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Epidemiology of Infant Mortality II: Person, Place, Time

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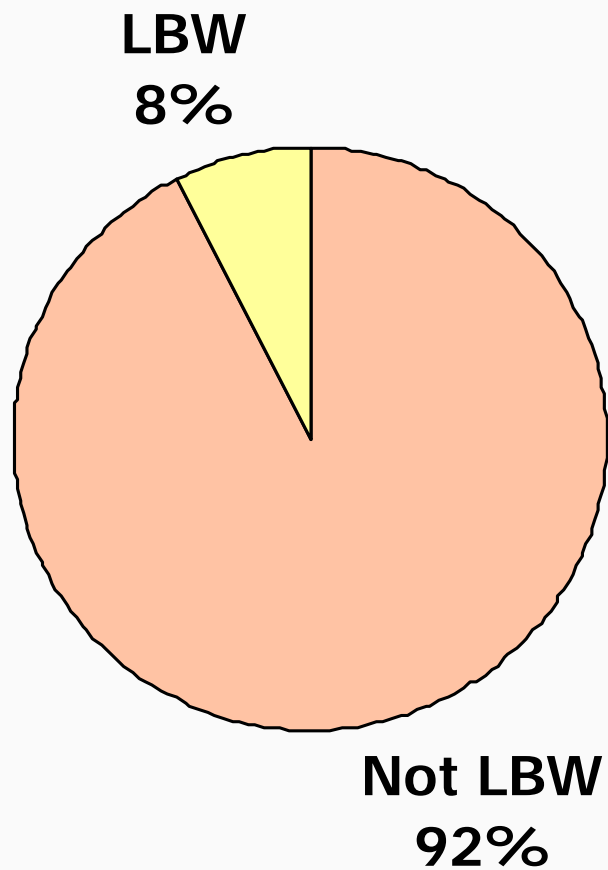


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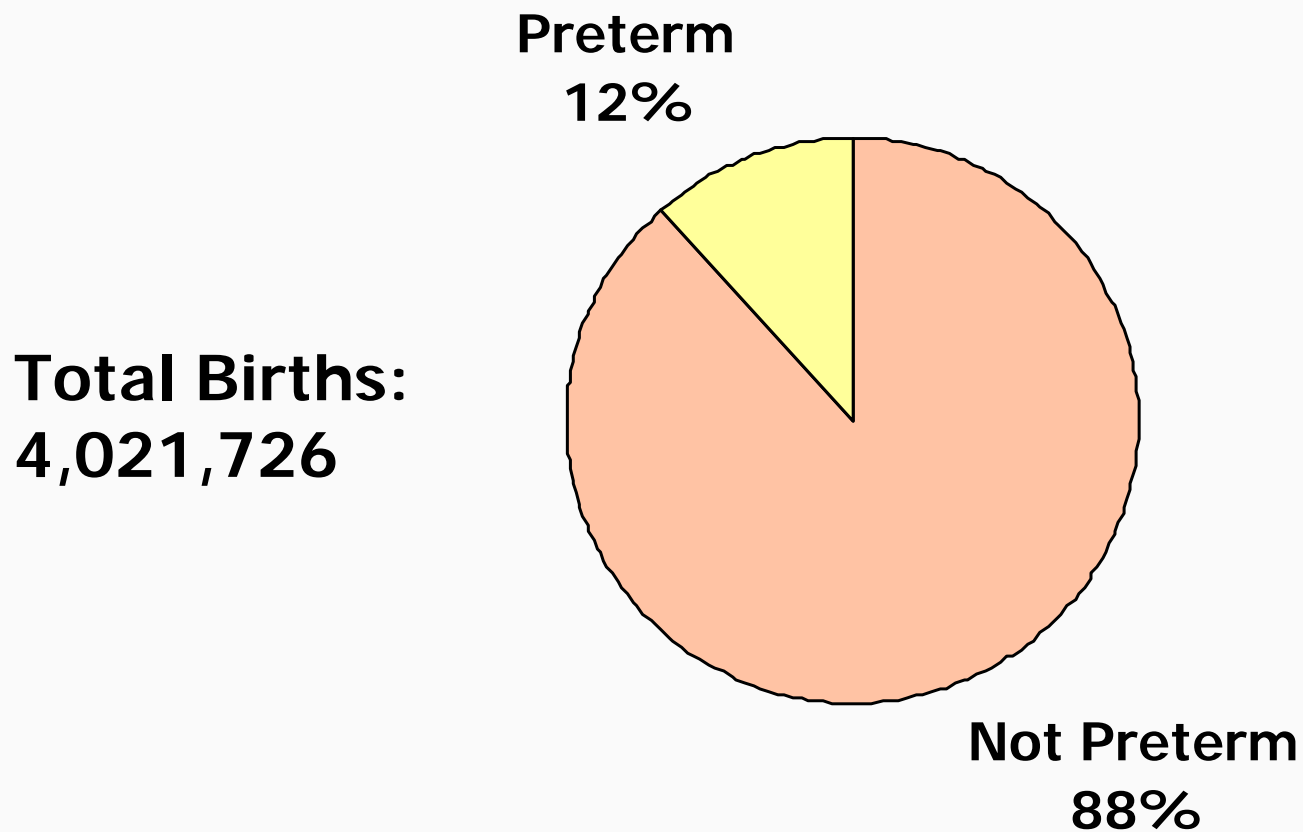
Section A

Person: Risk Factors for Infant Mortality, Part 1

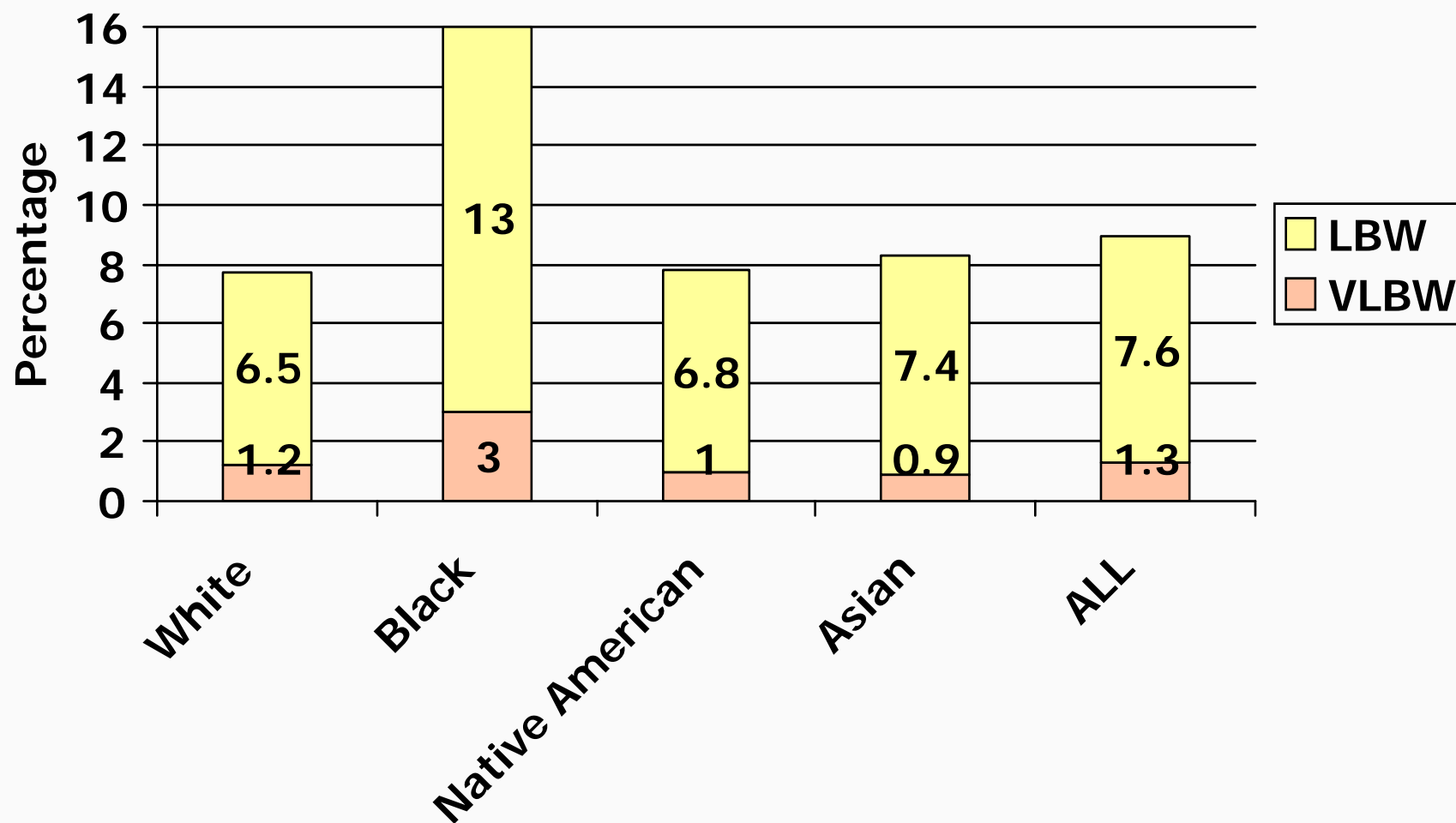
Live Births by Birth Weight, U.S., 2002



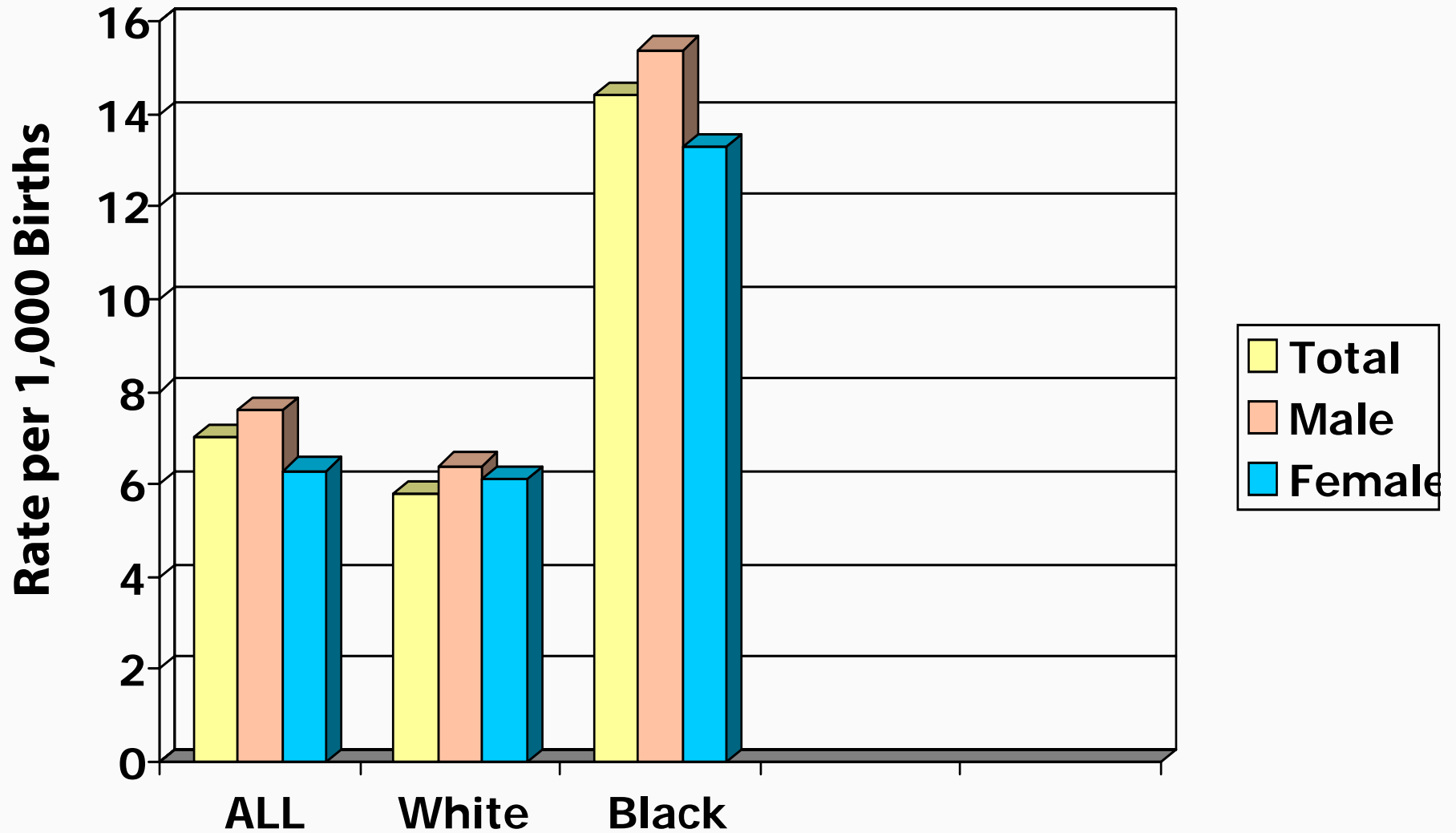
Live Births by Gestational Age, U.S., 2002



Low and Very Low Birth Weight Births by Maternal Race, U.S., 2002



Infant Mortality Rates by Maternal Race, U.S., 2002



Person: Risk Factors for IM

- Personal characteristics may relate to one of the component causes of IM or to several
 - Smoking increases risk of LBW and SIDS
 - Heavy alcohol use during pregnancy only appears to increase the LBW risk
- Two major causes of infant death
 - LBW
 - SIDS

- Determinants of LBW can be broadly classified as follows:
 - Demographic
 - Risks prior to pregnancy
 - Medical conditions during current pregnancy
 - Behavioral and environmental risks
 - Health care utilization

- **Socioeconomic Status (SES)**
 - Income, education, occupation, or some combination
 - Measures may fail to fully represent this construct
- Low SES increases the risk of pre-term delivery as well as of IUGR
- SES is one of the strongest and most consistent determinants of poor outcomes

Determinants of LBW: Demographic

- SES is highly correlated with race/ethnicity
 - SES gradients persist even in studies of populations which were ethnically homogeneous
- Unclear what it is about SES that causes poor outcomes

- **Race/Ethnicity**
- Measurement of race and ethnicity is fraught with problems
 - Frequently interpreted as a biological characteristic when it is a socially determined characteristic
- In the U.S., a black infant is more likely to die than a white infant
 - Higher LBW rates of blacks are primarily the result of higher pre-term birth rates

■ **Race/Ethnicity**

- In the U.S., a black infant is more likely to die than a white infant
 - Black women experience twice the rate of pre-term birth of white women and these differences are greatest for the most vulnerable newborns (< 1500 gms or < 32 weeks)
 - Higher rates of IUGR among black infants also contribute to the higher rates of LBW

Determinants of LBW: Demographic

- Reasons for race/ethnic differences, or the factors that race/ethnicity may be serving as a proxy for, are not often stated nor studied
- Adjustment for traditional risk factors has failed to account for these differences

Determinants of LBW: Demographic

- *Why have racial differences in pregnancy outcomes remained a perplexing problem?*
 - Years of education may not represent the same quality of life and opportunities for success for blacks and whites
 - ▶ Blacks and whites with college educations do not achieve similar levels of wealth

Determinants of LBW: Demographic

- *Why have racial differences in pregnancy outcomes remained a perplexing problem?*
 - Some traditional risk factors have been operationalized in a simplistic fashion
 - Need to look beyond traditional risk
 - ▶ Recently, psychosocial factors and physical activity have been examined
 - ▶ Home/neighborhood or work environment may help explain the "gap" in pre-term birth and IUGR

Determinants of LBW: Demographic

- *Why have racial differences in pregnancy outcomes remained a perplexing problem?*
 - Poorer pre-pregnancy health of the minority population infrequently considered
 - ▶ Increased rates of chronic disease among African-American women may account for some of their increased risk of poor pregnancy outcomes

Determinants of LBW: Demographic

- **Older maternal age** (> 34 years)
 - Has not been consistently shown to be a risk factor for IM
 - Increased risk for fetal death
- **Younger maternal age** (< 20 years)
 - Associated with increased rates of pre-term delivery, LBW, and infant mortality

Determinants of LBW: Demographic

- Maternal age may be associated with several other factors which relate independently to risk of poor outcomes
 - Some studies have shown that it is the first pregnancy for older mothers which is associated with the increased risk and not age per se

Determinants of LBW: Demographic

- Young motherhood is also associated with lower SES, nutritional inadequacy, lower pre-pregnancy weight and weight gain, and higher stress which may contribute to the perceived independent increase in risk
- Older mothers have more chronic medical problems which explains why some studies have found them to be at an increased risk



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Section B

Person: Risk Factors for Infant Mortality, Part 2

Determinants of LBW: Risks Prior to Pregnancy

- Prior pregnancy history
 - Adverse reproductive history increases risk for pre-term birth
- Maternal illness
- Pre-pregnancy weight
 - Low pre-pregnant weight has been related to pre-term birth

Determinants of LBW: Medical Conditions During the Current Pregnancy

- Inter-pregnancy interval
- Multiple gestation pregnancies
- Bleeding
- Infection
- Placenta previa or abruptio

Smoking

- 20%–25% of pregnant women smoke during pregnancy
- Cigarette smoke contains more than 2,500 chemicals (nicotine and carbon monoxide, among others, play a role in adverse outcomes)
- Modifiable risk factor
- Doubles the risk of LBW, primarily through IUGR
- Related to birth weight in a linear dose response fashion

Smoking

- Smoking does not appear to increase the risk of pre-term delivery (PTD)
 - Modest effect (2–4 days) on mean GA
 - Exception was the 1958 British national cohort study which found smoking doubled risk of PTD

Smoking

- Smoking does not appear to increase the risk of pre-term delivery (PTD)
 - If smoking does affect PTD risk, it may be confined to a subgroup of pre-term deliveries and therefore studies of pre-term delivery in general may be missing the effect

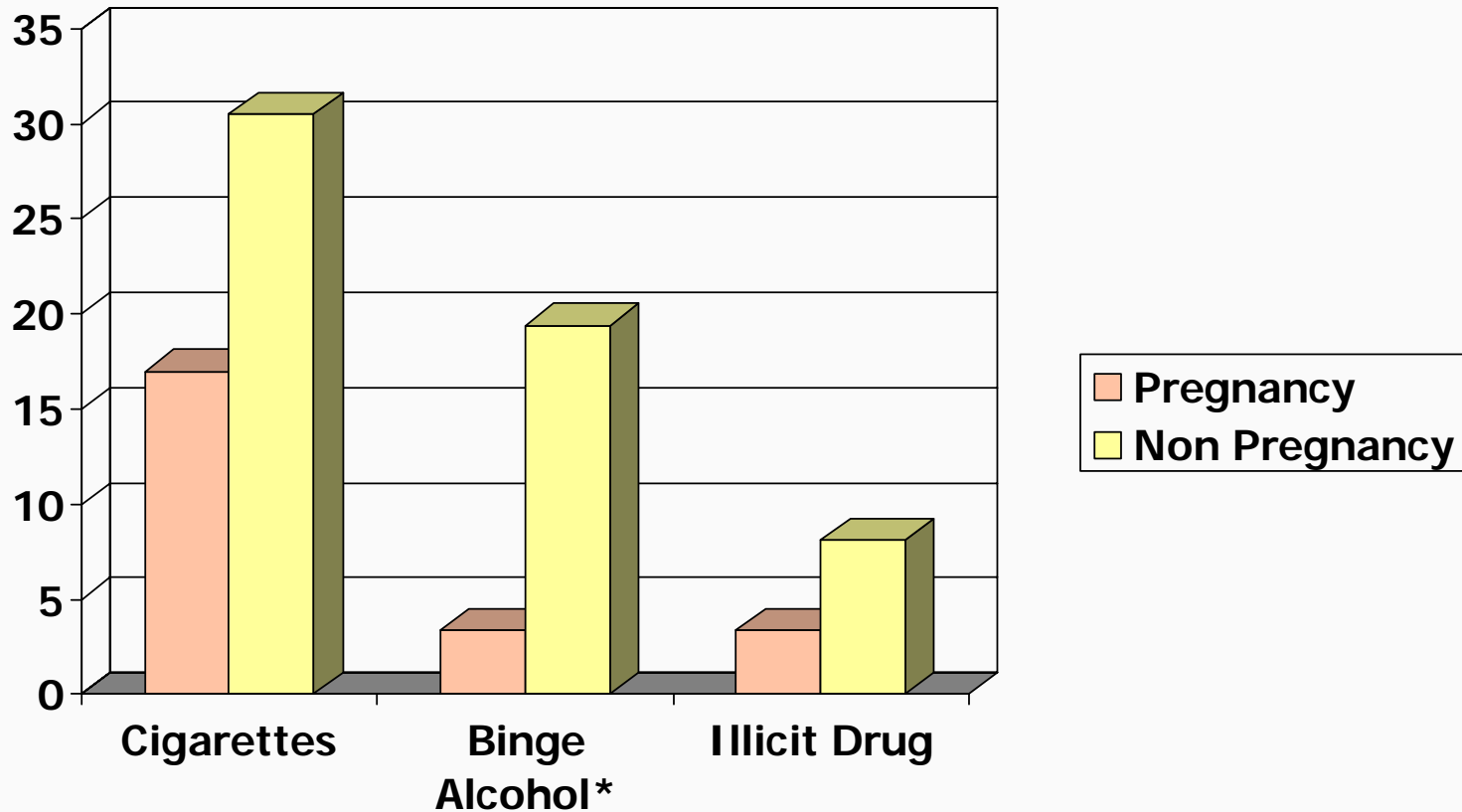
Alcohol

- Fetal Alcohol Syndrome (FAS)
- Exact timing, amount, and duration of exposure necessary to produce FAS is still not known
- Effect of heavy drinking on fetal growth independent of other factors
- Use during pregnancy has declined except among "high risk" women

Drug Use

- 7.5 to 15% of women abuse drugs during pregnancy
- Studies have failed to consistently find an adverse effect
 - Cocaine associated with numerous adverse perinatal outcomes
 - Effects of marijuana on the fetus related to growth retardation

Past Month Substance Use by Pregnancy Status, U.S., 2000



* Alcohol use defined as consuming one or more drinks on single occasion

** Illicit drug use includes marijuana, hash, cocaine, inhalants, hallucinogens, heroin, non medical use of psychotherapeutics

Nutrition

- Nearly linear association between weight gain during pregnancy and low birth weight
- Few studies of nutrition have examined pre-term delivery as the outcome

Stress

- Psychosocial stressors and their potential effect modifiers may be important sources of variability in pre-term labor risk
- Results from previous studies have been inconsistent (recent research focuses on biologic plausibility)
- Propose conceptual model based on the classic epidemiological “host, environment, agent” triangle

Domestic Violence

- Domestic violence in pregnancy, ranging from 4% to 20%
- Few controlled studies have been done to establish that abuse leads to poor outcomes
- Associated with other factors which independently increase risk

Altitude

- Living at high altitude has consistently been shown to increase a woman's risk of delivering a LBW infant
- Increased risk of LBW is result of fetal growth retardation, not pre-term delivery

Pollution

- 1st suggestion of a link in 1952 in London when the number of infant deaths doubled after weather inversion
- Evidence that outdoor air pollution contributes to illness and death in adults and children

Pollution

- 1st suggestion of a link in 1952 in London when the number of infant deaths doubled after weather inversion
- Evidence that outdoor air pollution contributes to illness and death in adults and children
- Further research needed to determine impact on fetal development and to fill the gap between our understanding of mechanisms and observed associations

Determinants of LBW: Health Care Utilization

- Traditional PNC has had little effect on decreasing rate of LBW
- Decrease in LBW that has been observed in recipients of PNC among mature full term infants
- Unclear whether it is PNC which is responsible for reduction in risk or whether it is other factors which are correlated with receipt of PNC

Sudden Infant Death Syndrome (SIDS)

- Death of an infant under one year of age, which remains unexplained after the performance of a complete post-mortem investigation
- Primary known factors related to SIDS risk are as follows:
 - Demographic (race, SES, maternal age)
 - Antenatal conditions (parity, PNC, weight gain, maternal smoking)
 - Postnatal conditions (sleeping position, temperature, feeding method, passive smoking)

- Incidence higher among infants born to African-American women
- Incidence higher among infants born to women of low SES
- Infants of younger mothers, particularly if the woman is multiparous, are at increased risk

SIDS: Antenatal Conditions

- Increased rate among infants born to women with late or no PNC
- Poor pregnancy weight
- Smoking during pregnancy

SIDS: Postnatal Conditions

- International studies linked an increased risk to the prone (face down) sleeping position
 - Recently, U.S. based studies confirmed
- Incidence is higher during the colder months
- Breastfed infants are at reduced risk
- Passive smoke exposure in the household is associated with an increased risk



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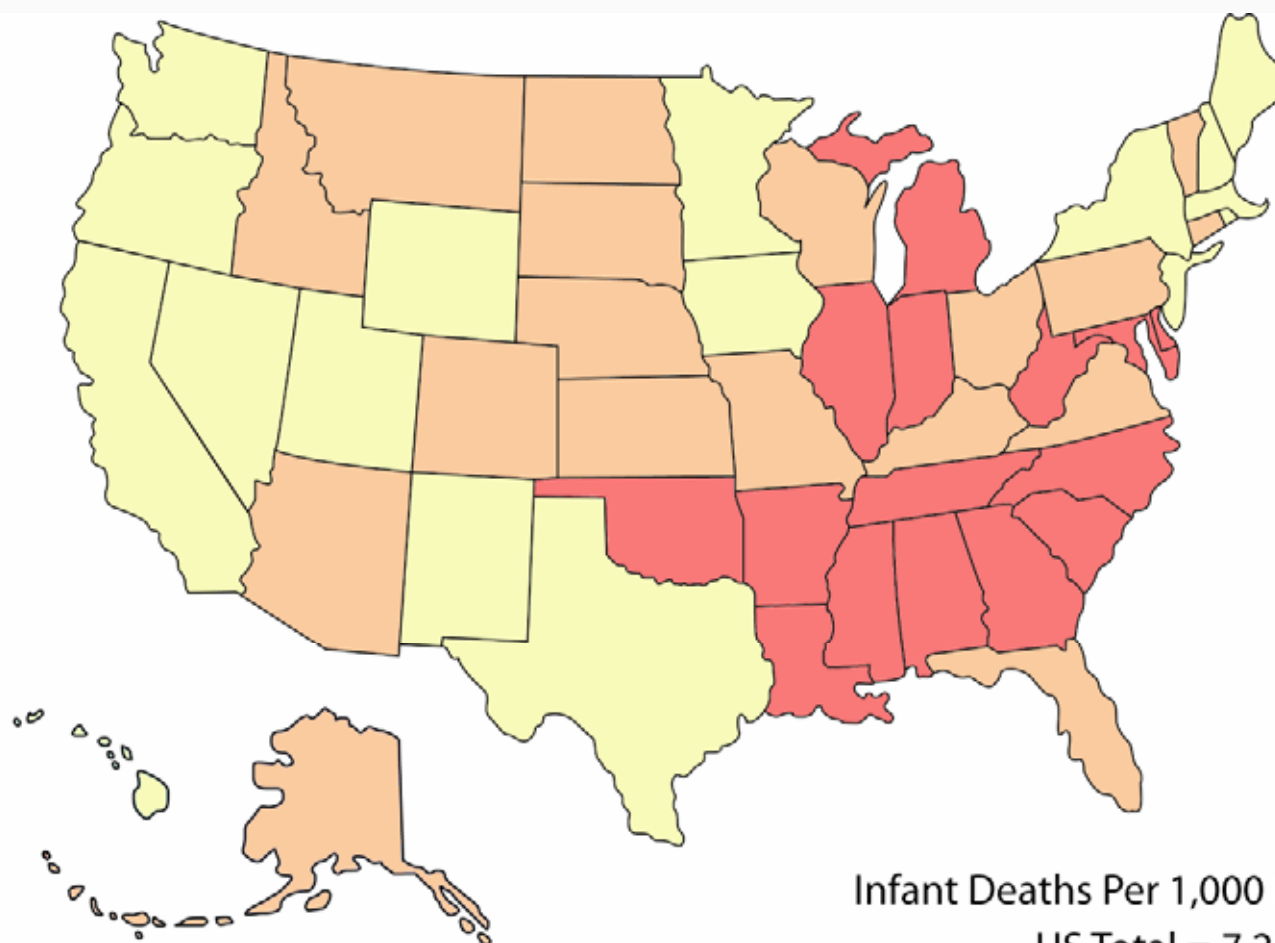
Section C

Place: Geographic Patterns of Infant Mortality in the U.S.

Geographic Patterns of Infant Mortality in the U.S

- Significant variation in IMR across states
- New England states have the lowest IMRs
- South Atlantic and East Central states have some of the higher rates

Infant Mortality Rates by State, United States (1998)



Notes: Value in () = number of states (includes District of Columbia)
Value ranges are based on an equal number of items in each range
Data Source: National Center for Health Statistics, 1998 final natality data
Prepared by March of Dimes Perinatal Data Center, 2001

Worldwide Patterns of Infant Mortality

- Most developed countries have relatively low IMRs
- Approximately 90% of the world's children are born in developing countries where IMR may be 30 times greater than developed countries
- Sweden traditionally has lowest IMR
 - Past few years Finland and Japan have had lowest rates
 - U.S. ranks between 20–30 in the world, well behind other industrialized nations

IMR by Region

- Africa has the greatest overall IMR
- Asia and Latin America have the 2nd and 3rd highest IMRs
 - Significant variation among countries within a specified region

NMR and PNMR in Developing vs. Developed Countries

- Developed world—neonatal deaths account for the majority of the IMR
- Developing world—only 50% of infants die in the neonatal period
 - Malnutrition and infection are the most common causes of post-neonatal infant death

IMR and Wealth of a Nation

- Lower GNP per capita, the higher its IMR
- Why do countries with less financial resources than the U.S. have lower IMRs?
 - Racial diversity of the U.S. cannot account for its poor ranking
 - IMR of U.S. whites is higher than that of European whites of similar SES

Factors Contributing to Decreased IMR in Industrialized Nations

- Social programs
- Health care system
- Comprehensive prenatal care
- Maternal risk factors

Factors Contributing to Decreased IMR in Industrialized Nations

Social Programs

- IMR not dependent on wealth of a country, but where wealth goes
 - Countries with the lowest IMRs have well developed social welfare systems
- In the U.S., period of greatest decline in the IMR coincided with the expansion of social support programs in the 1970s

Factors Contributing to Decreased IMR in Industrialized Nations

Health Care System

- Countries with low IMRs tend to have universal access to health care, including prenatal care
- In the U.S. poor and minority women are less likely to receive PNC

Factors Contributing to Decreased IMR in Industrialized Nations

Comprehensive Prenatal Care

- Not simply the provision of PNC, but the nature of care rendered which affects the IMR
- Comprehensive PNC program in France has demonstrated positive effects in preventing pre-term birth and LBW

Factors Contributing to Decreased IMR in Industrialized Nations

Maternal Risk Factors

- IMR of U.S. whites greater than European whites
 - Higher rates of LBW in U.S. whites
 - Birth weight specific mortality rates are better for U.S. infants

Factors Contributing to Decreased IMR in Industrialized Nations

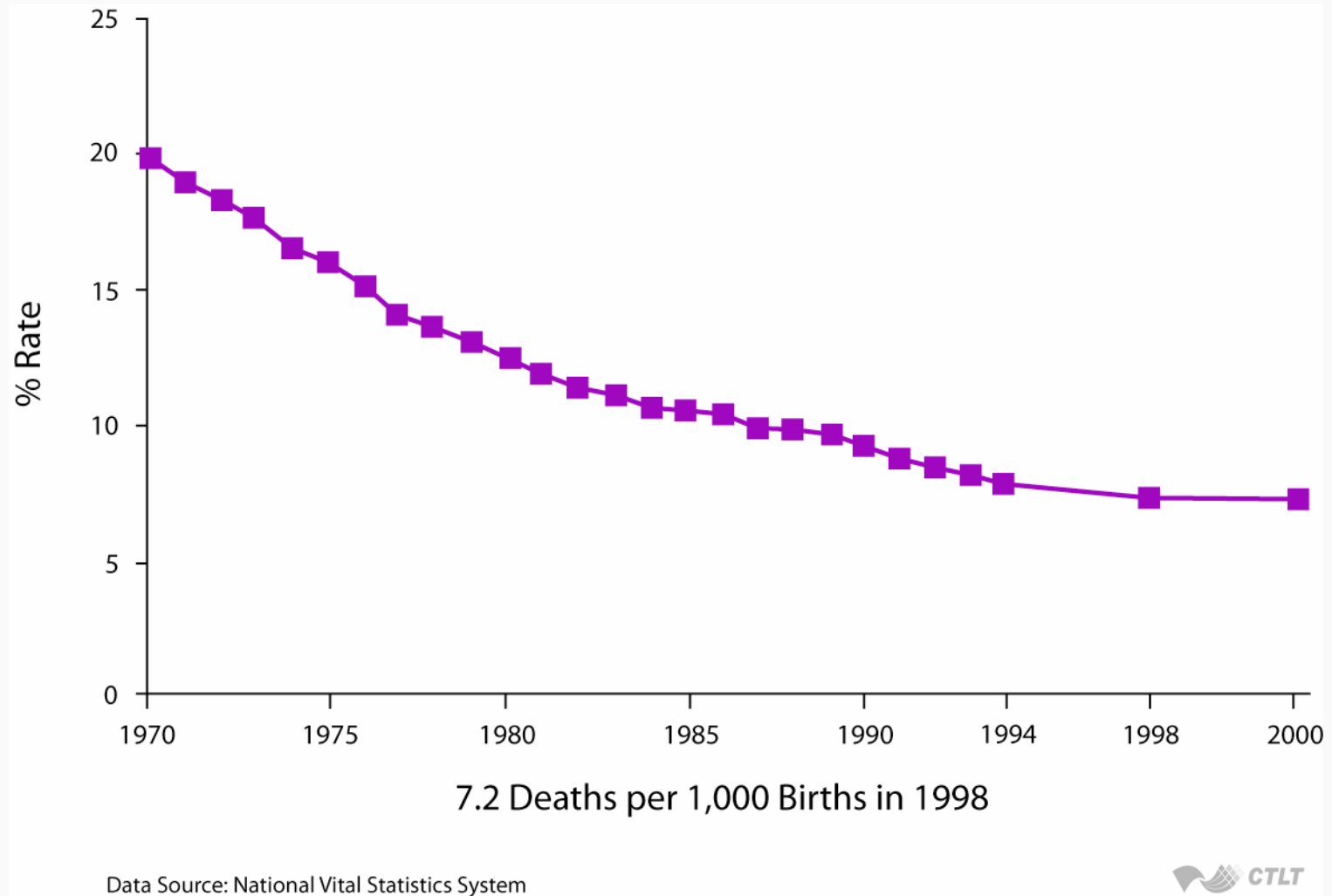
Maternal Risk Factors

- U.S. women have a higher rate PTD, a higher percentage of teenage pregnancies, lower percentage of women PNC in the 1st trimester

Factors Contributing to Decreased IMR in Industrialized Nations

	<i>FRANCE</i>	<i>U.S.</i>
<i>PNC 1st trimester</i>	96%	76%
<i>Birthrate in 15–19 year olds</i>	2.4	62.1
<i>% Preterm births</i>	14.1	23.5

Infant Mortality Rates in U.S.



Declines in U.S. IMRs

- **Late 1960s**—NICUs and oral contraceptives
- **1970s**—regionalized perinatal systems
- **Early 1980s**—decline began to slow dramatically as political debates about role of government programs intensified
- **End 1980s**—new artificial surfactant drugs improved survival of small infants with RDS