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by

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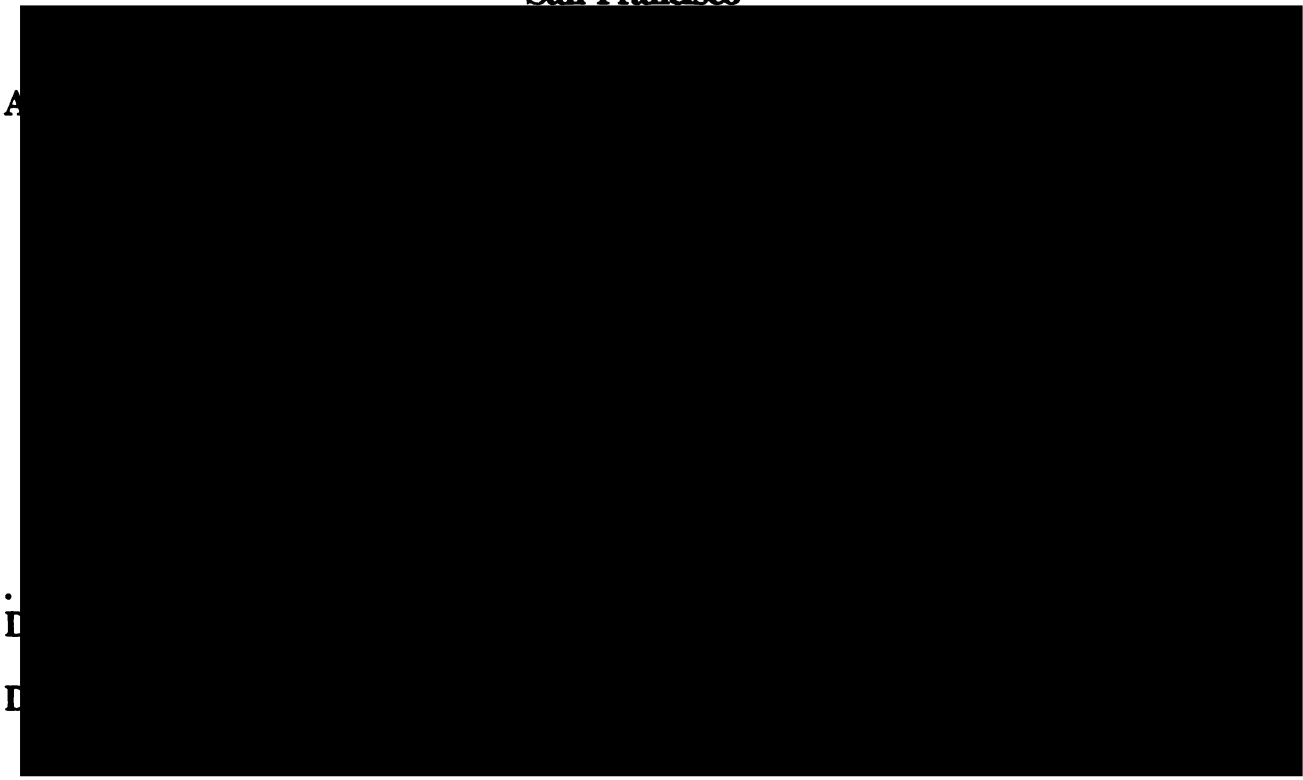
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Factors Associated With Rates of Adverse Pregnancy Outcomes Among Latinas in

Northern Sonoma County

Lynette Landry RN, BSN

Abstract

The goal of this historical cohort study was to determine the rates of adverse pregnancy outcomes among a largely Latino population in northern Sonoma County. Many Latinos are employed in agriculture, especially vineyards and orchards, in Sonoma County and exposure to pesticides can adversely effect pregnancy outcomes. This descriptive analysis of pregnancy outcomes of 151 women seeking care at a rural health clinic in northern Sonoma County included a review of medical records for all women who had a positive pregnancy test or received care for a spontaneous abortion. Demographic data, pertinent health and obstetric health data and pregnancies outcomes were analyzed. Rates of spontaneous abortion, fetal demise and congenital anomaly were compared to rates from the general population of Sonoma County. This study cohort had rates of spontaneous abortion and congenital anomaly well within or below the rates of the general population. Study participants had a rate of congenital anomalies of 9.9 per 1000 compared to an estimated rate, within California, of 27.8 per 1000 live births for Latinas. The rate of spontaneous abortions, within this cohort, was 11.9% which falls within the estimated range of 10 - 20% of all pregnancies. No fetal demises were recorded among study participants during the study period. Number of prenatal visits (OR = 2.6, 95% CI 1.1 - 6.2) and having a history of gynecological problems (OR = 2.6, 95% CI 1.0 - 6.8) were significant indicators for adverse pregnancy outcome. This study corroborates the findings of previous studies that have shown that Latinas, especially Mexican-born women and particularly recent immigrants who have been in the country less than 5 years, have positive pregnancy outcomes nearly equal to that of non-Hispanic whites, despite the presence of many known risk factors for adverse pregnancy outcomes. Small sample size

and the quality of the medical records may have limited the ability to detect a relationship to known pregnancy risk factors and adverse pregnancy outcomes.

Infant mortality is a commonly used indicator of a community's health. In 1994, the infant mortality rate of the United States was 8.0 per 1000 live births (Population Reference Bureau, 1995). There are a myriad of factors that can contribute to the death of an infant including low birth weight, congenital anomaly and infectious disease. Congenital anomalies are the second leading cause of infant mortality, in the United States, following low birth weight (Swartz, 1990; Dollfus, Patetta, Siegel & Cross, 1990) and are the leading cause of death in children until age four in industrialized countries (Penchaszadeh, 1994). There are approximately 170,000 children born in California each year with structural malformations (Croen, Shaw, Jensvold & Harris, 1991). While this number represents 2 - 5% of all births, these malformations account for approximately 20 - 30% of all pediatric hospitalizations (Powell-Griner & Woolbright, 1990; Keleher, 1991; Penchaszadeh, 1994). Moreover, an estimated 5.7% of stillbirths have major congenital anomalies (Copper, Goldenberg, DuBard, Davis & the Collaborative Group on Preterm Birth Prevention, 1994).

Spontaneous abortion is a frequently occurring pregnancy outcome that is not included in the calculation of the infant mortality rate. The estimated incidence rates of spontaneous abortion range from 10% - 20% of all live births (Chaudhuri, 1986, Keleher, 1991). Ascertaining definite rates of spontaneous abortion within a population is difficult because one-third of all spontaneous abortions occur before the second missed menstrual period and are not identified by either the woman experiencing the abortion or health care practitioners (Wilcox, 1983). Further, 30 - 60% of spontaneous abortions are associated with congenital anomalies of the fetus (Chaudhuri, 1986; Dejmek, Vojtassak & Malova, 1992; McDonald, Armstrong, Cherry, Delorme, Diodati-Nolin, McDonald & Robert, 1986). Spontaneous abortions may be an important reproductive health indicator although they are difficult to enumerate and evaluate because of the high percentage that are not identified as occurring.

This paper will identify the risk factors for adverse pregnancy outcomes among Latinas in Northern Sonoma County. The infant mortality rate is disproportionately high among minority populations within the United States. Latinas and African Americans had infant mortality rates in 1989 of 8.5 and 18.5 respectively, compared to 7.9 for non-Hispanic Whites (Giachello, 1994). The leading causes of death for Latino infants are congenital anomalies, respiratory distress syndrome and maternal/fetal perinatal conditions (Giachello, 1994). The spontaneous abortion rate for Latinas reported in the Hispanic Health and Nutrition Examination Survey (HHANES) 1982 - 1984 was 12.7% (Guendelman, Gould, Hudes & Eskenazi, 1990) compared with the estimated incidence rate for all pregnancies of 10 - 20% (Chaudhuri, 1986; Keleher, 1991).

Farmworkers, in California who are predominately Latino, are a subgroup whose occupation may put them at increased risk of experiencing an adverse pregnancy outcome. Research on the effects of pesticides has focused on acute toxicity with few studies evaluating the long term effects on reproductive health. Moreover, few studies have been done on the pregnancy outcomes of Latinas who work in the fields or who have significant others who are farmworkers. Farmworkers and their families can be exposed to high doses of pesticides by several methods; soil, drift from aerosol application, residues on leaf surfaces and crops, and inadequate protection during the application process (Ciesielski, Loomis, Mims & Auer, 1994). Often these workers lack simple toileting facilities and are unable to bathe after work or to launder contaminated clothing properly (Laughlin, 1993; Nelson, Laughlin, Kim, Rigakis, Raheel, & Scholten, 1992). These poor conditions increase the likelihood of exposure for family members to significant levels of pesticides (Moses, Johnson, Anger, Burse, Horstman, Jackson, Lewis, Maddy, McConnell, Meggs & Zahm, 1993). Even after laundering there can be enough pesticide residue, 1% - 42% of the original amount, on clothing to kill insects and contribute to the morbidity and mortality of adult males (Nelson, et al, 1992). Adequate protection from

pesticide exposures may have a significant impact on pregnancy outcomes in high risk groups, especially farmworkers and their significant others.

Review of the Literature: Risk Factors for Adverse Pregnancy Outcomes

Sociodemographics Sociodemographic factors that are considered to place mother and infant at high risk for adverse pregnancy outcomes include: age (Copper, et al, 1994), marital status (Curry, 1990; Grimes, 1994), educational status (Balcazar, Cole and Hartner, 1992; McDonald, et al, 1986) and occupation (Keleher, 1991). Researchers have used an educational attainment level of less than 12 years as a risk factor for increased infant mortality (Dollfus, Patetta, Siegel & Cross, 1990; Tyson, Guzick, Rosenfeld, Lasky, Gant, Jiminez & Heartwell, 1990; Swartz, 1990), but among Latinas, Balcazar, Cole and Hartner (1992) related that women who had less than nine years of formal education were at increased risk of adverse pregnancy outcomes. Maternal age can have a significant impact on a pregnancy. Baldwin, Raine, Jenkins, Hart & Rosenblatt (1994), classified women age 18 years to 34 years as low risk obstetric patients. Even when controlling for race, ethnicity and educational attainment, single women are three times less likely to receive adequate prenatal care than married women (Curry, 1990).

Maternal Medical Risk Factors Many studies have analyzed the association between maternal medical risk factors and adverse pregnancy outcomes. Maternal medical risk factors thought to put the infant at risk include hypertension (Thomas, Horner, McCaleb & Shepherd, 1991), diabetes (Buchanan & Kitzmiller, 1994; Greene, 1993), anemia (Bharati & Basu, 1990), thyroid disease (Leung, Millar, Kooinings, Montoro, & Mestman, 1993), cancer, hepatitis B, or renal disease (Cunningham, Cox, Harstad, Mason and Pritchard, 1990; Abe, 1991). Copper, et. al. (1994) however, found that few fetal deaths could be attributed to maternal medical conditions. Most studies indicate that even if a woman has a chronic medical condition that is a risk factor for adverse pregnancy outcomes, if the woman has adequate prenatal care during the pregnancy the risk for an adverse outcome approaches that of the general population.

Lifestyle Practices Maternal and paternal lifestyle practices that are known to put the fetus at risk include smoking (Copper, et. al., 1994; Savitz, Schwingl & Keels, 1991), alcohol consumption (Parazzini, Tozzi, Chatenoud, Restelli, Luchini & La Vecchia, 1994), intravenous drug use and multiple sex partners. Czeizel, Kodaj and Lenz (1994) found that women who smoked during pregnancy were 1.5 times more likely than women who did not smoke to have an infant with a terminal transverse limb deficiency and that maternal smoking was an indicator for increased rates of infant mortality and spontaneous abortion. In contrast, Pradat (1993) could find no correlation between maternal smoking and congenital heart defects. Armstrong, McDonald and Sloan (1992) reported that the odds ratio for spontaneous abortion increased with increased consumption of cigarettes or alcohol, indicating that the more a woman smokes or drinks the greater her risk of spontaneous abortion.

Gynecologic History Evidence is not clear or conclusive regarding the role a woman's gynecologic history has in influencing pregnancy outcomes. Certain gynecologic problems and sexually transmitted diseases have been linked to adverse pregnancy outcomes. Infection by sexually transmitted diseases can cause cervical cell dysplagia resulting in the need for excision; cone biopsy can jeopardize infant health as well as maternal well-being. Further, having multiple sex partners increases the risk of contracting sexually transmitted diseases, which, as in the case of the herpes simplex virus, can cause increased rates of congenital anomaly and spontaneous abortion (Minkoff, 1991). By contrast, Coste, Job-Spira and Fernandez (1991) detected no association between prior sexually transmitted diseases, chlamydia or pelvic inflammatory disease and increased rates of spontaneous abortion.

Obstetric History A woman's obstetric history may play a role in subsequent pregnancies and their outcomes. Several researchers have observed a significant relationship between history of spontaneous abortion and risk of having ensuing spontaneous abortions (Aschengrau, Zierler & Cohen, 1989). Women who have had repeated pregnancy losses

are at increased risk of preterm delivery, small for gestational age infants, low birth weight infants, congenital anomaly and perinatal mortality (Hughes, Hamilton & Tulandi, 1991). Increased parity places both the mother and infant at increased risk of morbidity and mortality (McDonald, et al, 1986). Several studies have shown an increase in rates of congenital anomaly with increasing parity (Verma, Chhatwal and Singh, 1991; Sipila, von Wendt & Hartikainen-Sorri, 1990). Baldwin, et al. (1994) considered parity of less than four an indicator that the woman is a low risk obstetric patient.

Prenatal Care Lack of prenatal care has been implicated in increased rates of perinatal mortality. Women who receive no prenatal care are three times more likely to have a low birth weight infant and/or an infant who dies before its first birthday (Machala & Miner, 1991). Malloy, Kao and Lee (1992) in analyzing pregnancy outcomes, found that the risk of fetal demise or infant death increased progressively, depending on when prenatal care was initiated, from a low of 0.6% for those women who entered prenatal care at 1 to 4 weeks compared to 2.96% for those who received no prenatal care.

Pesticides Few studies have analyzed the effects of pesticide exposure on the reproductive health of farmworkers. Further, results of the various exposure studies have provided inconclusive evidence of the effects of exposure on pregnancy outcomes (Olshan & Faustman, 1993). Difficulties in linking pregnancy outcomes with pesticide exposures are the result of the multiple factors that can influence a woman's reproductive health as well as the properties of the pesticide. An agent must be teratogenic to humans, exposure must occur at a sensitive period during organogenesis and the risk of teratogenesis is often dose dependent (Cordero, 1990). Occupational health studies have indicated that exposure to environmental toxins, specifically pesticides, increases the incidence rates of spontaneous abortion (Keleher, 1991). Studies evaluated by Willis, de Peyster, Molgaard, Walker & MacKendrick (1993) indicated that farmworkers have an increased risk of fetal demise secondary to either maternal or paternal pesticide exposure. Geschwind, Stolwijk, Bracken, Fitzgerald, Stark, Olsen & Melius (1992) report that exposure to pesticides is

associated with an increased incidence of clefts and musculoskeletal defects. In a study of 2036 couples, Rupa, Reddy & Reddi (1991) reported that infants of males who were exposed to pesticides while working in cotton fields there were significantly higher rates of congenital anomaly, spontaneous abortion, fetal demise and neonatal death, than among control group infants. Savitz, Whelan and Kleckner (1989), however found no correlation between employment as a farmworker and increased incidence of congenital anomaly, although exposure to pesticides was found to have a weak association with preterm delivery and fetal demise. Likewise, Grether, Harris, Neutra and Kizer (1987) were unable to find an association between aerial application of Malathion and the occurrence of congenital anomalies. There are few studies that have analyzed the exposure of women who have a relationship with someone who works with and/or around pesticides. Additionally, there is little data on the reproductive risks of women who work in the fields themselves.

Purpose of the Study

The purpose of the study was to describe the sociodemographic characteristics and pregnancy outcomes of Latina women who attend a rural primary care clinic for prenatal care, in northern Sonoma County. A high proportion of the population served by the clinic are farmworkers. The study was designed to investigate whether or not the population was at increased risk for adverse pregnancy outcomes secondary to potential pesticide exposure as indicated by employment of self or significant other as a farmworker. Further, examination of the rates of adverse pregnancy outcomes was done to determine if clinic attendees had higher rates of congenital anomaly and spontaneous abortion than would be expected. Finally, data were to be analyzed in order to describe the risk factors for adverse pregnancy outcomes within the study group.

Significance Examination of pesticide exposure risk, using farmwork as a proxy for degree of exposure while controlling for other known risk factors for adverse pregnancy outcomes, may clarify the role of pesticide exposure in adverse pregnancy outcomes and

identify farmworkers and their significant others as a high risk obstetric group. Additionally, policy and legislative changes to improve regulations and laws around pesticide use can be influenced by clarifying the role of pesticides in the occurrence of spontaneous abortions and congenital anomalies.

Study Questions The study questions were:

1) What are the characteristics and pregnancy outcomes of the women who attended a rural primary care clinic in northern Sonoma County, during the calendar year 1994?

2) Is occupation of self or significant other as a farmworker a predictor of adverse pregnancy outcomes among clinic attendees, while controlling for sociodemographic and other known and suspected risk factors?

3) Are the rates of adverse pregnancy outcomes among clinic attendees during 1994 higher than would be expected, based on a comparison with the rates of adverse pregnancy outcomes for the general population of Sonoma County?

Methods

Sample This retrospective cohort study examined the medical records of all the obstetric patients for the calendar year 1994 seen at a rural primary care clinic which serves the Latino population of northern Sonoma County. Records of patients included in the sample were reviewed by the author during 1995, using a standardized data collection tool developed by the author. Content validity of the data collection tool was determined by review of the instrument by a panel of expert nurse researchers from the University of California, San Francisco. Of 255 women who were obstetric patients in 1994, 62 were excluded because prenatal care was initiated at another locality and no prenatal records from that locality were available and 20 were excluded because prenatal care was initiated at the primary care clinic but then care was transferred to another care provider for any reason. Additionally, 12 women were excluded because the woman had a positive pregnancy test but then underwent a therapeutic abortion and 10 were excluded because data on the infant was missing. The final sample included 151 subjects.

Setting Sonoma County, with a population of 432,222 (Sonoma County Planning

Commission, 1996), is approximately 40 miles north of San Francisco. The clinic is

located in a town with a population of approximately 9788 (McCoy, 1996), in a primarily

agricultural area of the county. The clinic serves the indigent population of the northern

portion of the county and because it is the only clinic in the area that employs bilingual

staff, the majority of patients are Latino. A large portion of the patients of the clinic are

employed as farmworkers. The clinic serves approximately 1000 to 1500 people per year.

Many of the patients seen at the clinic receive infrequent medical care either because of their

immigration status or because they are migrant workers. In addition to family practice

physicians, patients may be seen by either a physician's assistant or a certified nurse

midwife. Most of the women deliver at either of two hospitals, in the county, that accept

MediCal (California's Medicaid program) patients. MediCal provides health care services

to those persons at 200% of the poverty level or below and is administered by the State of

California with funding provided by both the State and Federal governments.

Procedure Medical records were identified for review using several techniques. A

computer based billing system was established in 1994. All clients billed for an initial

obstetric visit, a pregnancy test, labor and delivery services and any patient with a

diagnostic code of spontaneous abortion during the year were included for review. Women

who entered care prior to the implementation of the computer based billing system, a

manual review of all records was done. Using this method, mothers were identified if

there was a chart for an infant born in 1994 with a chart number that corresponded to that

of the woman.

Data collected on the mother included sociodemographics, lifestyle practices, maternal

medical risk factors, obstetric history, prenatal care received and pregnancy outcome.

Sociodemographic data collected included: age, marital status, highest level of education

completed, birth place, occupation and occupation of partner. Specific obstetric factors

considered included: obstetric history and patient's, patient's family and partner's health

histories from information gathered during the intake process for the Comprehensive Perinatal Services Program (CPSP). Data collected for the pregnancy under study included: date prenatal care began, estimated gestational age of the baby at the beginning of care, total number of prenatal visits, and specific lab values for anemia. Pregnancy outcomes considered included normal infant, spontaneous abortion, fetal demise and congenital anomaly.

Data collected on the infant included the presence or absence of a congenital anomaly. The record was reviewed for a period of up to one year after delivery. A normal infant was defined as having no anomalies noted in the medical record by age 1 year. Congenital anomaly was determined using the guidelines established by the California Birth Defects Monitoring Program based on reportable ICD9-CM codes (California Birth Defects Monitoring Program , 1994). Congenital anomalies included defects of the central nervous system, craniofacial anomalies, cardiac, gastrointestinal, genitourinary and musculoskeletal defects. Fetal demise was considered to be any birth at $\geq$ 20 weeks with APGAR scores of 0 at 1 minute and at 5 minutes. Spontaneous abortion was the loss of the conceptus before 20 weeks, as determined by serial serum hCG levels.

Data about the rates of adverse pregnancy outcomes among general population of Sonoma County were collected from the Sonoma County Public Health Department, which tracks the total number of live births/year, the total number of fetal deaths/year. Estimates of the incidence of spontaneous abortion, for the general population were derived from an extensive review of the literature. The prevalence rate of congenital anomalies for the county were obtained from data collected by the California Birth Defects Monitoring Program during the period 1985 to 1990, when data were collected from all California counties. Since 1990, data are available from only 11 counties in the state not including Sonoma County and because there is no official reporting requirement for congenital anomalies, more current rates were not available for comparison (California Birth Defects Monitoring Program , 1994).

Approval for the study was obtained from the Committee on Human Research of the University of California, San Francisco and from the medical staff and clinic employees of the rural primary care clinic.

Analysis Data were grouped for analysis based on risk factors identified from previous research. Age was calculated as of December 31, 1994. Farmwork was considered as present (self or significant other) or absent. Risk factors were stratified into dichotomized variables, grouping subjects with risk factors present for adverse pregnancy outcomes into the high risk category for each variable and subjects with risk factors absent for adverse pregnancy outcomes into the low risk category for each variable (Table 1).

Data were entered into a database contained within SPSS, Chicago, IL. Statistical analysis was done at the completion of data collection. Statistical analysis included frequencies and cross tabulations of descriptive data. Independent variables, including age, parity, education, birth place and occupation were examined using bivariate analysis of association with pregnancy outcomes.

Chi square analysis ($\alpha = 0.05$) was done to determine if there was a correlation between the presence of any of the independent variables and adverse pregnancy outcomes. If any variable was found to be significant in bivariate analysis, it was entered into logistic regression to evaluate the role of confounding between the variables and analyze the magnitude of effect of the independent variables on the dependent variable.

The sample was described in terms of farmwork, present or absent. Independent variables, those factors which can influence pregnancy outcomes were described in terms of the pregnancy outcomes of the sample. Fetal death rate of the population of Sonoma County were calculated using the standard formula: the number of fetal deaths divided by total number of births of the same period plus the number of fetal deaths multiplied by 1000.

<u>Results</u>

Description of the Study Sample

Sociodemographics There were a total of 151 subjects included in the study. The mean age of study participants was 26.5 years (S. D. = 6.8). Twelve (7.9%) of the women were less than 19 years old and 25 (17.9%) were 34 years old or older. The women had a mean education level of 7.98 (S. D. = 3.32) years, with 77.1% (n = 108) having completed less than 12 years of education. All but one of the foreign-born women (n = 125) were born in Mexico. Five of the women (3.3%) reported their occupation as farmworker, while 53 reported that their significant other was a farmworker for a total of 54 (35.8%) subjects who were associated with farmwork.

Women born outside the United States were 12 times as likely to be farmworkers or have a significant other who was employed as a farmworker than women born in the United States (x^2 = 8.7) (Table 2). Those women who had 8 years or less of education were 3.1 times as likely to be employed as a farmworker or have a significant other who was employed as a farmworker than women who had completed 9 or more years of education (x^2 = 9.7). Women who were married or living with a significant other being were 1.6 times more likely to report their occupation or that of their significant other as farmworker (x^2 = 15. 4). Age was not related to employment as a farmworker.

Health History Forty - nine (32.5%) subjects reported one or more chronic health conditions (Table 3). Forty - one (27.2%) subjects were anemic, 5 (3.3%) subjects had renal disease, 4 (2.6%) subjects had primary hypertension, 2 (1.3%) subjects reported having cancer and 1 (0.7%) subject each had diabetes, hepatitis and thyroid disease. None reported liver disease. Six (4.0%) subjects had more than one chronic health condition.

Maternal/paternal lifestyle practices that may effect fetal development were reported by 62 (41.1%) of the subjects. Most women were non-smokers, though 6 (4.0%) women reported using tobacco and 32 (21.2%) reported that their significant others smoked. Alcohol use was more common among the significant others (n = 39) of the subjects than

among the subjects themselves (n = 8). Few subjects reported the presence of other potentially harmful lifestyle practices including: intravenous drug abuse (n = 2), partner uses intravenous drugs (n = 3), had multiple sex partners (n = 1), significant other had multiple sex partners (n = 2). None of the subjects reported that either they or their significant others were bisexual.

Twenty- two women (14.6%) reported having a poor gynecologic history. Ten (6.6%) subjects had a previous sexually transmitted disease or herpes simplex infection. Abnormal pap smears and endometrosis were reported by 5 (3.3%) subjects each. Three (2.0%) of the women had condyloma acuminata. There were no subjects with a history of cone biopsy or DES exposure.

Obstetric Factors The health histories of 32 women (21.3%) indicated that they had high risk obstetric histories: previous spontaneous abortion (n = 19), previous therapeutic abortion (n = 12) and previous fetal demise (n = 6). Complications of this pregnancy were rare. Abruptio placentae and chorioamnionitis were referred to in the medical records of 1 subject each. No cases of polyhydramnios were identified, while 15 subjects reported having first trimester bleeding. Subjects had a mean parity of 1.2 (S. D. = 1.5), with 6 women (4.0%) having a parity of 5 or more.

Prenatal care Ninety-seven (64.2%) of the women started prenatal care during the first trimester. The mean number of weeks, at which prenatal care was initiated, was 13. 4 (S. D. = 6.8). Ten women (6.6%) started prenatal care in the third trimester. Fifty-seven women (37.7%) had 14 or more prenatal visits. The mean number of prenatal visits was 11.2 (S. D. = 5.1).

Pregnancy Outcomes Thirty-six (23.8%) subjects had adverse pregnancy outcomes. Adverse pregnancy outcomes were evenly divided between congenital anomalies of the infant and spontaneous abortion with each category having 18 (11.9%) subjects. There was 1 multiple gestation in the study group and no reported fetal demise.

Relationship of Risk Factors to Pregnancy Outcomes

Sociodemographics Analysis of sociodemographic data in relation to pregnancy outcomes revealed that there was no association between adverse pregnancy outcomes and employment as a farmworker, age, education (Table 3). No analysis of the relationship between pregnancy outcome and birthplace or marital status was performed because the sample size was too small to make such analysis meaningful.

Health History There were no significant relationships between chronic maternal medical conditions, lifestyle practices and adverse pregnancy outcomes. There was a significant relationship between the presence poor gynecologic history (p < 0.05) and adverse pregnancy outcomes (OR 2.6, 95% CI = 1.0 - 6.8).

Obstetric Factors High risk obstetric history and parity of 5 or more were not a significant indicators of adverse pregnancy outcome. Moreover, no significant relationship was detected between high risk obstetric history and adverse pregnancy outcomes when controlling for previous therapeutic abortions. No analysis of the relationship between complications of this pregnancy and adverse outcomes was undertaken because the sample size was too small.

Prenatal care No relationship was found between the trimester at which care was initiated and outcome for this pregnancy. The number of prenatal visits a woman had was a significant indicator (p < 0.05) of the outcome of this pregnancy. Those women who had less than 14 prenatal visits were 2.6 times as likely to experience either a spontaneous abortion or have a infant with a congenital anomaly as women who had 14 or more prenatal visits.

Bivariate analyses of all the independent variables are shown in Table 3. Logistic regression analysis of the two significant independent variables, number of prenatal visits and poor gynecologic history, revealed that the number of prenatal visits made remained a significant indicator (p < 0.05) of adverse pregnancy outcomes while unfavorable gynecologic conditions became less significant (Table 4).

Sample comparison to Sonoma County Population According to statistics available from the Department of Health Services of Sonoma County, there were 5286 live births in the county during 1994 and the fetal death rate was 5.64 per 5286 live births. No fetal deaths were noted among study participants. The California Birth Defects Monitoring Program (1994) reported that the rate of congenital anomalies in Sonoma County was 32.2 per 1000 live births, during the data collection period of 1987 - 1989. Latinas statewide experience rates of congenital anomaly at 27.8 per 1000 live births (California Birth Defects Monitoring Program , 1994). The rate of congenital anomalies among study participants was 9.9 per 1000 well below the reported county rate and substantially lower than the reported rates among Latinas statewide. Based on a high estimate of the incidence of spontaneous abortion of 20% of all live births (Chaudhuri, 1986, Keleher, 1991), the study group had a spontaneous abortion incidence rate of 11.9%, well within the rate of the general population. One study participant had two spontaneous abortions during the study period, only the first spontaneous abortion was considered in this analysis.

Discussion

Farmwork was not found to be an indicator of adverse pregnancy outcomes. One explanation for this finding may be that there was limited information available about the exposure status of the clinic attendees, in this retrospective study. Also information in the charts about the patient's or spouse's occupation at the time of conception and during the first trimester was often lacking, as was more detailed information about workplace hazards. As discussed by Savage (1992), the use of a proxy to estimate exposure status will lead to reduced strength of association between the suspected teratologic agent and adverse pregnancy outcomes. This study used the occupation of the study participant and/or the occupation of the woman's partner as proxies for potential exposure to pesticides. Further, only occupation as a farmworker was considered to place the pregnant woman and fetus at risk, although other occupations listed in the medical record could have resulted in exposure to teratogenic agents. As a result, the effect of pesticide exposure may

not have been detected because the sample of exposed individuals was diluted by unexposed individuals and the sample of unexposed individuals was diluted by exposed individuals.

Pesticides may alter the germ cell of exposed males allowing fertilization but not embryogenesis (Cordero, 1993). Moreover, up to 40% of pregnancies may end in spontaneous abortion but only 13% are clinically apparent (Keleher, 1991), leading to a decreased ability to identify early spontaneous abortion that are the result of exposure to environmental toxins and causing an underestimation of the effects of pesticides on pregnancy outcomes (Hemminki, Axelson, Niemi & Ahlborg, 1983). Like other studies of this nature, this study underestimated early spontaneous abortions resulting in an inability to detect a relationship between occupation and spontaneous abortion. Participation in farmwork, per se, either by the study participant or her significant other, did not appear to pose a risk for this group of women as a whole.

Unlike several of the occupational health studies described (Hanify, Metcalf, Nobbs & Worsley, 1981; Savitz, Whelan & Kleckner, 1989; Olshan & Faustman, 1993), a relationship between farmwork and adverse pregnancy outcomes was not detected among these women. Further study with a larger sample and more detailed exposure analysis is required to investigate the hazards that farmwork in California may pose for women who work in the fields or whose partners are farmworkers.

The fertility rate, defined as the number of births per 1000 women, is substantially higher for Latina women than for non-Latina populations, 107.7 compared to 67.1 respectively (Giachello, 1994). The fertility rate indicates that Latinas start having children at a younger age and continue to have children later into their reproductive years than their non-Latina counterparts. The fertility rate implies that Latinas tend to have more children than their non-Hispanic White counterparts; thereby, placing them at increased risk of experiencing an adverse pregnancy outcome.

The number of prenatal visits and poor gynecologic history were significant bivariate indicators of adverse pregnancy outcomes. Although twice the proportion of women (40.9%) with poor gynecologic histories had adverse pregnancy outcomes as did women (20.9%) without poor gynecologic histories, this variable did not remain a significant predictor in logistic regression analysis. These two risk factors have been implicated in relation to adverse pregnancy outcomes in previous studies (Malloy, Kao & Lee, 1992; Machala & Miner, 1991).

The significance in number of prenatal visits in improving pregnancy outcomes may reflect the difference between women who seek care and those who do not seek care rather the effects of prenatal care. Women who seek care may have different socioeconomic and health characteristics than those women who do not seek prenatal care. Additionally, migrant workers may be at increased risk because they receive sporadic or no health care. In 1990, only 60% of Latinas began prenatal care during the first 3 months of pregnancy compared with 83% of non-Hispanic White women (Giachello, 1994). The average number of weeks at which Mexican immigrants to Los Angeles initiated prenatal care was 14.6 weeks (Zambrana, 1990). Additionally, only 50% of immigrant woman initiated care in the first trimester while 12% initiated care in the third trimester (Zambrana, 1990). Latinas, especially recent immigrants, may not seek medical care for fear of deportation or because they encounter barriers when seeking health care (Guendelman, Gould, Hudes & Eskenazi, 1990).

Although poor gynecologic history was not significant in a logistic regression analysis for this study, it has been associated with reproductive health problems in previous studies. Women who have experienced gynecologic complications or infections may seek medical care at different rates than their counterparts who have not experienced gynecologic complications or infections. The difference in health seeking behaviors between these two groups of women may have led to an overestimation of the influence of poor gynecologic history in this study group. A community based study would detect differences between

those women who seek care, and therefore lead to identification of intrinsic and extrinsic characteristics to explain why number of prenatal care and gynecologic history are indicators for adverse pregnancy outcomes.

Education may have reflected degree of acculturation rather than educational attainment in this population. Degree of acculturation has been shown to have a greater affect on pregnancy outcomes among Mexican-Americans than educational attainment (Cobas, Balcazar, Benin, Keith & Chong, 1996). Most of the subjects were recent immigrants and had been in the U. S. for less than 5 years. Acculturation is thought to be a progressive process taking many years. The study results were analogous to other studies that have evaluated Latina pregnancy outcomes, primarily that first generation Mexican-Americans experience birth outcomes similar to those experienced by their non-Hispanic White counterparts (Balcazar, Aoyama, & Cai, 1991; Balcazar, Cole, & Hartner, 1992; Guendelman, English, & Chavez, 1995) and that with increased length of stay in the United States, the risk of experiencing an adverse pregnancy outcome increases.

Lifestyle practices of women born in Mexico are unlike their American counterparts. Mexican women tend to abstain from alcohol consumption and smoking. Among Mexican immigrant women surveyed in Los Angeles county 70% had never smoked, 66.6% reported that they never consumed alcohol and none of the respondents reported ever having used recreational drugs (Zambrana, 1990). Though 44.1% of participants, in this study, reported lifestyle practices that may have put the fetus at risk, this may have been the result of combining maternal and paternal lifestyle practices into one variable. Maternal lifestyle practices except smoking may be more directly related to pregnancy outcomes than paternal lifestyle practices. The apparent relationship between lifestyle practices and adverse pregnancy outcomes may have been artificially increased by combining maternal and paternal lifestyle practices.

Study Limitations

The sample size was small resulting inadequate power. However, trends toward significance were noted for several variables including age, presence of one or more chronic medical conditions and parity of 5 or more. Power analysis indicated that a minimum sample size of greater than 290 would have been needed to detect a relationship between the variables tending to significance and the outcome of interest.

Conclusion

Given the current political trend to deregulate industry and the inability of the government to regulate and monitor pesticide use, it is imperative that more studies linking exposure to pesticides and pregnancy outcomes be undertaken. A longitudinal community based study that evaluates both exposures and pregnancy outcomes can provide the data necessary to educate the public and legislators about the hazards of pesticide exposure to the well being of those exposed and their progeny. The cost for medical care of individuals handicapped in utero or due to occupational exposure will continue to increase if this trend toward deregulation continues unabated. Decisions about pesticide use are being made based on the economic needs of agribusiness, studies that increase awareness about the health risks of pesticide exposure will motivate the public to voice their concerns about the continued use of pesticides that are known to be teratogenic and/or embryotoxic. Only with comprehensive occupational health data about pesticides and their risks will there be any inclination to reverse the current legislative policies.

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Table 1
Definition of Variables Used to Determine Risk Factors for Adverse Pregnancy Outcomes
Among 151 Women Attending a Rural Primary Care Clinic in Northern Sonoma County
in 1994

	high risk	low risk
age	$\leq$ 18 or $\geq$ 35	19 to 34
education	< 9 years	9 years or more
living situation (regardless of marital status)	living singly	living with a significant other
birthplace	not the U. S.	U. S.
farmwork	yes	no
chronic disease anemia, cancer, diabetes, hepatitis B, hypertension, liver, renal or thyroid disease	present	absent
poor lifestyle practices history of intravenous drug use, smoking, alcohol consumption, having multiple sex partners.	present	absent
poor gynecologic history previous abnormal pap smear, condyloma, history of having had a cone biopsy, DES exposure, previous diagnosis of Herpes or other sexually transmitted disease, endometrosis.	present	absent
poor obstetric history previous spontaneous abortion, therapeutic abortion or fetal demise.	present	absent

Table 1
Definition of Variables Used to Determine Risk Factors for Adverse Pregnancy Outcomes
Among 151 Women Attending a Rural Primary Care Clinic in Northern Sonoma County
in 1994

	high risk	low risk
parity	≥ 5	< 5
prenatal visits	< 14	≥ 14
trimester care initiated	2nd or 3rd	1st

Table 2
Sociodemographic Characteristics of 151 Women Attending a Rural Primary Care Clinic in
Northern Sonoma County in 1994, by Occupation as a Farmworker

	farmwork # (%)	no farmwork # (%)	total # (100%)
age ≤18 or ≥35	15 (40.5)	22 (59.5)	37
19 to 34	39 (34.2)	75 (65.8)	114
* education < 9 years	36 (49.3)	37 (50.7)	73
9 years or more	16 (23.9)	51 (76.1)	67
† birthplace not the U.S.	52 (41.6)	73 (58.4)	125
U.S.	1 (5.6)	17 (94.4)	18
# living situation single	2 (6.3)	30 (93.8)	32
not single	52 (43.7)	67 (56.3)	119

* education: n=140, education level attainment data were missing for 11 subjects, p < 0.005, 95% CI = 1.5 - 6.4.

† birthplace: n=143, birth place data were missing for 8 subjects, p < 0.005, 95% CI = 1.6 - 93.9.

living situation was significant, p < 0.001, 95% CI = 1.4 - 2.0.

Table 3
Frequency of Risk Factors for Adverse Pregnancy Outcomes of 151 Women Attending a
Rural Primary Clinic in Northern Sonoma County in 1994, by Pregnancy Outcome

	adverse pregnancy outcome # (%)	normal pregnancy outcome # (%)	total # (100%)
age			
≤18 or ≥35	9 (24.3)	28 (75.7)	37
19 to 34	27 (23.7)	87 (76.3)	114
***education**			
< 9 years	13 (17.8)	60 (82.2)	73
9 years or more	14 (20.9)	53 (79.1)	67
farmworker			
yes	8 (14.8)	46 (85.2)	54
no	25 (25.8)	72 (74.2)	97
chronic disease			
present	13 (26.5)	36 (73.5)	49
absent	23 (22.5)	79 (77.5)	102
poor lifestyle practices			
present	11 (17.7)	51 (82.3)	62
absent	25 (28.1)	64 (71.9)	89
# poor gynecologic history			
present	9 (40.9)	13 (59.1)	22
absent	27 (20.9)	102 (79.1)	129
‡ parity			
5 or more	2 (33.3)	4 (66.7)	6
< 5	33 (22.9)	111 (77.1)	144
‡ poor obstetric history			
present	7 (21.9)	25 (78.1)	32
absent	28 (23.7)	90 (76.3)	118

* education: n = 140, educational attainment data were missing for 11 subjects.
‡ parity, pregnancy history: n = 150, parity and previous pregnancy history data were missing for 1 subject.
# poor gynecologic history and number of prenatal visits were significant at p = < 0.005

Table 3
Frequency of Risk Factors for Adverse Pregnancy Outcomes of 151 Women Attending a
Rural Primary Clinic in Northern Sonoma County in 1994, by Pregnancy Outcome

	adverse pregnancy outcome # (%)	normal pregnancy outcome # (%)	total # (100%)
# prenatal visits			
<14	28 (29.8)	66 (70.2)	94
14 or more	8 (14.3)	49 (86.1)	57
trimester			
2nd or 3rd	11 (20.4)	43 (79.6)	54
1st	25 (25.8)	72 (74.2)	97

* education: n = 140, educational attainment data were missing for 11 subjects.
‡ parity, pregnancy history: n = 150, parity and previous pregnancy history data were missing for 1 subject.
# poor gynecologic history and number of prenatal visits were significant at p = < 0.005

Table 4
Logistic Regression Analysis Predicting Adverse Pregnancy Outcomes of 151 Women
Attending a Rural Primary Clinic in Northern Sonoma County in 1994

	Coefficient	Standard Error	Significance	Odds Ratio
# of visits	0.91	0.05	0.04	2.5
poor gynecologic history	0.89	0.49	0.07	2.4