

This Masters Research Project contains three sections:

A research proposal, a report to the  
public health authorities of Josephine County  
and an abstract of the study.

A Research Proposal for a Study of  
Neonatal Mortality in Josephine County  
as Compared to the State of Oregon  
1978 Through 1987

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## TABLE OF CONTENTS

|   | <u>Page</u> |
|---|-------------|
| <u>LIST OF FIGURES</u> . . . . .            | v           |
| Introduction to the Problem . . . . .       | 1           |
| Review of the Literature . . . . .          | 4           |
| Low Birth Weight . . . . .                  | 5           |
| Prenatal and Perinatal Care . . . . .       | 8           |
| Congenital Anomalies . . . . .              | 9           |
| Conceptual Framework . . . . .              | 9           |
| Research Questions . . . . .                | 11          |
| Research Methods . . . . .                  | 13          |
| Design . . . . .                            | 13          |
| Data Collection . . . . .                   | 14          |
| Sample and Setting . . . . .                | 17          |
| Data Analysis . . . . .                     | 18          |
| Confidentiality . . . . .                   | 20          |
| Potential Utilization of Findings . . . . . | 21          |
| <u>REFERENCES</u> . . . . .                 | 23          |

LIST OF FIGURES

|  | <u>Page</u> |
|--|-------------|
| <u>Figure</u>  |             |
| 1 Conceptual framework adapted from Lalonde's (1974) <u>A New Perspective on the Health of Canadians</u> . . . . . | 10          |

## Introduction to the Problem

Recent history has seen a gradual decline in the infant mortality rate (IMR) throughout the world. This decline has been most pronounced in industrialized nations where many advantages including advanced health care, improved living conditions, and nutrition are available. In 1940, the United States IMR was 47 per 1,000 live births; and by 1979, it had plummeted to 13.1, an average drop of 4.6% per year. However, in 1982 the United States ranked 17th in the world's industrialized nations with an IMR of 11.5. For the same time period, Finland and Japan achieved rates of 6.0 and 6.6, respectively (Miller, 1985). Current comparisons show that 20 industrialized nations are doing a better job of keeping infants alive than the United States (Cagle, 1987).

Much energy nationwide from health professionals, governmental and voluntary organizations has been and continues to be invested in the effort to continue to lower U.S. infant mortality rates (Arkin, 1986). In 1980, the U.S. Surgeon General, addressing this important issue, established four goals to be reached by 1990:

1. Cut the infant mortality rate to 9 deaths per 1,000 live births; no county, racial or ethnic subgroup should have more than 12 deaths per 1,000.
2. Reduce the neonatal (under 28 days) mortality rate (NMR) to 6 deaths per 1,000 live births.
3. Lower the postneonatal (28 days to 1 year) mortality rate to 2.5 deaths per 1,000 live births.

4. Reduce the number of low birth weight infants to 5% of all live births; no county, racial or ethnic subgroup should have more than 9 low birth weight infants per 1,000 live births (Department of Health and Human Services, 1980).

In comparison with the United States as a whole, Oregon's IMR has consistently been lower than the national rate, although its rate of decline has been slower. From 1976 to 1986, the United States IMR declined 31.6%, from 15.2 to 10.4, while Oregon's rate fell from 12.7 to 9.5, a decrease of 25.2% (Oregon State Health Division [OSHD], 1986). In 1986, the neonatal mortality rate for the state of Oregon was 4.7 compared with a rate nationwide of 6.8. During that year, Oregon met one of the Surgeon General's goals, that is, the neonatal death rate was below 6 deaths per 1,000 live births. In addition, Oregon came close to reaching two of the other three goals, that is, the Oregon IMR was 9.5 (goal: 9.0), and 5.1 of all live births were low birth weight infants (goal: 5.0). Oregon lagged behind the final goal of a postneonatal death rate of less than 2.5, with a rate of 4.8.

Contrasted with the state of Oregon's 1986 IMR of 9.5 deaths per 1,000 live births, the rate for Josephine County was more than twice the state rate, or 20.1, for the same period (OSHD, 1986a). These figures, although representing only 1 year's experience, serve to focus attention on a long-standing problem with increased infant mortality that Josephine County has experienced as compared to the state of Oregon as a whole. In the 20-year period between 1968 and 1987, Josephine County's IMR has exceeded that of the state 14 times. Since 1980, the county's



annual IMR has been below the state rate only one time (OSHD, 1986b). In comparison with other Oregon counties, Josephine County's 1986 IMR rate of 20.1 was second only to that of Malheur County (10.9) for the same period. In addition, the IMR 5-year averages for 1982-1986, show that Josephine County had the highest average IMR for Oregon counties with over 50,000 population, with an average rate of 12.7. (Counties with under 50,000 are excluded because of the increased inherent variability in rates the small numbers of births in these communities engender.)

While one Oregon county, Lincoln, met all four of the Surgeon General's goals in 1986, and a total of 11 Oregon counties met three out of the four, Josephine County failed to meet any one of them. The Josephine County 1986 IMR of 20.1 far exceeded the goal of no county having more than 12 deaths per 1,000 births. A neonatal mortality rate of 10.7 (goal: 6) and a postneonatal rate of 9.4 (goal: 2.5) are discrepancies that are major health concerns. That year 5.5% of infants born in Josephine County were low birth weight (goal: 5.0%).

Infant mortality rates represent the sum of the neonatal (under 28 days) and postneonatal (28 days to 1 year) deaths. These are often incorporated together and expressed statistically as the IMR. However, there is value in analyzing them independently, since risk factors and causes of death in each age range are to some extent distinct. Neonatal risk factors cluster around perinatal issues such as infant birth weight, adequacy of perinatal care, and maternal health. Postneonatal mortality is more heavily influenced by social, economic, and

environmental factors such as safety and adequacy of sanitation, and incorporates the majority of Sudden Infant Death Syndrome (SIDS) deaths. Deaths due to congenital anomalies span both age groups.

The specific focus of this study will be neonatal mortality. This will allow for examination of the majority of infant deaths, since deaths occurring in the first 28 days of life represent approximately two thirds of all infant deaths. Focusing on neonatal mortality will permit a more in-depth analysis of the predisposing factors which are characteristic of or specific to it. This type of in-depth analysis will provide new insight into Josephine County's neonatal mortality experience, since OSHD's Center for Health Statistics does not carry out studies on an individual county basis unless specifically requested to do so. The outcome of this research will be the identification of neonatal mortality risk factors which are operant in Josephine County. Once these have been identified, public health nurses will take a leadership role in planning and implementing interventions that could be expected to positively impact neonatal health outcomes.

#### Review of the Literature

Much is known about the causes and predisposing factors of neonatal mortality. This review will be organized around three major causes: low birth weight, inadequacy of prenatal and perinatal care, and congenital anomalies. Many maternal and neonatal factors predispose toward neonatal mortality primarily because they increase the risk of

low birth weight infants; therefore, these factors will be discussed under low birth weight.

#### Low Birth Weight

Two thirds of all infant deaths are neonatal deaths occurring within the first 28 days of life (Hogue, Buehler, Strauss, & Smith, 1987). Low birth weight infants, defined as infants weighing less than 2,500 g, while only representing 7% of all births, account for almost 70% of neonatal deaths (Committee on Labor and Human Resources, 1980). Low birth weight babies, whether caused by prematurity or intrauterine growth retardation, are 40 times more likely than other newborns to die in the neonatal period (Brown, 1985).

Maternal age is an important factor in low birth weight and its associated elevated risk of neonatal mortality. This is especially true for women under 17 years of age, and for 18- to 19-year-old multiparas (McCormick, Shapiro, & Starfield, 1984). In 1978, 17% of all U.S. births were to teen-agers, yet this group accounted for 24% of all low birth weight infants (Brown, 1985). Much of this risk may be an artifact of socioeconomic status, nutritional status and inadequate prenatal care, but it remains a serious problem. Lee, Ferguson, Corpuz and Gartner (1988) studied records from 184,567 single live births of 40 weeks gestation. They found that the incidence of low birth weight was highest in mothers less than 17 years old (3.2%), and gradually decreases with advancing maternal age to a low of 1.3% for women 25 to 34 years. However, when adjusted for other maternal factors of race, education, parity, marital status, and adequacy of prenatal care, they

concluded that risk for low birth weight at term was lowest for teen-agers and increased with maternal age. Over age 35, there appears to be reduced potential for fetal growth. Optimum maternal age to prevent low birth weight appears to be 25-29 for Black mothers and 30-34 for Caucasian mothers (Hogue et al., 1987).

Race is one of the most significant risk factors for low birth weight. Black mothers are twice as likely as Caucasian mothers to have babies weighing less than 2,500 g (Brown, 1985). In addition, Black infants are twice as likely to die within their first year (Hogue et al., 1987). In contrast, Native Americans experience only a slightly greater frequency of low birth weight and neonatal mortality rates that are similar to those of Caucasian infants (Vanlandingham, Buehler, Hogue, & Strauss, 1988). Spanish-surname women have also been shown to have birth weight outcomes and neonatal mortality rates very similar to those of Caucasian women (Williams, Binkin, & Clingman, 1986).

Low socioeconomic status has long been recognized as a risk factor in low birth weight and the accompanying elevated neonatal mortality risk. The Federal Children's Bureau, in 1912, undertook studies of 10 cities and several rural areas in the United States. They concluded:

The coincidence of a high infant mortality rate with low earnings, poor housing, the employment of the mother outside the home and large families was indicated in all these studies. They all showed that there is great variation in infant mortality rates not only in different parts of the United States but also in different parts of the same state. . . . These differences were found to be caused by

different population elements, widely varying social and economic conditions and differences in appreciation of good prenatal and infant care and the facilities available for such care. (Cited in Miller, 1985, p. 31)

Most recently, Stockwell, Swanson, and Wicks (1988) reviewed records of neonatal mortality from eight Ohio cities for the period 1979 to 1981. Their finding was a persistent inverse relationship between income level and mortality rates.

Unmarried women are two times more likely than their married counterparts to deliver low birth weight babies (Brown, 1985). This, too, is likely to be related to the socioeconomic status of the group as a whole.

Neonatal mortality declines with advancing maternal educational level. Mothers with fewer than 8 years of education are more than two times as likely to have a low birth weight infant than their college-educated counterparts (Brown, 1985).

Frequent childbearing increases the risk of low birth weight. When the interval between pregnancies is less than 6 months, this effect is most pronounced, gradually decreasing to an apparent optimum spacing of 2 to 4 years. A poor obstetric history, including previous miscarriages, stillbirths or neonatal deaths are also indicators of increased risk. Multiple births, such as twins and triplets, are prone to prematurity and low birth weights (Brown, 1985).

Additional maternal risk factors include: smoking; drug and alcohol abuse; stress; concurrent illnesses, most notably hypertension,

diabetes, and infection; and inadequate diet (Brown, 1985; Hogue et al., 1987; Miller, 1985).

#### Prenatal and Perinatal Care

Infants born to mothers who do not receive adequate prenatal care (defined as beginning before the third trimester and including more than four visits), have substantially higher mortality rates (Hogue et al., 1987). Statistics from OSHD show that a woman in Oregon who does not receive adequate prenatal care is three times more likely to have a low birth weight infant and three and one half times more likely to have an infant who dies than a woman who receives adequate care (OSHD, 1985). A study conducted by the Institute of Medicine, National Academy of Sciences, projects that rates of low birth weight could be reduced by 12% among Blacks and 15% among Caucasians if all pregnant women received prenatal care beginning in their first trimester and continuing throughout the pregnancy (Brown, 1985). The positive effect of prenatal care on pregnancy outcome is most pronounced for high-risk pregnancies (Gortmaker, 1979).

In addition to prenatal care, the quality of medical care at the time of the infant's birth is also a factor in neonatal mortality. Schramm, Barnes, and Bakewell (1987) studied neonatal mortality in home versus hospital births. Neonatal mortality was found to be elevated for home births as compared to physician-attended hospital births. Nearly all of the mortality excess experienced in the home births was in association with lesser trained attendants.

### Congenital Anomalies

Congenital anomalies represent another leading cause of mortality in the neonatal period, causing 27.2% of all neonatal deaths nationwide in 1980 (Berry, Buehler, Strauss, Hogue & Smith, 1987). Thirty-seven percent of the 1986 Oregon NMR was attributed to congenital anomalies (OSHD, 1986a). The leading causes of mortality were: anomalies of the cardiovascular system such as transposition of the great vessels; anomalies of the nervous system, such as spina bifida; and chromosomal defects (Center for Disease Control, 1986). These anomalies are known to originate in the first trimester during embryogenesis; however, much research needs to be done as to their specific causes.

### Conceptual Framework

In A New Perspective on the Health of Canadians, Lalonde (1974) conceptualized the determinants of health as fourfold: human biology, environment, life-style, and health care. This conceptual framework has relevance for an examination of the health status of pregnant women and their infants within Josephine County (see Figure 1).

The central goal of neonatal health can be conceptualized as being determined by a multiplicity of influences suggested by the literature and divided into Lalonde's four major categories. Human biology determinants include the maternal characteristics of race, age, and poor obstetric history including: frequent childbearing, a history of miscarriages, stillbirths, or previous neonatal death. In addition, medical risks such as concurrent illness, complications during

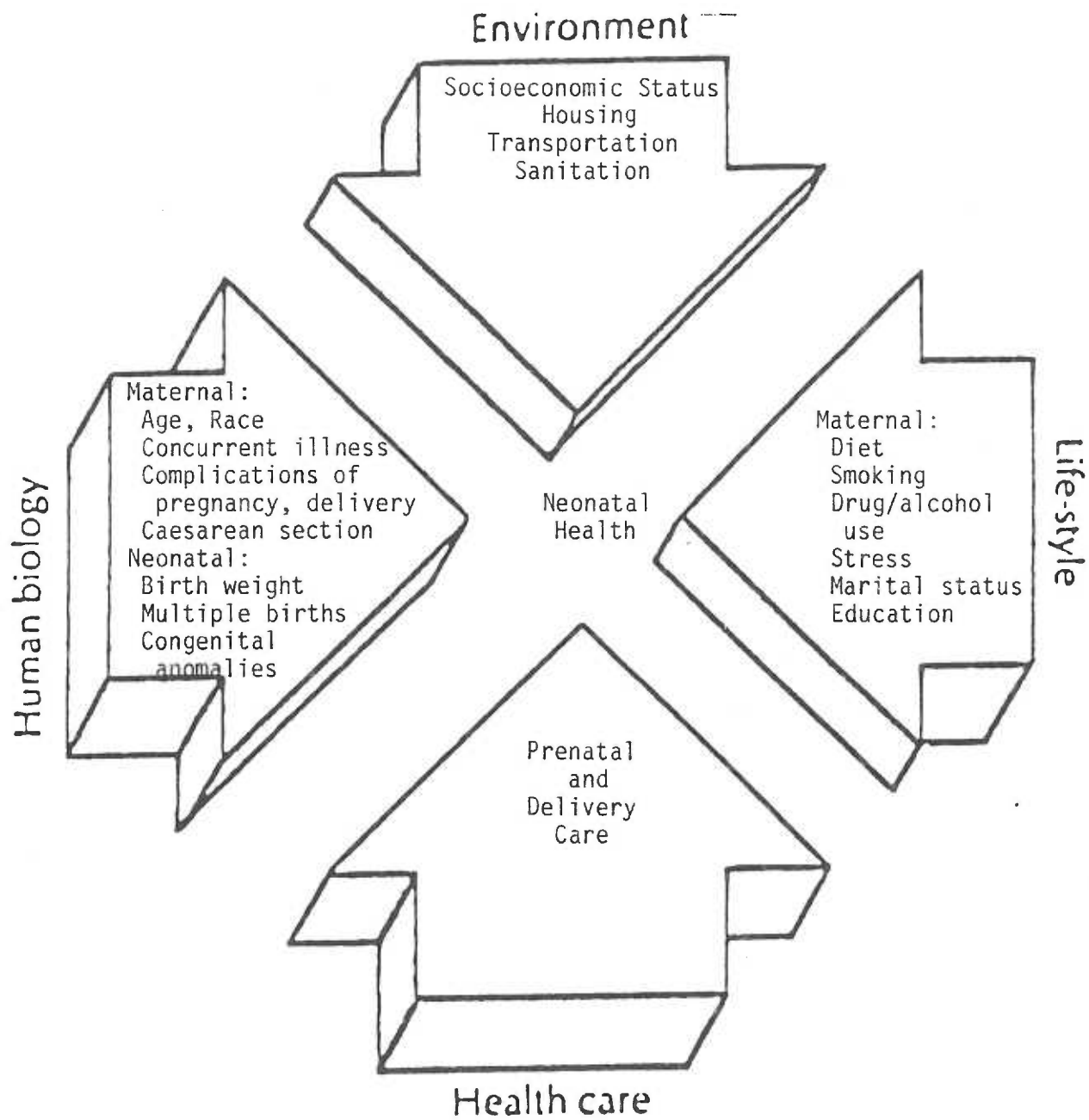


Figure 1. Conceptual framework adapted from LaLonde's (1974) A New Perspective on the Health of Canadians.



pregnancy, Caesarean birth, and other complications of labor and delivery fall into this category. Neonatal human biology determinants include birth weight, presence of congenital anomalies, gestation, and multiple births. Environment describes the socioeconomic health of the community, including such influences as adequacy of housing and transportation, sanitation, and income levels. Life-style determinants include maternal smoking, drug and/or alcohol use, stress, diet, marital status, and parental educational levels. Health care determinants include the delivery of prenatal and perinatal care.

Each of Lalonde's four major categories can be conceptualized as operating to positively or negatively impact the health of the infant during the neonatal period. This model is useful to organize the specific neonatal risk factors suggested by the review of the literature, thereby providing a framework for the study.

#### Research Questions

The following research questions will be addressed in this study:

1. Test the hypothesis: Josephine County experienced a significantly higher neonatal mortality rate than the state of Oregon overall for the period 1978 through 1987.
2. Which risk factors for neonatal mortality had a significantly higher or lower incidence rate for Josephine County, as compared to the state of Oregon overall, for the period 1978 through 1987?
  - a. Which risk factors for neonatal mortality had a significantly higher or lower incidence rate for Josephine County,

as compared to the state of Oregon overall, for the 5-year period 1978-1982?

b. Which risk factors for neonatal mortality had a significantly higher or lower incidence rate for Josephine County, as compared to the state of Oregon overall, for the 5-year period 1983-1987?

3. Which risk factors were significantly correlated with the neonatal mortality rate in Josephine County for the period 1978 through 1987?

a. Which human biology determinants were significantly correlated with neonatal mortality in Josephine County for the period 1978 through 1987?

b. Which life-style determinants were significantly correlated with neonatal mortality in Josephine County for the period 1978 through 1987?

c. Which health care determinants were significantly correlated with neonatal mortality in Josephine County for the period 1978 through 1987?

4. Among infants born in Josephine County during the years 1978 through 1987 who subsequently died during the neonatal period, which risk factors for neonatal mortality showed a significantly higher incidence as compared to all live births in the county for those years?

5. Are there significant differences in the incidence rates of specific causes of neonatal deaths in Josephine County, as compared to the state of Oregon overall, for the period 1978 through 1987?

## Research Methods

### Design

The research questions will be explored by means of a retrospective, descriptive study design using secondary data from OSHD. The dependent variable will be the incidence of neonatal mortality in Josephine County for the years 1978 through 1987. The independent variables will be the following selected known risk factors:

1. Human biology determinants: maternal age; race; obstetric history, including frequent childbearing, concurrent illness, complications of pregnancy, labor and delivery; neonatal birth weight; congenital anomalies; and multiple births.

2. Health care determinants: prenatal care, as measured by the month prenatal care began and the total number of visits, and adequacy versus inadequacy (as defined by OSHD as beginning before the third trimester and including more than four visits); adequacy of perinatal care, as measured by whether or not the birth was in a hospital and the medical qualifications of the person attending.

3. Life-style determinants that will act as independent variables include marital status and educational level of the mother. Maternal smoking, drug and alcohol abuse, diet and stress are excluded because there are no data available to approximate the incidence of these factors in the population.

4. Environment determinants also are excluded because the data set does not include this information.

A 10-year period has been chosen for the study because of the statistical difficulty that is presented by the relatively small numbers of births and deaths in the county. There is inherent random variation in the NMR when such small numbers are analyzed, and, therefore, a given year may be a departure from the long-term trend (Kleinman, 1986).

#### Data Collection

The data set for this research will come from OSHD with whom an agreement for cooperation in this study has been reached. The data are derived from a compilation of information collected on birth and death certificates.

In Josephine County, as throughout the remainder of the state of Oregon, births are recorded on a Certificate of Live Birth. This registration of each birth is required by Oregon Revised Statute (ORS) 432.205 and is to be accomplished within 7 days after the birth "by either the physician or any other person in attendance at or immediately after the birth or, if not so attended, by one of the parents" (ORS. 432.205, p. 361). Included in this certificate is information about: time and place of birth; parental information including names, ages, race, educational levels, marital status and residence; and infant data such as name, sex, birth weight and Apgar scores, whether this was a plural birth, presence of any congenital anomalies; and a pregnancy history including previous live births and terminations, date of last menses, month prenatal care began, number of prenatal visits, complications or concurrent illness affecting the pregnancy, and complications of labor and/or delivery.

Demographic data are by self-report of the parents, while medical information, including prenatal history and birth information, is from the care provider. When there is no birth attendant, the data are derived totally from parent self-report and recorded by the county registrar or health official. ORS 432.205 requires that the informant for birth certificate information "shall attest to the accuracy of the personal data entered" (ORS 432.205, p. 361), and a signature to that effect is required on the form.

Completed forms are compiled by each county, births are recorded in county logs, and then the Certificate of Live Birth is forwarded to OSHD's Center for Health Statistics. They are then checked by computer for completeness and, to the extent possible, for accuracy. Obvious discrepancies, for example, between date of last menses and date of birth, are pulled out, researched, and then edited to reflect correct information. However, no attempt is made to verify data that do not pose obvious inconsistencies. No data are discarded. Statistics for state and county incidence for known perinatal risk factors are then developed and published by the Center for Health Statistics. These published statistics for the 10-year period 1978 through 1987 will be utilized in the study.

The Center for Health Statistics also compiles information regarding deaths in the state of Oregon. A Certificate of Death is required to be filed with the registrar within 5 days after the death (ORS 432.307). This document elicits information regarding the name, sex, age, social security number, birthplace, race, residence, marital

status, and educational level of the decedent. In addition, the certifying physician records a time, place, and cause of death.

OSHD's Center for Health Statistics creates a matched infant death file on all infant deaths in the state. This file matches the infant birth certificate information with the corresponding death certificate information, thereby creating a method for assessing perinatal risk that may have predisposed for infant death. A copy of this matched infant death file will be made for the purposes of analysis in this study.

The underlying assumptions in using the data obtained by the state Center for Health Statistics is that it is both complete and accurate. Completeness of individual forms is monitored by the county as well as the Center for Health Statistics. State law attempts to assure that all births are recorded (ORS 432.205) and also requires that all deaths be recorded (ORS 432.307). No data are available regarding how many births or deaths might go unrecorded in Josephine County or the state; however, there is no available information which indicates that this number is significant. Accuracy is a more difficult problem. As stated above, the source of much of the demographic information is self-report, and, as such, its reliability is subject to the bias of social desirability. Medical data, such as prenatal history, diagnoses of complications, and cause of death, are subject to the judgment of the reporting practitioner.

Content validity of the instruments is supported by the fact that they were devised by health statistics experts to measure those variables of interest related to live births and deaths. Included "as a

minimum [are] the items recommended by the federal agency responsible for national vital statistics" (ORS 432.010, p. 355).

Data derived from birth certificates will be utilized to answer Questions 2, 2a, and 2b concerning incidence of neonatal risk factors county and statewide. Death certificate information will answer Questions 1 and 5 which explore neonatal death rates and stated causes of death, respectively. Matched infant death files will be examined to answer Questions 3, 3a, 3b, and 3c. These analyze the correlation of specific risk factors with neonatal deaths in Josephine County. Question 4 will be answered by comparison of matched Josephine County infant death files with birth certificate information from all live births in Josephine County for the prescribed years.

#### Sample and Setting

The subjects for this study will be all childbearing women and their infants born alive in Josephine County during the years 1978 through 1987. There are approximately 750 to 800 births in the county each year. A subsample of this group is the birth cohort, or all infants who were born alive during those years but who subsequently died during the neonatal period.

Josephine County is a rural southwestern Oregon county with a population of 61,450. It encompasses 1,570 square miles. Three fourths of its residents live outside city limits. There is no public transportation available.

The county can be described as economically depressed. The median income for the county in 1986 was \$21,000. That same year 11,010

persons (22.4% of the population) fell below poverty level. The unemployment rate was 9.6%. There were 902 Aid-To-Dependent-Children cases. Food Stamps were used by 3,277 households. The county experiences a high school drop-out rate of 36%.

### Data Analysis

Analysis of the data will use both descriptive and inferential statistics in the form of frequencies, means, standard deviations, z tests for the difference between proportions, chi-square analysis and t tests. Individual questions will be analyzed in the following manner:

1. Question 1, which tests the hypothesis that Josephine County experienced a significantly higher neonatal mortality rate than the state of Oregon overall for the period 1978 through 1987, will be analyzed by means of a z test for the difference between two proportions.

2. Questions 2, 2a, and 2b ask which risk factors for neonatal mortality had a significantly higher or lower incidence for Josephine County as compared to the state for the 10-year period and for each of two 5-year increments. The variables to be tested for which nominal data are available are:

Human Biology - Maternal

race

birth order

concurrent illness

complications of pregnancy

complications of delivery



Human Biology - Neonatal

birth weight  
congenital anomalies  
multiple births

Life-Style

marital status  
maternal educational level

Health Care

prenatal care (month care began)  
prenatal care (adequate vs. inadequate)  
perinatal care (place of birth)  
perinatal care (birth attendant)

Chi-square statistics, comparing Josephine County and the state of Oregon, will be used to ascertain if the two groups differ significantly on each of the variables. A t test for significant difference between means will be used to analyze two additional variables for which interval data are available: the maternal human biology variable of age and the health care variable number of prenatal care visits.

3. Questions 3, 3a, 3b, and 3c ask which risk factors were significantly correlated with Josephine County's 10-year neonatal mortality experience. Analysis will be accomplished by means of chi-square, nonparametric measure of association.

4. Question 4 explores the differences that may exist in the incidence of known risk factors in all Josephine County live births for the 10-year period as compared with the incidence in those infants who

died during the neonatal period. The risk factors that will be analyzed are identical to those for Question 2. Analysis will likewise be carried out by means of chi-square and  $t$  tests. A significance level of 0.05 will be utilized.

5. A  $z$  test for the difference between proportions will be used to answer question 5, "Are there significant differences in the incidence rates of specific causes of neonatal deaths in Josephine County, as compared to the state of Oregon overall, for the period 1978 through 1987?" A significance level of 0.05 will be used.

#### Confidentiality

An important ethical consideration with regard to the Certificate of Live Birth and Certificate of Death is one of confidentiality. ORS 432.120 requires that "rules adopted under this section shall provide for adequate standards of security and confidentiality of vital records" (ORS 432.120, p. 358). Only those with a "direct and tangible interest in the vital record" (ORS 432.120, p. 358) and researchers, authorized by the state registrar, have access to identifying information. A proposal to the state registrar has been made in order to utilize matched infant death files, since these contain identifying information as part of the record. No identifying information from these records will be utilized in this research effort, however. Statistical information from birth and death certificates is not confidential, and it will also be utilized for this project.

### Potential Utilization of Findings

Zemach (1986) relates the experience of health officials in Michigan in 1981 when a sharp increase in infant mortality occurred: Health officials were well aware of the state's continuing high infant mortality rates, with appallingly high rates in some urban areas, and were involved in a long term effort to increase funding for prenatal and infant care. This effort was greatly enhanced by the publicity given to the one year IMR increase. An air of crisis prevailed. A special committee was formed to look for the cause of this alarming upturn. No specific cause could be established. The special committee therefore turned its attention, not to the one year increase, but to the state's long term infant mortality problems. By the time the IMR was shown to have dropped sharply in 1982, the state was well on its way to expanded prenatal and infant care programs, with prenatal care earmarked to become a basic "right" under the Michigan Public Health Code. (p. 688)

This research project will define the extent of the increased neonatal mortality being experienced by Josephine County. In addition, it will identify relevant risk factors for that mortality. This will enable public health nurses to take a leadership role in focusing public attention on this long-standing and serious problem in much the same way as the Michigan experience. Information about the magnitude and potential sources of the problem, along with the zeal to remedy it, could be channeled to stimulate resource allocation toward effective

interventions. Program innovations could be developed to meet identified needs within Josephine County.

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## TABLE OF CONTENTS

|   | <u>Page</u> |
|---|-------------|
| <u>LIST OF TABLES</u> . . . . .                       | iv          |
| <u>LIST OF FIGURES</u> . . . . .                      | vi          |
| Introduction . . . . .                                | 1           |
| Setting . . . . .                                     | 2           |
| Predisposing Factors for Neonatal Mortality . . . . . | 3           |
| Low Birth Weight . . . . .                            | 3           |
| Prenatal and Delivery Care . . . . .                  | 5           |
| Congenital Anomalies . . . . .                        | 6           |
| Complications . . . . .                               | 6           |
| Methodology . . . . .                                 | 7           |
| Results . . . . .                                     | 11          |
| Discussion . . . . .                                  | 22          |
| Recommendations . . . . .                             | 25          |
| Limitations of the Study . . . . .                    | 27          |
| Summary . . . . .                                     | 28          |
| <u>REFERENCES</u> . . . . .                           | 29          |

LIST OF TABLES

| <u>Table</u>   | <u>Page</u> |
|--|-------------|
| 1 Risk Factors Used in the Study and the Comparison Groups . . . . .   | 9           |
| 2 Maternal Age, Race, Marital Status, Education and Birth Order: All Live Births, Josephine County Compared With the Rest of the State of Oregon, 1978-1987 . . . . .                    | 12          |
| 3 Plurality and Birth Weight: All Live Births, Josephine County Compared with the Rest of the State of Oregon, 1978-1987 . . . . .   | 13          |
| 4 Month Care Began, Number of Prenatal Visits and Adequacy of Prenatal Care: All Live Births, Josephine County Compared With the Rest of the State of Oregon, 1978-1987 . . . . .        | 14          |
| 5 Place of Delivery and Delivery Attendant: All Live Births, Josephine County Compared With the Rest of the State of Oregon, 1978-1987 . . . . .   | 15          |
| 6 Congenital Anomalies: All Live Births, Josephine County Compared With the Rest of the State of Oregon, 1978-1987 . . . . .   | 15          |
| 7 Concurrent Illness, Complications of Pregnancy, and Delivery: All Live Births, Josephine County Compared With the Rest of the State of Oregon, 1984-1987 . . . . .                     | 16          |
| 8 Maternal Age, Marital Status, Education, Plurality and Birth Weight: All Neonatal Deaths, Josephine County Compared With the Rest of the State of Oregon, 1977-1986 . . . . .          | 17          |
| 9 Month Care Began, Number of Visits, Place of Delivery and Delivery Attendant: All Neonatal Deaths, Josephine County Compared With the Rest of the State of Oregon, 1977-1986 . . . . . | 19          |
| 10 Maternal Age, Race, Marital Status, Education, and Plurality: Josephine County Neonatal Deaths Compared With all Other Live Births, 1978-1986 . . . . .                               | 20          |

LIST OF TABLES (Continued)

| <u>Table</u> |   | <u>Page</u> |
|--------------|---|-------------|
| 11           | Month Care Began and Number of Prenatal Visits:<br>Josephine County Neonatal Deaths Compared With all<br>Other Live Births, 1978-1986 . . . . . | 21          |
| 12           | Congenital Anomalies: Josephine County Neonatal Deaths<br>Compared With all Other Live Birth, 1978-1986 . . . . .                               | 22          |
| 13           | Summary Table of Significant Results . . . . .  | 23          |

LIST OF FIGURES

| <u>Figure</u>   | <u>Page</u> |
|---|-------------|
| 1 Neonatal Death Rates, Josephine County and the State of Oregon: 1978-1987 . . . . . | 1           |

## Introduction

Oregon has seen a gradual decline over the last decade in the number of infants who die during their first month of life. For the 5-year period 1978 through 1982, Oregon experienced an average rate of 6.89 neonatal (under 28 days) deaths per 1,000 live births. This rate decreased to 5.15 for the years 1983 through 1987. For this same 10-year period, 1978 through 1987, Josephine County's neonatal death rate exceeded that of the state 8 out of 10 years (see Figure 1). Furthermore, in contrast to the state experience, the trend for Josephine County's neonatal death rate was an increase. For the years 1978 through 1982, Josephine County had a neonatal death rate of 7.73. This average rose to 8.43 neonatal deaths per 1,000 live births for the

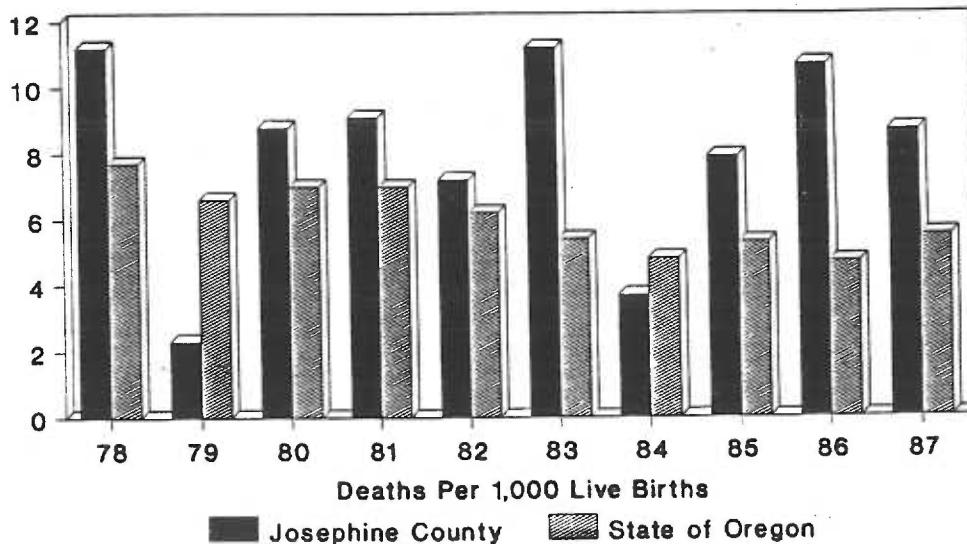


Figure 1. Neonatal death rates, Josephine County and the state of Oregon: 1978-1987.

5-year period 1983 through 1987. Stated another way, a baby born in Josephine County had a 33% greater chance of dying in the first month of life than did babies throughout the rest of the state. The purpose of this study was to explore the incidence of factors predisposing to the excessive neonatal mortality that Josephine County experienced. The following is a report to Josephine County public health authorities of the study findings.

### Setting

Josephine County is a rural southwestern Oregon county with a population of 61,450. The county encompasses 1,570 square miles. Three fourths of its residents live outside the city limits. There is no public transportation available within the county.

The county can be described as socioeconomically depressed. For 6 out of the last 10 years, Josephine County had the lowest per capita income of all counties in Oregon and never ranked above 34th out of 36. In 1986, 22.4% of the population fell below poverty level. The county Women's, Infant's and Children's Supplemental Nutrition Program (WIC) had a caseload of 1,200 clients. The county experienced a high school drop-out rate of 36%. According to Oregon State Law Enforcement Data System (1988) records, the county led the state in per capita drug offense arrests in 1986 and 1987.

There are approximately 750 to 800 births in the county each year. The majority of these births occur in Josephine Memorial Hospital (JMH), the only hospital in the county that has obstetrical facilities. There

are no neonatal intensive care facilities in the county. The nearest neonatal facility is approximately 30 freeway miles away at Rogue Valley Medical Center (RVMC). When possible, high-risk mothers are transported to RVMC before delivery. Otherwise, newborn infants are transported via ambulance to RVMC's Neonatal Intensive Care Unit or, based on their condition, to Doernbecher Children's Hospital in Portland.

#### Predisposing Factors for Neonatal Mortality

In order to improve the health of newborns in our community, it is important to know what factors are placing infants at increased risk. The scientific literature cites four major causes of neonatal mortality: (a) low birth weight, (b) inadequate prenatal and delivery care, (c) congenital anomalies (birth defects), and (d) complications of pregnancy, labor and delivery.

##### Low Birth Weight

Low birth weight infants are defined as infants weighing less than 5 1/2 lb (2,500 g). While representing only 7% of all live births nationally and 5% in Oregon, they account for approximately 70% of neonatal deaths in the state (Committee on Labor and Human Resources, 1980; Oregon State Health Division [OSHD], 1986b). These infants are 40 times more likely than other newborns to die in the neonatal period. For a very low birth weight infant, weighing less than 3.3 lb (1,499 g), the risk of neonatal death is more than 200 times greater than for a normal birth weight infant (Institute of Medicine, 1985).



Maternal age is an important factor in low birth weight and its associated risk of neonatal mortality. In 1985, 12.7% of all U.S. births were to teen-agers, yet these births accounted for 17.6% of all low birth weight infants (Children's Defense Fund, 1986). Much of this risk may be a result of a low socioeconomic status and poor nutrition contributing to low birth weight, as well as inadequate prenatal care. Nevertheless, it remains a serious problem. Over the maternal age of 35, there appears to be reduced potential for fetal growth. Optimum maternal age to prevent low birth weight appears to be 25-29 for Black mothers and 30-34 for Caucasian mothers (Hogue et al., 1987).

Race is one of the most significant risk factors for low birth weight. Black mothers are twice as likely as Caucasian mothers to have babies weighing less than 2,500 g (Institute of Medicine, 1985). In addition, Black infants are twice as likely to die within their first year of life (Hogue et al., 1987). In contrast, Native Americans experience only a slightly greater frequency of low birth weight, and neonatal mortality rates are similar to those of Caucasian infants (Vanlandingham, Buehler, Hogue, & Strauss, 1988). Spanish-surname women also are shown to have birth weight outcomes and neonatal mortality rates very similar to those of Caucasian women (Williams, Binkin, & Clingman, 1986).

Unmarried women are two times more likely than their married counterparts to deliver low birth weight babies (Institute of Medicine, 1985). Lower socioeconomic status and inadequate prenatal care contribute to this discrepancy.

Neonatal mortality declines with advancing maternal educational level. Mothers with fewer than 8 years of education are more than two times as likely to have a low birth weight infant than their college-educated counterparts (Institute of Medicine, 1985). The generally lower socioeconomic status of less educated women contributes to the increased risk.

Frequent childbearing and closely spaced pregnancies increase the risk of low birth weight and neonatal death (Park, 1986). Multiple births, such as twins and triplets, are also more prone to prematurity and low birth weight (Institute of Medicine, 1985).

#### Prenatal and Delivery Care

Infants born to mothers who do not receive adequate prenatal care (defined as beginning before the seventh month and including more than four visits) have substantially higher neonatal mortality rates. Statistics from OSHD (1985, 1986b) show that a woman in Oregon who does not receive adequate prenatal care is three times more likely to have a low birth weight infant and four times more likely to have an infant who dies than a woman who receives adequate care. A study conducted by the Institute of Medicine, National Academy of Sciences (1985), projects that rates of low birth weight could be reduced by 12% among Blacks and 15% among Caucasians if all pregnant women received prenatal care beginning in their first trimester and continuing throughout the pregnancy. The positive effect of prenatal care on pregnancy outcome is most pronounced for high-risk pregnancies (Gortmaker, 1979).

In addition to prenatal care, the quality of health care at the time of the infant's birth is also an important factor in neonatal mortality. Schramm, Barnes, and Bakewell (1987) studied neonatal mortality in home versus hospital births. Neonatal mortality was found to be elevated for home births as compared to physician-attended hospital births. Nearly all of the mortality excess experienced in the home births was in association with lesser trained attendants. While for some women home births may represent a philosophical choice, research among Oregon WIC nutritional program recipients found that more than 50% of women planning home births did so for financial reasons, especially if they lacked insurance or welfare benefits. These women were also less likely to be receiving prenatal care and more likely to anticipate delivery with an untrained attendant (Curry & Brandon, 1986).

#### Congenital Anomalies

Congenital anomalies represent another leading cause of mortality in the neonatal period, accounting for 37% of neonatal deaths in Oregon in 1986 (OSHD, 1986a). Certain anomalies are known to be associated with inherited genetic traits. Others are caused by preventable factors such as maternal alcohol and drug use, and chemical, radiation and infectious agent exposure from the environment. More research needs to be conducted as to the specific causes of these anomalies.

#### Complications

Maternal illnesses during pregnancy, most notably high blood pressure and diabetes, increase the risk of neonatal death. Complications of pregnancy, labor and delivery, including Caesarean

section, are also predisposing factors (Hogue et al., 1987; Institute of Medicine, 1985; Miller, 1985).

### Methodology

In this study, the incidence of neonatal mortality risk factors in Josephine County was viewed from three perspectives: (a) the incidence of specific know risk factors in all live births in Josephine County as compared to the remainder of the state; (b) the incidence of these risk factors in infants who died during the neonatal period in Josephine County as compared to the remainder of the state; and (c) the incidence of risk factors in infants who died during the neonatal period in Josephine County as compared to all other live births in the county.

Data for this report came from OSHD's Center for Health Statistics in two forms. Analysis of maternal and neonatal characteristics in all live births utilized data compiled by the Center for Health Statistics from birth certificates, 1978 through 1987, except as noted (in some cases data were available only for a portion of the 10-year-period). Josephine County births were excluded from state data so that they would not be counted twice.

Second, the Center for Health Statistics creates a matched infant death file, matching birth certificate information with corresponding death certificate information. A copy of this matched infant death file for 1977 through 1986, the most recent years available, was provided by the Center for Health Statistics for analysis in this study. It

contained information about occurrence of risk factors in all resident neonatal deaths.

Comparisons of risk factor incidence in neonatal deaths in Josephine County to all other Josephine County live births utilized data from the matched infant death file and from birth certificate compilations. Because matched infant death files were available only through 1986, this perspective includes data for the years 1978 through 1986.

Only risk factors for which data were available from the Center for Health Statistics were analyzed in this study. Table 1 lists the risk factors used in the report with descriptions of how raw data were categorized.

All comparisons of risk factor incidence were subjected to a chi-square ( $\chi^2$ ) statistical test for significant. Chi square tests the likelihood that the differences observed between groups (i.e., Josephine County vs. the state of Oregon) are the result of chance. A probability of less than 5% ( $p < .05$ ) means that there is greater than a 95% likelihood that the differences observed in the incidence of risk factors is significant and not due to chance. A probability of less than 1% ( $p < 0.01$ ) means that there is greater than a 99% likelihood that the differences between the groups is significant and not due to chance. Stated another way, when  $p < .05$  or  $p < .01$ , there is a statistically significant difference in the incidence of risk factors between comparison groups.

Table 1

Risk Factors Used in this Study and the Comparison Groups

| Risk factor                              | Comparison groups   |
|--|---|
| Maternal age                             | Less than 18 years; 18-34 years; greater than 34 years  |
| Maternal race                            | Caucasian; Black; Native American; other  |
| Marital status                           | Married; unmarried  |
| Maternal education                       | Less than 12 years; 12 or more years  |
| Birth order                              | First through third pregnancy; fourth or later pregnancy  |
| Plurality                                | Singleton; multiple birth (twin, triplet)   |
| Birth weight                             | Less than 1,499 g (3.3 lb); 1,500-2,499 g (3.3-5.5 lb); 2,500-4,499 g (5.5-9.9 lb); greater than 4,500 g (9.9 lb)   |
| Month prenatal care began                | 1st through 6th month; 7th through 9th month (includes no care)   |
| Number of prenatal visits                | Less than 5 visits; 5 or more visits  |
| Inadequate versus adequate prenatal care | Inadequate (beginning after the 6th month and consisting of less than 5 visits); adequate (beginning before the 7th month and consisting of 5 or more visits) |
| Place of delivery                        | Hospital; out of hospital (includes home, office, clinic)   |

(Continued)

Table 1 (Continued)

| Risk factor                | Comparison groups   |
|----------------------------|---|
| Delivery attendant         | Medical (physician, nurse midwife, other medical persons); nonmedical (includes lay midwives) |
| Congenital anomalies       | Yes (present); no (absent)  |
| Caesarean section          | Yes (present); no (absent)  |
| Concurrent illness         | Yes (present); no (absent)  |
| Complications of pregnancy | Yes (present); no (absent)  |
| Complications of delivery  | Yes (present); no (absent)  |

## Results

When comparing all live births, it is noteworthy that Josephine County as compared to the remainder of Oregon experienced a significantly higher incidence rate for most predisposing factors for neonatal mortality. During the 10-year period 1978 through 1987, there were significantly more births to teen-age mothers in Josephine County. Although incidence of maternal race was significantly different, this did not represent increased risk since the county had fewer non-Caucasian births than did the state. Josephine County mothers were more likely than their counterparts in the remainder of the state to be unmarried, less educated, and experiencing their fourth or more pregnancy. Each of these differences was significant at the .01 level (see Table 2).

Incidences of multiple births and birth weights between county and state births were not significantly different, despite the higher incidence of factors in the county which predispose to low birth weight (see Table 3).

During this 10-year-study period, Josephine County pregnant women and their infants received less health care than those throughout the rest of the state. Josephine County women were more likely to begin prenatal care later in the pregnancy and to have fewer prenatal visits. For the period 1981 through 1987, 10.1% of Josephine County women did not receive adequate prenatal care compared to 7.3% statewide (see Table 4).



Table 2

Maternal Age, Race, Marital Status, Education, and Birth Order: All Live Births, Josephine County Compared With the Rest of the State of Oregon, 1978-1987

|                    | Josephine County |      | Oregon   |      | $\chi^2$ |
|--------------------|------------------|------|----------|------|----------|
|                    | <u>n</u>         | %    | <u>n</u> | %    |          |
| Maternal age       |                  |      |          |      |          |
| < 18               | 413              | 5.0  | 15,750   | 4.0  | 20.67*   |
| 18 or older        | 7,901            | 95.0 | 379,969  | 96.0 |          |
| up to 34           | 7,908            | 95.1 | 374,472  | 94.6 | 3.79     |
| > 34               | 406              | 4.9  | 21,247   | 5.4  |          |
| Race               |                  |      |          |      |          |
| Caucasian          | 8032             | 96.4 | 367,252  | 92.8 | 275.69*  |
| Black              | 28               | .3   | 9,635    | 2.4  |          |
| American Indian    | 175              | 2.1  | 6,532    | 1.7  |          |
| Other              | 94               | 1.2  | 12,285   | 3.1  |          |
| Marital status     |                  |      |          |      |          |
| Married            | 6,602            | 79.4 | 329,954  | 83.4 | 92.37*   |
| Unmarried          | 1,712            | 20.6 | 65,765   | 16.6 |          |
| Maternal education |                  |      |          |      |          |
| < 12 years         | 2,059            | 24.7 | 76,881   | 19.4 | 147.55*  |
| 12 or more         | 6,255            | 75.2 | 318,838  | 80.6 |          |
| Birth order        |                  |      |          |      |          |
| 1-3 pregnancy      | 6,543            | 78.7 | 337,607  | 82.8 | 115.34*  |
| 4+ pregnancy       | 1,771            | 21.3 | 68,112   | 17.2 |          |

\* $p < .01$ .

Out-of-hospital births accounted for 15.3% of all births in the county; this was significantly more than the 4.0% experienced by the rest of the state. In addition, nonmedical persons attended 0.8% of

Table 3

Plurality and Birth Weight: All Live Births, Josephine County Compared  
With the Rest of the State of Oregon, 1978-1987

|   | Josephine County |      | Oregon   |      | $\chi^2$ |
|---|------------------|------|----------|------|----------|
|   | <u>n</u>         | %    | <u>n</u> | %    |          |
| Plurality                               |                  |      |          |      |          |
| Multiple birth                          | 146              | 1.7  | 8,077    | 2.0  | 3.31     |
| Singleton                               | 8,168            | 98.2 | 387,642  | 98.0 |          |
| Birth weight<br>(in grams) <sup>a</sup> |                  |      |          |      |          |
| < 1,499                                 | 48               | .7   | 2,697    | .8   | 3.92     |
| 1,500-2,499                             | 276              | 4.2  | 13,381   | 4.2  |          |
| 2,500-4,499                             | 6,071            | 92.8 | 292,558  | 92.3 |          |
| > 4,500                                 | 149              | 2.3  | 8,272    | 2.6  |          |

<sup>a</sup>These data are for the years 1980 through 1987.

Josephine County births, as compared to 0.5% elsewhere in Oregon. This difference also was statistically significant (see Table 5). Josephine County experienced a higher incidence of congenital anomalies as compared to the rest of Oregon as well (see Table 6).

During the years 1984 through 1987, Josephine County pregnant women experienced significantly higher rates of concurrent illness, as well as complications of pregnancy and delivery, than did women throughout the rest of the state (see Table 7).

The second perspective compared the incidence of neonatal mortality risk factors in Josephine County infants who died during their first month of life with neonatal deaths throughout the rest of the state. In

Table 4

Month Care Began, Number of Prenatal Visits, and Adequacy of Prenatal Care: All Live Births, Josephine County Compared With the Rest of the State of Oregon, 1978-1987

|   | Josephine County |      | Oregon   |      | $\chi^2$ |
|---|------------------|------|----------|------|----------|
|   | <u>n</u>         | %    | <u>n</u> | %    |          |
| Month care began                                      |                  |      |          |      |          |
| 1st - 6th   | 7,706            | 93.2 | 376,927  | 95.9 | 140.25** |
| 7th - 9th   | 560              | 6.8  | 16,267   | 4.1  |          |
| Number of prenatal visits <sup>a</sup>                |                  |      |          |      |          |
| < 5   | 223              | 5.7  | 9,628    | 5.0  | 3.87*    |
| 5 or more   | 3,683            | 94.2 | 182,398  | 95.0 |          |
| Adequate versus inadequate prenatal care <sup>b</sup> |                  |      |          |      |          |
| Adequate  | 5,037            | 89.9 | 253,118  | 92.7 | 65.02**  |
| Inadequate  | 566              | 10.1 | 19,834   | 7.3  |          |

<sup>a</sup>These data are for the years 1983-1987. <sup>b</sup>These data are for the years 1981-1987.

\* $p < .05$ . \*\* $p < .01$ .

contrast to comparisons made on all live births, only a few incidence rates were significantly different.

Teen births accounted for a significantly higher proportion of neonatal deaths in Josephine County, 15.6%, as compared with 6.7% statewide. There were no significant differences in the incidences of the risk factors of race, marital status, maternal education, plurality

Table 5

Place of Delivery and Delivery Attendant: All Live Births, Josephine County Compared With the Rest of the State of Oregon, 1978-1987

|                    | Josephine County |      | Oregon   |      | $\chi^2$  |
|--------------------|------------------|------|----------|------|-----------|
|                    | <u>n</u>         | %    | <u>n</u> | %    |           |
| Place of delivery  |                  |      |          |      |           |
| Hospital           | 7,439            | 84.7 | 391,119  | 96.0 | 2,719.84* |
| Out of hospital    | 1,342            | 15.3 | 16,193   | 4.0  |           |
| Delivery attendant |                  |      |          |      |           |
| Medical            | 7,812            | 99.2 | 366,328  | 99.5 | 10.32*    |
| Nonmedical         | 61               | .8   | 1,886    | .5   |           |

\* $p < .01$ .

Table 6

Congenital Anomalies: All Live Births, Josephine County Compared With the Rest of the State of Oregon, 1978-1987

|                      | Josephine County |      | Oregon   |      | $\chi^2$ |
|----------------------|------------------|------|----------|------|----------|
|                      | <u>n</u>         | %    | <u>n</u> | %    |          |
| Congenital anomalies |                  |      |          |      |          |
| Yes                  | 134              | 1.6  | 4,358    | 1.1  | 19.29*   |
| No                   | 8,180            | 98.4 | 391,361  | 98.9 |          |

\* $p < .01$ .

Table 7

Concurrent Illness, Complications of Pregnancy and Delivery: All Live Births, Josephine County Compared With the Rest of the State of Oregon, 1984-1987

|                            | Josephine County |      | Oregon   |      | $\chi^2$ |
|----------------------------|------------------|------|----------|------|----------|
|                            | <u>n</u>         | %    | <u>n</u> | %    |          |
| Concurrent illness         |                  |      |          |      |          |
| Yes                        | 197              | 6.3  | 5,997    | 3.9  | 46.86**  |
| No                         | 2,917            | 93.7 | 147,368  | 96.1 |          |
| Complications of pregnancy |                  |      |          |      |          |
| Yes                        | 261              | 8.4  | 11,223   | 7.3  | 5.08*    |
| No                         | 2,853            | 91.6 | 142,148  | 92.7 |          |
| Complications of delivery  |                  |      |          |      |          |
| Yes                        | 823              | 26.4 | 30,998   | 20.2 | 72.81**  |
| No                         | 2,291            | 73.6 | 122,367  | 79.8 |          |

\* $p < .05$ . \*\* $p < .01$ .

or birth weight among infants who died during the neonatal period (see Table 8).

Women in Josephine County whose infants subsequently died during the neonatal period began prenatal care later in their pregnancy and had fewer numbers of prenatal visits than those throughout Oregon. The differences, however, were not large enough to be statistically significant.

Almost 10% of the county's neonatal deaths were infants born outside the hospital, significantly more than the 3.1% statewide. Also,

Table 8

Maternal Age, Race, Marital Status, Education, Plurality and Birth  
Weight: All Neonatal Deaths, Josephine County Compared With the Rest of  
the State of Oregon, 1977-1986

|                            | Josephine County |      | Oregon   |      | $\chi^2$ |
|----------------------------|------------------|------|----------|------|----------|
|                            | <u>n</u>         | %    | <u>n</u> | %    |          |
| Maternal age               |                  |      |          |      |          |
| < 18                       | 10               | 15.6 | 162      | 6.7  | 7.78*    |
| 18 to 34                   | 51               | 79.7 | 2,144    | 88.3 |          |
| > 34                       | 3                | 4.7  | 123      | 5.0  |          |
| Race                       |                  |      |          |      |          |
| Caucasian                  | 62               | 96.9 | 2,220    | 90.3 | 2.37     |
| Non-Caucasian              | 2                | 3.1  | 237      | 9.7  |          |
| Marital status             |                  |      |          |      |          |
| Married                    | 47               | 73.4 | 1,849    | 76.4 | 0.16     |
| Unmarried                  | 17               | 26.6 | 571      | 23.6 |          |
| Maternal education         |                  |      |          |      |          |
| < 12 years                 | 17               | 27.9 | 571      | 24.5 | 0.19     |
| 12 or more                 | 44               | 72.1 | 1,755    | 75.5 |          |
| Plurality                  |                  |      |          |      |          |
| Multiple                   | 9                | 14.1 | 357      | 14.5 | 0.005    |
| Singleton                  | 55               | 85.9 | 2,099    | 85.5 |          |
| Birth weight<br>(in grams) |                  |      |          |      |          |
| < 1,499                    | 26               | 40.6 | 1,341    | 55.5 | 7.11     |
| 1,500 - 2,499              | 12               | 18.7 | 398      | 16.5 |          |
| 2,500 - 4,499              | 26               | 40.6 | 661      | 27.3 |          |
| > 4,500                    | 0                | 0.0  | 17       | .7   |          |

\*  $p < .05$ .

among Josephine County neonatal deaths, a significantly larger percentage of births were attended by nonmedical persons: 6.2% compared to 1.8% in Oregon.

The rate of congenital anomalies in Josephine County neonatal deaths was 34.9%, whereas for the rest of Oregon, it was 26.5%. Rates for Caesarean section deliveries among neonatal deaths were 15.6% in Josephine County as compared to 16.2% throughout the rest of the state. These rates were not significantly different (see Table 9).

The final perspective from which the problem was viewed compared the incidence of risk factors in Josephine County neonatal deaths with all other live births in the county during the period 1978 through 1986. Chi-square results for those factors having less than 10 subjects in each group should be interpreted with caution, since small numbers reduce the confidence that can be placed on these statistical test results.

Once again, teen births surfaced as a significant risk, disproportionately representing 15.5% of all neonatal deaths but only 4.9% of all births. Caucasian and non-Caucasian rates were similar among live births and neonatal deaths. Mothers who were unmarried and those with less than 12 years of education experienced somewhat higher neonatal death rates; however, these differences were not statistically significant. Multiple births (twins or triplets) were also at significantly increased risk (see Table 10).

Infants whose mothers had four or fewer prenatal visits were more likely to die in the first month of life than those whose mothers had

Table 9

Month Care Began, Number of Visits, Place of Delivery and Delivery Attendant: All Neonatal Deaths, Josephine County Compared With the Rest of the State of Oregon, 1977-1986

|                      | Josephine County |      | Oregon   |      | $\chi^2$ |
|----------------------|------------------|------|----------|------|----------|
|                      | <u>n</u>         | %    | <u>n</u> | %    |          |
| Month care began     |                  |      |          |      |          |
| 1st - 6th            | 55               | 87.3 | 2,112    | 92.0 | 1.25     |
| 7th - 9th            | 8                | 12.7 | 183      | 8.0  |          |
| Number of visits     |                  |      |          |      |          |
| < 5                  | 10               | 16.1 | 608      | 26.8 | 2.98     |
| 5 or more            | 52               | 83.9 | 1,663    | 73.2 |          |
| Place of delivery    |                  |      |          |      |          |
| Hospital             | 57               | 90.4 | 2,356    | 96.9 | 6.50*    |
| Out of hospital      | 6                | 9.6  | 73       | 3.1  |          |
| Delivery attendant   |                  |      |          |      |          |
| Medical              | 60               | 93.8 | 2,387    | 98.2 | 6.82*    |
| Nonmedical           | 4                | 6.2  | 43       | 1.8  |          |
| Congenital anomalies |                  |      |          |      |          |
| Yes                  | 22               | 34.9 | 634      | 26.5 | 1.81     |
| No                   | 41               | 65.1 | 1,759    | 73.5 |          |
| Caesarean section    |                  |      |          |      |          |
| Yes                  | 10               | 15.6 | 397      | 16.2 | 0.003    |
| No                   | 54               | 84.4 | 2,060    | 83.8 |          |

\* $p < .05$ .

more than four visits. This represented a statistically significant difference. While 6.2% of all women who gave birth began prenatal care late in the pregnancy, 10.5% of the women whose babies subsequently died



Table 10

Maternal Age, Race, Marital Status, Maternal Education and Plurality:  
Josephine County, Neonatal Deaths Compared With all Other Live Births,  
1978-1986

|                                  | Josephine County |      | Oregon   |      | $\chi^2$ |
|----------------------------------|------------------|------|----------|------|----------|
|                                  | <u>n</u>         | %    | <u>n</u> | %    |          |
| Maternal age                     |                  |      |          |      |          |
| < 18                             | 9                | 15.5 | 365      | 4.9  | 13.64*   |
| 18 to 34                         | 47               | 81.5 | 6,757    | 90.6 |          |
| > 34                             | 2                | 3.5  | 332      | 4.5  |          |
| Race                             |                  |      |          |      |          |
| Caucasian                        | 56               | 96.5 | 7,198    | 96.4 | 0.008    |
| Non-Caucasian                    | 2                | 3.5  | 271      | 3.6  |          |
| Marital status                   |                  |      |          |      |          |
| Married                          | 42               | 72.4 | 5,967    | 80.1 | 2.07     |
| Unmarried                        | 16               | 27.6 | 1,487    | 19.9 |          |
| Maternal education<br>(in years) |                  |      |          |      |          |
| < 12                             | 16               | 28.6 | 1,793    | 24.0 | 0.65     |
| 12 or more                       | 40               | 71.4 | 5,663    | 76.0 |          |
| Plurality                        |                  |      |          |      |          |
| Multiple birth                   | 8                | 13.8 | 118      | 1.6  | 57.25*   |
| Singleton                        | 50               | 86.2 | 7,336    | 98.4 |          |

\* $p < .01$ .

began late prenatal care. However, this difference was not statistically significant (see Table 11).

Congenital anomalies were reported in 36.8% of all neonatal deaths in Josephine County between 1978 and 1986, compared with 1.3% of live

Table 11

Month Care Began and Number of Prenatal Visits: Josephine County,  
Neonatal Deaths Compared With all Other Live Births, 1978-1986

|  | Josephine County |      | Oregon   |      | $\chi^2$ |
|--|------------------|------|----------|------|----------|
|  | <u>n</u>         | %    | <u>n</u> | %    |          |
| Number of prenatal visits <sup>a</sup> |                  |      |          |      |          |
| < 5                                    | 4                | 15.4 | 150      | 4.9  | 4.91*    |
| 5 or more                              | 22               | 84.6 | 2,937    | 95.1 |          |
| Month care began                       |                  |      |          |      |          |
| 1st - 6th                              | 51               | 89.5 | 6,992    | 93.8 | 1.88     |
| 7th - 9th                              | 6                | 10.5 | 463      | 6.2  |          |

<sup>a</sup>These data are for the years 1983-1986.

\* $p < .05$ .

births in the county for the same period. These differences in incidence rates were significant (see Table 12).

In summary, each of the three perspectives in this study yielded somewhat different results. Maternal age (i.e., teen mothers) remains the only comparison group with significant differences across all three perspectives. Number of prenatal visits and congenital anomalies were significantly different for two of three perspectives. Place of delivery and delivery attendant were significantly different for two perspectives as well, but were not tested for the third due to insufficient data. Table 13 summarizes the results by highlighting significantly different results.

Table 12

Congenital Anomalies: Josephine County, Neonatal Deaths Compared With  
all Other Live Births, 1978-1986

|                      | Josephine County |      | Oregon   |      | $\chi^2$ |
|----------------------|------------------|------|----------|------|----------|
|                      | <u>n</u>         | %    | <u>n</u> | %    |          |
| Congenital anomalies |                  |      |          |      |          |
| Yes                  | 21               | 36.8 | 98       | 1.3  | 459.52*  |
| No                   | 36               | 63.2 | 7,357    | 98.7 |          |

\* $p < .01$ .

#### Discussion

Each of the three study perspectives yielded somewhat differing results. One reason for this was that data were not available to test each risk factor from all three perspectives. For example, place of delivery and delivery attendant were significantly different from two perspectives but could not be tested for the third. Data concerning adequacy of care, concurrent illness and complications were only available for live births.

Results also varied between perspectives based on the composition of comparison groups. While significant differences were found for 13 risk factors in live births, there were only 3 significant differences among neonatal deaths. A possible explanation is that infants who died in their first month of life elsewhere in Oregon had the same high rates of risk predisposing to neonatal death as did Josephine County neonatal

Table 13

Summary Table of Significant Results

| Risk factor                | Live Births | Neonatal Deaths | County Births/Deaths |
|----------------------------|-------------|-----------------|----------------------|
| Maternal age               | +           | +               | +                    |
| Maternal race <sup>a</sup> | +           | 0               | 0                    |
| Marital status             | +           | 0               | 0                    |
| Maternal education         | +           | 0               | 0                    |
| Birth order                | +           | -               | -                    |
| Plurality                  | 0           | 0               | +                    |
| Birth weight               | 0           | 0               | -                    |
| Month care began           | +           | 0               | 0                    |
| Number prenatal visits     | +           | 0               | +                    |
| Adequacy of care           | +           | -               | -                    |
| Place of delivery          | +           | +               | -                    |
| Delivery attendant         | +           | +               | -                    |
| Congenital anomalies       | +           | 0               | +                    |
| Caesarean section          | -           | 0               | -                    |
| Concurrent illness         | +           | -               | -                    |
| Complications of pregnancy | +           | -               | -                    |
| Complications of delivery  | +           | -               | -                    |

Note. + = significant result; 0 = nonsignificant result; - = not tested.

<sup>a</sup>Significantly lower incidence of this risk factor indicated.

deaths. What apparently distinguished Josephine County's experience was that a greater proportion of its live births were in the high-risk group. When examining from the third perspective, the incidence of risk factors in Josephine County live births compared to neonatal deaths, fewer incidence rates were significantly different, perhaps because rates in county live births were already so high.

A third reason for variation among perspectives was the difference in the size of comparison groups. Live birth comparisons included more than 400,000 births, whereas neonatal deaths totaled about 3,000 with some subgroups less than 10. Greater confidence can be placed in comparisons with larger numbers of subjects.

This study utilized OSHD's definition of adequate prenatal care (i.e., care beginning before the seventh month and consisting of five or more visits). Therefore, comparison groups for "month prenatal care began" were 1st through 6th month and 7th through 9th month. In order to improve outcomes, prenatal care optimally begins in the first 3 months of pregnancy, especially in cases of high risk. A criteria of adequate care beginning in the first 3 months would have been a more sensitive measure of adequacy of care and its effect on improving neonatal health.

Data failed to show a significant difference in birth weights among live births in Josephine County and the rest of Oregon, despite the higher incidence in the county of many factors which predispose to low birth weight. This similarity in birth weights may in part be a result of high enrollment among pregnant women in the WIC supplemental

nutrition program. In addition, within the county there are many social service agencies to assist pregnant women with meeting basic needs such as housing and nutrition. These services, as well as the access many women have to home grown produce and game meat, may have positively affected birth weights in the county.

Josephine County women experienced higher incidences than the rest of Oregon for many neonatal mortality risk factors. County women were more likely to be young, unmarried, less educated, and experiencing their fourth or greater pregnancy. They were more likely than their counterparts throughout the state to have a concurrent illness, an infant with a congenital anomaly, or complications of pregnancy and delivery. Yet these same high-risk women were less likely to receive adequate prenatal care, and more likely to deliver outside of a hospital with a nonmedical attendant. This presents a particular hazard, as high-risk pregnancies need intensive health care services to improve outcomes.

#### Recommendations

The health of newborns in our community will be improved and neonatal death rates reduced by a decrease in the incidence of neonatal mortality risk factors. This decrease can be accomplished for many of the risk factors cited in this study by a coordinated community response. Intensification of existing efforts or development and implementation of new strategies will positively impact on the problem. Specific recommendations include:

1. Multiagency coordinated efforts to reduce the incidence of teen-age pregnancy. Contributing agencies should include area schools, PTAs, public health nurses, local church and civic organizations, and Planned Parenthood.

2. Recent efforts, most notably the Student Retention Initiative, have focused on encouraging young people to finish their high school education. These efforts should be increased, with special attention to pregnant teens who are at exceptional risk of not completing high school.

3. Improve access for all pregnant women to prenatal care services beginning early in pregnancy. A previous study identified the troublesome financial and transportation barriers which many Josephine County women experience (Adams, 1988). These factors should be considered when strategies are devised to improve access to care.

4. Intensive efforts are needed to educate the public regarding the importance of obtaining early prenatal care.

5. The Oregon State Health Division should reexamine its definition of adequate prenatal care based on the preponderance of literature that prenatal care should begin within the first 3 months of pregnancy. A revised definition would be a more sensitive measure of the efficacy of prenatal care in affecting outcomes.

6. A hospital delivery should be available to any women who desire that option, regardless of financial status. Research is needed to identify why so many women in Josephine County choose an out-of-hospital delivery.

7. Further research into Josephine County's excessive rate of congenital anomalies is needed to explore for predisposing factors including drug and alcohol use.

8. Josephine County women experienced excessive illness and complications associated with their pregnancies. More research should be done to determine their cause.

#### Limitations of the Study

Two limitations of the study will be described. First, certain risk factors for neonatal mortality were not included because they were not part of the data set available from the Oregon State Health Division. Most notably, these include socioeconomic factors such as low income, poor housing and sanitation. In addition, maternal life-style practices that have a significant impact on pregnancy outcomes, including diet, smoking, stress, and drug and alcohol use, were not included. Inferences about the prevalence of these factors can be drawn from county population data; however, no data were available about their incidence in childbearing women in Josephine County.

Second, when comparing risk factors among neonatal deaths, small numbers of infants in some groups limited the reliability of the results. Larger sample groups with at least 10 subjects in each group would have increased the confidence that could be placed in the results.



### Summary

This study examined the incidence in Josephine County of certain risk factors known to be associated with increased neonatal mortality. Josephine County had a significantly higher incidence of many of these risk factors as compared to the rest of Oregon. The problem of neonatal deaths in Josephine County is a serious and long-standing one. Reversing the trend of excessive deaths will require extraordinary measures by a community responsive to the value of human life.

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AN ABSTRACT OF THE MASTERS RESEARCH PROJECT OF  
VIRGINIA ADAMS, R.N., B.S.N.

For the MASTER OF NURSING

Date of Receiving this Degree:

TITLE: NEONATAL MORTALITY IN JOSEPHINE COUNTY AS COMPARED TO THE STATE  
OF OREGON, 1978 THROUGH 1987

APPROVED:

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Cecelia F. Capuzzi, Ph.D., Associate Professor, Advisor

Josephine County, in rural southwestern Oregon, experienced an excessively high neonatal (under 28 days) death rate as compared to the state of Oregon during the 10-year period 1978-1987. Compared to the state's neonatal mortality rate of 6.4 deaths per 1,000 live births, Josephine County's rate of 8.6 was 33% higher.

Utilizing data compiled from birth and death certificates by the Oregon State Health Division, this retrospective study examined the incidence of 17 selected known risk factors for neonatal mortality in Josephine County. Among these were maternal age, race, marital status, education, congenital anomalies, prenatal care, complications of pregnancy and delivery, place of birth and delivery attendant. Incidence of risk factors in the county was viewed from three perspectives: (a) all live births, Josephine County residents compared to the rest of the state; (b) all neonatal deaths, Josephine County residents compared to the rest of the state; and (c) Josephine County neonatal deaths compared to all other live births in the county.

Data indicated that increased incidence of many risk factors predisposed to excessive neonatal mortality in Josephine County. Among live births, Josephine County experienced incidence rates significantly higher than the rest of Oregon for 13 of 16 predisposing factors tested.

These included: maternal age, marital status, education, number of prenatal visits, month care began, adequacy of prenatal care, place of delivery, delivery attendant, concurrent illness, complications of pregnancy or delivery, birth order and congenital anomalies.

Infants who died during their first month of life experienced similar high incidence of risk factors independent of place of resident. Maternal age, place of delivery and delivery attendant were the only risk factors with significantly different incidences among neonatal deaths.

Comparison of neonatal deaths to all other live births revealed significant differences in four of eight predisposing factors studied. These were: maternal age, plurality, number of prenatal visits, and congenital anomalies.

## Executive Summary

Title: Neonatal Mortality in Josephine County Compared to the State of Oregon, 1978 Through 1987

Author: Ginny Adams, RN, MSN, Public Health Nurse

Josephine County experienced an excessively high neonatal (under 28 days) death rate as compared to the rest of the state during the most recent 10-year period, 1978-1987. Compared to Oregon's neonatal mortality rate of 6.4 deaths per 1,000 live births, Josephine County's rate of 8.6 was 33% higher.

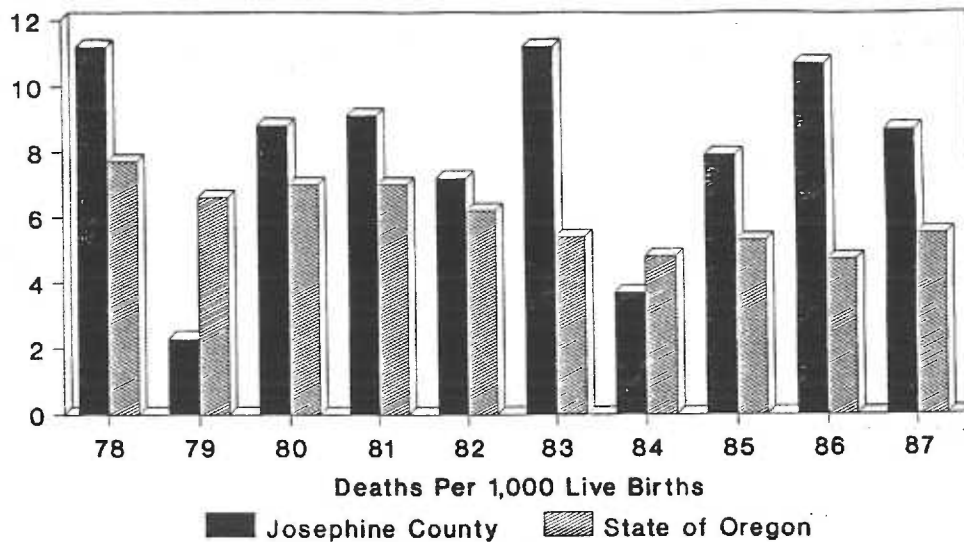


Figure 1. Neonatal death rates, Josephine County and the state of Oregon: 1978-1987.

Utilizing data compiled from birth and death certificates by the Oregon State Health Division's Center for Health Statistics, this study examined the incidence of 17 selected known risk factors for neonatal mortality in Josephine County. Among these were maternal age, race, marital status, education, congenital anomalies (birth defects), prenatal care, complications of pregnancy and delivery, place of birth and delivery attendant. Incidence of these risk factors in the county was viewed from three perspectives:

1. All live births, Josephine County residents compared to the rest of the state.
2. All neonatal deaths, Josephine County residents compared to the rest of the state.
3. Josephine County neonatal deaths compared to all other lives births in the county.

Among live births, Josephine County experienced incidence rates significantly higher than the rest of Oregon for 13 of 16 predisposing

factors tested. These included: maternal age, marital status, education, number of prenatal visits, month care began, adequacy of prenatal care, place of delivery, delivery attendant, concurrent illness, complications of pregnancy or delivery, birth order, and congenital anomalies.

The increased incidence of many risk factors predisposes to excessive neonatal mortality in Josephine County. Improvement will require community interventions aimed at decreasing the incidence of predisposing factors. Specific recommendations include:

- Improved access for all pregnant women to prenatal care services beginning early in pregnancy.
- Multiagency coordinated efforts to reduce the incidence of teen-age pregnancy.
- Availability of hospital delivery option for all women regardless of their financial status.
- Additional research to determine why Josephine County women experienced excessive illness and complications associated with their pregnancies.
- An intensification of efforts to encourage young people to complete high school, especially pregnant teens.
- Further research into Josephine County's excessive rate of congenital anomalies to explore for predisposing factors, including drug and alcohol use.