births and stillbirths, for singletons and all births, and, for several countries, for early neonatal, late neonatal, and postneonatal deaths. We know that, for virtually all countries, the validity of the lower end of the distributions is doubtful because of problems of definitions of viability, but this will have little effect on the overall distribution.

Moreover, infant mortality rates calculated in the usual way may be misleading, for these rates are based on occurrences in a year rather than on deaths to a specific birth cohort. Thus, the usual rates presented are the numbers of infant, neonatal, and postneonatal deaths occurring in a calendar year divided by the number of live births occurring in the same calendar year. We have asked our members to present the data by birth cohorts so that the denominators become the number of infant, neonatal, or postneonatal deaths of those live births born in a given calendar year, even if the relevant death occurred in the next calendar year. In practice, the rates do not differ from those derived from cross-sectional data unless there have been sharp changes in the number of births occurring from year to year. Even then, there will be no differences in stillbirth rates and minimal differences in neonatal deaths, which are most likely to occur in the same calendar year as the year of birth, except for births in late December. The major differences will be found in postneonatal death rates. However, data presentation by cohorts will avoid possibly artifactual differences among years or among countries where there have been marked variations in birth rate.

Multiple births

For our analyses, we have also asked for multiple-birth data to be presented separately, because differences in multiple-birth rates over the years or among countries could account for considerable changes in the lower end of the birth weight distribution.

Results

Only a few examples of the results of the preliminary processing of some of these data are presented, showing some of the features that we think are the most interesting. First, the method gives us an ability to demonstrate how remarkably robust are these data. Smooth curves have been drawn by cubic spline interpolation through the actual data points, and figure 1 shows the smoothed curve of the birth weight distribution of singleton live-birth deliveries in Japan and Norway in 1981, the former representing 1.5 million, the latter about 50,000 births. In figure 2, there is what appears to be virtually the same curve for Japan, but it is in fact all the curves for each year from 1973 through 1983 superimposed on each other. Figure 3 gives the superimposition of all Norwegian curves from 1973 through 1982. It would be difficult to find a

better demonstration of the remarkable consistency of these distributions. It is, of course, not unexpected that, although the curves show intranational consistency, each country's distribution differs in shape--most, like Norway, having a wider distribution than Japan. From figure 4, giving as examples curves for 1981 births in some areas--all births in Japan and Norway and black births in California--it can be demonstrated how the shape characteristic of one population varies from that of another.

However, despite the intranational consistency that was found, there was also evidence that continual, albeit small changes are occurring within these distributions, sometimes suggesting a consistent pattern over several years. This can be demonstrated by the trends in the 50th (median), 10th, and 90th percentiles, these being obtained from the data by linear interpolation. Thus, to take the case of Norway, if we plot the estimated medians (figure 5) of the distribution for each year from 1973 through 1982, it is apparent that there has been a steady, if very small, rise in the median over most of these years, of the order of 40 g overall. The vertical scale is, of course, greatly magnified. The 10th percentile curve (figure 6) and 90th percentile curve (figure 7) are largely but not wholly similar to that of the median.

In contrast, the Japanese data show a fairly consistent fall in the median (figure 8), 10th percentile (figure 9), and 90th percentile (figure 10) from 1973 to 1983.

We are still at a very early stage in these analyses. The data presented have been limited to singleton live births. Soon we will have similar data for quite a number of populations and will be able to exploit these further by looking at multiple births also. However, these trends, on their own, whether intranational or international, tell us little until they are related to the corresponding deaths to see what effects even very small variations in birth weight distributions can have on mortality risk, bearing in mind the remarkable variation in birth weight-specific mortality rates. We plan to present these data in another paper at a later date.

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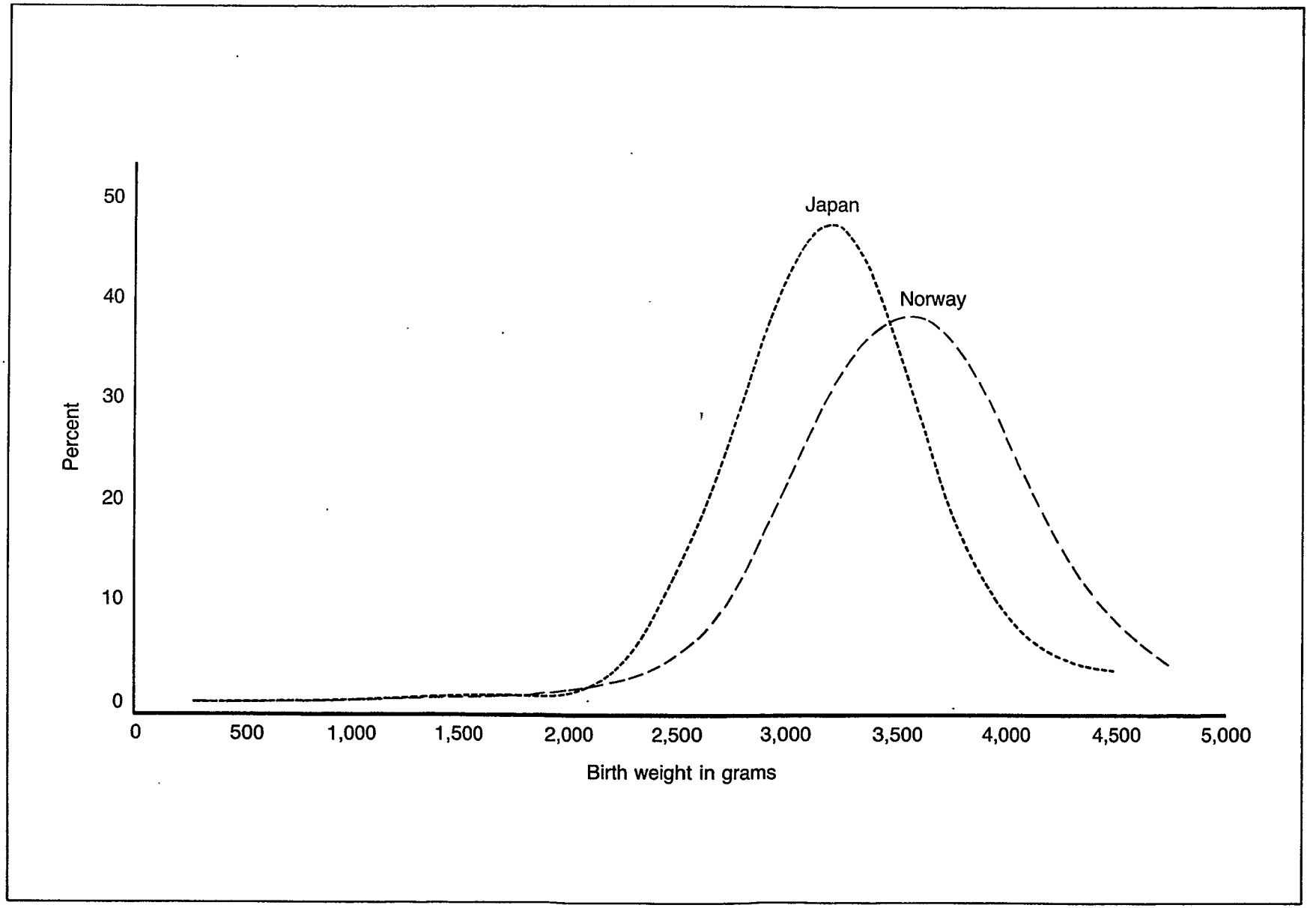

Figure 1. Percent of singleton live births, by birth weight: Japan and Norway, 1981

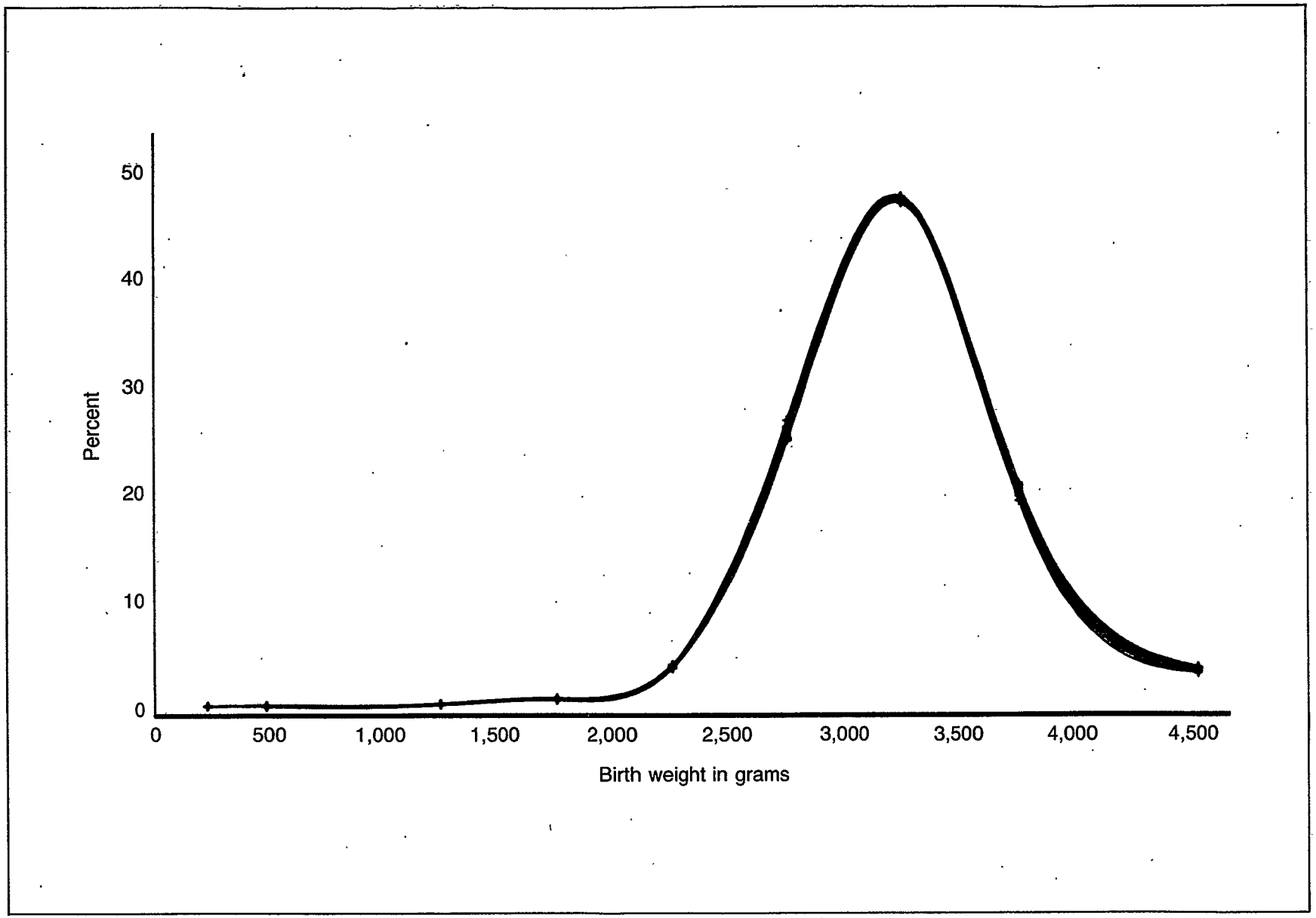

Figure 2. Percent of singleton live births, by birth weight: Japan, 1973–83

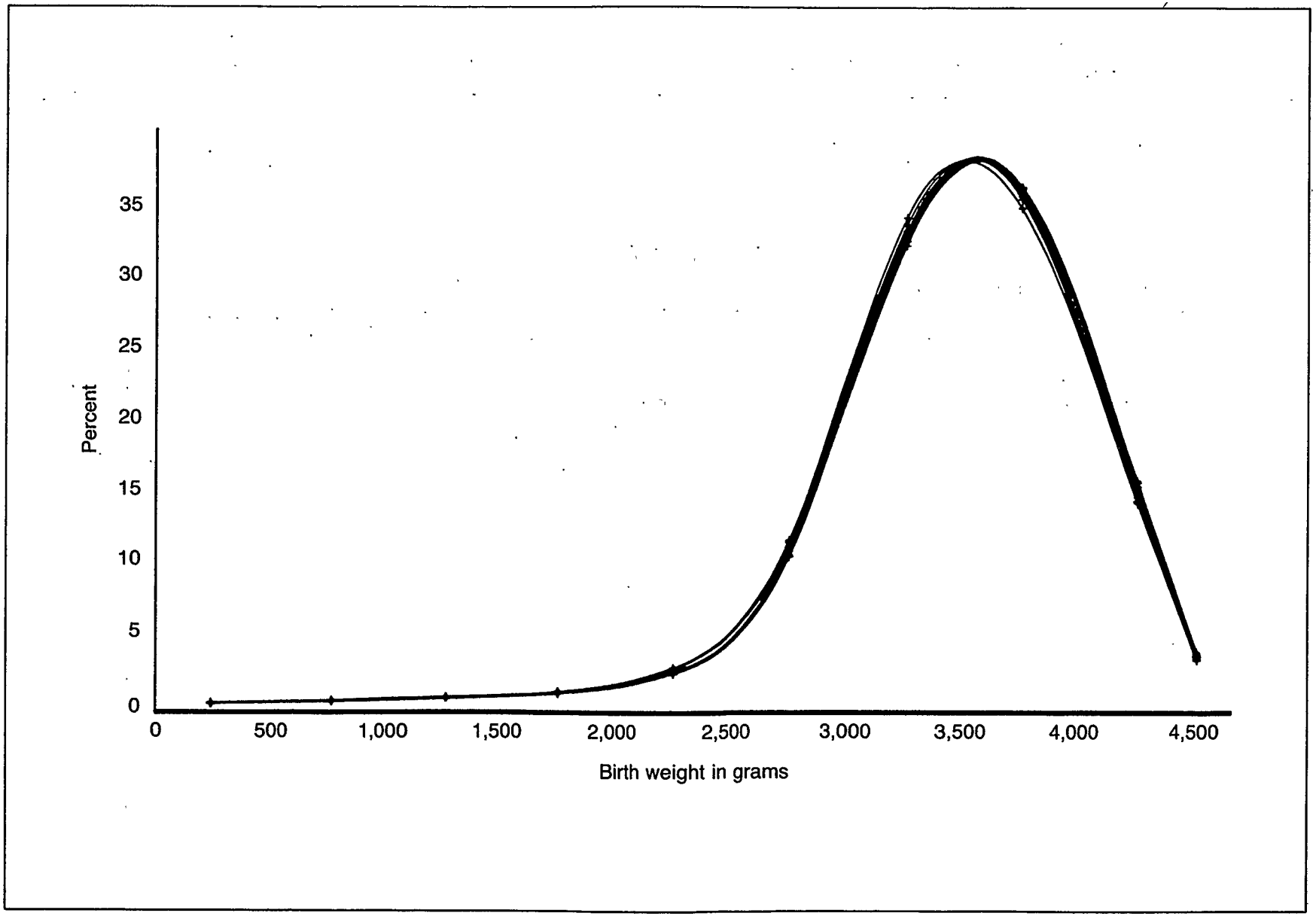

Figure 3. Percent of singleton live births, by birth weight: Norway, 1973–82

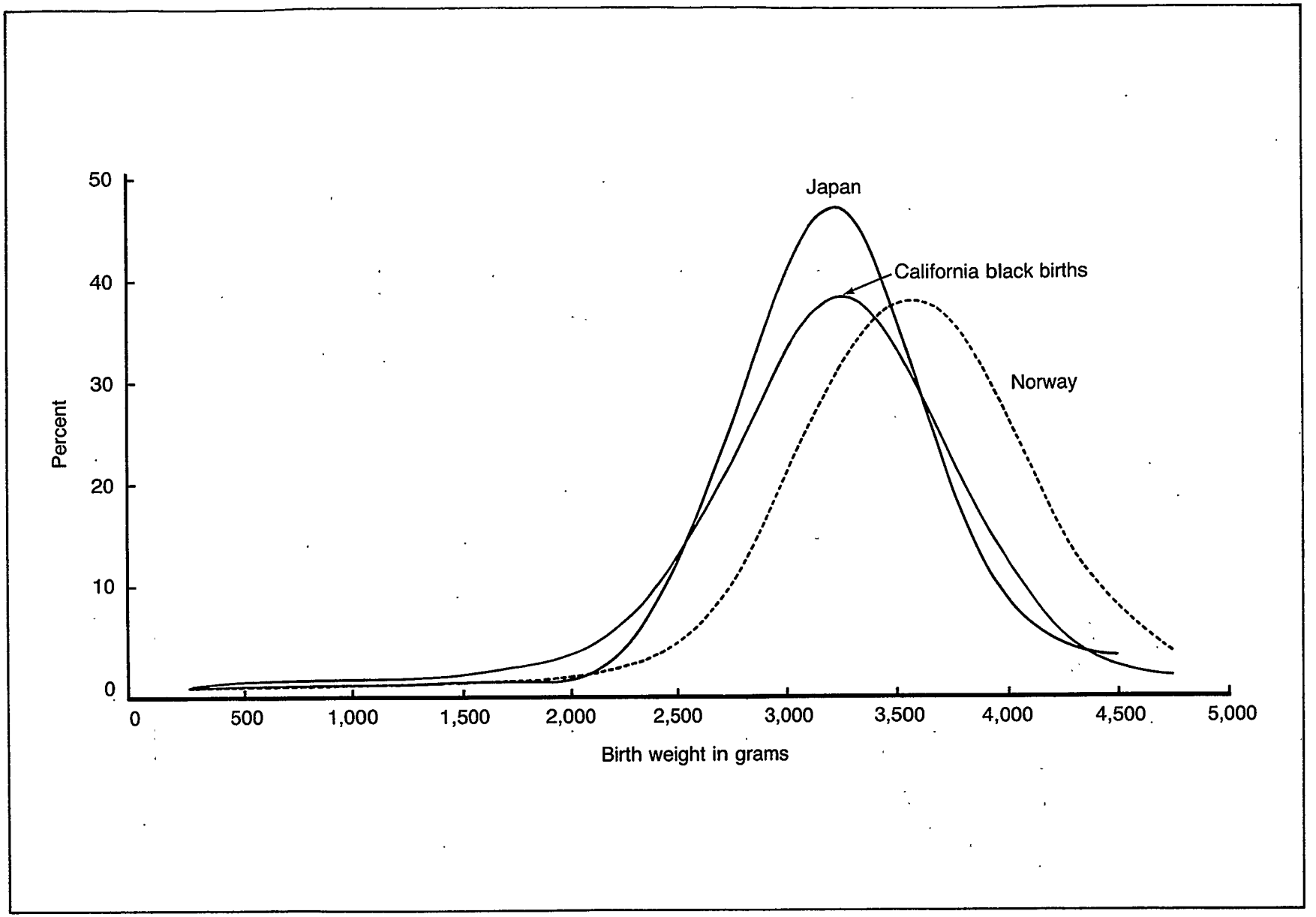

Figure 4. Percent of singleton live births, by birth weight: Black births in California and all births in Japan and Norway, 1981

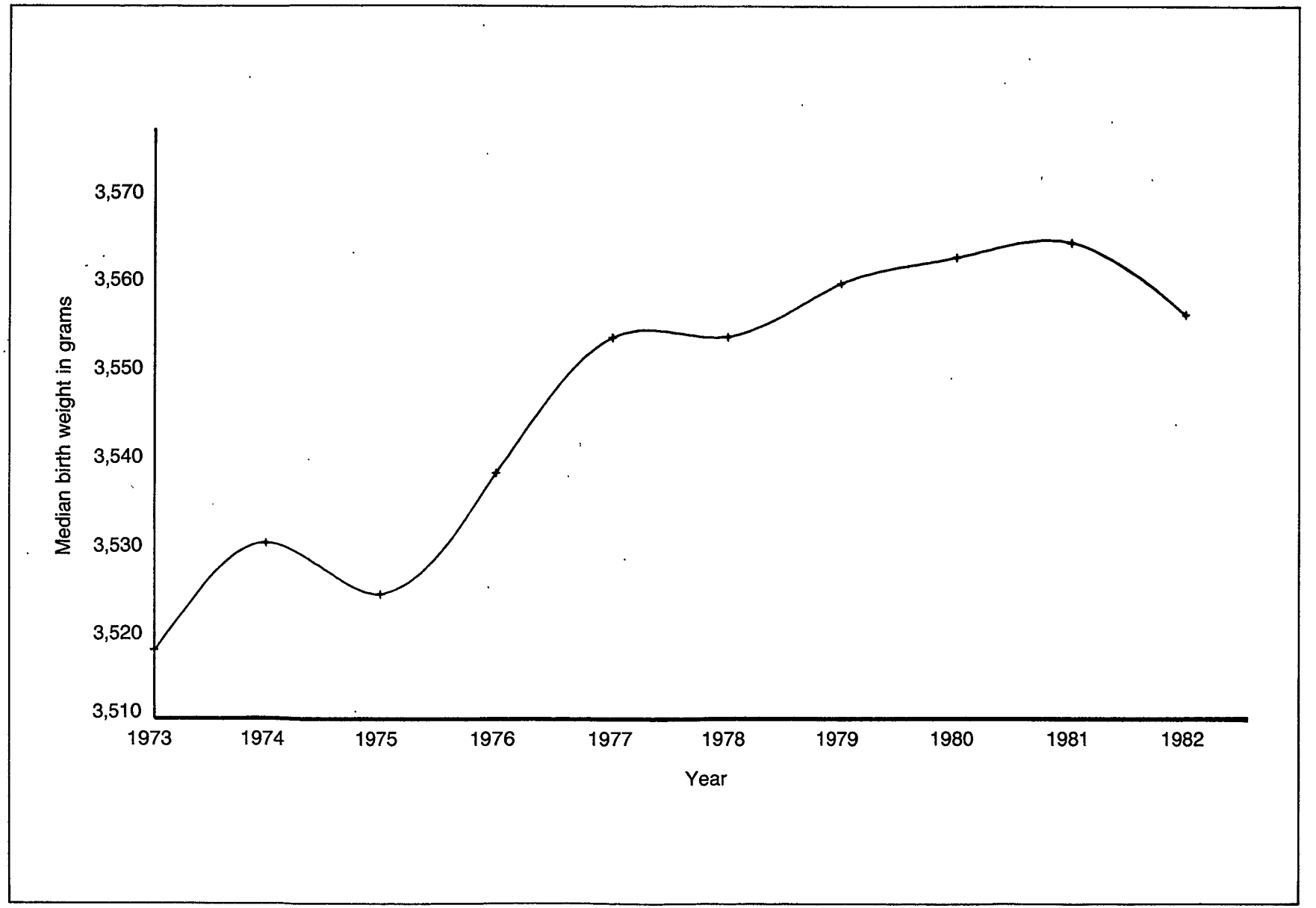

Figure 5. Median birth weights for singleton live births, by year: Norway, 1973–82

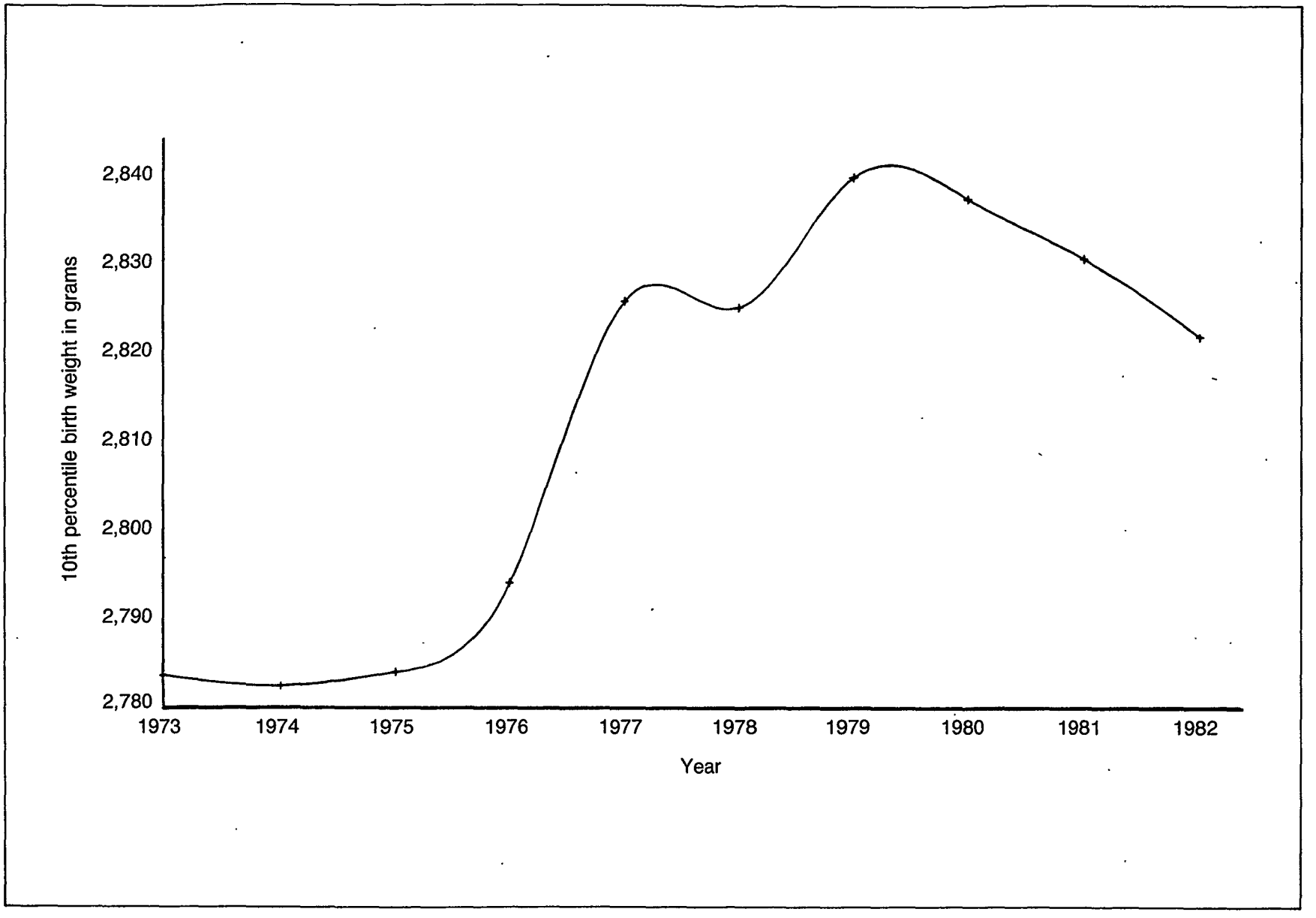

Figure 6. Tenth percentile birth weights for singleton live births, by year: Norway, 1973–82

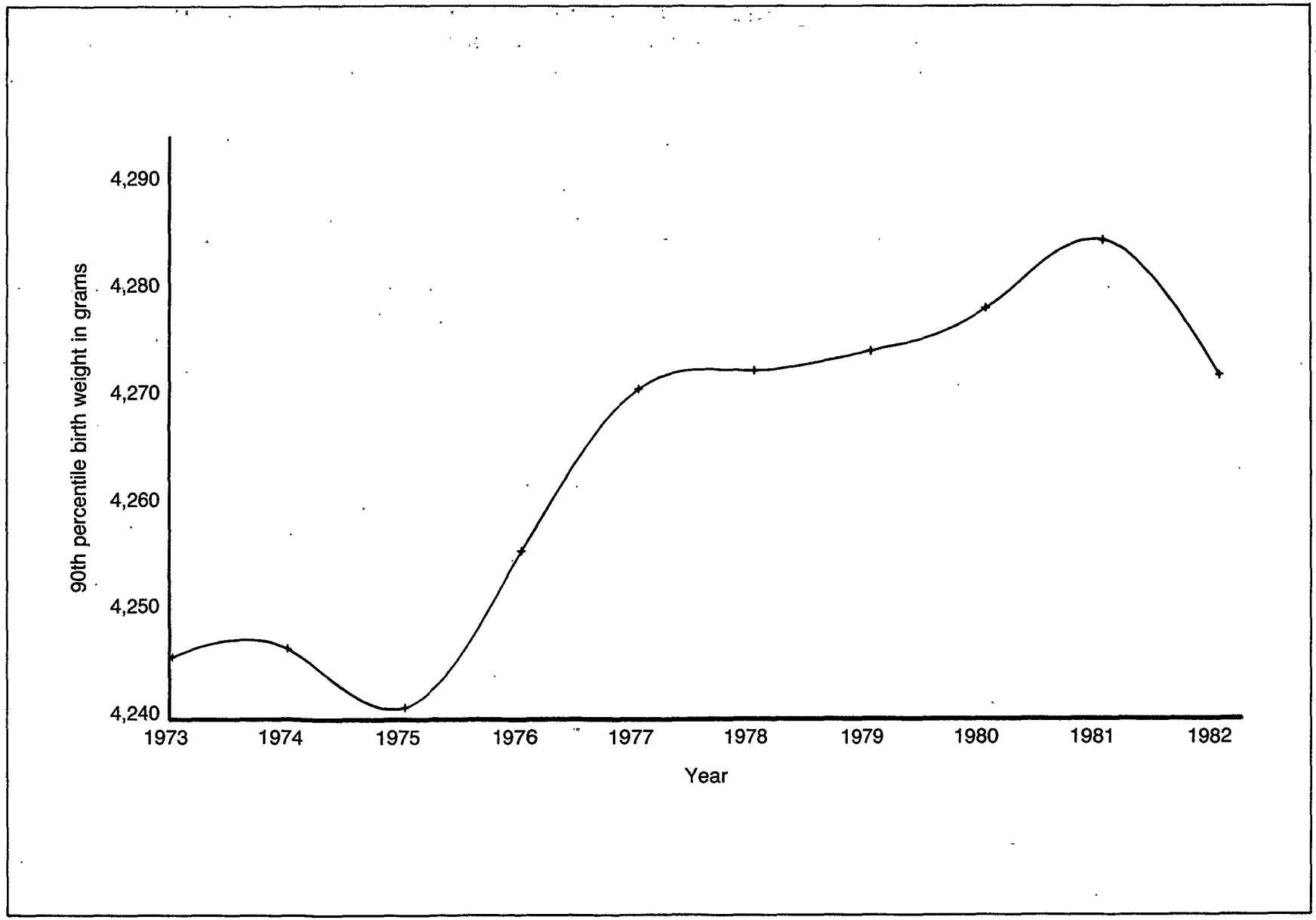

Figure 7. Ninetieth percentile birth weights for singleton live births, by year: Norway, 1973–82

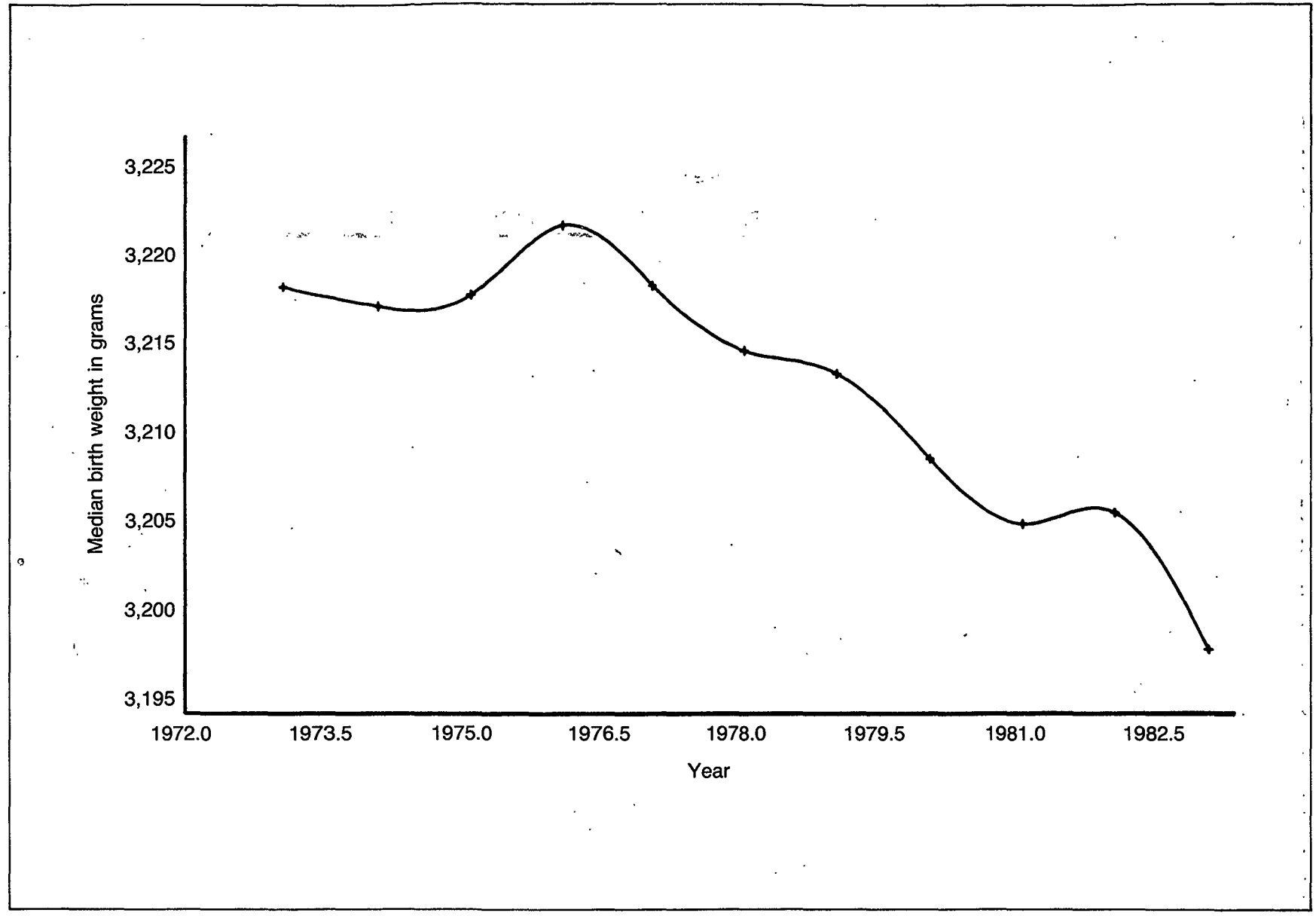

Figure 8. Median birth weights for singleton live births, by year: Japan, 1973–83

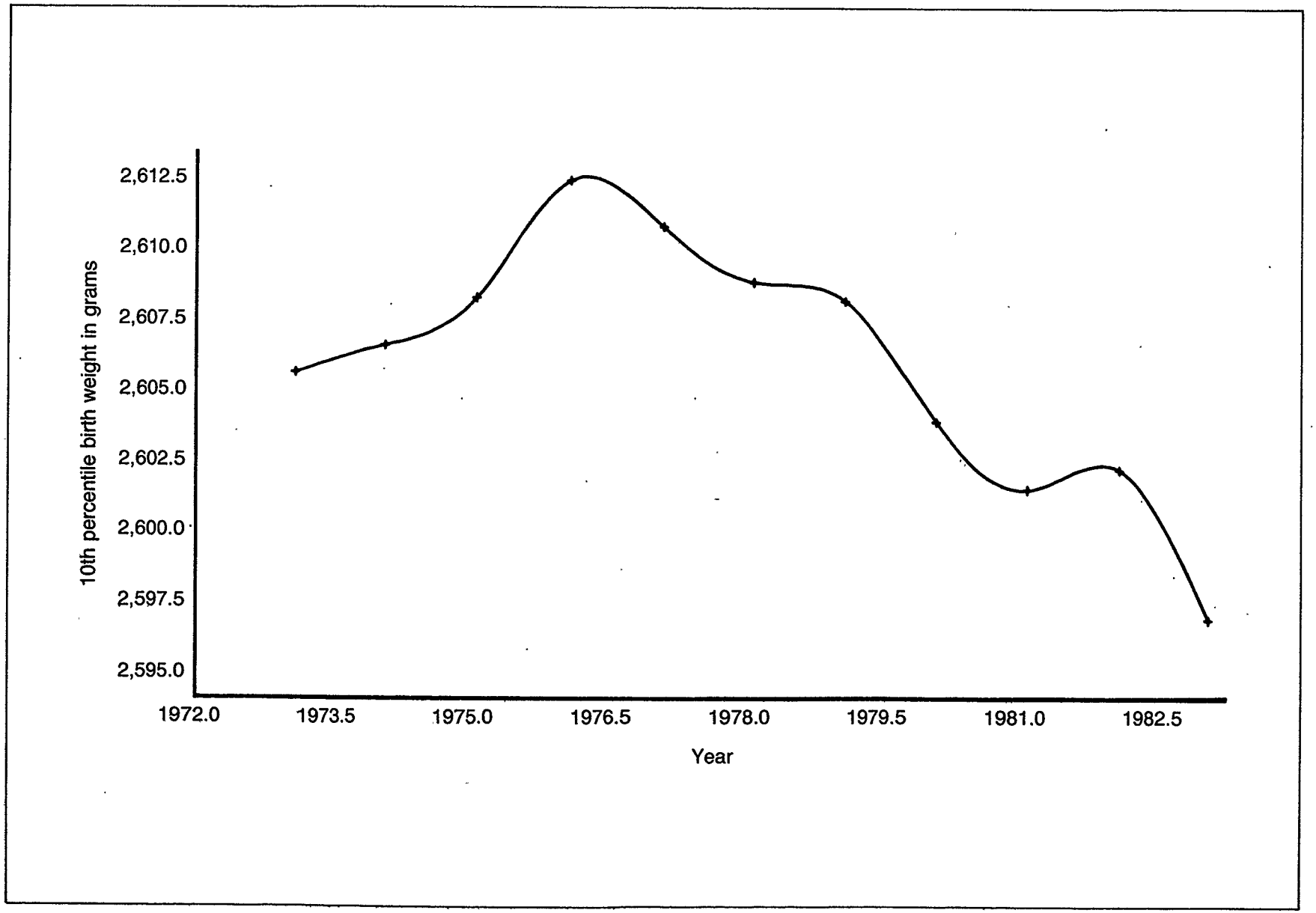

Figure 9. Tenth percentile birth weights for singleton live births, by year: Japan, 1973–83

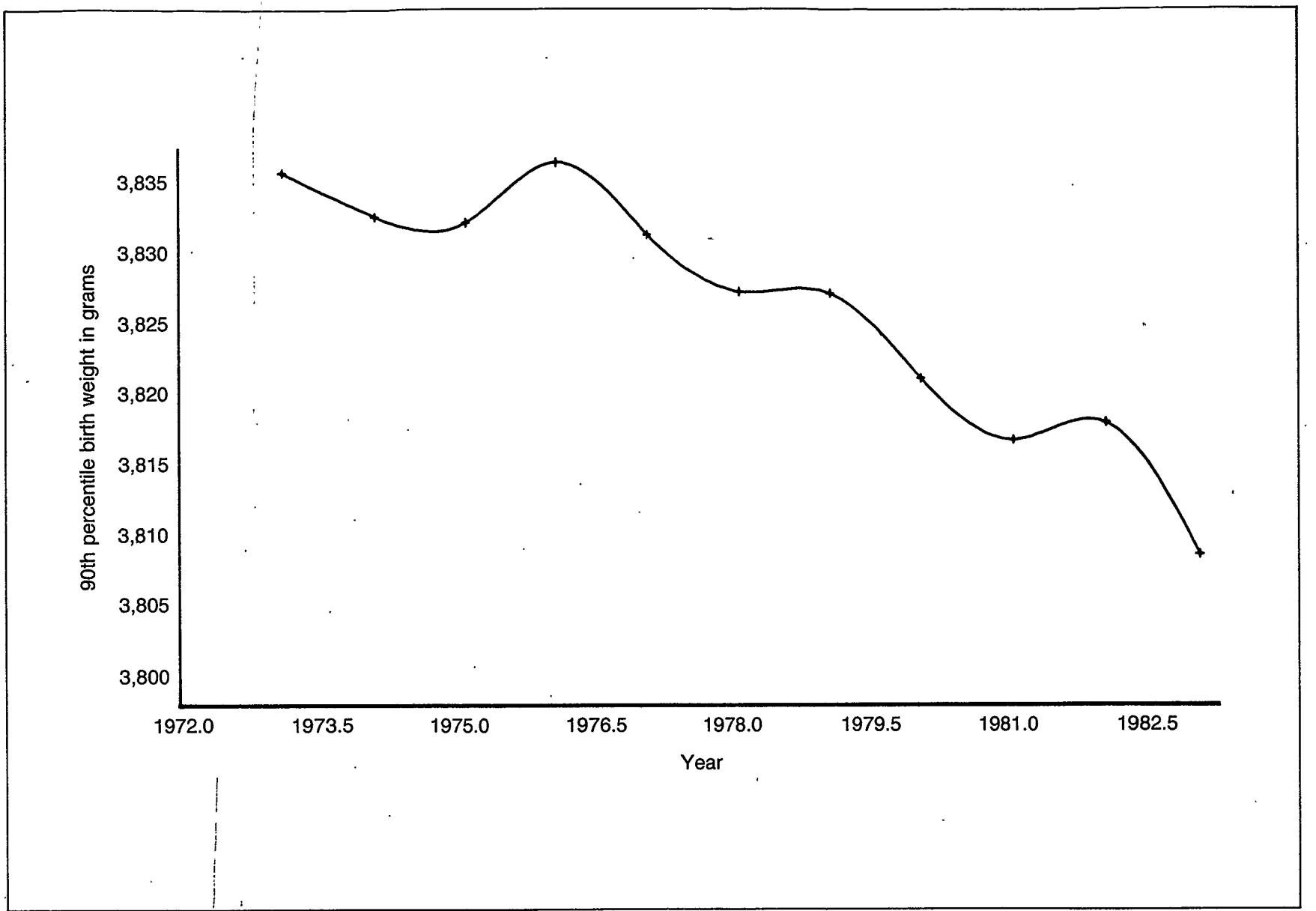

Figure 10. Ninetieth percentile birth weights for singleton live births, by year: Japan, 1973–83

Trends in Birth Weight-Specific Perinatal Mortality Rates: 1970-83

by Howard J. Hoffman, M.A., Per Bergsjø, M.D., and Daniel W. Denman III, M.A.

In the past two decades, perinatal and infant mortality rates have fallen steadily (National Center for Health Statistics, 1972; Kleinman et al., 1978; Bakketeig, Hoffman, and Oakley, 1984). Much of the explanation for this fall may lie in the improvements made in the provision of medical care to high-risk low birth weight and very low birth weight infants. Such a claim seems warranted for neonatal mortality, one of the two constituents of perinatal mortality (Lee et al., 1980; Williams and Chen, 1982). However, the other component of perinatal mortality--fetal mortality--more likely has shown greater improvements for normal or high birth weight infants (Hoffman, Meirik, and Bakketeig, 1984). When taken together, a nearly uniform improvement in birth weight-specific perinatal mortality rates has occurred over this time period in the United States. The data presented in this report are used to compare the recent improvements in perinatal mortality rates in the United States and selected foreign countries during the past decade and a half, 1970-83.

Study Materials

Data for this study were provided by U.S. States and foreign countries participating in the International Collaborative Effort on Perinatal and Infant Mortality, which is sponsored by the U.S. Public Health Service under the leadership of the International Statistics Staff, Office of Planning and Extramural Programs, National Center for Health Statistics. Wherever possible, data on infant deaths were based on birth cohort year rather than year of occurrence. The basic data tables provided by participating States or countries included live births, late fetal deaths (28 weeks and over), and infant deaths (under 1 week, 1-4 weeks, 4 weeks-1 year) by race and 500-gram birth weight categories. Tables were provided separately for singleton and all births. In this report, the analysis is restricted to perinatal mortality rates (late fetal deaths plus early neonatal deaths occurring during the first week of life). Data in the tables include rates for 1983 if available. However, for ease of presentation, the birth weight-specific perinatal mortality rates over time have been collapsed into four consecutive 3-year time periods, with data for 1970 and 1983 deleted.

Time Trends

U.S. perinatal mortality rates by race (black and white) for 14 years are shown in figure 1. These data are derived from five States--California, Michigan, Missouri, Upstate New York, and North Carolina--which represent approximately one-fifth of the total number of births in the United States each year. In comparison with perinatal mortality rate data from the total United States, these five States are consistently lower than average. They have a perinatal

mortality rate about 10 percent lower than the rate for the total United States during this time period.

During the 14-year period, the perinatal mortality rates (PMR's) have been reduced by almost one-half, regardless of race. On a standard scale, the black PMR has fallen somewhat more rapidly than the white PMR (see figure 1). However, in the relative sense of a logarithmic scale, the two races have nearly identical rates of change. The lower two lines in the figure (for black and white separately) represent late fetal mortality rates (FMR's) for death of 28 weeks gestation or more. The late FMR's have not declined as rapidly as the PMR's. By implication, the early neonatal mortality rates have contributed more to the decline in the overall PMR during the past decade. Thus in 1983, both black and white late fetal mortality rates were approximately 50 percent of the 1970 level. However, early neonatal mortality rates in 1983 had declined to approximately 38 percent of the 1970 level for both black and white U.S. births.

The PMR time trends shown for black births in each of the five States in table 1 are generally similar. North Carolina and Upstate New York had consistently higher black PMR's during this time period than did California, Michigan, or Missouri. No one State was consistently better (lower PMR) throughout this time period; however, North Carolina was ranked highest most years, with especially marked differences in the first 6 years of the time period. The PMR time trends shown in table 2 for white births in these same five States indicate that North Carolina had consistently higher perinatal mortality than the other States and, also, that Michigan had the lowest perinatal mortality rates for white births in most years.

Time trends in perinatal mortality rates in the six countries participating in the International Collaborative Effort on Perinatal and Infant Mortality are shown in table 3. In some countries, for example, England and Wales and Israel, birth weight-specific data are available only in the more recent years, since 1979 and 1977, respectively. The perinatal mortality rate for Sweden is considerably lower than that for the remaining countries during this time period. Japan and Norway have very similar PMR's throughout this time period (see figure 2). Norway was slightly lower during most of the time period, but Japan caught up with Norway in 1982. Because infant mortality rates for Japan are similar to or lower than rates for Sweden in recent years (Wegman, 1985), this coincidence of the Japanese and Norwegian PMR's is surprising. The difference is accounted for by the relatively larger number of late fetal deaths in Japan than in Sweden. England and Wales and Scotland have quite similar PMR's, as shown in table 3. Based on a review of earlier data for England and Wales, it is clear that the convergence in PMR's between England and Wales and Scotland during this 7-year period (1973-79) results from a relative improvement in the Scottish PMR (Bakketeig, Hoffman, and Oakley, 1984).

Birth Weight-Specific Perinatal Mortality Rates

In order to compare improvements in birth weight-specific perinatal mortality over the time period in which these international data were compiled, it was decided to combine the data in 3-year intervals, i.e., 1971-73, 1974-76, 1977-79, and 1980-82. The following tables and figures are all based on these four time periods.

Tables 4 and 5 provide birth weight-specific perinatal mortality rates for all singleton black and white births in the five U.S. States. These data are also shown graphically in figures 3 and 4. In the figures, perinatal mortality rates are plotted on a logit (symmetrical logarithmic) scale in order that relative changes in the PMR's can be assessed more appropriately (Hoffman, Meirik, and Bakketeig, 1984). From figure 3, it is clear that birth weight-specific mortality rates for black births have improved (are lower) in each of the successive time periods. The improvement is especially clear from the earliest (1971-73) to the most recent time period (1980-82). Also, the improvements have occurred throughout the entire range of birth weights, from small births, weighing 500-1,500 grams to the largest births, weighing more than 4,000 grams at delivery.

The time trend comparisons for U.S. white births, shown in figure 4, are similar, although the improvements are less marked for births weighing approximately 2,500 grams at birth. These infants are frequently growth retarded in utero (small for gestational age). Births that are growth retarded in utero are at an increased risk for fetal mortality compared with early neonatal mortality (McIlwaine et al., 1979). As noted previously, fetal mortality declined more slowly than early neonatal mortality during this time period.

Comparisons in birth weight-specific perinatal mortality rates over time are shown in tables 6-8 and figures 5-7 for Japan, Norway, and Sweden. The birth weight-specific PMR comparisons for Japan indicate that the greatest relative improvement has occurred in the normal birth weight range, 2,500 grams or more. In Norway, the largest and steadiest improvement over time in birth weight-specific PMR's has occurred in the low birth weight range and, especially, in the very low birth weight range, less than 1,500 grams. This same pattern is evident also in Sweden. These different patterns in the relative improvement in birth weight-specific PMR's in Japan versus Norway and Sweden reflect the fact that late fetal mortality rates have improved relatively more in Japan while early neonatal mortality rates have improved relatively more in Scandinavia during this time period.

In table 9, a summary of the birth weight-specific perinatal mortality rates is provided for the most recent time period, 1980-82, for Japan and Norway and for U.S. black and white births (five States). For this time period, the data are also shown graphically in figure 8. Striking differences in birth weight-specific perinatal mortality are evident for these four different racial or national population groups. For example, the perinatal mortality rate for very low birth weight infants is highest for Japan, followed in succession by Norway, then U.S. white births and, finally, U.S. black births. Such apparent paradoxes have been noted before (North and MacDonald, 1977; Erickson and Bjerkedal, 1982; Wilcox and Russell, 1983a and 1983b; Hoffman, Meirik and Bakketeig, 1984).

The explanation offered to account for most of this effect is that the underlying birth weight distributions for each of the different racial or national population groups are also markedly different. Table 10 and figure 9 document these differences by providing the cumulative birth weight distributions for the same racial or national groups as shown in table 9 and figure 8. The United States has the highest proportion of low weight births (and the proportion is especially high for black births); Japan and Norway have the fewest such births. Thus, interracial or international comparisons of birth

weight-specific perinatal mortality rates without attention to differences in the underlying birth weight distribution can be quite misleading.

Within the field of perinatal epidemiology it is well known that twin births have a lower perinatal mortality rate at 37-38 weeks gestation than singleton births have (Hoffman and Bakketeig, 1984). Similar results are documented in the data provided for the International Collaborative Effort on Perinatal and Infant Mortality. The majority of twin births are delivered slightly before term, and these infants are not at the same risk of dying in the perinatal period as are comparable birth weight and gestational age singleton births, which, for totally different reasons, may be delivered preterm. Similarly, the larger number of U.S. black or white births of low birth weight, as compared with either Japanese or Norwegian births, do not experience the same high perinatal mortality at these low birth weights.

Conclusion

The causes of low birth weight delivery among U.S. black or white births may be quite different from the causes of low birth weight in either Japan or Norway. An investigation of cause-specific mortality, including changes over time in cause-specific mortality rates, will be necessary to answer many of the questions raised by the inspection of the data contained in this report. However, the preparation of comparably defined data sets, both across States and across countries, is a prerequisite to any more detailed inquiry into the underlying basis for differences. In this sense, the International Collaborative Effort on Perinatal and Infant Mortality has provided a strong stimulus for joint research undertakings in the maternal and child health field.

Several important questions could not be addressed with the data that were provided by participating States and countries. The inability to examine cause of death is one example. Another limitation was the lack of gestational age information, which is required in order to properly distinguish growth-retarded small babies from preterm small babies. The importance of this distinction has been stressed in both clinical and public health terms (Philip et al., 1981; David and Siegel, 1983). However, future studies will be able to supply the needed information in this area, particularly for the years 1980 and beyond.

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Table 1. Perinatal mortality rates for U.S. black births based on birth year cohort: Selected States, 1970-83.

Year	California	Michigan	Missouri	Upstate New York	North Carolina
			Rate per 1,000 total births		
1970	32.2	25.9	32.8	33.0	38.2
1971	30.2	28.0	28.4	29.2	34.4
1972	28.9	32.3	31.0	30.8	34.5
1973	26.6	28.6	27.3	27.7	34.1
1974	24.6	26.7	28.6	25.3	31.0
1975	24.9	24.6	27.6	24.7	28.8
1976	23.5	23.2	21.3	28.6	26.0
1977	20.1	22.5	23.8	24.0	25.2
1978	23.0	20.7	25.8	23.6	25.8
1979	20.8	20.2	20.7	22.4	24.3
1980	21.1	21.6	19.0	21.9	21.2
1981	17.1	20.7	16.9	21.0	20.5
1982	16.3	20.0	18.5	20.5	20.8
1983	17.6	18.1	17.5	19.2	19.9

Table 2. Perinatal mortality rates for U.S. white births based on birth year cohort: Selected States, 1970-83.

Year	California	Michigan	Missouri	Upstate New York	North Carolina
			Rate per 1,000 total births		
1970	19.2	19.1	17.4	18.6	24.2
1971	18.2	17.9	18.8	17.6	21.7
1972	17.2	17.1	15.7	17.5	22.4
1973	16.0	16.7	15.7	15.8	22.1
1974	15.5	14.6	14.7	14.8	19.5
1975	14.3	13.4	14.5	13.9	17.3
1976	13.8	12.7	14.9	14.6	18.1
1977	12.8	11.6	13.1	12.9	14.9
1978	12.3	10.7	13.0	12.6	14.3
1979	11.9	10.9	12.7	12.0	13.6
1980	11.4	10.5	11.4	11.0	13.3
1981	10.9	10.7	11.7	11.0	12.0
1982	10.2	10.2	10.0	10.7	11.9
1983	9.7	8.9	9.5	10.3	11.0

Table 3. Perinatal mortality rates for 6 countries based on birth year cohorts: 1970-83

Year	England and Wales	Israel	Japan	Norway	Scotland	Sweden
			Rate per 1,000 total births			
1970	...	...	21.3	19.3	24.8	16.4
1971	...	...	20.2	18.0	24.5	15.7
1972	...	...	18.8	17.9	23.7	14.3
1973	...	...	17.8	16.9	22.5	14.4
1974	...	...	16.7	15.7	22.8	13.2
1975	...	...	15.9	14.5	21.1	11.4
1976	...	...	14.7	13.8	18.3	10.6
1977	...	14.0	14.0	13.5	18.3	10.1
1978	...	15.8	12.9	11.3	16.8	9.1
1979	14.6	14.5	12.4	12.1	14.1	8.6
1980	13.7	12.6	11.6	11.4	12.8	8.2
1981	11.8	14.0	10.7	9.8	11.6	7.3
1982	11.2	12.5	10.0	10.2	11.5	6.9
1983	10.4	...	9.2	10.3	10.6	6.6

Table 4. Time trends in U.S. black birth weight-specific perinatal mortality rates: California, Michigan, Missouri, Upstate New York, and North Carolina, 1971-82

Birth weight	1971-73	1974-76	1977-79	1980-82
	Rate per 1,000 singleton births			
All birth weights	30.3	26.0	22.9	19.8
Less than 500 grams	925.9	920.1	910.7	886.7
500-999 grams	762.0	719.9	647.4	525.6
1,000-1,499 grams	358.7	299.3	215.7	160.4
1,500-1,999 grams	134.1	105.2	95.9	60.6
2,000-2,499 grams	36.1	30.0	25.4	20.7
2,500-2,999 grams	9.2	7.4	6.8	5.3
3,000-3,499 grams	5.6	4.6	3.7	3.1
3,500-3,999 grams	6.4	5.0	3.9	3.2
4,000-4,499 grams	11.0	7.7	7.4	5.1
4,500 grams or more	51.1	39.8	25.5	14.4

Table 5. Time trends in U.S. white birth weight-specific perinatal mortality rates: California, Michigan, Missouri, Upstate New York, and North Carolina, 1971-82

Birth weight	1971-73	1974-76	1977-79	1980-82
	Rate per 1,000 singleton births			
All birth weights	18.1	15.1	12.6	11.1
Less than 500 grams	932.3	938.9	948.8	916.7
500-999 grams	823.3	783.7	696.4	601.0
1,000-1,499 grams	471.9	391.5	308.2	237.9
1,500-1,999 grams	202.2	156.7	121.2	106.6
2,000-2,499 grams	50.1	41.3	34.1	30.4
2,500-2,999 grams	10.7	9.0	8.1	7.7
3,000-3,499 grams	4.5	3.8	3.3	2.9
3,500-3,999 grams	3.6	2.9	2.5	2.2
4,000-4,499 grams	4.2	3.4	3.0	2.3
4,500 grams or more	12.6	11.0	7.3	5.8

Table 6. Time trends in Japanese birth weight-specific perinatal mortality rates: 1971-82

Birth weight	1971-73	1974-76	1977-79	1980-82
		Rate per 1,000 singleton births		
All birth weights	18.9	15.8	13.1	10.8
Less than 500 grams	...	...	965.7	990.3
500-999 grams	...	...	809.2	735.2
1,000-1,499 grams	662.3	638.2	579.6	485.4
1,500-1,999 grams	332.4	308.5	271.1	215.6
2,000-2,499 grams	70.5	61.8	53.0	40.2
2,500-2,999 grams	12.7	10.6	8.2	6.3
3,000-3,499 grams	6.8	5.3	4.0	3.0
3,500-3,999 grams	6.3	5.1	3.7	2.8
4,000 grams or more	13.4	10.7	8.1	6.5

Table 7. Time trends in Norwegian birth weight-specific perinatal mortality rates: 1971-82

Birth weight	1971-73	1974-76	1977-79	1980-82
		Rate per 1,000 singleton births		
All birth weights	17.6	14.7	12.3	10.5
Less than 500 grams	1,000.0	1,000.0	1,000.0	1,000.0
500-999 grams	908.4	838.7	745.9	680.3
1,000-1,499 grams	601.5	528.0	454.1	352.9
1,500-1,999 grams	299.2	222.6	179.7	158.9
2,000-2,499 grams	82.2	69.6	62.6	54.9
2,500-2,999 grams	20.1	14.7	14.9	13.9
3,000-3,499 grams	6.5	5.0	4.9	4.1
3,500-3,999 grams	3.5	2.8	2.8	2.0
4,000-4,499 grams	3.2	3.0	2.4	2.9
4,500 grams or more	6.9	4.9	3.7	3.1

Table 8. Time trends in Swedish birth weight-specific perinatal mortality rates: 1971-82

Birth weight	1971-73	1974-76	1977-79	1980-82
	Rate per 1,000 singleton births			
All birth weights	14.8	11.8	9.3	7.0
Less than 500 grams	*	*	*	*
500-999 grams	*	*	*	*
1,000-1,499 grams	531.9	488.8	378.8	270.2
1,500-1,999 grams	232.3	210.1	173.8	113.7
2,000-2,499 grams	69.5	58.8	53.7	40.4
2,500-2,999 grams	15.0	13.0	11.1	9.1
3,000-3,499 grams	5.0	4.0	3.3	2.8
3,500-3,999 grams	3.3	2.2	2.1	2.0
4,000-4,499 grams	3.2	2.5	1.8	1.9
4,500 grams or more	13.6	5.3	3.2	2.8

Table 9. Birth weight-specific perinatal mortality rates for Japan, Norway, and U.S. black and white births: 1980-82

Birth weight	Japan	Norway	U.S. black	U.S. white
	Rate per 1,000 singleton births			
All birth weights	10.8	10.5	19.8	11.1
Less than 500 grams	990.3	1,000.0	886.7	916.7
500-999 grams	735.2	680.3	525.6	601.0
1,000-1,499 grams	485.4	352.9	160.4	237.9
1,500-1,999 grams	215.6	158.9	60.6	106.6
2,000-2,499 grams	40.2	54.9	20.7	30.4
2,500-2,999 grams	6.3	13.9	5.3	7.7
3,000-3,499 grams	3.0	4.1	3.1	2.9
3,500-3,999 grams	2.8	2.0	3.2	2.2
4,000-4,499 grams	[1]6.5	2.9	5.1	2.3
4,500 grams or more	...	3.1	14.4	5.8

[1]4,000 grams or more.

NOTE: U.S. rates are based on births occurring in California, Michigan, Missouri, Upstate New York, and North Carolina.

Table 10. Cumulative percent distributions of singleton births by birth weight for Japan, Norway, and U.S. black and white births: 1980-82

Birth weight	Japan	Norway	U.S. black	U.S. white
	Cumulative percent distribution			
Less than 500 grams	0.0	0.0	0.3	0.1
500-999 grams	0.2	0.2	1.3	0.4
1,000-1,499 grams	0.6	0.7	2.4	0.9
1,500-1,999 grams	1.3	1.4	4.6	1.8
2,000-2,499 grams	5.0	3.5	11.5	4.8
2,500-2,999 grams	30.8	13.9	35.0	18.4
3,000-3,499 grams	77.7	45.8	73.5	54.9
3,500-3,999 grams	97.0	81.6	94.3	87.1
4,000-4,499 grams	99.8	96.7	99.1	97.7
4,500 grams or more	100.0	100.0	100.0	100.0

NOTE: U.S. distributions are based on births occurring in California, Michigan, Missouri, Upstate New York, and North Carolina.

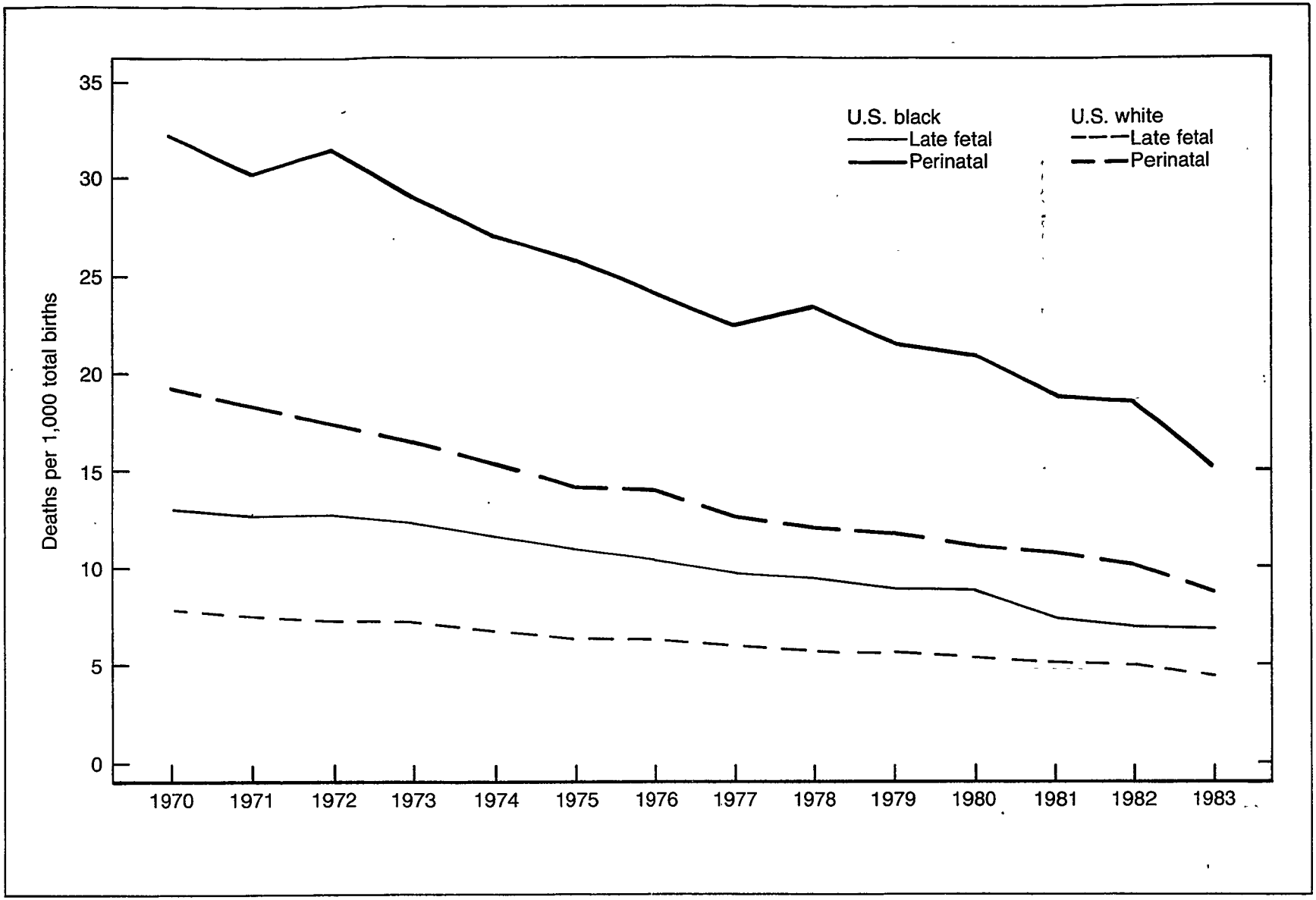


Figure 1. Time trends in perinatal and late fetal mortality rates for U.S. black and white births: California, Michigan, Missouri, upstate New York, and North Carolina, 1970–83

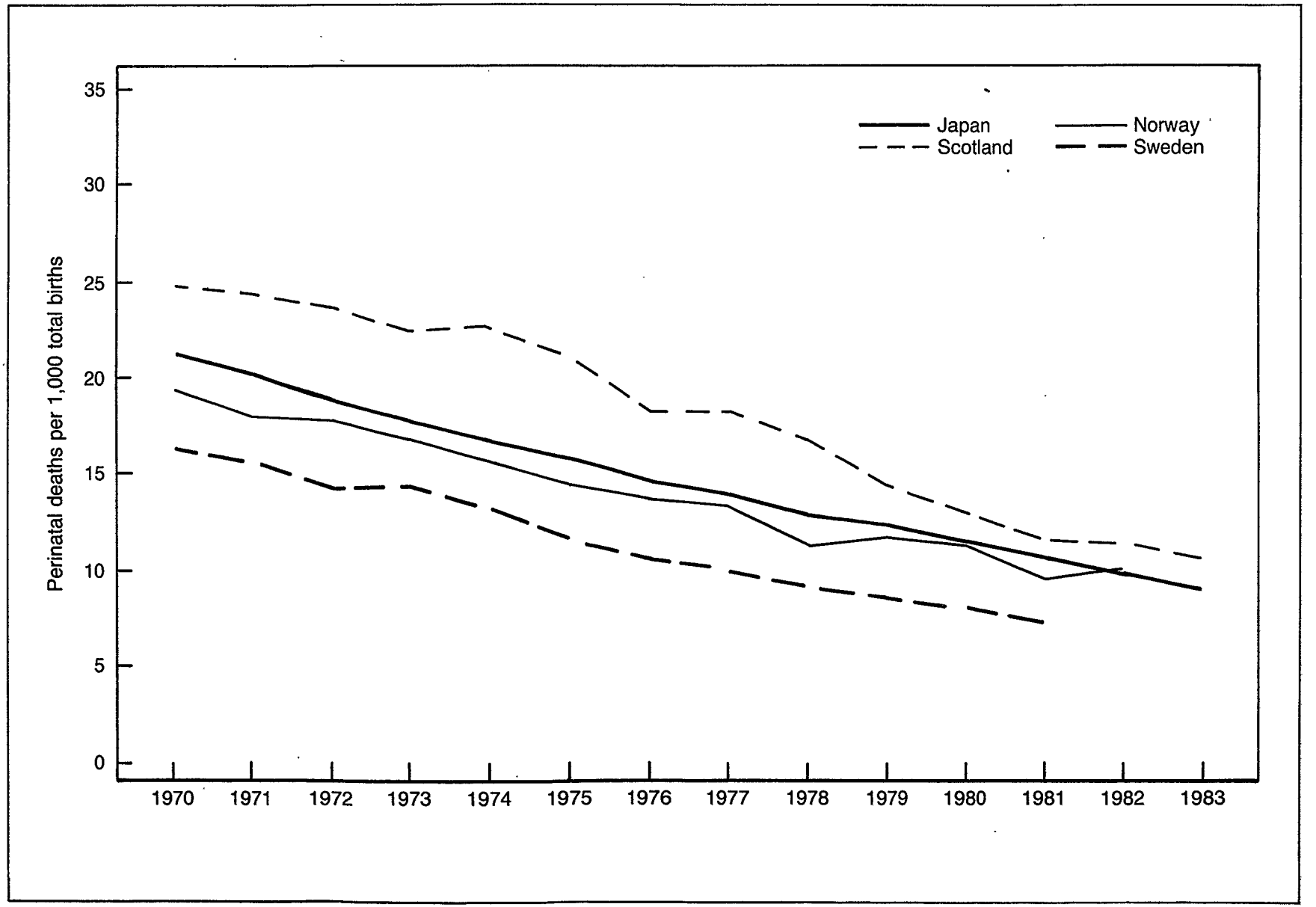
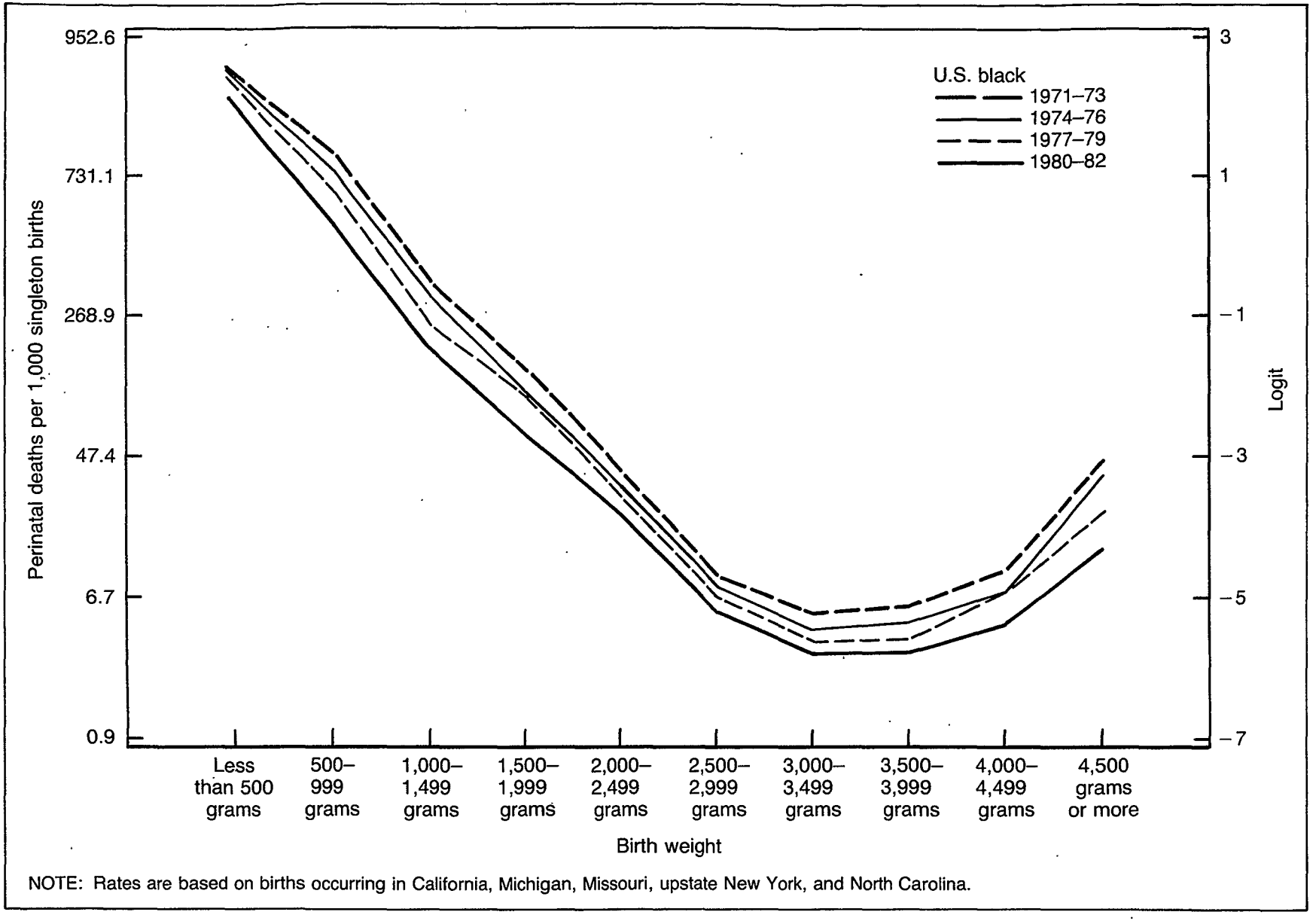
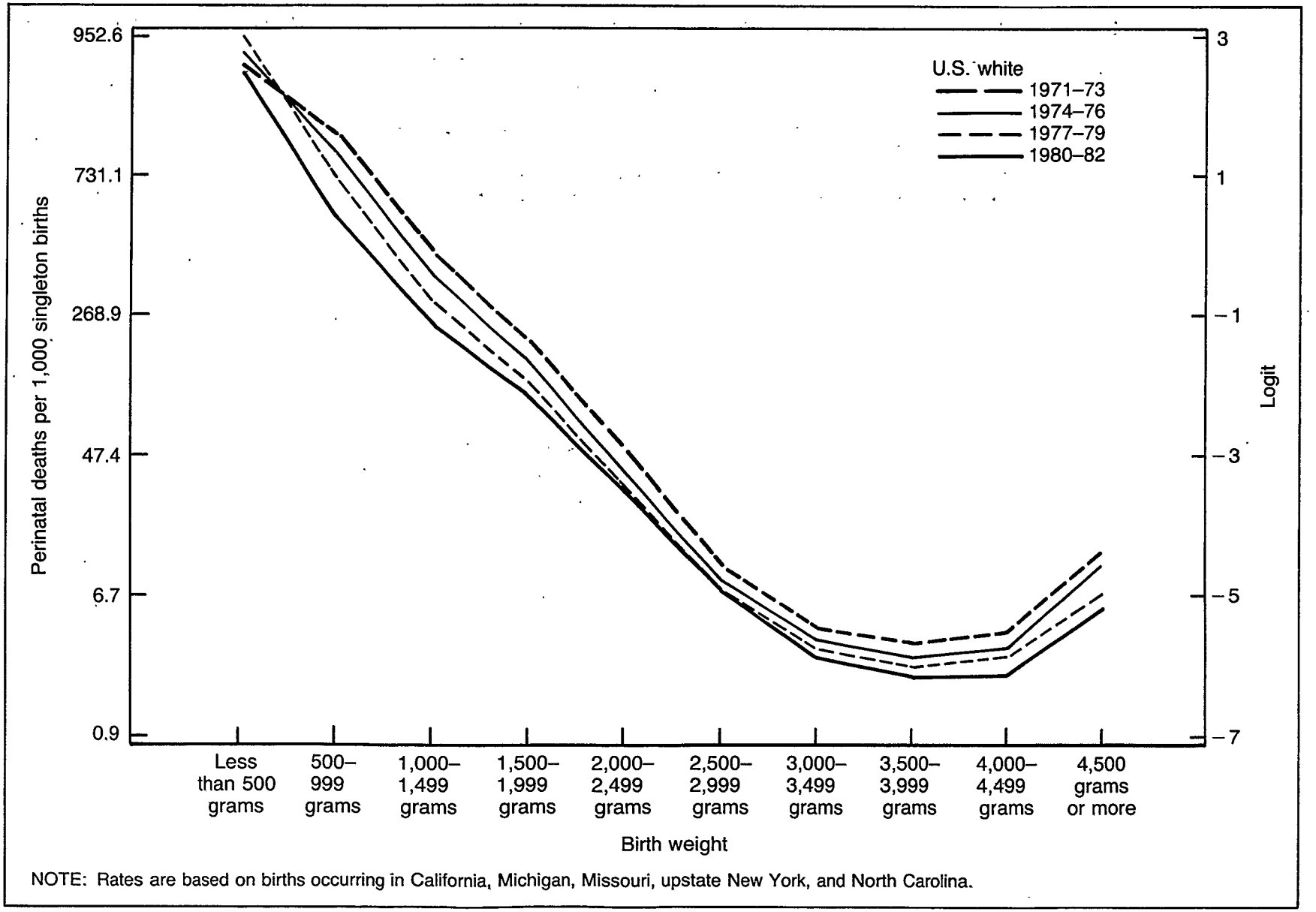


Figure 2. Time trends in perinatal mortality rates: Japan, Norway, Scotland, and Sweden, 1970–83



NOTE: Rates are based on births occurring in California, Michigan, Missouri, upstate New York, and North Carolina.

Figure 3. Birth weight-specific perinatal mortality rates for U.S. black births in 4 successive time periods: 1971–82



NOTE: Rates are based on births occurring in California, Michigan, Missouri, upstate New York, and North Carolina.

Figure 4. Birth weight-specific perinatal mortality rates for U.S. white births in 4 successive time periods: 1971–82

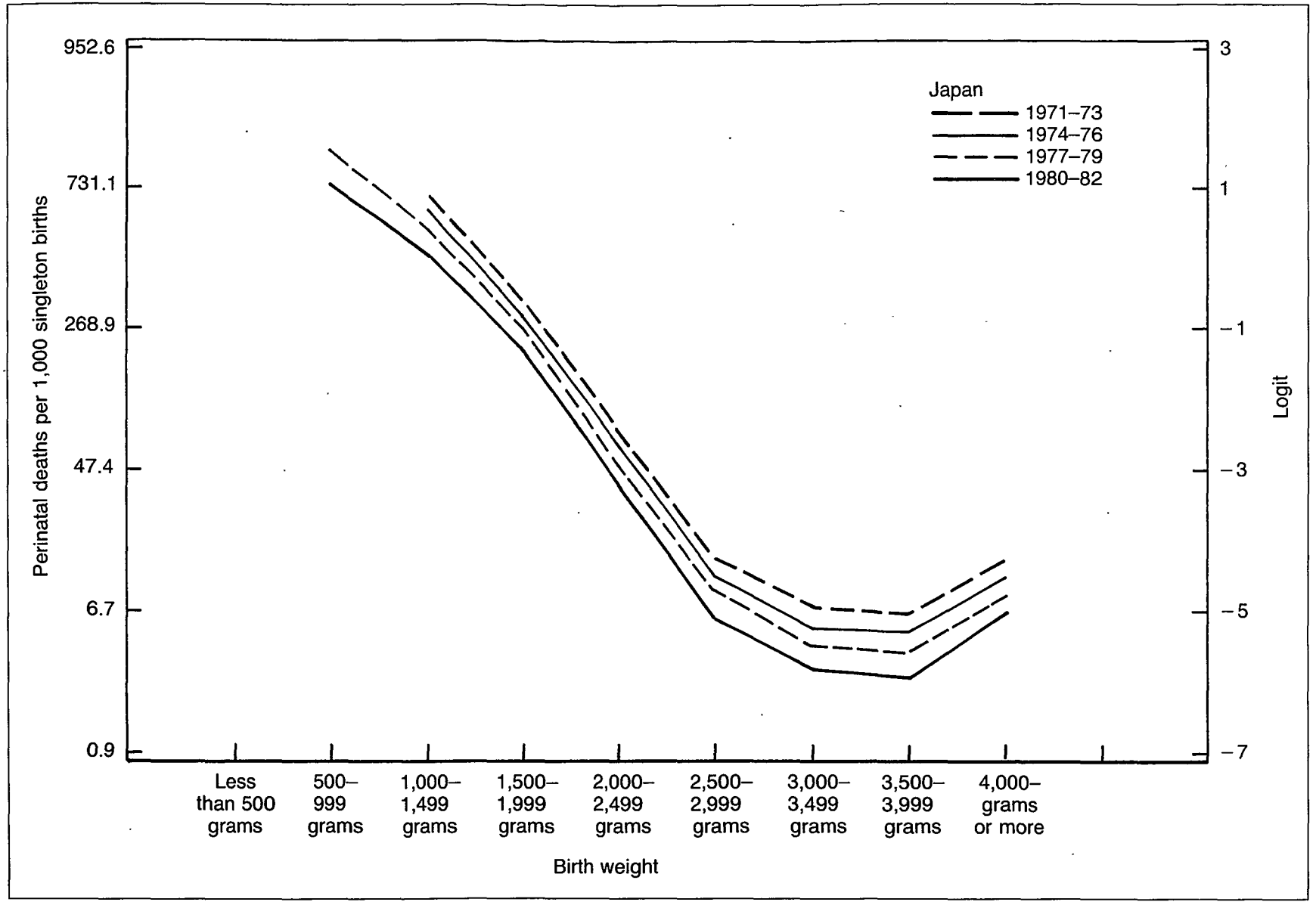


Figure 5. Birth weight-specific perinatal mortality rates for Japanese births in 4 successive time periods: 1971–82

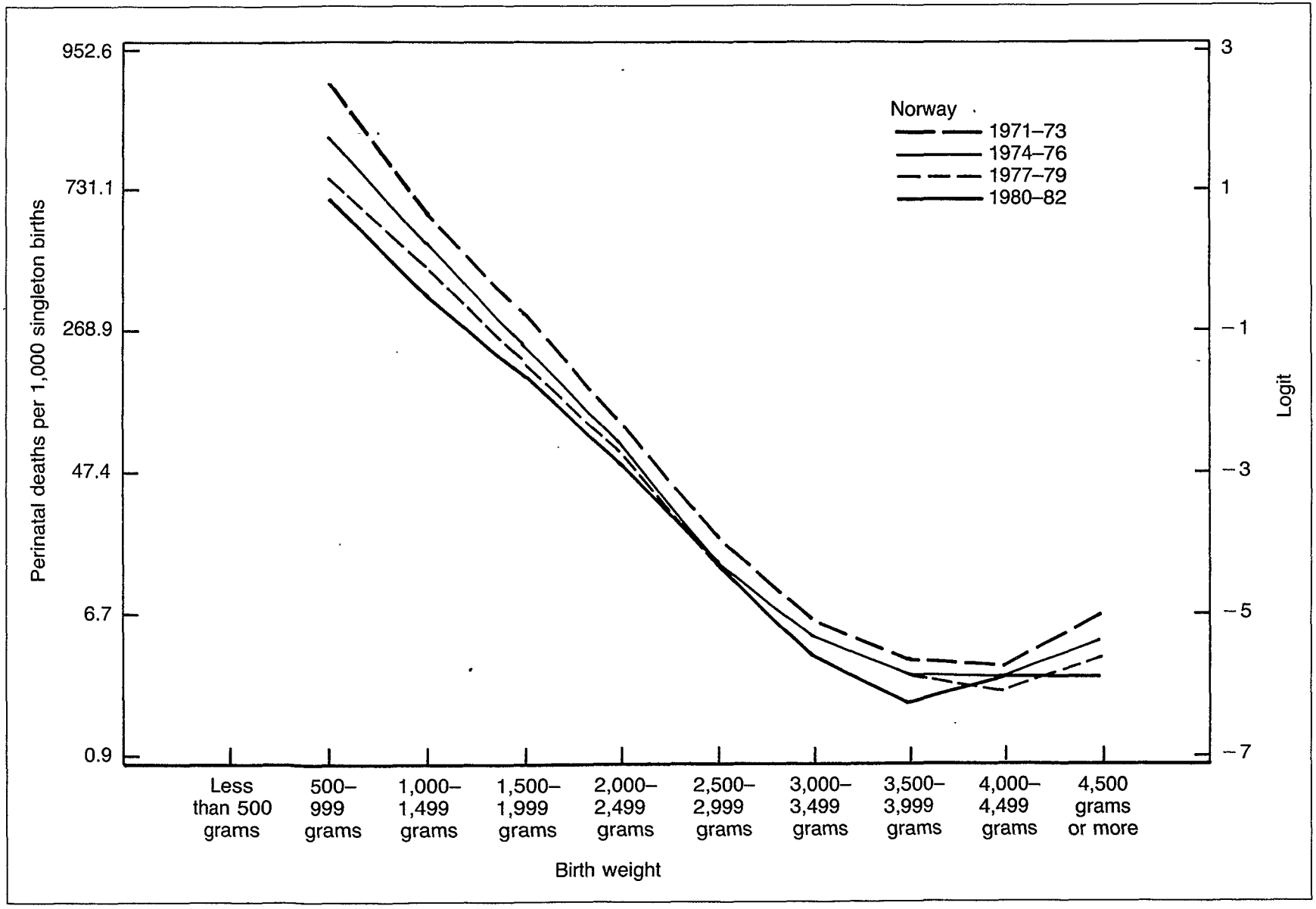


Figure 6. Birth weight-specific perinatal mortality rates for Norwegian births in 4 successive time periods: 1971–82

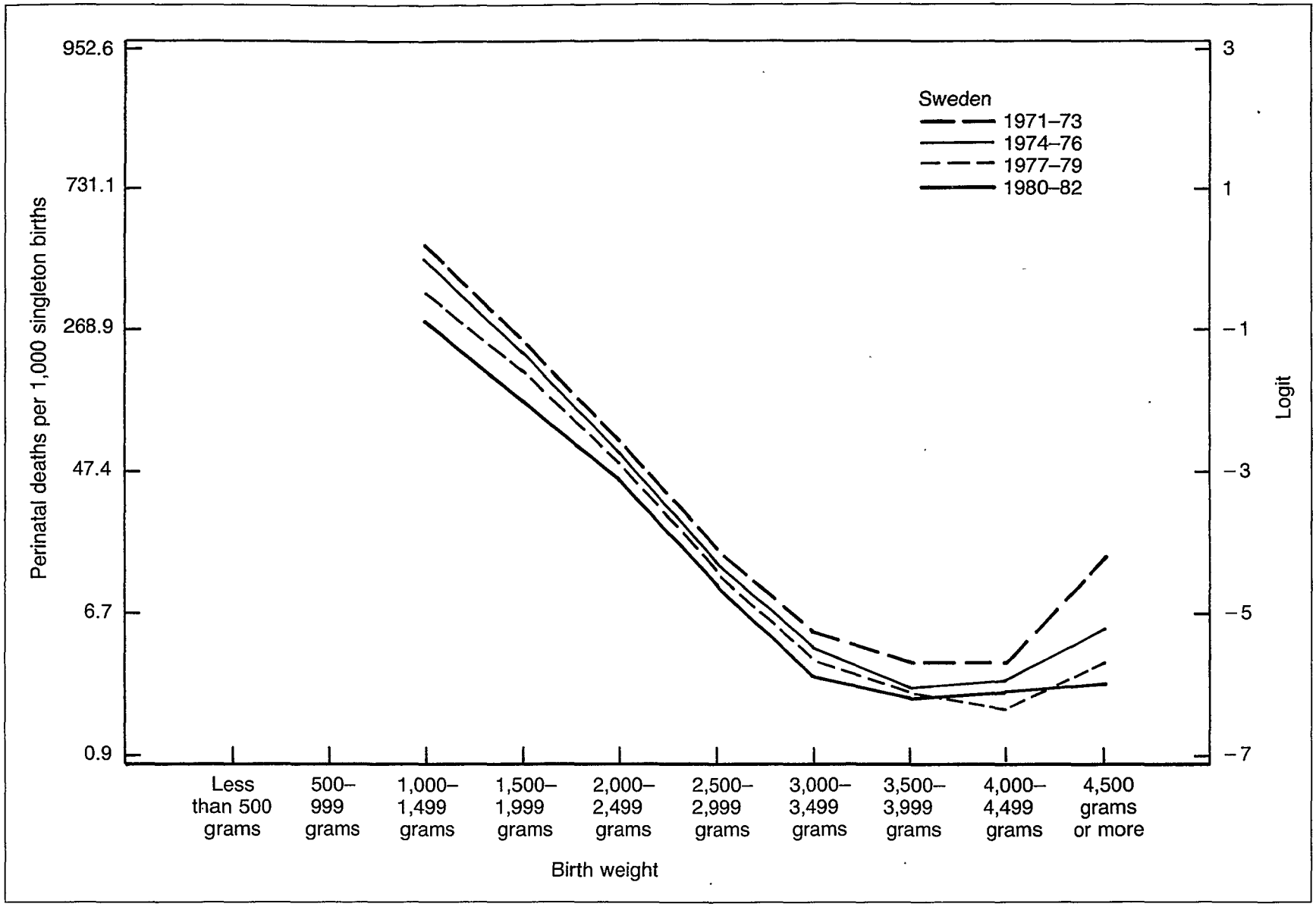
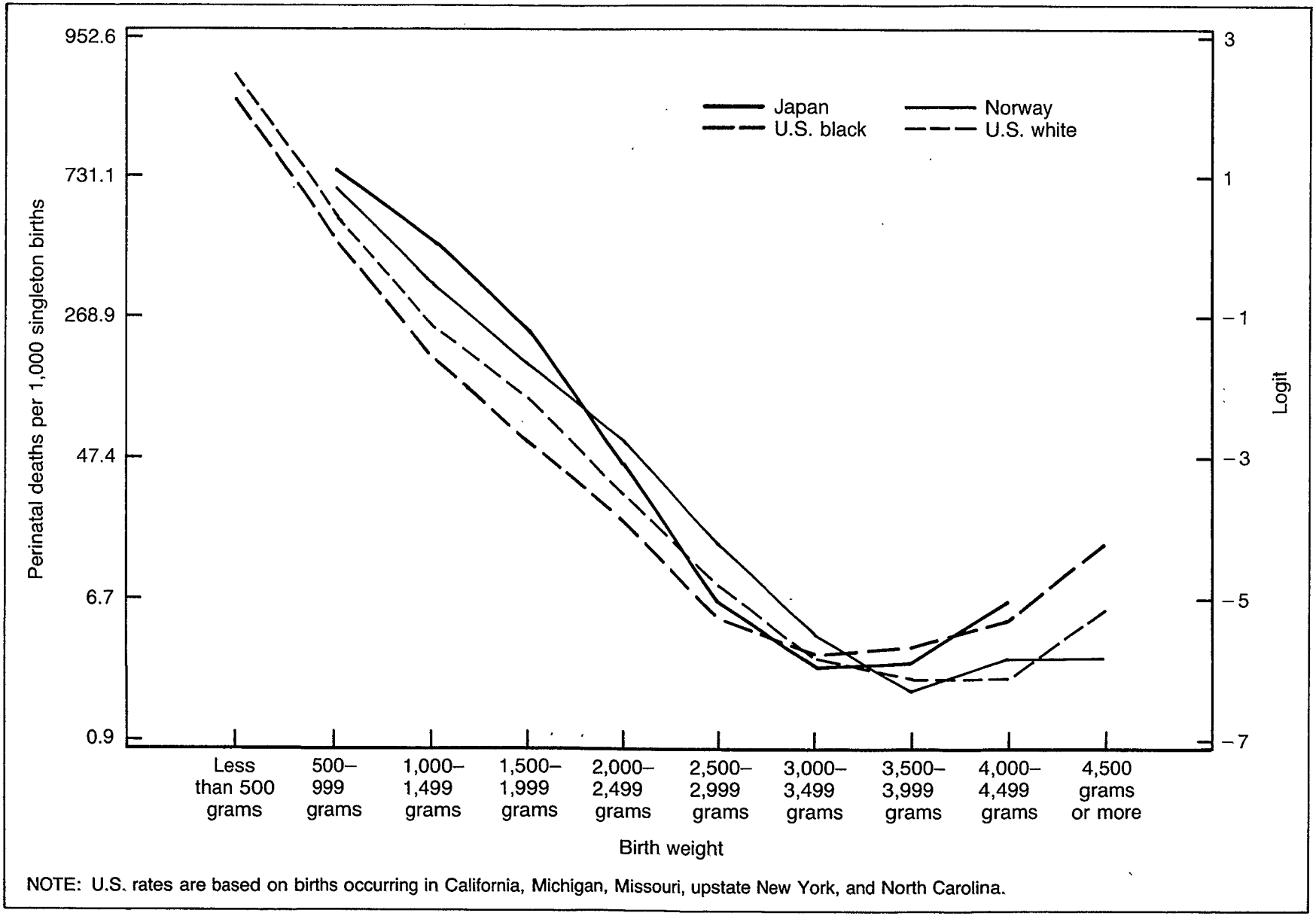
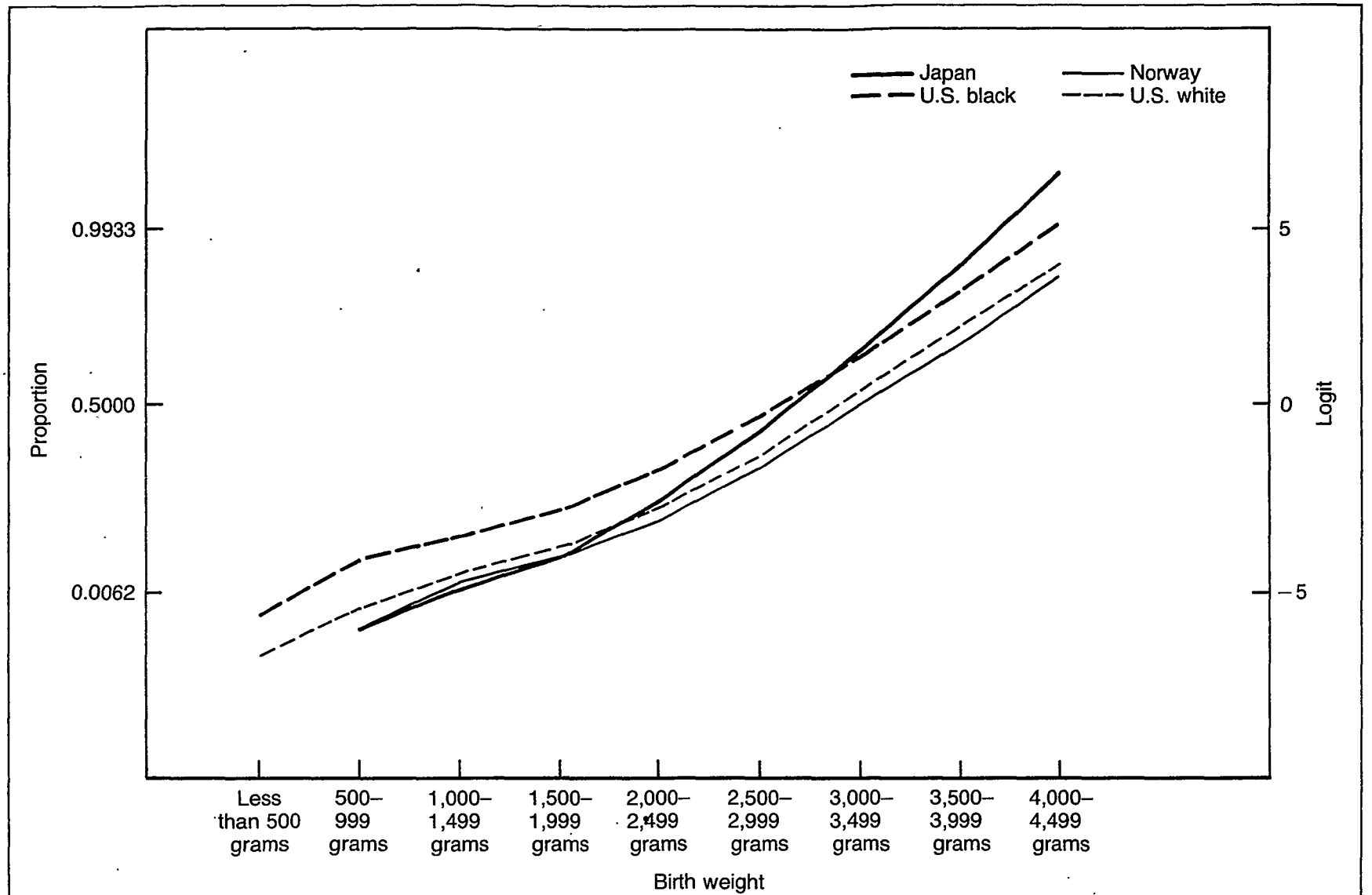


Figure 7. Birth weight-specific perinatal mortality rates for Swedish births in 4 successive time periods: 1971–82



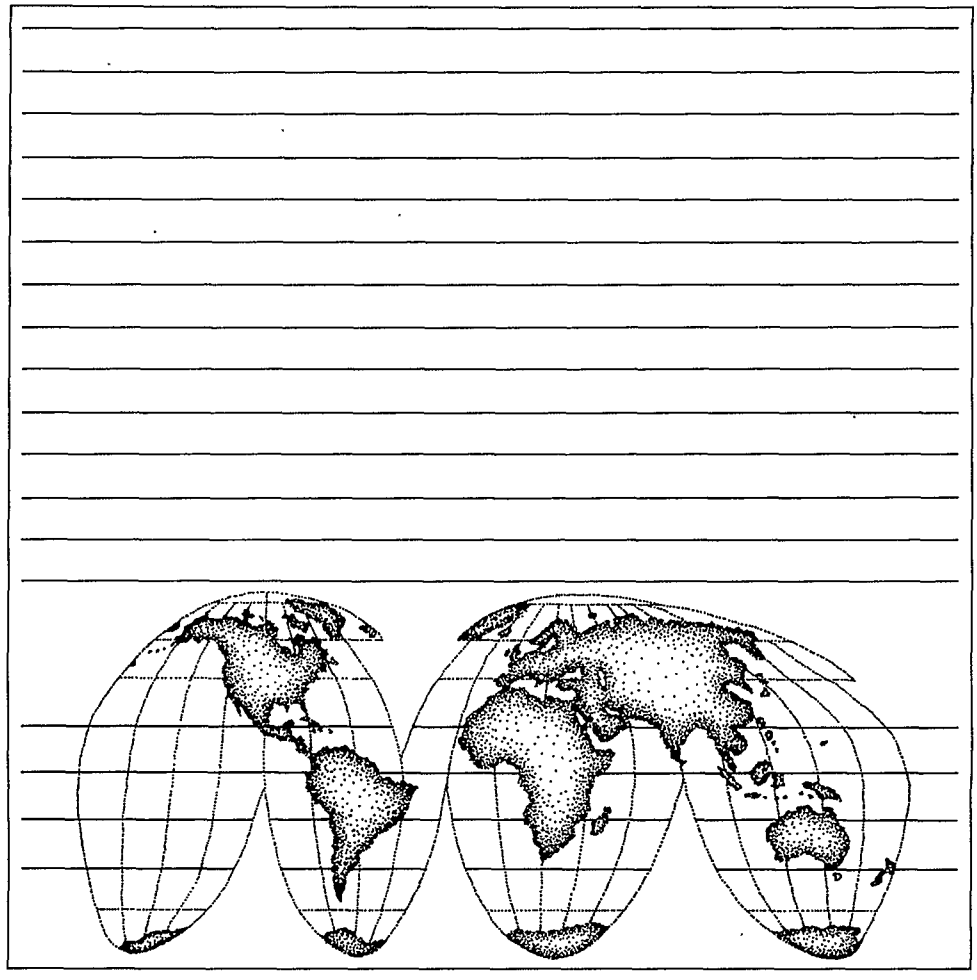
NOTE: U.S. rates are based on births occurring in California, Michigan, Missouri, upstate New York, and North Carolina.

Figure 8. Birth weight-specific perinatal mortality rates for Japan, Norway, and U.S. black and white births: 1980–82



NOTE: U.S. distributions are based on births occurring in California, Michigan, Missouri, upstate New York, and North Carolina.

Figure 9. Cumulative birth weight distributions for Japan, Norway, and U.S. black and white births: 1980–82



Chapter IV: Comparative Health Care Systems

Having a Baby in Europe: Lessons for North America

by Marsden Wagner, M.D., M.P.H.

Introduction

In 1979, maternal and child health issues were discussed at the annual meeting of the 33 Member States of the European Region of the World Health Organization (WHO). During this discussion, many countries expressed concern about the services offered for pregnancy, birth, and following birth. The countries recognized that, as yet, unsolved problems remain which must be examined, and they asked the European Regional Office of WHO to mount activities to study and report on these problems surrounding birth and birth care. In response to this request, the maternal and child health unit of the European Regional Office organized a Perinatal Study Group. The Group's 15 members came from 10 countries and spanned 10 professional disciplines: economics, epidemiology, health administration, midwifery, nursing, obstetrics, pediatrics, psychology, sociology, and statistics. For 5 years, the Group conducted surveys, reviewed the literature, and brought its own personal and professional experience to discussions of the health services for women and their babies during pregnancy, birth, and following birth. The entire group met together at least once a year, and findings from the previous year's work were presented, followed by lengthy, sometimes heated, open and free discussions. No member of the Group remained unchanged by this process.

Methodology

The material presented and discussed in this paper is based on three surveys conducted by the Perinatal Study Group. The first survey was an initial study of the official perinatal services, i.e., those services provided by the medical, midwifery, and allied professions and recognized by law and governments as the appropriate means of safeguarding maternal and child health. A questionnaire was sent to 31 of 33 countries of the European Region of WHO and replies were received from 23 countries. After a preliminary analysis of the raw data from this questionnaire had been completed, it was clear that there was a need for more detailed information about hospital practices during pregnancy and birth which have psychosocial implications. Consequently, in the second survey, a shorter psychosocial questionnaire was prepared and sent to 10 representative countries.

The third survey came after the first 2 years of work, when the Perinatal Study Group realized that they were overlooking a part of the picture. While the majority of mothers and babies received care from the official services, a significant minority were turning to a range of services that lie outside or at the margin of the official system. These services, here termed "alternative," exist in most if not all of the countries of the Region. Although these

alternative services are the source of care for a relatively small proportion of the Region's mothers and babies, these services nevertheless represent an important commentary on the shape of the official services themselves, and especially on the extent to which the official services can be considered adequately to be meeting the expressed needs of those who use the services. Consequently, eight countries in Europe and two countries in North America (the United States and Canada) were visited by a research midwife who, together with a medical sociologist, conducted this survey of alternative perinatal services in Europe and North America.

The information from all of these surveys, as well as the literature reviews, has been drawn together in an official WHO report, Having a Baby in Europe, which was published by the European Regional Office of the World Health Organization in Copenhagen, Denmark (World Health Organization, 1985).

In this paper, five aspects of perinatal care have been selected for which it appears that the lengthy and varied experience of the countries in the European Region with regard to perinatal services has direct implications for the further development of perinatal care in North America: prenatal care, maternity protection, obstetrical intervention, midwifery, and perinatal data systems. The paper will present first the information on the European situation for each of these issues, followed by a discussion of implications for North America.

Prenatal Care

There are considerable data on the number of visits for official care during pregnancy in the European Region. Twenty-one out of 23 survey countries regulate the officially recommended number of visits during pregnancy. The recommended number of routine visits for uncomplicated pregnancy ranges from 3 to 4 visits in two central European countries to 30 visits in one eastern European country. (In this report, "uncomplicated" pregnancy or birth refers to the judgment made by the doctor and/or midwife. The judgment made by the pregnant woman herself may be quite different.) Ten countries recommend between 10 to 12 routine visits and the mean for all 21 countries is 12 visits. The distribution of the recommended number of visits is shown in table 1.

The recommended number of visits for women whose pregnancies are complicated or judged to be at increased risk is reported as "unlimited" or "as necessary" by 10 countries. Those countries giving figures for recommended visits for complicated or risky pregnancies range from 16 visits to 37 visits.

In 15 of the surveyed countries, data were reported on the actual (as opposed to recommended) number of routine visits of women with uncomplicated pregnancies. These data are also shown in table 1. In 5 countries, this information is based on national data, while in 10 countries it is based on regional data or surveys. The 9 countries with monopolistic health care systems all have data on attendance and show actual numbers of visits quite close to the recommended numbers. In fact, in 5 of these countries, the actual number of visits was higher than the recommended number. Only 6 of 14 countries with pluralistic health care systems have data on attendance, and there is considerable variation among countries with regard to actual versus recommended number of visits. One country reports that 30 percent of women make the recommended 10 routine visits, while 11.4 percent make less than 6 visits. Another country finds that private

institutions are visited more frequently (7 actual visits when 12-15 are recommended) than state institutions (5.5 actual visits).

Out of 23 survey countries, 12 report policies directed toward pregnant women who never receive care or who fail to return for care. One country reports no need for such a policy because of almost 100-percent participation (0.02 percent nonattendance). In 9 countries, the policy consists of home visiting if there is nonattendance. The effectiveness of this policy seems to vary widely. Of the 6 of these 9 countries that have information on attendance, the percent of women who do not attend is reported as: 0 percent, 0.4 percent, 4.7 percent, 20 percent, and 10-50 percent. (This last country is a less developed country with vast rural areas and shortage of personnel.)

In 2 countries, the policy consists of withdrawing financial benefits from pregnant women who fail to make visits. (See section on maternity benefits.) The percentage of pregnant women who do not attend is reported by these 2 countries as 0.5 percent and 0.6 percent. Among the 10 countries with no official policy for nonattendance, 5 do not know the percentage of pregnant women who do not attend care, and the remaining 5 countries report nonattending women as: 1 percent, 4.3-15 percent, 5 percent, and 35 percent.

It is not possible with the data presented to draw definite conclusions regarding the effectiveness of these policies for pregnant women who do not attend this official care. It is interesting to note, however, that for those countries with attendance data, in countries with monopolistic health care systems the mean percentage of nonattending women is 4.4 percent, as opposed to 15 percent in those countries with pluralistic health care systems.

It was about 50 years ago that countries in the European Region began to formalize systems of health care for pregnant women based on routine visits to an officially approved doctor or midwife at regular specified intervals. The extraordinary fact is that this basic scheme has not changed over the years. With the coming of ever more sophisticated laboratory and electronic innovations, more tests have been added and changes made in place of visit, but there has been little or no questioning of the basic ideas behind the scheme. Today, every European Region country has a legally mandated or recommended system of visits for all pregnant women. In all but one of the countries included in the official survey, the woman is not required to pay directly out of her own purse for the officially sanctioned visits. The recommended number of visits for an uncomplicated pregnancy, however, varies enormously--from 4 to 30, with an average of 12 visits.

Except for the more developing countries in the Region, a vast majority of pregnant women with uncomplicated pregnancies attend all recommended visits. Most countries follow up nonattendance with a home visit. The reasons why all of these women choose to go to all of these visits has not been extensively studied. Some countries provide financial incentives, but attendance is equally high in other countries without them. It is possible that a strong motivating factor to attend is the need for social support--to share the experience of pregnancy with others outside the family.

Why does every country have a system of visits for pregnant women? Why do most women attend? Why are nonattenders pursued? Why is there such variation among

countries concerning number of visits? Clearly, there must be a widespread belief that more is better--that increasing the number of visits means a better outcome. Is this true? Figures to support this claim have mainly been comparisons between one time period and a later one, and comparisons among countries or regions with different economic and social backgrounds. In fact, a significant relationship between increased number of visits during pregnancy and decreased perinatal mortality has never been convincingly shown. (Indeed, one study including over a quarter of a million births found an increasing number of visits associated with more complications during birth.) The inverse, that fewer visits are associated with higher mortality, has been shown, but this may prove to mean nothing, since premature birth (a major contributor to mortality) automatically means a shorter pregnancy with less time for scheduled visits. Furthermore, it has been repeatedly shown that women least likely to have trouble during pregnancy go earlier for care and therefore have more visits.

These systems of many visits involve very large amounts of money and human resources and yet persist in the face of inadequate proof of value. Since the quantity of care given during pregnancy is no guarantee of quality, it seems most reasonable to pay more attention to quality (i.e., content) and reduce the quantity to the optimal minimum. In this regard, it is interesting to note that many studies and many programs have involved increasing visits to pregnant women with problems (or increased risk of problems), while little or no attention has been given to decreasing the number of visits for women with no complications. Based on the work of the Perinatal Study Group, it seems worthwhile to experiment, through randomized clinical trials, with a system of reduced visits for a woman with an uncomplicated pregnancy. Such an experimental system of fewer medical visits should be combined with other forms of social support for the pregnant woman. It is also important to experiment with user choice with regard to number of visits.

There is very little information on the actual content of care for pregnant women. Of the 23 survey countries, 18 report having guidelines on routine services to be provided. In 12 countries, detailed government regulations are available, while the remaining 6 countries have more general recommendations outlined by university centers. But even where detailed regulations exist, it is not known what the actual practices are. Little is known about the actual face-to-face interaction between the pregnant woman and the helper. A few studies have shown that the pregnant woman tends to be intimidated by a physician and often hesitates to bring forward her concerns. Midwives are reported to be sensitive to social needs and to provide health education. But there remains a need for investigation of what goes on between helper and pregnant woman and its relevance to the content of care. Clearly, a rational system of care must be based on who does what best.

What are the implications for North America of the European experience with prenatal care? The United States and Canada are both rightly concerned about the fact that their perinatal mortality rates are significantly higher than the rates found in many countries in the European Region. These North American countries have organized expert committees of various kinds to assess the situation and make recommendations. Again and again, the recommendation is made that there is a need for more prenatal care if there is to be an improvement in perinatal mortality in North America. Does the European experience support this proposal? The answer is no. There is no apparent relationship in Europe

between the amount of prenatal care that a woman receives and the outcome of the pregnancy, either for herself or for her baby. Furthermore, if prenatal care does any good, we certainly do not know what parts of it are useful and what parts are not. One would hope that, before rushing off to mount more extensive prenatal care systems in North America, there could be careful assessment of the content of the prenatal care and its relationship to outcome. For example, the two factors most correlated with low birth weight newborns (the major cause of perinatal mortality in Europe and in the United States and Canada) are smoking and lack of social support. Perhaps programs to address these two issues among pregnant women might be far more cost effective than expanding the traditional medically oriented prenatal care.

Maternity Protection

All 23 survey countries in Europe have laws or regulations for the protection of pregnancy and motherhood. The picture is a complicated one, and one scheme does not fit all countries. Even within a country, hardly any laws apply to all women, since particular circumstances lead to exclusions. Eligibility for and extent of benefits depend on many factors, including how long the woman has held her present job, what type of work she does outside the home, family income, and number of children. The countries with monopolistic systems generally provide the most generous benefits. The Scandinavian countries have the most progressive legislation.

Prenatal and postnatal paid maternity leave in 22 countries is shown in figure 1. In all countries, the combined period is at least 12 weeks. The length of prenatal leave varies less than postnatal leave, and in 4 countries unused prenatal leave may be carried over into the postnatal period. Some countries offer a choice between short or long leave, with less money per month for the longer leave. Many countries automatically extend the postnatal leave in case of certain conditions such as premature birth and multiple birth. In some countries, the length of postnatal leave grants depends on the number of children; the more children a woman has, the longer her leave. Most recently, the Scandinavian countries have led the way in extending these benefits to fathers. The usual pattern is to allow the mother and father to choose which parent will stay home during which parts of the postnatal leave period.

Beyond continuing to receive a job salary, or part of a salary, while on maternity leave, mothers in nearly all countries receive other special benefits, financial or otherwise. Some of these benefits are shown in table 2. Nineteen countries provide a grant of money for each child born to help with expenses. The size of the grant may vary, increasing in certain countries, for example, if there are more children, the new baby is sick or handicapped, the mother is breast feeding or the mother is a student. Several countries make the payment of the money contingent on attendance at prenatal visits. (See earlier section on prenatal care.) In addition to the lump sum of money, many countries also provide a "family allowance" consisting of regular monthly payments for each child. The amounts vary widely among countries: For two children, the amount ranges from 2 percent to 20 percent of the average monthly industrial wage for that country. The amount usually increases progressively with each subsequent child.

In addition to financial benefits, a number of other diverse social benefits are available. Twenty surveyed countries mentioned additional benefits during pregnancy and after childbirth, including special privileges when traveling by public transport; priorities for loans; priorities for housing; permission to change jobs; free milk, vitamins, baby equipment; and special working hours.

Most survey countries have laws and regulations regarding the working conditions of women during pregnancy and after childbirth. (Most often the protection of working conditions does not include agricultural workers and, to date, it never includes work at home.) Often nighttime work, overtime work, and dangerous work are prohibited, and women are often transferred automatically to a less demanding job. In this regard, it is important that in some countries the woman is protected from unfair dismissal because of pregnancy, and in most countries her right to reinstatement after maternity leave is ensured.

With regard to working conditions for women who are pregnant or have young children, all survey countries provide various types of leave. If the pregnant woman is sick, she has, on medical certification, sick leave with partial or full salary for as long as necessary in all countries. If, on the other hand, the baby is sick, most countries provide for leave from work for either parent. The number of days per year allowed for the care of the sick child varies from 5 days to 6 weeks (with partial or full salary). Some countries have unlimited unpaid leave with job protection when a child is sick. Fourteen of the surveyed countries provide paid time off from work to allow women to attend official health care visits during pregnancy. In addition, several countries also offer paid time off for women (and sometimes men) to attend pregnancy classes.

An important final aspect of working conditions for women to be mentioned is regulations for breast-feeding women. Nursing breaks from work are provided in most countries and counted as fully paid hours of work. The durations of the nursing breaks vary from two 1/2-hour breaks to two 1-hour breaks. In a few countries, the breast-feeding mother is entitled to a shorter working day at full pay.

Single mothers, on the increase in most countries, are eligible for special rights in nearly all countries. These rights include longer maternity leave, increased financial benefits, loans and education grants, and priority for placement for her child in day care centers.

There are important implications for North America with regard to the European experience with maternity protection. As indicated earlier in this paper, there is growing evidence of an important correlation between social support for pregnant women and pregnancy outcome. European countries have made a major commitment to provide adequate maternity benefits during pregnancy and after birth to reduce workload, to provide an economic safety net for the family, and to provide adequate parental caring for the young infant. All 23 survey countries in the European Region, including a number of countries which are developing or only partially industrialized and with a gross national product far below that of the United States and Canada, have made this commitment to maternity protection. In terms of cost benefit, it might be more effective for the North American countries to consider promoting such maternity protection as a higher priority than expanding the highly costly prenatal care systems.

Obstetrical Intervention Rates

A major component of the content of birth care is the operative delivery--when the baby is either pulled out by forceps or vacuum extractor or lifted out through a surgical cut in cesarean section. The data collected by the Perinatal Study Group on these procedures are contained in table 3. Of the 13 countries that supplied national data, only about half claimed to have some sort of national registration, while the others gave collected hospital reports or data on representative samples. Just looking at these figures in table 3 clearly demonstrates great variation: The operative vaginal rate (forceps and/or vacuum) varied from 1 percent to 13 percent; the cesarean section rate varied from 4 percent to 12 percent.

The overall operative delivery rate (forceps plus vacuum plus cesarean section) varied from 6 percent to 24 percent. It is clear that this fourfold difference in operative rates cannot be explained by differences in women in these countries but must rather represent differences in medical practice customs. Such differences in professional customs take on significance since, in general, expanding the indications for a procedure usually means a decreasing benefit of the procedure, while there is no similar decrease in the hazards of the procedure. Our survey of alternative birth care showed a definite drop in operative delivery rates in 7 out of 10 countries if the birth took place in a setting where there was alternative care. There is also a trend for these intervention rates to be lower in those countries where midwifery is independent and/or stronger in its contribution to maternity care.

The rationale for operative delivery is to minimize the risk of injury, disease, and death for mother and child. The only practical yardstick for international comparison is the perinatal mortality rate. When these operative delivery rates are compared with national perinatal mortality rates in the 11 countries for which data are available, only very weak correlations are found. This means that the frequencies of operative delivery do not contribute much, if anything, to the variation in perinatal mortality rates among the countries in question. Interestingly, the association was actually weakened when the vaginal operative deliveries were added to the cesarean section rates.

Our questionnaire also asked about the frequency of induction of labor. Only four countries had national data on the frequency of induction, these being Denmark (12 percent), Poland (15 percent), Norway (17.5 percent), and England and Wales (36 percent). All these values represent the years 1977, 1978, and 1979. Finland, quoting annual reports from health centers, had 15 percent inductions in 1979. Regional data were recorded by three countries, with values of 5.8 percent, 20 percent, 25 percent, and 30 percent from four different Italian regions; 25.4 percent from the municipality of Bucharest, Romania; and 25 percent from a regional study in Munich, Federal Republic of Germany. Five countries gave national estimates, and two quoted data from large hospitals. These ranged from "rather rare" to 83 percent. Eight countries gave no data. The difference in the reported frequency of induction of labor is great, ranging from 5.8 percent to 36 percent. Problems of definition exist. (For example, stimulation of ongoing labor with drugs should not be confused with induction.) However, the wide range of figures points to real differences far beyond the range of faulty definitions. These differences obviously reflect different medical opinions on the value of induction. Few physicians would

dispute the value of inducing labor in some, perhaps up to 10 percent of women having babies. But in the remainder, the indications are doubtful and can be contested. Attempts to prove a causal relationship between rising induction rates and falling perinatal mortality rates have failed.

All of these obstetrical interventions have been increasing in a number of countries in Europe to an extent that the practices are causing concern. The great variation which has been demonstrated in the use of these interventions also suggests reason for concern. The data from North America suggest that these obstetrical intervention rates are as high or higher than the highest intervention rates presented here for Europe. There is little or no evidence to support the notion that increasing these interventions to such high levels has a significant impact on the overall mortality rates. The European experience in this regard strongly supports the need both in Europe and, especially, in North America to carefully reassess the use of all of these interventions. It is for this reason that a World Health Organization meeting in 1985 made the following recommendations for perinatal services worldwide:

> Countries with some of the lowest perinatal mortality rates in the world have cesarean section rates of less than 10%. There is no justification for any Region to have a rate higher than 10% to 15%.
>
> The induction of labor should be reserved for specific medical indications. No Region should have rates of induced labor higher than 10% (Lancet, 1984).

Midwifery

In 17 of 21 survey countries in the European Region, the midwife is the primary birth attendant for uncomplicated births. The obstetrician is the birth attendant in the great majority of complicated births in the European countries. Five countries indicated, however, that either the midwife or the general practitioner was the attendant for some complicated births. Furthermore, in the great majority of European countries, the midwife is also the principal caregiver for prenatal and postnatal care.

This European pattern of midwives providing the majority of prenatal and postnatal care as well as being the principal birth attendant at uncomplicated births is fundamental to the entire perinatal care system in the European Region. This division of labor is important, since midwives and doctors, in general, have quite different styles of care during pregnancy and birth. The midwife stays with the woman during all stages of labor and birth and sees her role as encouraging and assisting the woman without taking over, while also serving as the woman's advocate when needed. This is a more social as well as noninterventionist clinical approach. The physician does not stay with the woman but rather comes when called by the midwife to diagnose and treat any undesirable deviation. The physician's role is more interventionist and medical in nature. These two styles have nicely complemented each other. In several countries, the midwife's presence, even at complicated births, is an essential reminder to all those present that most of what is going on is still normal.

The implications of midwifery practice in Europe for the situation in North America are profound. The United States and Canada are the only two developed

countries in the world where midwifery is not widely practiced. Every single country in the world with perinatal mortality rates lower than the United States and Canada uses midwives as the principal or only birth attendant for at least 70 percent of all births. This fact alone should dispel any notions that obstetricians are preferable to midwives as birth attendants at uncomplicated births. As mentioned earlier, there is also evidence that a strong independent midwifery profession is an important counterbalance to the obstetrical profession in preventing excessive interventions into the normal birth process. Consequently, it is perhaps not surprising that in the United States and Canada, one finds the highest obstetrical intervention rates as well as serious problems with malpractice suits. The European experience and our data strongly support the urgent need for an introduction of widespread independent midwifery practice in North America as a most important counterbalance to the present situation.

Perinatal Data Systems

The past decade has seen the beginning of cross-national studies of perinatal services and their benefits, hazards, and outcomes. Mention has already been made of the work of the European Regional Office of the World Health Organization in gathering and analyzing such data. The European Perinatal Study Group evaluated the systems for collecting routine perinatal data, and the results are available (Mugford, 1983). The Nordic countries have been involved now for a number of years in comparing their perinatal statistics and perinatal service systems and then actually carrying out various kinds of experimental programs. The Nordic experience in this regard appears to have been quite fruitful (Bergsjø and Bakketeig, 1984). The National Center for Health Statistics in the United States has also recently mounted an international collaborative effort and has begun with an important cross-national evaluation of perinatal data. All of these efforts appear to be important in further understanding the need for improvements in perinatal services. The European experience with perinatal data systems suggests the need for increasing collaboration at the international level if we are all to learn from each other about the best ways to have a baby.

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Table 1. Recommended and actual number of visits for uncomplicated pregnancies in 23 European survey countries

Recommended number	3-5	6-7	8-11	12-15	16 or more	No recommendation
Number of countries	4	1	8	7	1	2
Actual number	3-5	6-7	8-11	12-15	16	No information
Number of countries	5	3	3	3	1	8

Table 2. Some maternity benefits in 24[1] European survey countries

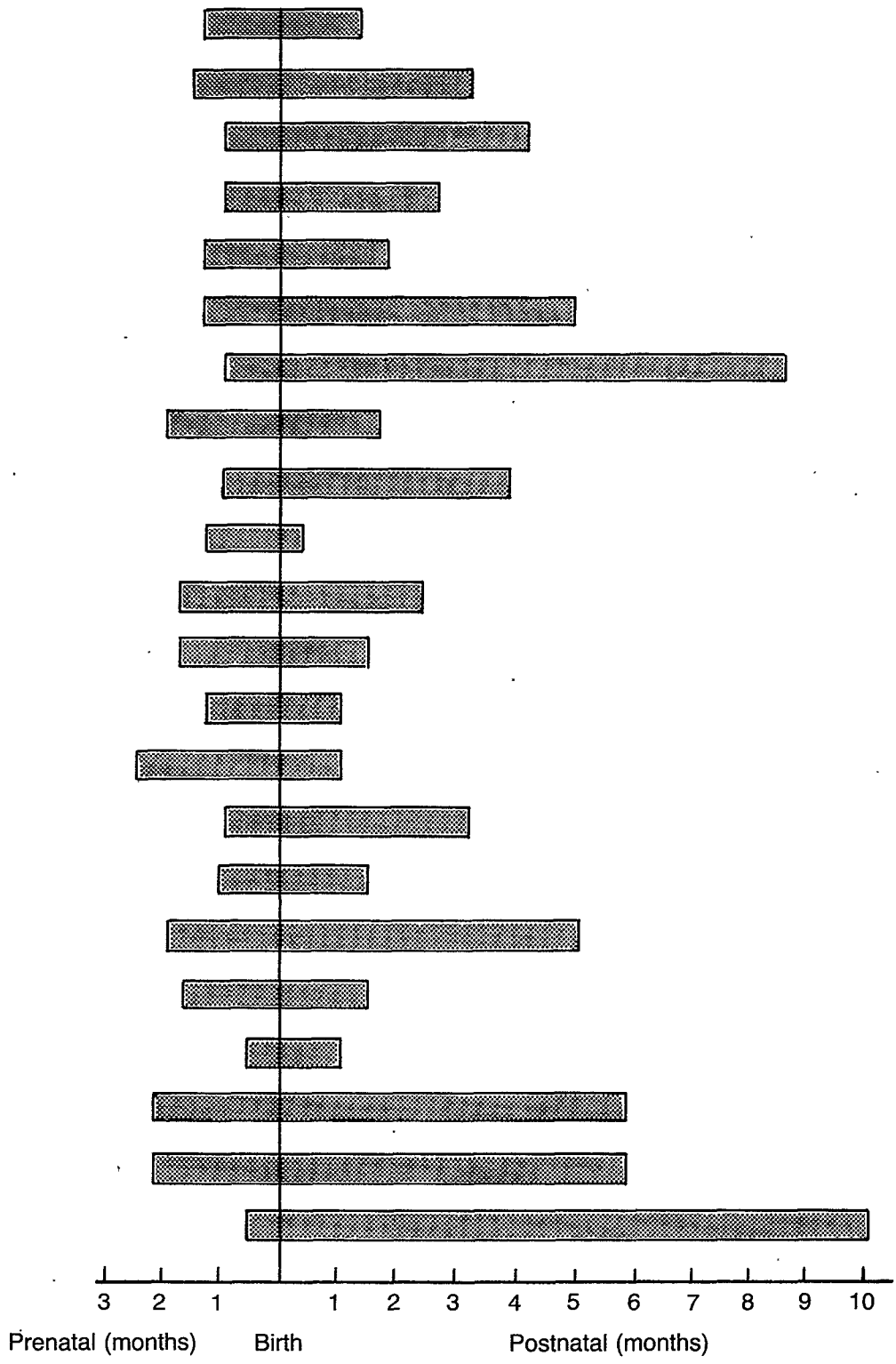
Benefit	Yes	No	No answer
	Number of countries		
Financial grant at birth	19	4	1
Financial aid for care during pregnancy	18	5	1
Night or dangerous work forbidden	12	4	8
Benefits for single mothers	14	7	3
Other social benefits	20	2	2

[1]There are 24 countries in this table because the United Kingdom has been divided into 2 parts: England and Wales, and Scotland.

Table 3. Incidence rate of specified procedures for operative delivery in some European countries

Country or region	Procedure: Forceps (a)	Procedure: Vacuum (b)	Procedure: Cesarean section (c)	Procedure: Operative vaginal (a+b)	Total interventions (a+b+c)	Year	Source
National data			Percent				
Belgium	NR	NR	7.2	---	---	1979	Social Security statistics--incomplete
Czechoslovakia	1.3	1.0	4.0	2.3	6.3	1979	Hospital reports to Ministry of Health
Denmark	0.7	8.6	10.3	9.3	19.6	1979	Total birth survey--Ministry of Health
Finland	0.3	3.4	11.9	3.7	14.6	1979	Collected reports from National Health Centers
France	8.0	4.0	8.0	12.0	20.0	1976	Representative sample--4,600 births
Hungary	0.4	2.0	8.0	2.4	10.4	----	Annual report from obstetrical departments
Netherlands	1.7	3.6	3.6	5.3	8.9	1978	Ministry of Health--national data
Norway	3.2	3.4	8.0	6.6	14.6	1979	Medical birth registry--covers all births
Poland	0.8	0.4	5.0	1.2	6.2	----	National statistics
Romania	NR	NR	4.6	---	---	----	National statistics
Sweden	0.3	6.8	11.7	7.1	18.8	1979	National medical birth registry--all births
United Kingdom: England and Wales	13.3	NR	7.3	13.3	20.6	1978	National survey--10 percent sample of hospital records
Scotland	13.0	NR	10.7	13.0	23.7	1978	National data--single births only
Regional data							
West Germany	1.8	11.1	12.7	12.9	25.6	1975	Munich perinatal study, 1975
Romania	4.7	0.3	4.5	5.0	9.5	----	Bucharest
Turkey	0.6	1.0	0.9	1.6	2.5	1978	Cubuk and Etimesgut districts--ad hoc study
Yugoslavia	0.6	2.0	5.9	2.6	7.5	----	Slovenia--national data

NOTE: NR = not reported.



NOTE: This figure is intended to represent the range of maternity leave available in the survey countries. Thus, for our purposes, it does not entail the identification of individual nations.

Figure 1. Duration of prenatal and postnatal paid maternity leave in 22 European survey countries

Birth Weight-Specific Mortality Through the Fifth Year of Life in Sweden: 1973-81

by Olav Meirik, M.D., Ph.D., and Anders Ericson, M.Sc.

There is a well-documented negative correlation between birth weight and neonatal morbidity and mortality. This correlation also holds for the postneonatal period. Very little is known, however, about childhood morbidity and mortality relative to birth weight. We present here preliminary data on mortality from birth through the fifth year of life relative to birth weight for Swedish live births from 1973 through 1976.

Material and Methods

Two Swedish data bases were utilized in this study: the Medical Birth Registry at the National Board of Health and Welfare and the Registry of Causes of Death at the National Central Bureau of Statistics. The Medical Birth Registry contains sociodemographic, anthropometric, and medical data for all births in Sweden since 1973; among other items recorded is the newborn's birth weight. Mothers and infants are identifiable through their unique personal identification numbers. The National Registry of Causes of Death similarly contains data on causes of all deaths occurring in Sweden. Also, individuals are identifiable through the personal identification number in this registry.

Each year, the two registries are linked to each other, primarily to verify cases of neonatal death. For the purpose of this study, we compiled data on mortality from birth through the fifth year of life according to the infants' birth weight. The data presented here refer to infants born from 1973 through 1976 and their mortality through 1981. All mortality rates referring to a specific age (e.g. 12-23 months) include in the denominator only infants who had survived to that specific age. A total of 418,595 live births were included in the analyses, of whom 4.3 percent were low birth weight (less than 2,500 grams) and 0.6 percent were very low birth weight (less than 1,500 grams).

Results

Figure 1 summarizes the findings. The well known relationships between early neonatal (0-6 days) and late neonatal (7-27 days) mortality, on the one hand, and birth weight, on the other, appear clearly. Also, postneonatal (1-11 months) mortality is strongly related to birth weight.

Judging from the rates for the second year of life (12-23 months), there is still a gradient in mortality for the various birth weight categories. The differentials in mortality seem to disappear for all birth weight categories except for the very low birth weight infants in the fifth year of life (48-59 months). In their fifth year of life, the very low birth weight children had an

approximately threefold excess in mortality compared to other birth weight categories.

Comments

The results of this analysis suggest that infant birth weight not only is correlated to mortality through the first year of life but continues to be associated with it in the second, third, and even fourth and fifth years of life. In this context, it must be emphasized, however, that the mortality rates for the fourth and fifth year of life in this study were based on very small numbers of deaths, and the influence of chance should be kept in mind. On the other hand, the trends that appear are suggestive of a true relationship.

It is beyond the scope of this preliminary study to determine whether the increased mortality for low and very low birth weight infants in their second year of life and thereafter is attributable to birth weight per se or to the same genetic and environmental factors leading to low birth weight, which may also operate in childhood and cause the higher mortality.

The importance of our findings from a Swedish public health perspective is difficult to assess until more detailed data relating to causes of death and occurrence of severe malformations among the deceased infants are available. The birth weight distribution in Sweden is favorable compared to many other countries, and very few deaths actually occurred in the low and very low birth weight categories beyond the first year of life because of small numbers of infants and low mortality rates. If our finding reflects a true pattern, it may be of more importance in populations with less favorable birth weight distributions.

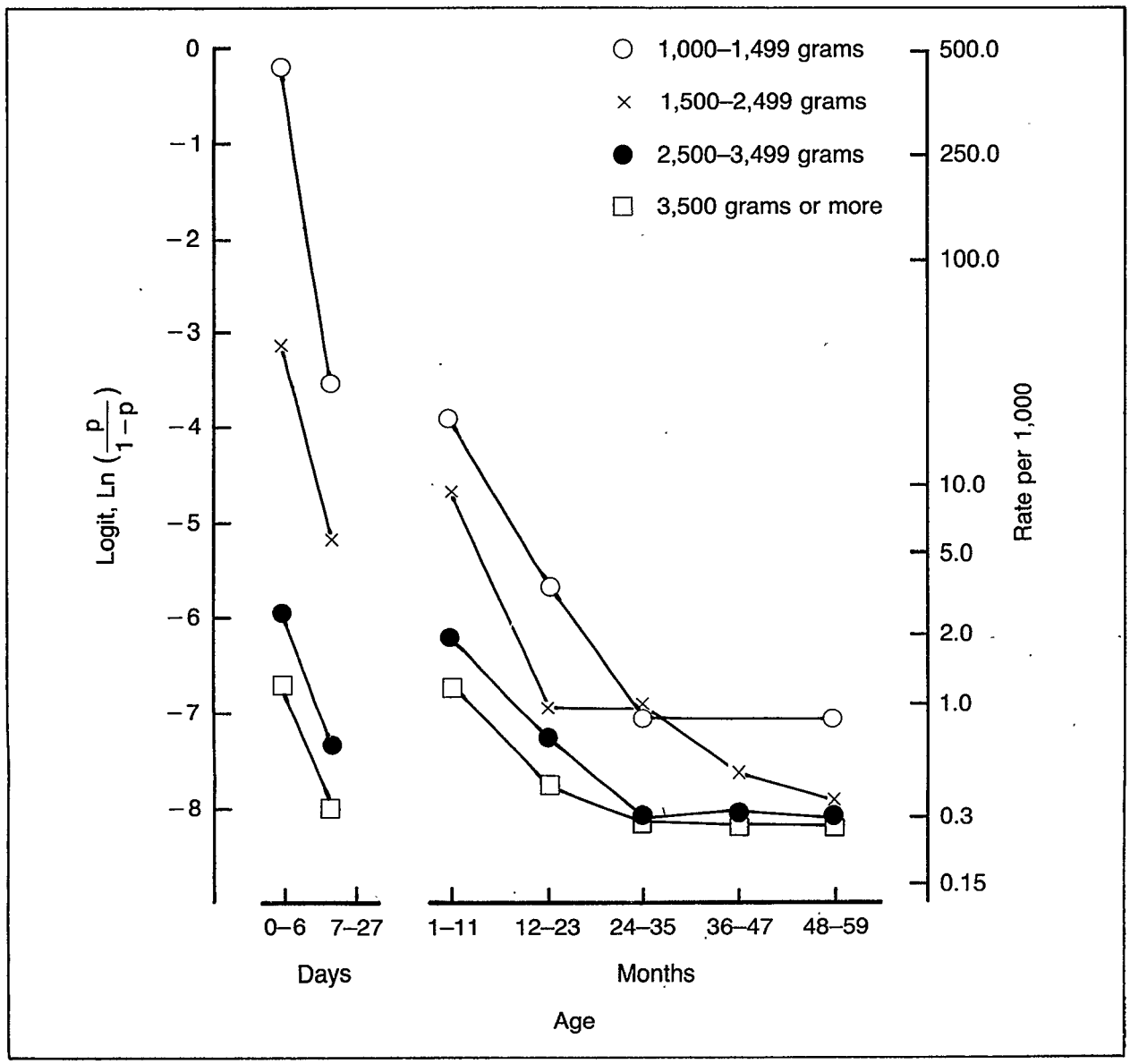


Figure 1. Mortality rates, by birth weight and age at death, for Swedish infants born from 1973 through 1976

Detection, Monitoring, and Care of High-Risk Pregnancies in Sweden

by Olav Meirik, M.D., Ph.D., and Gunilla Lindmark, M.D., Ph.D.

Since the late 1950's, the perinatal mortality rate in Sweden has been among the lowest in the world. This has been attributed to a generally high standard of living, a homogeneous and healthy population, a high level of education, and equality in access to qualified antenatal, obstetric, and neonatal care (Alberman, 1980; Hein, 1982; Rooth, 1979). The Swedish model for antenatal care has in this context received attention because it is mainly run by midwives, contrary to the practice in many other developed countries, where medical doctors have the main responsibility for the antenatal care. In this paper, the organization and the content of Swedish antenatal care are presented, and the potentials of this Swedish model to detect high-risk pregnancies are discussed.

Organization of Antenatal Care

In general, health care is regarded as being a task for the public sector in Sweden. Twenty-three county councils and three large municipalities are responsible for individual health services and medical care. In health care terms, these units are called principal health care districts. These principal districts have populations ranging from 60,000 to 1,500,000 people, with an average of about 300,000. Each principal district has at least one hospital with departments of obstetrics and gynecology and of pediatrics.

The principal districts are divided into primary health care districts for outpatient care, each with a number of primary health care clinics serving populations of 5,000 to 50,000 people. Antenatal care is a separate activity within the framework of primary health care, and each primary health care district has at least one clinic for antenatal care. Table 1 outlines the structure of this organization.

The antenatal care clinics are staffed with midwives, and there is usually one midwife per 2,000 women aged 15-44 years. The general fertility rate is about 0.055; thus, a midwife takes care of 100-120 pregnant women per year on average.

Each antenatal care clinic is supervised by a general practitioner or an obstetrician. As many as 85 percent of the doctors engaged in antenatal care supervision are obstetricians who pay regular visits to the clinics and are consulted by the pregnant women themselves.

During the 1970's, when obstetrical and neonatal care was centralized (National Board of Health and Welfare, 1973) to a greater extent than before, the need was felt for a highly qualified antenatal care system with the ability to detect and refer high-risk pregnancies to adequate levels of care for delivery.

Consequently, many of the county councils created posts for senior obstetricians with the responsibility to organize and supervise antenatal care within the principal districts of health care. These senior obstetricians now provide continuous postgraduate training to the midwives and are in charge of referral antenatal clinics, usually located at the largest hospital in the principal districts. At the referral antenatal clinic, the obstetricians work in close collaboration with pediatricians, midwives, and social workers, as well as other specialists (e.g., specialists in internal medicine at the hospital).

Content of Antenatal Care

General guidelines for the personnel working in antenatal care have been given by the National Board of Health and Welfare. They recommend two visits to a medical doctor during pregnancy, as outlined in table 2. The guidelines also advise that high-risk pregnancies should be transferred to referral antenatal care clinics. Among the indications for such transferral are previous stillbirth, previous premature or low birth weight infants, and repeated spontaneous abortion. Also, older and young pregnant women should, as a rule, have at least one visit to a referral antenatal clinic.

Pregnant women registered at the antenatal clinics are seen by a midwife at their first visit, when a careful interview is taken according to a standardized case record used in all of Sweden. The interview includes an active search for factors that might increase the risk for preterm birth, fetal growth retardation, or other complications in pregnancy or labor. Besides the medical and obstetric history, the interview also focuses on the woman's family and social situation, her working conditions, and lifestyle, such as cigarette smoking and use of alcoholic beverages.

Table 3 gives an overview of the various laboratory tests and examinations used at the visits in antenatal care. At all visits hemoglobin, blood pressure, dipsticks for protein and glucose in urine, and symphysis-fundus measurements are taken. In addition, several other tests are used, as outlined in figure 1. In this context, it should also be stressed that every visit to the antenatal clinic is used for health information and education and discussions about the pregnant woman's general situation. The father is also encouraged to participate whenever possible.

Antenatal Care Attendance

In Sweden, antenatal care has a relatively long tradition, and attendance and acceptance of it are very high. It is rare to find a pregnant woman who has not had any antenatal care, and no pregnant woman could admit she had not visited the antenatal care clinic without getting reproaches from friends and family members for jeopardizing her own and her baby's health. Most women are also familiar with the antenatal clinics, as they may have visited them for contraceptive advice or cervical cytological screening. As many as 85 percent of pregnant women register before the 14th week of pregnancy.

Comments

The present organization and content of antenatal care in Sweden have their roots in the 1970's. In the early 1970's, the organization and, to some extent,

the content of care were evaluated by the National Board of Health and Welfare (1973). The concept of high-risk pregnancies was reinforced, and the idea of special referral antenatal clinics was raised. Also, in the 1970's, new methods for monitoring fetal growth, such as symphysis-fundus measurements and ultrasound screening, were introduced and came into common use. Improved methods for biochemical and electronic monitoring during pregnancy and delivery were also utilized on a broader basis, and the number of obstetricians engaged in antenatal care increased.

Another important factor in this context is the Swedish social insurance system. All Swedish citizens and foreign nationals resident in Sweden--adults and children--are insured under the National Insurance Act, which includes allowances for medical expenses, sickness benefits, parental insurance, and unemployment insurance as well. This means that no woman need deprive herself of medical treatment, hospital care, or leave from work for economic reasons.

It is hard to determine to what extent these aforementioned changes toward the present organization and content of care have contributed to the continuous decline in perinatal mortality in Sweden or to what extent they have increased the detection of high-risk pregnancies and transferral of these cases to adequately equipped hospitals for care and delivery.

All studies examining possible causality of these shifts over time are by necessity observational and have their weaknesses. It is irrefutable, however, that there have been decreasing rates of low birth weight infants and preterm births at the smaller and less equipped hospitals but not at the better equipped referral hospitals (National Board of Health and Welfare, various years). Also, differences in perinatal mortality among primary catchment areas for various types of hospitals (with and without pediatric departments), reported earlier (Falk and Wranne, 1973), have disappeared (Meirik, 1986). Thus, available data suggest that improved detection of high-risk pregnancies may have had an impact on referral of these pregnancies, and the leveling out of mortality might also be a consequence of appropriate referral decisions.

Theoretically, the fine-meshed net for detection of high-risk pregnancies in the present Swedish antenatal care system should work with high sensitivity. On the other hand, this high sensitivity, or potentially high yield, might work with correspondingly low specificity, leading to unnecessary examinations and even interventions. On the whole, such a situation might create equal amounts of harm and benefit. It is apparent, however, that through the system of referral antenatal care clinics, the diagnostic precision is increased. Thus, redundant and potentially harmful examinations and interventions are avoided in low-risk pregnancies.

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Table 1. Organization of antenatal care in Sweden

Principal district Departments of obstetrics/gynecology and pediatrics	Senior obstetrician, obstetricians, midwives	Referral antenatal care
Primary health care districts	General practitioners, obstetricians	
Antenatal care clinics	Midwives	Ordinary antenatal care

Table 2. Schedule for routine visits and contacts in antenatal care in Sweden

Week of pregnancy	Contact	Activity
8-11	Midwife	Medical, Obstetric, social history,
12	Obstetrician or general practitioner	counseling, risk assessment
16	Midwife	Ultrasound
20	Midwife	
24	Midwife	
26	Midwife	
28	Midwife	
30	Midwife	
32	Midwife	
34	Midwife	
36	Obstetrician or general practitioner	Counseling, risk assessment
37	Midwife	
38	Midwife	
39	Midwife	
40	Midwife	

Table 3. Screening for risk pregnancies in Sweden

Indication complication	*Instrument*	*Week of pregnancy* 10	20	30	40
Anemia	Hb	═══	═══	═══	═══
Hypertension		═══	═══	═══	═══
Proteinuria		═══	═══	═══	═══
Glucosuria		═══	═══	═══	═══
Rh-immun.	Serology	═══		═══	═══
Gestational age	History	═══			
	Palpation	═══	═══		
	Ultrasound		────	────	────
	S-F measurement		═══	═══	
Multiple pregnancy	S-F measurement		═══	═══	
	Ultrasound		────		
Preterm birth	History	═══	═══	═══	═══
	Palpation		────	────	────
Fetal growth, asphyxia	S-F measurement		═══	═══	═══
	Ultrasound		────	────	────
	CTG			────	────
	Fetal movement			────	────
Malformation	AFP		────		
	Ultrasound		═══	────	
	Amniocentesis		═══		
Infections					
Syphilis	Serology	═══			
Rubella	Serology	═══			
Other					

═══ Mandatory or in general use.
──── Used in most instances or on specific indications.

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