

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE 4 August 1998		3. REPORT TYPE AND DATES COVERED
4. TITLE AND SUBTITLE PATTERNS OF INFANT MORTALITY IN TEXAS' TRIETHNIC POPULATION DURING 1993 THROUGH 1995			5. FUNDING NUMBERS	
6. AUTHOR(S) Horacio P. Guerra				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) The University of Texas Health Science Center at Houston School of Public Health			8. PERFORMING ORGANIZATION REPORT NUMBER 98-044	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) THE DEPARTMENT OF THE AIR FORCE AFIT/CIA, BLDG 125 2950 P STREET WPAFB OH 45433			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION AVAILABILITY STATEMENT Unlimited distribution In Accordance With AFI 35-205/AFIT Sup 1			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words)				
14. SUBJECT TERMS			15. NUMBER OF PAGES 35	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT	

PATTERNS OF INFANT MORTALITY IN TEXAS' TRIETHNIC
POPULATION DURING 1993 THROUGH 1995

By

HORACIO P. GUERRA, IV, M.D.

APPROVED:

JACK HAYES, Ph.D.

WALTER R. ROGERS, Ph.D.

PATTERNS OF INFANT MORTALITY IN TEXAS' TRIETHNIC
POPULATION DURING 1993 THROUGH 1995

By

HORACIO P. GUERRA, IV, M.D., M.P.H.

THESIS

Presented to the Faculty of the University of Texas

Health Science Center at Houston

School of Public Health

in Partial Fulfillment

of the Requirements

for the Degree of

MASTER OF PUBLIC HEALTH

THE UNIVERSITY OF TEXAS HEALTH SCIENCE CENTER AT HOUSTON
SCHOOL OF PUBLIC HEALTH
Houston, Texas
August, 1998

PREFACE

This study, which was undertaken to determine if the Texas' Health Objectives goal for the year 2000 of lowering the IMR from the 1990 rate of 8.0 to less than 7.0 is being met, is written in the form of a manuscript for submission to *The Journal of Texas Medicine*.

ACKNOWLEDGEMENTS

I graciously thank my professors and advisors for all of their guidance and wisdom. I especially wish to thank Dr. Hayes and Dr. Rogers for their continued efforts to help me improve my thesis and their ability to make the impossible doable. I would also like to thank Brian R. King, B.A. and William T. Pollard of the Texas Department of Health, Bureau of Vital Statistics, for making the data available for these analyses. I am also indebted to my wonderful wife, Monica, and my children, Horacio, Theresa, and Isabel, who endured the changes in our lifestyle caused by moving to San Antonio, TX, to accomplish this work.

Thesis submitted to the MPH Committee on July 20, 1998

PATTERNS OF INFANT MORTALITY IN TEXAS' TRIETHNIC POPULATION
DURING 1993 THROUGH 1995

Horacio P. Guerra, IV, M.D., M.P.H.
The University of Texas
Health Science Center at Houston
School of Public Health, 1998

Supervising Professor: Jack Hayes

This study evaluated the patterns of infant mortality in relation to birth weight, gestational and maternal age, parity, and prenatal care in Texas' triethnic population from 1993 through 1995 using Texas Department of Health, Bureau of Vital Statistics data. A similar study was conducted by Verrier et al. (1994) using data compiled by the Texas Department of Health, Bureau of Vital Statistics from 1984 through 1986. Verrier et al. (1994) found that the overall infant mortality rate (IMR) was 8.4 per 1000 live births. For Anglo, Hispanic and Black births, the IMRs were 7.4, 7.8 and 13.4 respectively. This study found that the overall IMR during 1993 through 1995 was 6.2. IMR was 5.5, 5.7 and 11.2 for Anglo, Hispanic and Black births respectively. The Texas' Health Objective for the year 2000 included reducing the overall IMR from 8.0 in 1990 to less than 7.0 by the year 2000. This objective has been met. However, the IMR disparity among ethnic groups continues, as similarly described by Verrier et al. (1994).

TABLE OF CONTENTS

	Page
1. List of Tables.....	vii
2. List of Figures.....	viii
3. Introduction.....	1
4. Literature Review.....	3
5. Materials and Methods.....	7
6. Results.....	9
7. Discussion.....	30
8. References.....	34
9. Vita.....	36

LIST OF TABLES

	Page
Table 1. Overall neonatal, postnatal, and infant mortality rates per 1000 live births by ethnicity in Texas during 1984 through 1986.....	2
Table 2. Infant, neonatal, and postnatal mortality rates by specified race of mother: United States, 1995-linked file.....	5
Table 3. Overall neonatal, postnatal, and infant mortality rates per 1000 live births by ethnicity in Texas during 1993 through 1995.....	10
Table 4. Comparison of overall neonatal, postnatal, and infant mortality rates per 1000 live births by ethnicity in Texas during 1984 through 1986 and 1993 through 1995.....	11
Table 5. Neonatal, postnatal, and infant mortality rates associated with parity by ethnicity in Texas during 1993 through 1995.....	21

LIST OF FIGURES

	Page
Figure 1. Percent of Texas triethnic births and deaths during 1993 through 1995.....	9
Figure 2. Neonatal mortality rate by ethnicity and gestational age at birth for resident, singleton Texas births during 1993 through 1995.....	13
Figure 3. Postnatal mortality rate by ethnicity and gestational age at birth for resident, singleton Texas births during 1993 through 1995.....	14
Figure 4. Infant mortality rate by ethnicity and gestational age at birth for resident, singleton Texas births during 1993 through 1995.....	15
Figure 5. Neonatal mortality rate associated with birth weight categories by ethnicity in Texas during 1993 through 1995.....	17
Figure 6. Postnatal mortality rate associated with birth weight categories by ethnicity in Texas during 1993 through 1995.....	18
Figure 7. Infant mortality rate associated with birth weight categories by ethnicity in Texas during 1993 through 1995.....	19
Figure 8. Percent of Texas triethnic infants born in the very low and moderately low birthweight categories during 1993 through 1995.....	20
Figure 9. Neonatal mortality rates associated with maternal age by ethnicity in Texas during 1993 through 1995.....	22
Figure 10. Postnatal mortality rates associated with maternal age by ethnicity in Texas during 1993 through 1995.....	23
Figure 11. Infant mortality rates associated with maternal age by ethnicity in Texas during 1993 through 1995.....	24
Figure 12. Neonatal mortality rate associated with adequacy of prenatal care by ethnicity in Texas during 1993 through 1995.....	26
Figure 13. Postnatal mortality rate associated with adequacy of prenatal care by ethnicity in Texas during 1993 through 1995.....	27

Figure 14. Infant mortality rate associated with adequacy of prenatal care by ethnicity in Texas during 1993 through 1995.....	28
Figure 15. Percent adequacy of prenatal care as determined by the Kessner index for Texas' triethnic population during 1993 through 1995.....	29

***PATTERNS OF INFANT MORTALITY IN TEXAS' TRIETHNIC
POPULATION DURING 1993 THROUGH 1995***

Horacio P. Guerra, IV, M.D.

Abstract

This study evaluated the patterns of infant mortality in relation to birth weight, gestational and maternal age, parity, and prenatal care in Texas' triethnic population from 1993 through 1995 using Texas Department of Health, Bureau of Vital Statistics data. A similar study was conducted by Verrier et al. (1994) using data compiled by the Texas Department of Health, Bureau of Vital Statistics from 1984 through 1986. Verrier et al. (1994) found that the overall infant mortality rate (IMR) was 8.4 per 1000 live births. For Anglo, Hispanic and Black births, the IMRs were 7.4, 7.8 and 13.4 respectively. This study found that the overall IMR during 1993 through 1995 was 6.2. IMR was 5.5, 5.7 and 11.2 for Anglo, Hispanic and Black births respectively. The Texas' Health Objective for the year 2000 included reducing the overall IMR from 8.0 in 1990 to less than 7.0 by the year 2000. This objective has been met. However, the IMR disparity among ethnic groups continues, as similarly described by Verrier et al. (1994).

Introduction

The infant mortality rate (IMR), defined as the number of infant deaths per 1000 live

births in the first year, is the best measure of societal health and well-being (Weeks, 1996). The Texas' Health Objectives for the Year 2000 IMR goal is 7.0 (Texas Department of Health, 1991). Using 1984 through 1986 data provided by Texas Department of Health, Bureau of Vital Statistics, Verrier et al. (1994) found a total IMR of 8.4. IMRs for Anglo, Hispanic and Black were 7.4, 7.8 and 13.4 respectively (Table 1).

Table 1. Overall neonatal, postnatal, and infant mortality rates per 1000 live births by ethnicity in Texas during 1984 through 1986. *

Index	Anglo	Hispanic	Black	Total
Neonatal mortality rate	4.6	4.8	8.0	5.1
Postnatal mortality rate	2.8	3.0	5.3	3.2
Infant mortality rate	7.4	7.8	13.4	8.4

*Based on 877,738 resident, singleton triethnic births and 7344 triethnic infant deaths

Verrier et al. (1994) found that all mortality rates were increased in the Black population relative to those for Anglo and Hispanic mortality rates, which were roughly similar. Preterm and low birth weight births were strong predictors of mortality. Verrier et al. (1994) also found that infant mortality was highest among infants born to mothers younger than 18 years, of high multiparity, and with either inadequate or no prenatal care.

This study was conducted to determine if progress toward the Year 2000 goal had been made and if reductions in mortality rates in the Texas triethnic population had been achieved. Factors studied include: (1) gestational age at birth, (2) maternal age, (3) parity, (4) prenatal care, and (5) birth weight for the 1993 through 1995 triethnic cohort for

associations among ethnicity. Interest to reduce IMR to less than 7.0 by the year 2000 meant targeting potentially preventable causes of infant mortality (Kerr et al., 1997). Methods suggested for achieving this goal include: (1) improving clinical care to high risk newborns, (2) reducing the number of sudden infant deaths, (3) reducing deaths from bacterial infections by optimal use of antibiotics, (4) reducing injuries by optimal parental supervision, (5) improving prenatal and obstetrical care, (6) and reducing the number of neural tube defects by promoting adequate preconceptional use of folic acid (Kerr et al., 1997).

Literature Review

Among the world's developed nations, the United States has a relatively low IMR ranking of 24 (Centers for Disease Control and Prevention, 1996). However, IMR in the United States has dropped from 12.6 in 1980 to 7.6 in 1995 (National Center for Health Statistics, 1997). Among countries, the range of IMRs in the world is considerable. In Japan, the IMR is about 4 (Lepert, 1993). In Sierra Leone, the IMR is 144, or 36-fold higher (McDaniel, 1992). Lepert (1993) indicated that the low IMR in Japan occurs because of: (1) its low percentage of unmarried mothers, (2) universal access to health care, (3) high literacy, and (4) extensive public health education.

In the United States (National Center for Health Statistics, 1997), IMRs differ approximately 4-fold by race (Table 2). Despite a continuing downward trend, Blacks had the highest IMR with a 1995 rating of 14.6 while that of Whites was 6.3 (Oechsli, 1995; Singh et al., 1995; National Center for Health Statistics, 1997; Rowland et al., 1993).

Chinese ranked the lowest, with an IMR of 3.8. Rowland et al. (1993) made the point that the disparity in Black and White IMRs was caused by wide social and health-care differences.

Similarly, Hispanics, despite subgroup differences, had a lower IMR compared to Blacks. The total Hispanic IMR was 7.6 compared to the White IMR of 6.3. It appears that the high IMR among Blacks in the United States contributes a considerable degree to the low ranking. Therefore, racial/ethnic differences in IMR might contribute to the overall low ranking for the United States.

Table 2. Infant, neonatal, and postnatal mortality rates by specified race of mother: United States, 1995-linked file.

Racial/ethnic group	Infant mortality rate	Neonatal mortality rate	Postnatal mortality rate
All Races	7.6	4.9	2.6
White	6.3	4.1	2.2
Black	14.6	9.6	5.0
American Indian	9.0	3.9	5.1
Asian and Pacific Island	5.3	3.4	1.9
Chinese	3.8	2.3	1.5
Japanese	5.3	3.3	---
Hawaiian	6.6	4.0	---
Filipino	5.6	3.4	2.2
Other Asian	5.5	3.7	1.9
Total Hispanic	6.3	4.1	2.1
Mexican	6.0	3.9	2.1
Puerto Rican	8.9	6.1	2.8
Cuban	5.3	3.6	1.7
Cent. & South American	5.5	3.7	1.9
Other Hispanic	7.4	4.8	2.6
Total Non-Hispanic	7.8	5.0	2.8
Non-Hispanic White	6.3	4.0	2.2
Non-Hispanic Black	14.7	9.6	5.0

Birth defects are the number one cause of infant mortality in the United States, with prematurity/low birth weight a distant second (National Center for Health Statistics, 1997).

According to Sepkowitz (1995), low birth weight (<1500 g) is thought to be the major cause of infant mortality.

The ethnic/racial patterns observed nationally also occur in Texas. The IMR in Texas in 1990 was 8.1, 6.6% greater than the United States average. Kerr et al. (1995) found that during 1989 through 1991, the IMR was 6.8 for Anglo, 7.7 for Hispanic, and 15.3 for Black infants. A study conducted using data from 1984 through 1986 (Verrier et al., 1994), found that IMR in Texas was highest in infants born to (1) mothers younger than 18, (2) mothers with high multiparity, and (3) mothers with inadequate or no prenatal care. Verrier et al. (1994) found neonatal mortality rate (NMR, defined as number of infant deaths per 1000 live births in days 0 – 27 of life), postnatal mortality rate (PNMR, defined as number of infant deaths per 1000 live births in days 28 – 365 days of life), and IMR (NMR plus PNMR) were increased in infants born to Black women relative to the other Texas' ethnic groups studied. Preterm and low-birth weight births were strong predictors of mortality. This study found that NMR of preterm Black infants was lower than NMRs of other ethnic groups. Yet, the increased proportion of Black pregnancies resulting in preterm and low-birth weight births combined with the elevated Black PNMR produced an IMR two times that of Anglo and Hispanic infants. Verrier et al. (1994) suggest that the Texas IMR-reduction Health Objective might be achieved with: (1) improvement in socioeconomic conditions, (2) reduction in risk factors associated with increased NMRs, (3) reduction in environmental risk factors associated with increased PNMRs, and (4) improved access to more efficient health care.

Examination of data provided by the Texas Department of Health, Bureau of Vital Statistics for the years 1993 through 1995 should provide an answer regarding the status of the effort to reduce the IMR below 7.0 by the year 2000. Data analysis should also determine which ethnic group(s) benefited from mortality rate reductions and whether this was accomplished primarily by a reduction in NMR, PNMR, or both.

Materials and Methods

The Texas Department of Health compiled 943,087 computer files containing birth certificate information matched with information on the death of those infants who died. This data was reviewed for the Texas' births occurring from 1993 through 1995. A three-year period was sampled because Verrier et al. (1994) collected information over a three-year time period. A three-year period provides sufficient data for meaningful analysis of uncommon events such as infant mortality.

Analyses were limited to singleton births of Texas residents of the three major ethnic groups, Anglo, Hispanic, and Black; and the "total" Texas cohort. The "triethnic" grouping included 97.3% of all Texas births during this time period of study. The total Texas cohort consists of all singleton births of all Texas residents. This analysis limitation was done to reduce the risk of missing out-of-state deaths and to eliminate the increased risk for prematurity and low birth weight associated with multiple-birth pregnancies. A Texas Department of Health staff statistician identified Anglo, Hispanic and Black categories on the birth certificates using the mainframe computer located at the Texas Department of Health, Bureau of Vital Statistics.

Birth weight, reported on 99.3% of all birth certificates, was grouped into one of four categories, including: (1) very low birth weight (less than 1500 g), (2) moderately low birth weight (1500 through 2499 g), (3) normal birth weight (2500 through 3999 g), and (4) high birth weight (4000 g or more). Gestational age at birth, defined as weeks of pregnancy completed from the first day of the last menstrual period, was determined for 92.5% of births. Information was grouped into (1) less than 19 weeks, (2) 2-week intervals between 19 to 20 and 43 to 44 weeks, and (3) 45 or more weeks.

Maternal age was reported on more than 99.9% of birth certificates. Information was grouped into less than 15 years, 15 through 19, 20 through 24, 25 through 29, 30 through 34, 35 through 39, and 40 years and over. Parity, reported on 100% of births, was grouped into: (1) primiparous, (2) high multiparous (3 or more pregnancies to women aged 25 years or less; 4 or more to women aged 25 years or more) and (3) low multiparous (any other combination of parities and ages).

Prenatal care visit information, categorized according to the Kessner Health Service Index as: (1) adequate, (2) intermediate, (3) inadequate, (4) incomplete (insufficient information to calculate the Kessner Index) or (5) no prenatal care, was reported on 89.3% of births. This Kessner Index is based on the trimester of the first prenatal care visit and the total number of visits during gestation (Kessner et al., 1973).

NMR, PNMR, and IMR were determined for each ethnic group with respect to: (1) birth weight, (2) gestational age, (3) maternal age, (4) parity, and (5) prenatal care. Overall NMR, PNMR and IMR was determined for each ethnic group. These overall mortality rates were compared to the overall mortality rates obtained by Verrier et al. (1994), and a percent

change was determined.

Results

Births and infant deaths

Among Texas' births, births to the racial groups comprising the triethnic population of interest, the percentages were 44.4%, 42.8% and 12.8% for Anglo, Hispanic and Black respectively (Figure 1). A total of 5,803 infant deaths were reported in this time period. Of these, 86.8% were Anglo, Hispanic or Black infant deaths. The percent infant deaths for the Texas' triethnic population were 44.1%, 43.8% and 12.1% for Anglo, Hispanic and Black respectively.

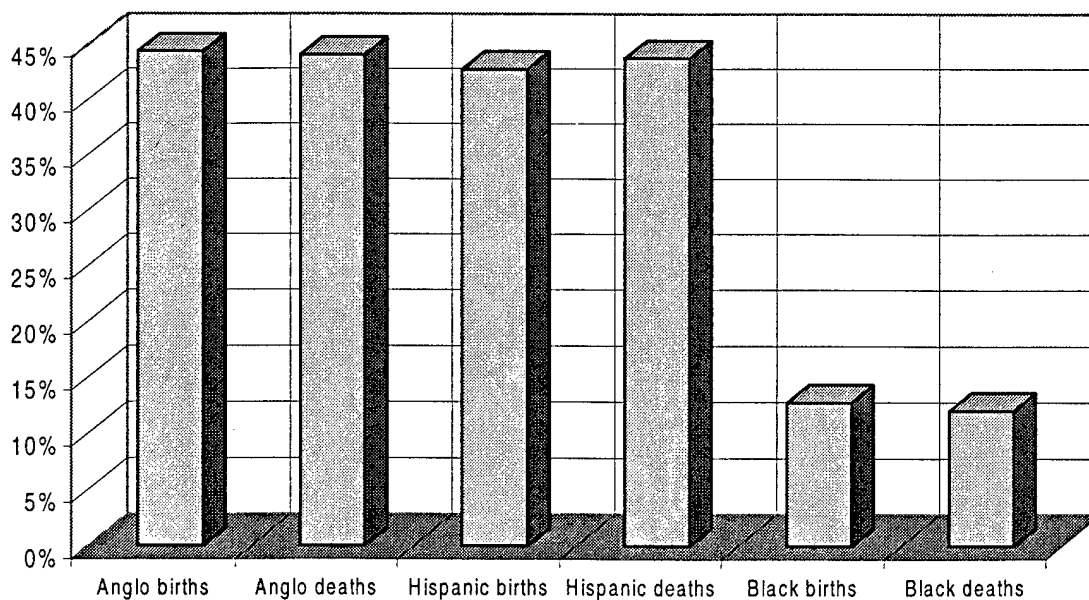


Figure 1 . Percent of Texas triethnic births and deaths during 1993 through 1995.

The overall IMR was 6.2. IMRs were 5.5, 5.7, and 11.2 for Anglo, Hispanic and Black populations respectively (Table 3). Neonatal deaths accounted for 65.3% of the triethnic deaths. The overall NMR was 3.5. NMRs were 3.0, 3.5 and 6.2 for Anglo, Hispanic and Black populations respectively. The overall PNMR was 2.6. PNMRs were 2.5, 2.2 and 5.0 for Anglo, Hispanic and Black populations respectively.

Table 3. Overall neonatal, postnatal, and infant mortality rates per 1000 live births by ethnicity in Texas during 1993 through 1995. *

	Anglo	Hispanic	Black	Total
Neonatal mortality rate	3.0	3.5	6.2	3.5
Postnatal mortality rate	2.5	2.2	5.0	2.6
Infant mortality rate	5.5	5.7	11.2	6.2

*Based on 917,504 resident, singleton, triethnic births and 5,035 triethnic infant deaths.

The most recent time period of 1993 through 1995 was characterized by a reduction in all mortality rates from 1984 through 1986 for all ethnic groups (Table 4). There was a total reduction of 1.6 for NMR, 0.6 for PNMR, and 2.2 for IMR.

Table 4. Comparison of overall neonatal, postnatal, and infant mortality rates per 1000 live births by ethnicity in Texas during 1984 through 1986 and 1993 through 1995.

	1984 through 1986 time period	1993 through 1995 time period	Difference	Percent drop
Anglo NMR	4.6	3.0	1.6	35%
Hispanic NMR	4.8	3.5	1.3	27%
Black NMR	8.0	6.2	1.8	23%
Total NMR	5.1	3.5	1.6	31%
Anglo PNMR	2.8	2.5	0.3	11%
Hispanic PNMR	3.0	2.2	0.8	27%
Black PNMR	5.3	5.0	0.3	6%
Total PNMR	3.2	2.6	0.6	19%
Anglo IMR	7.4	5.5	1.9	26%
Hispanic IMR	7.8	5.7	2.1	27%
Black IMR	13.4	11.2	2.2	16%
Total IMR	8.4	6.2	2.2	26%

Infant mortality associated with birth gestational age

NMR was relatively lower among infants born with a gestational age of less than 23 weeks for Anglo and Hispanic infants, 21 weeks for Black infants (Figure 2). NMR peaked at 23 – 24 weeks for Anglo and Hispanic infants and 21 – 22 weeks for Black infants. NMR reached a peak of 446.5 for Anglo infants, 349.6 for Hispanic infants and 409.5 for Black infants. A parallel sharp decrease in NMR was noted for all ethnic groups with advancing gestational age, yet NMRs at gestational ages between 27 – 28 weeks and 37 – 38 weeks

were consistently lower for Black infants.

A low PNMR was noted for all ethnic groups at 21 – 22 weeks (Figure 3), but rose sharply reaching peaks of 39.8 at 23 – 24 weeks for Anglo infants, 43.3 at 25 – 26 weeks for Hispanic infants and 56.9 at 23 – 24 weeks for Black infants. A decline in mortality in all ethnic groups was noted after these peaks, with the majority of the PNMR readings remaining higher for Black infants. PNMR reached a trough for Black infants at 41 – 42 weeks, but rose for Black infants of older gestational ages.

IMR peaked for Anglo infants at 486.3 at 23 – 24 weeks, for Hispanic infants at 381.4 at 23 – 24, and for Black infants at 414.3 at 21 – 22 weeks (Figure 4). As expected, given the smaller PNMR values relative to NMR in the earlier gestational ages, the IMR curves resembled the shape of the NMR curves. IMR fell sharply for all ethnic groups after 23 – 24 weeks.

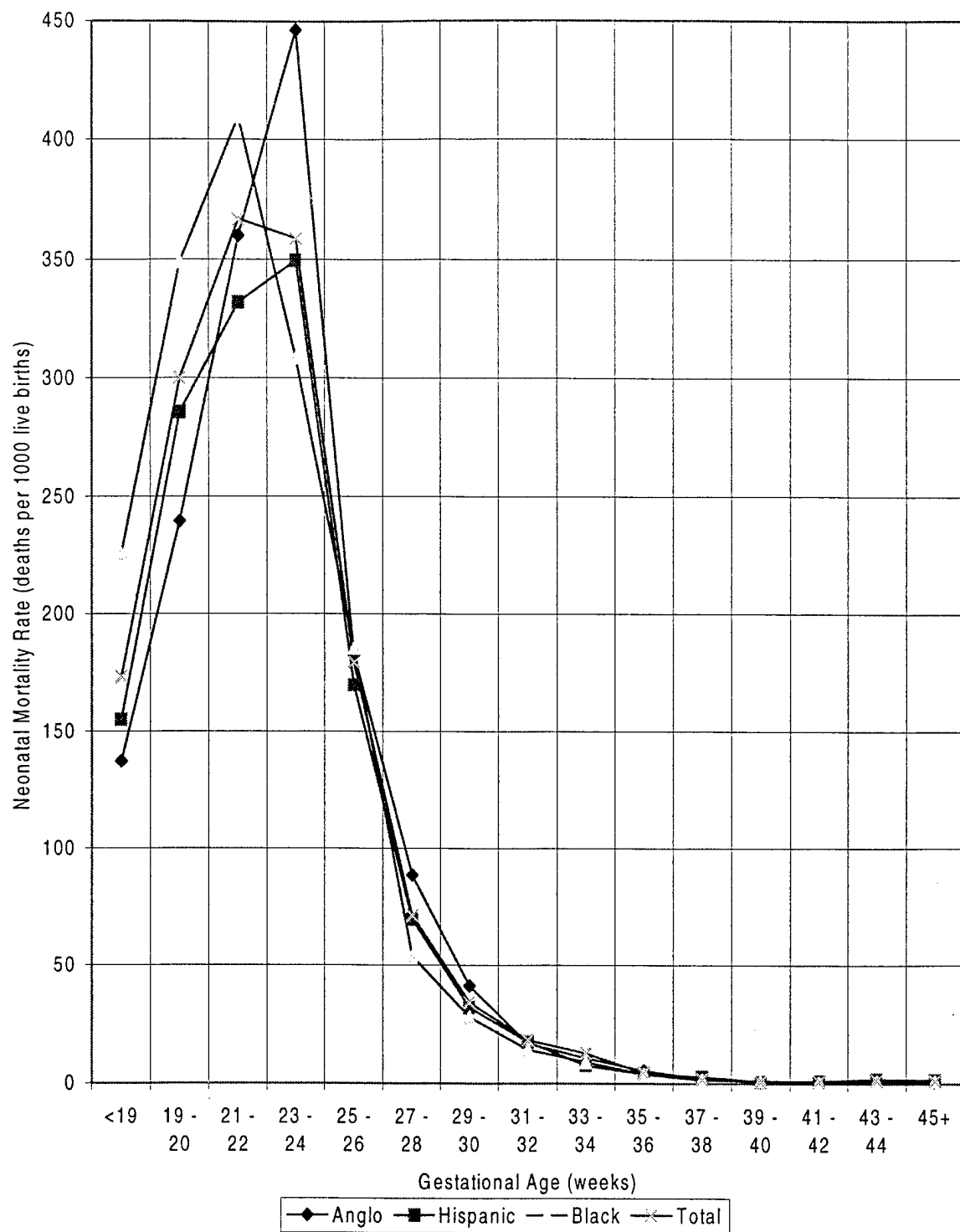


Figure 2. Neonatal mortality rate by ethnicity and gestational age at birth for resident, singleton Texas births during 1993 through 1995.

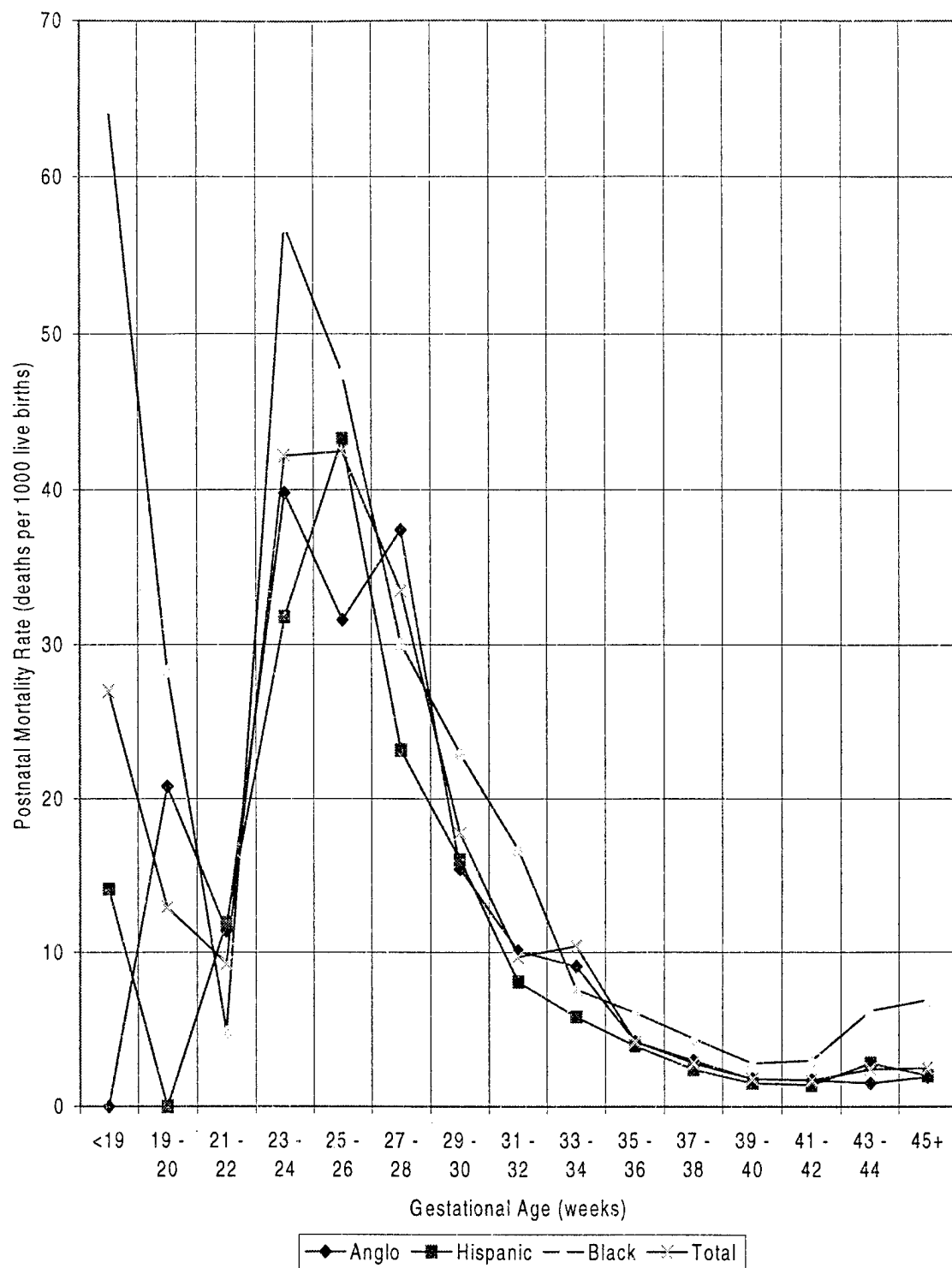


Figure 3. Postnatal mortality rate by ethnicity and gestational age at birth for resident, singleton Texas births during 1993 through 1995.

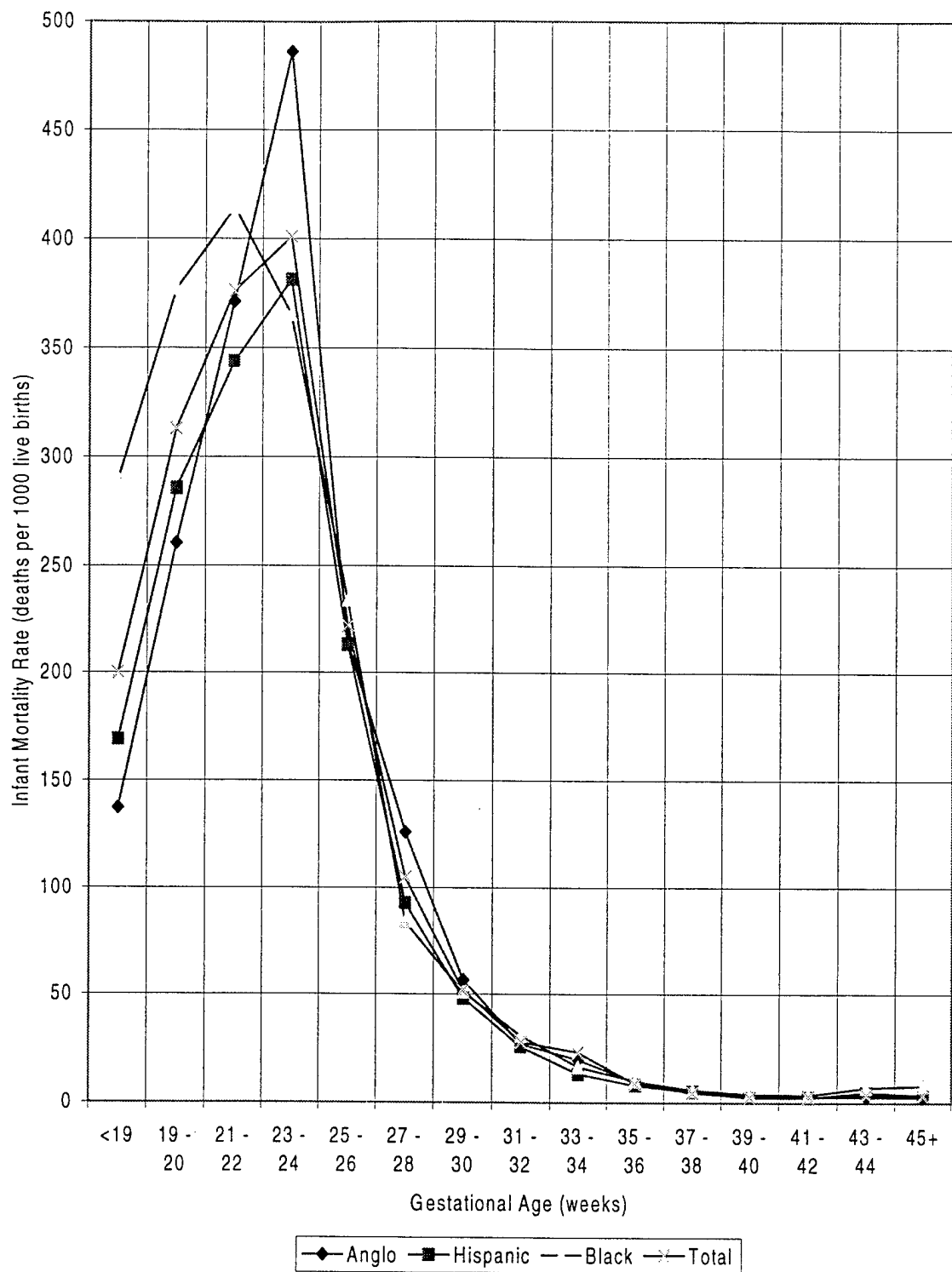


Figure 4. Infant mortality rate by ethnicity and gestational age at birth for resident, singleton Texas births during 1993 through 1995.

Mortality associated with birth weight

As expected, low birth weight was associated with high mortality rates (Figures 5 – 7). Very low birth weight had the highest mortality rates followed by moderately low birth weight. High birth weight was consistently associated with low mortality rates for all three ethnic groups and the total cohort. NMR was consistently higher than PNMR for the very low birth weight category. In the moderately low birth weight category, NMR and PNMR were roughly equal. PNMR was consistently higher than NMR in the normal and high birth weight categories. PNMR and IMR were consistently highest in Black infants in the normal and high birth weight categories compared to the other two ethnic groups.

There was a striking difference in the percent of births of Black infants in the very low and moderately low birth weight categories compared to Anglo and Hispanic infants (Figure 8). The percent of births in the very low birth weight category was more than two-fold higher for Black infants compared to Anglo and Hispanic infants. There was roughly a two-fold higher percentage of Black infants born in the moderately low birth weight category compared to Anglo and Hispanic infants.

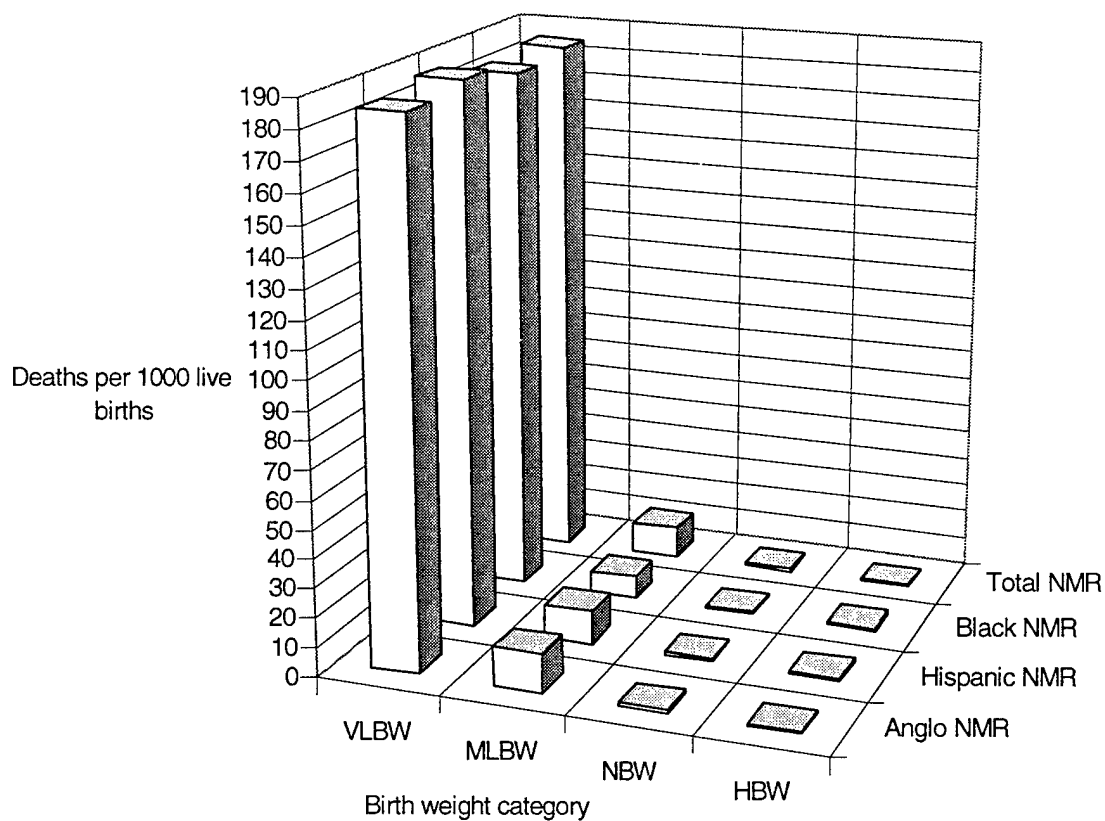


Figure 5. Neonatal mortality rate associated with birth weight categories by ethnicity in Texas during 1993 through

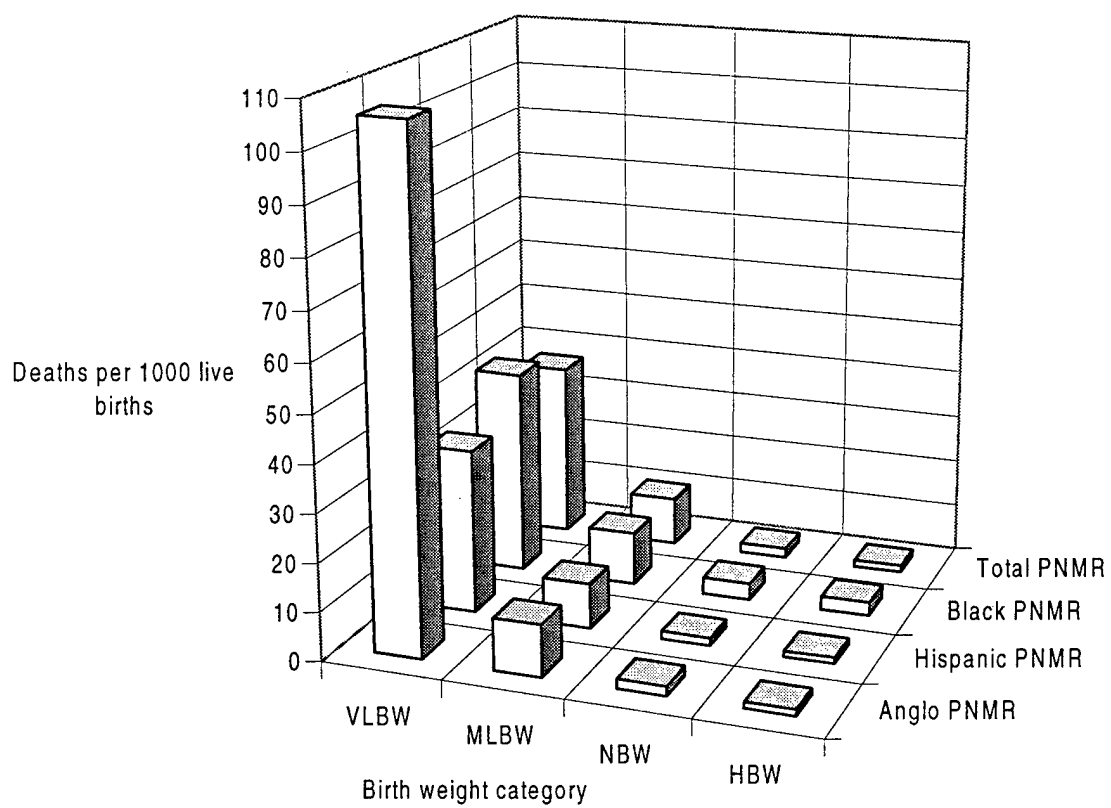


Figure 6 . Postnatal mortality rate associated with birth weight categories by ethnicity in Texas during 1993 through 1995.

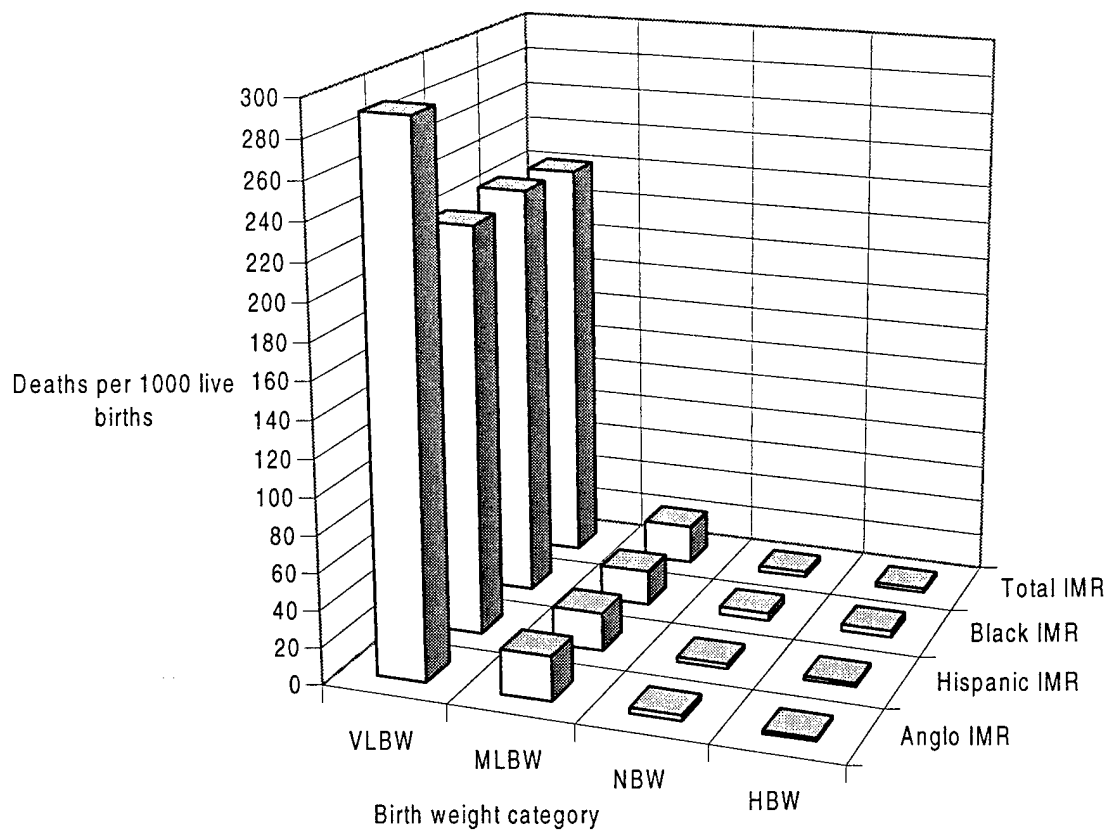


Figure 7. Infant mortality rate associated with birth weight categories by ethnicity in Texas during 1993 through 1995.

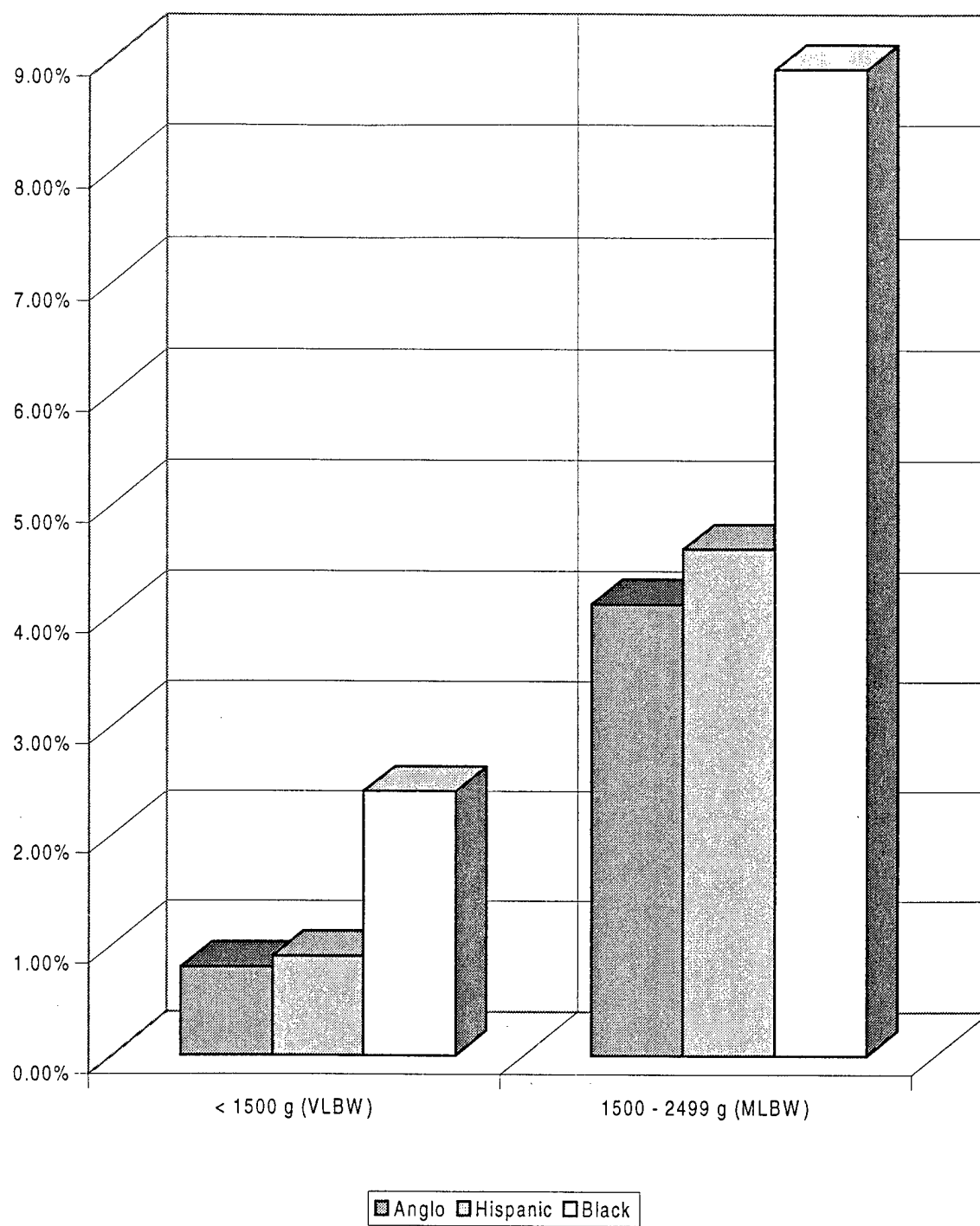


Figure 8 . Percent of Texas triethnic infants born in the very low and moderately low birth weight categories during 1993 through 1995.

Mortality associated with maternal age

As expected, mortality rates were highest in infants born to mothers less than 15 years of age (Figures 9 - 11). There was a consistent drop in NMR, PNMR, and IMR in Anglo and Black infants to the 30 – 34 age category. The drop in NMR, PNMR, and IMR was consistent in Hispanic infants to the 25 – 29 age category. There was a consistent rise in IMRs in all ethnic groups thereafter. In the “less than 15 year” age category, Anglo infants had a higher NMR and IMR compared to the other ethnic groups. However, all mortality rates were consistently highest in Black infants, starting at the 15 – 19 year category.

Mortality associated with parity

PNMRs and IMRs were consistently highest in the high multiparous category for all ethnic groups. NMRs and IMR were consistently higher for the primiparous category compared to the low multiparous category (Table 5). All mortality rates were consistently highest for Black infants, in all parity categories, compared to the other two ethnic groups. There was little difference noted between low multiparous and primiparous infants.

Table 5. Neonatal, postnatal, and infant mortality rates associated with parity by ethnicity in Texas during 1993 through 1995.

	Anglo NMR	Hisp. NMR	Black NMR	Anglo PNMR	Hisp. PNMR	Black PNMR	Anglo IMR	Hisp. IMR	Black IMR
Primiparous	3.1	3.7	7.7	2.2	2.0	4.1	5.3	5.7	11.8
Low multiparous	2.5	2.9	5.2	2.4	2.2	4.5	4.9	5.1	9.7
High multiparous	3.0	3.2	5.0	4.0	2.8	7.6	7.0	6.0	12.6
Total	3.0	3.5	6.2	2.5	2.2	5.0	5.5	5.7	11.2

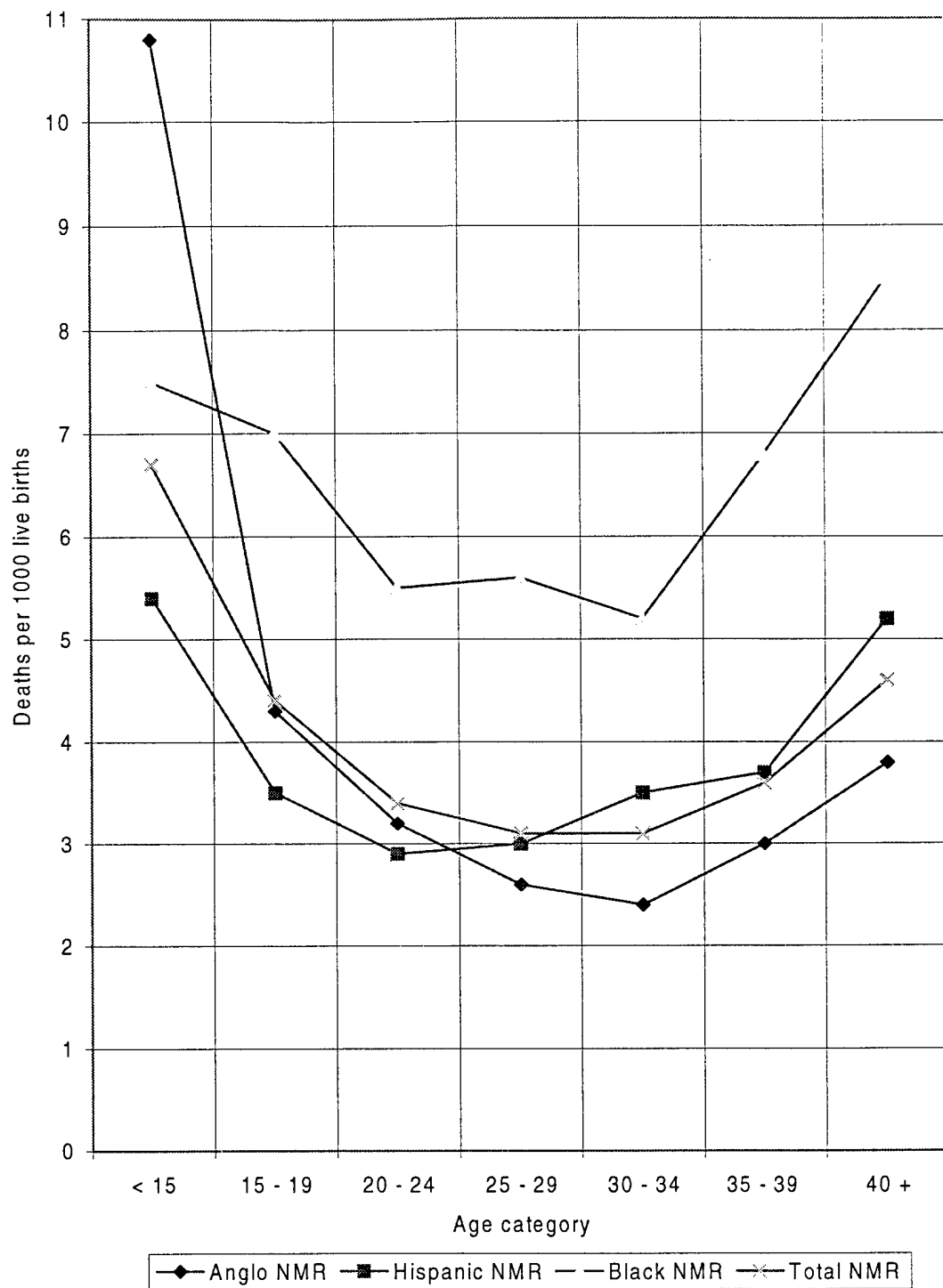


Figure 9. Neonatal mortality rate associated with maternal age by ethnicity in Texas during 1993 through 1995.

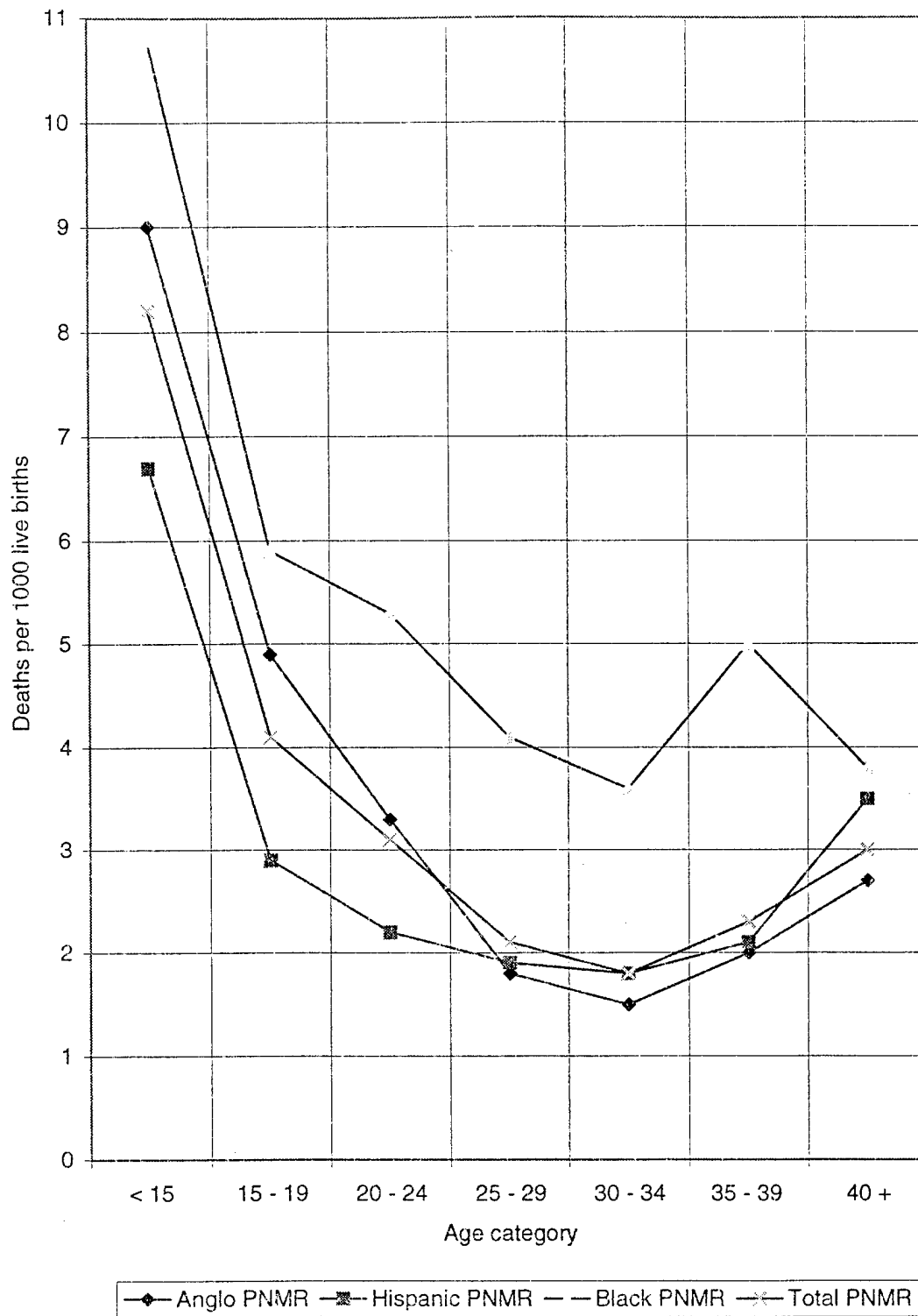


Figure 10. Postnatal mortality rate associated with maternal age by ethnicity in Texas during 1993 through 1995.

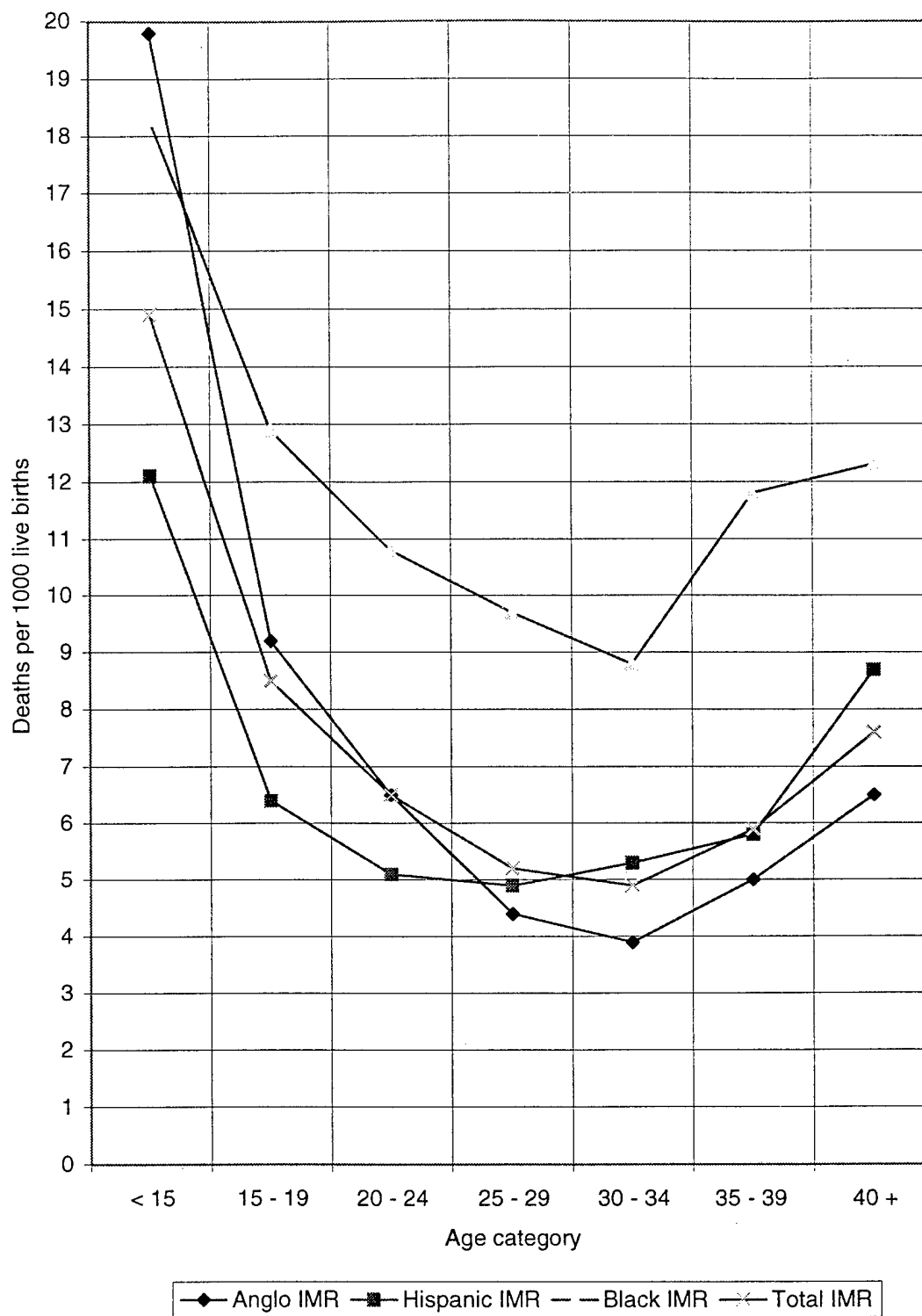


Figure 11. Infant mortality rate associated with maternal age by ethnicity in Texas during 1993 through 1995.

Mortality associated with prenatal care index

As expected, all mortality rates for the triethnic cohort were increased in infants born to women who received no prenatal care. Black infants consistently had higher mortality rates in all categories (Figures 12 - 14). A general decrease in all mortality rates was noted for the triethnic cohort with improved prenatal care. Prenatal care was deemed adequate according to the Kessner Index for 72% of Anglo infants, 48.3% of Hispanic infants and 52.1% of Black infants (Figure 15). No prenatal care was definitive for 0.7% of Anglo infants, 3.6% of Hispanic infants and 2.6% for Black infants. Inadequate prenatal care was definitive for 3.3% of Anglo infants, 9.0% for Hispanic infants and 6.9% for Black infants. Inadequate information was available on prenatal care for 7.6% of Anglo infants, 12.4% of Hispanic infants and 15.3% of Black infants.

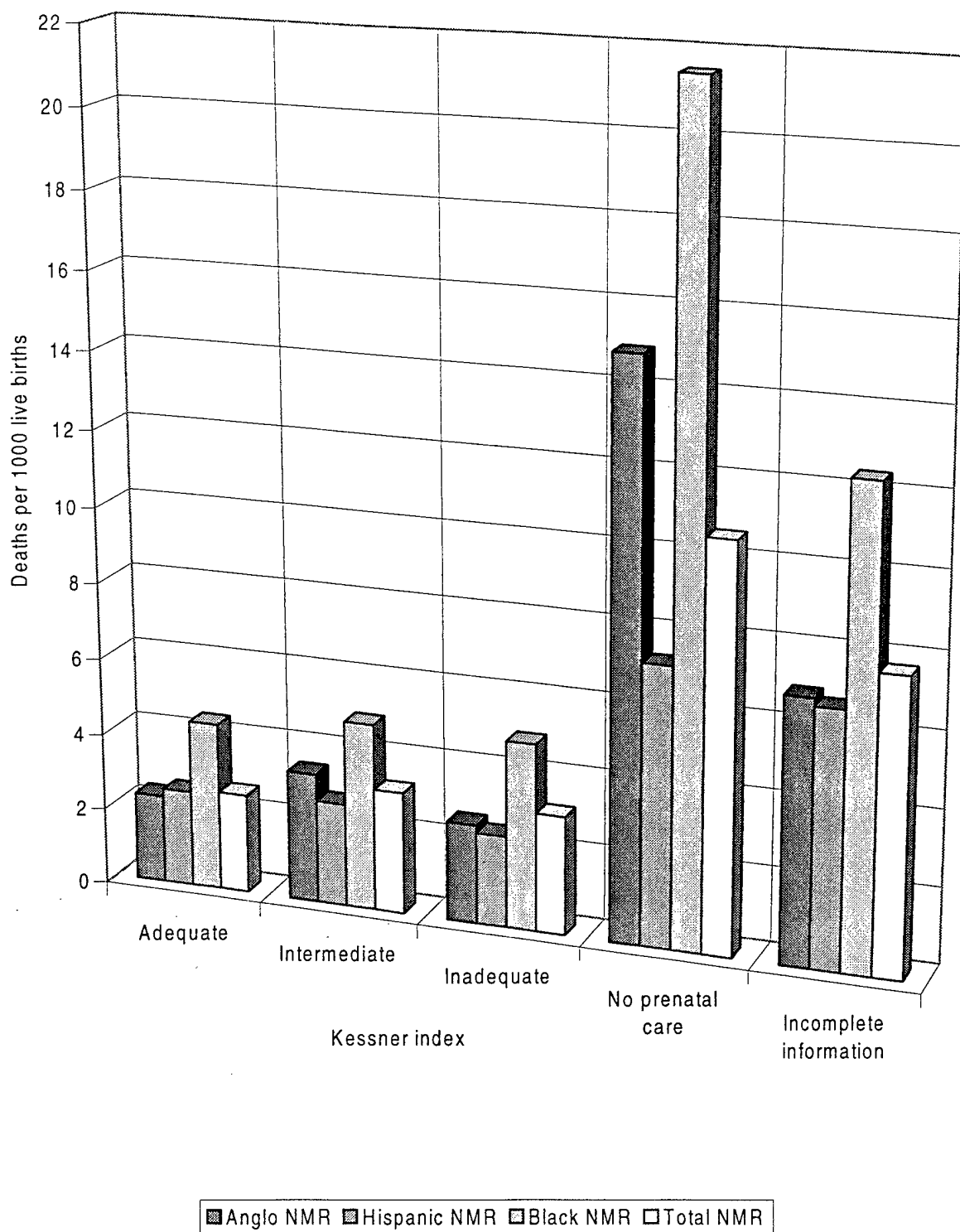
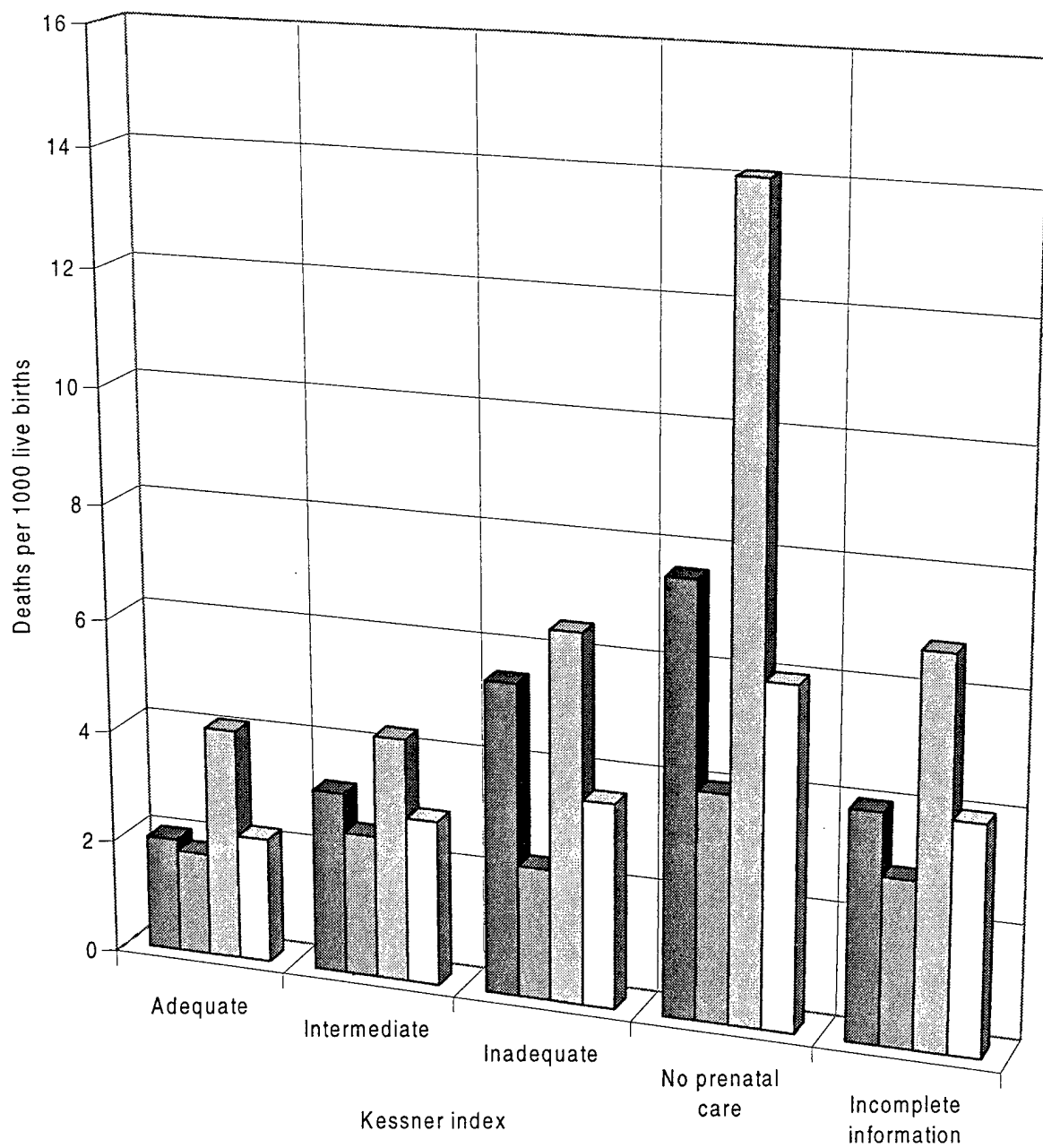


Figure 12. Neonatal mortality rate associated with adequacy of prenatal care by ethnicity in Texas during 1993 through 1995.



■ Anglo PNMR ■ Hispanic PNMR ■ Black PNMR □ Total PNMR

Figure 13. Postnatal mortality rate associated with adequacy of prenatal care by ethnicity in Texas during 1993 through 1995.

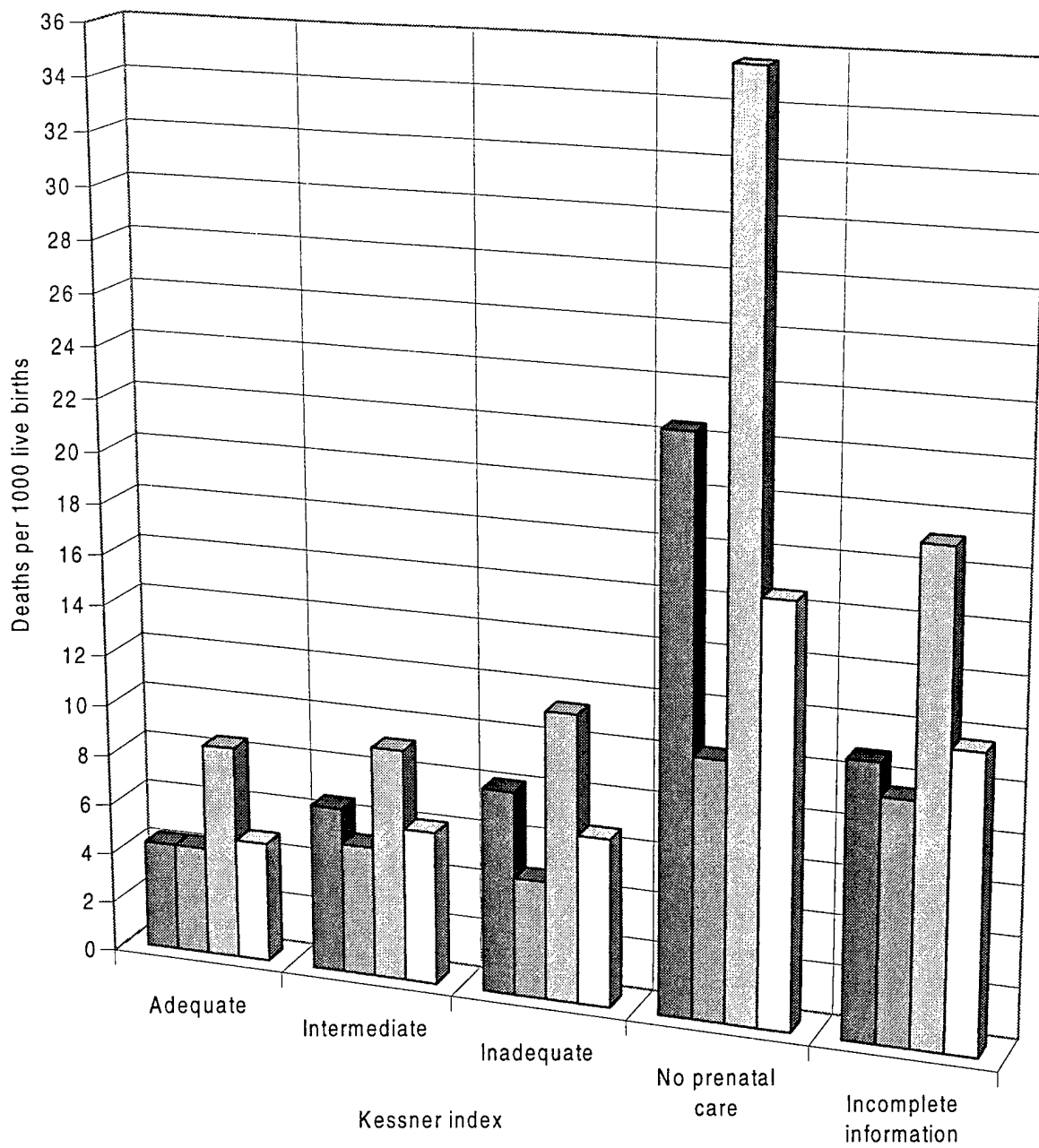


Figure 14. Infant mortality rate associated with adequacy of prenatal care by ethnicity in Texas during 1993 through 1995.

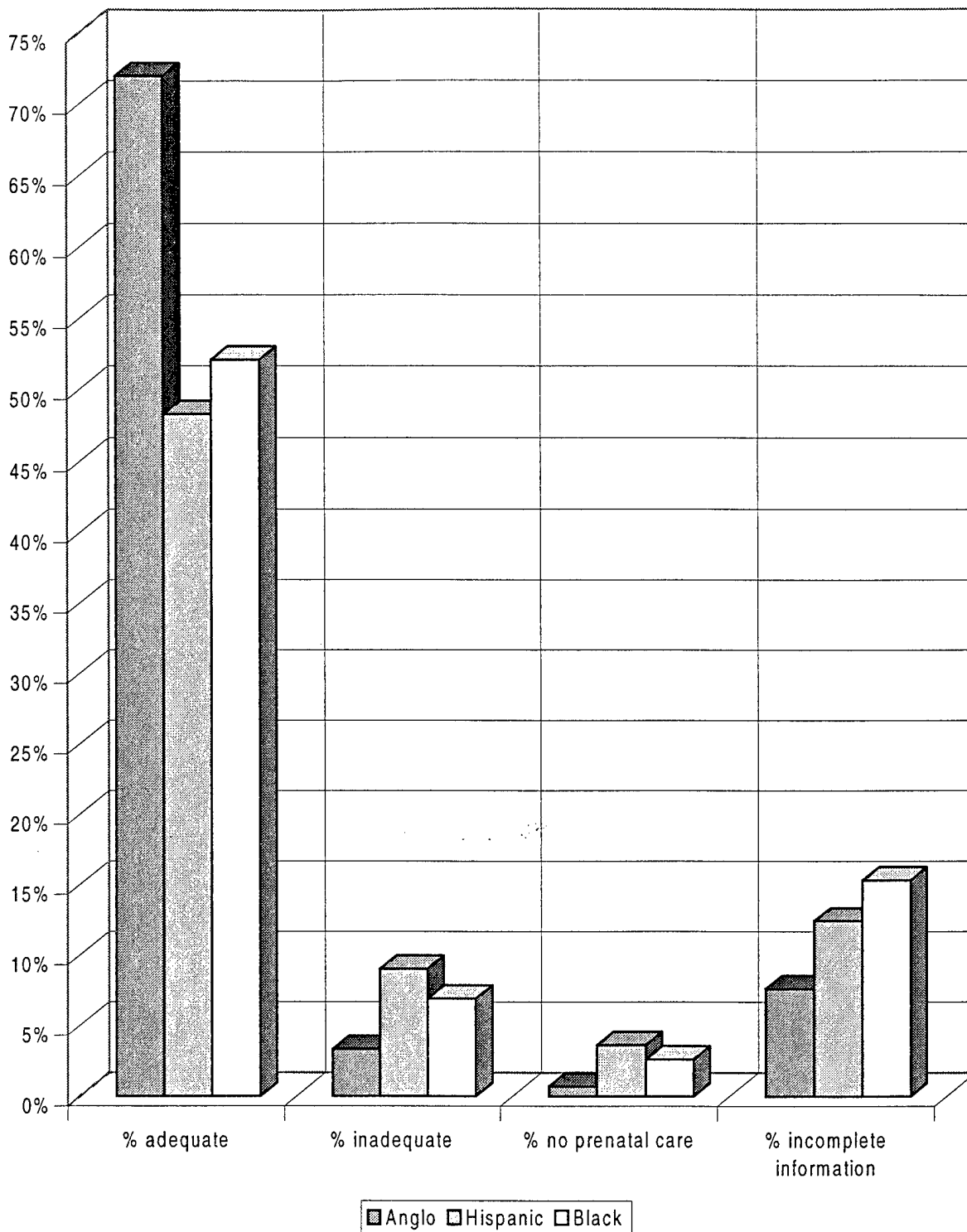


Figure 15. Percent adequacy of prenatal care as determined by the Kessner index for Texas triethnic population during 1993 through 1995.

Discussion

Births and infant deaths

The reduction of all mortality rates compared to the ones determined by Verrier et al. (1994) are obvious. The total overall IMR reduction was 26%. For Anglo, Hispanic, and Black populations, the IMR reduction was 26%, 27%, and 16%. This represents good progress. The IMR-reduction Health Objectives for the Year 2000 for Texas to reduce IMR below 7.0 has been met at the state level, but it has not been met for Black infants. Despite a decline in Black IMR, improvements in Black NMR and PNMR are needed to bring the overall Black IMR below 7.0. How this will be accomplished is unclear. But, it might be that improvement in Black NMR and PNMR is still ongoing such that Black IMR will be below 7.0 by the year 2012, if Black IMR continues declining at the determined rate of 0.25/year between 1984 through 1986 and 1993 through 1995. In other words, interventions that have led to the improvement of all mortality rates might be also benefiting the Black population that might eventually produce more favorable mortality rates.

Infant mortality associated with birth gestational age

Prematurity continues to be a major contributor of high infant mortality. The reason for the peak of mortality rates at 21 – 22 or 23 – 24 weeks for NMRs and IMRs is unknown. As noted by Verrier et al. (1994), the enigma of higher IMRs of preterm Anglo infants compared to Black infants (Wilcox et al., 1990) is a characteristic finding of this study. Yet the contribution of higher IMR for preterm Anglo infants came mainly from a higher preterm

Anglo NMR. The highest peak in PNMR was seen in Black preterm infants. The reason for this disparity of mortality rates in Anglo and Black preterm infants cannot be determined from this study.

Mortality associated with birth weight

With prematurity comes low birth weight, another major risk factor for infant mortality (National Center for Health Statistics, 1997; Sepkowitz, 1995). Black mothers had a higher proportion of infants born in the very and moderately low birth weight categories compared to Anglo and Hispanic mothers. This continues to be a problem for Black mothers in Texas, a problem also noted by Verrier et al. (1994). This represents an area where efforts to improve mortality rates can be focused.

Not surprisingly, high birth weight was found to be associated with the lowest mortality rates for all three ethnic groups. Despite the maternal medical problems associated with the birth of large infants, such as gestational diabetes and maternal obesity, high birth weight infants had consistently lower mortality rates, a similar finding noted by Verrier et al. (1994). Good nutrition during pregnancy might partly explain this finding. But improvements in the care of large infants, such as intensive neonatal monitoring and parental education, may also explain the low mortality rates in this group.

Mortality associated with maternal age, parity, and prenatal care

It is not surprising that higher mortality rates continue to be seen at the extremes of

reproductive age (Seidman et al., 1990) for all three ethnic groups, but especially so in the under 15 year age category. Anglo infants in this age category had the highest NMR and IMR, yet Black infants born to mothers of all other age categories had consistently higher NMRs, PNMRs and IMRs. Headway in improving IMR could be made by curbing teenage pregnancies, yet the biggest gains could be seen in the Black population because of a larger proportion of infants are born to teenage Black women compared to teenage Anglo women.

Extremes in parity are associated with modest increases in IMRs (Seidman et al., 1991), but remain consistently highest for Black infants, as noted also by Verrier et al. (1994). As expected, “inadequate” and “no prenatal care” were associated with higher mortality rates (Hemminki, 1988) for all three ethnic groups, yet the Hispanic infants were the least affected. The reason for this disparity cannot be determined from this study.

Again, there are consistently higher mortality rates for Black infants in all categories of prenatal care. The providing and receiving of adequate prenatal care remains essential in assuring that every pregnancy culminates in the delivery of a healthy baby without impairing the health of the mother (Cunningham et al., 1989; Lepert, 1993).

Study Limitations

This study had limitations similar to those described by Verrier et al. (1994). Limitations exist in estimating gestational age and the adequacy of prenatal care. Getting accurate information for determining gestational age and adequacy of prenatal visits requires good recall and/or good record-keeping on the part of prospective parents and caregivers.

However, the information obtained from linked birth/death certificates continues to provide the best valuable information on the historical perspectives and current status of the infant health in a defined population.

In summary, much headway has been made in Texas in the lowering of all mortality rates in Anglo, Hispanic and Black infants since the 1984 through 1986 time period, with a significant reduction in the IMR below the Texas' Health Objectives for the Year 2000 of 7.0. Yet room for improvement remains. Efforts at preventing premature and low birth weight births, curbing teenage pregnancy, and assuring adequate prenatal care remain paramount in the continuing effort to improve IMR. Black women in their reproductive years stand to gain the most from such efforts.

References

- Centers for Disease Control and Prevention. Infant mortality-United States, 1993. *Journal of the American Medical Association* 275:980, 1996.
- Cunningham FG, MacDonald PC, Gant NF. Prenatal care in *Williams Obstetric*. Appleton and Lange. 257, 1989.
- Hemminki E. Content of prenatal care in the United States. A historic perspective. *Medical Care* 26:199, 1988.
- Kessner DM, Singer J, Kalk CE, Schlesinger ER. *Infant Death: An Analysis by Maternal Risk and Health Care*. National Academy Press, Washington DC, 1973.
- Kerr GR, Ying J, Spears W. Searching for preventable causes of infant mortality in Texas. *Texas Medicine* 93:81-88, 1997.
- Kerr GR, Ying J, Spears W. Ethnic differences in causes in infant mortality: Texas birth, 1989 through 1991. *Texas Medicine* 91:7, 1995.
- Lepert PC. An analysis of the reasons for Japan's low infant mortality rate. *Journal of Nurse-Midwifery* 38:353-357, 1993.
- McDaniel A. Extreme mortality in nineteenth century Africa: the case of Liberian immigrants. *Demography* 29:581-94, 1992.
- National Center for Health Statistics: Monthly Vital Statistics Report. Total number of births, rates and percent of births with selected demographic characteristics, by specified race of mother: United States, 1995. 45:11(S), 1997.
- National Center for Health Statistics: Birth, infant mortality, and life expectancy, 1980-1995. *National Center for Health Statistics Webpage*, 1997.
- National Center for Health Statistics: Infant mortality rates, fetal death rates, and perinatal mortality rates, according to race: United States, selected years 1950-1995. *National Center for Health Statistics Webpage*, 1997.
- National Center for Health Statistics: Ten leading causes of infant mortality: United States 1994. *National Center for Health Statistics Webpage*, 1997.
- Oechsli FW. Editorial: Ethnicity, socioeconomic status, and the 50-year U.S. infant mortality record. *American Journal of Public Health* 85:905-906, 1995.

Rowland Hogue CJ, Hargraves MA. Class, race and infant mortality in the United States. *American Journal of Public Health* 83:9-12, 1993.

Seidman DS, Samueloff A, Mor-Yosef S, Schenker JG. The effect of maternal age and socioeconomic background on neonatal outcome. *International Journal of Gynecology and Obstetrics* 133:7-12, 1990.

Seidman DS, Dollberg S, Stevenson DK, Gale R. the effects of high parity and socioeconomic status on obstetric and neonatal outcome. *Archives of Gynecology and Obstetrics* 249:119-127, 1991.

Sepkowitz S. International rankings of infant mortality and the United States' vital statistics natality data-collecting system-failure and success. *International Journal of Epidemiology* 24:583-588, 1995.

Singh GK, Yu SM. Infant mortality in the United States: trends, differentials, and projections, 1950 through 2010. *American Journal of Public Health* 85:957-964, 1995.

Texas Department of Health. Healthy Texans. Year 2000 Partnership. Austin, TX, 1991.

Verrier M, Spears W, Ying J, Kerr GR. Patterns of infant mortality in relation to birth weight, gestational and maternal age, parity, and prenatal care in Texas' triethnic population, 1984 through 1986. *Texas Medicine* 90:50-56, 1994.

Weeks JR. Age differentials in mortality in *Population, an introduction to concepts and issues*. Wadsworth Publishing Co. 200-204, 1996.

Wilcox A, Russell I. Why small black infants have a lower mortality rate than small white infants: the case of population-specific standards for birth weight. *Journal of Pediatrics*. 116:7-10, 1990.

Vita

Horacio P. Guerra, IV, the first born of Horacio P. Guerra, III and Josepha Guerra, was born in McAllen, TX, on 22 February 1963. His father, a retired Army Judge Advocate General officer, is part owner of a law firm in Rio Grande City, TX. His mother is the Rio Grande City Independent School District facilitator. After graduating as a high school honor student in 1981, Horacio attended Texas A&M University and graduated Cum Laude with a bachelors degree in biochemistry in 1985. He attended medical school at the University of Texas Southwestern Medical Center and, after receiving his medical degree in 1989, completed a 3-year Family Practice residency at Central Texas Medical Foundation in Austin, TX. Since graduating from his residency in 1992, Horacio served as an active duty family physician and flight surgeon in the Air Force. He attended the Aerospace Medicine Primary course at Brooks AFB, TX in 1993. Horacio finished his assignment at Altus AFB, OK, as a family physician and deployed to Guantanamo Bay, Cuba, during Operation Sea Signal in 1995. In 1995, he also received an assignment at Nellis AFB, NV, as a hospital-assigned flight surgeon. During his two-year tour at Nellis AFB, Horacio also served as the attached flight surgeon to the United States Air Force Weapons School at Nellis AFB prior to his acceptance into the Residency of Aerospace Medicine. He currently lives in San Antonio with his wife, Monica, and their three children, Horacio, Theresa and Isabel.

Permanent Address: 20122 Grail Quest
San Antonio, TX 78258

This thesis was typed by Horacio P. Guerra, IV M.D.