INCIDENCE AND REPORTED CAUSES OF STILLBIRTHS IN ARIZONA

Seventh Annual Report
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Health and Wellness for all Arizonans

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State of Arizona

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MISSION

To improve the health and wellness of people and communities in Arizona.

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Executive Summary

This report completes the annual requirement set forth by the Arizona State Legislature to present the incidence and causes of stillbirth. Fetal death certificate data were utilized to draw conclusions about the risks of stillbirth by women's age, race, education, initiation of prenatal care, and tobacco/alcohol use during pregnancy. The report also examined the prevalence and causes of stillbirth, and the use of autopsy by region and county.

The findings of this report indicate that the incidence of stillbirth in Arizona declined slightly from last year (19%), but did not meet the 2010 Healthy People Objective of 4.1 stillbirths per 1,000. The 2010 rate of stillbirth in Arizona (5.1 per 1,000 live births and fetal deaths) is still lower than the last reported U.S. rate in 2005 (6.2 per 1,000 live births and fetal deaths).[1]

The findings in this report show that disparities in the rate of stillbirths persist. African American women are significantly more likely to experience a stillbirth compared to all other races. The largest preventable risk behavior for stillbirth, tobacco use during pregnancy, was more commonly found in women delivering a stillbirth compared to mothers delivering a live birth. Risk markers such as limited education, pregnancy beyond 35 years of age, and no prenatal care are also associated with stillbirth in Arizona. Maricopa and Pima Counties accounted for the vast majority of stillbirths (80 percent) in 2010. The rate of stillbirth among residents of urban counties (5.2 per 1,000 live births plus stillbirths) was higher than the rate in rural counties (4.0 per 1,000 live births plus stillbirths). In addition, border counties had a slight higher stillbirth rate than non-border counties, 5.2 and 5.0 per 1,000 live births plus stillbirths, respectively (see Appendix A)

Gestational age and birth weight are associated with the incidence and causes of stillbirth. Stillbirths were more likely to occur at early term (51 percent) rather than at term (19 percent), and the majority weighed less than 1,500 grams (61 percent). Malformation was reported as the leading cause of death for early term stillbirths, while cord problems was the leading cause of death in term/late term stillbirths. Although autopsy is recognized as the most useful procedure in determining the cause of death, only twelve percent of stillbirths underwent the procedure. This report did not examine the medical, legal or infrastructure barriers to increasing the autopsy rate for stillbirths. Arizona utilizes 1989 the U.S. Standard Fetal Death Certificate that restricts a more in-depth examination of the incidence and causes of stillbirth.

INTRODUCTION

Background

As required by Arizona law (ARS 36-2291), the first annual report on the Incidence and Reported Causes of Stillbirths was completed in May of 2005 using data from the 2003 fetal death cohort. The second annual report examined cases from 2000 through 2004 and the fifth and sixth annual reports used a one-year cohort of fetal deaths. This year's report examines a one-year cohort of stillbirth infants delivered in 2010.

Methodology

Arizona electronic fetal death certificate data for deaths occurring between the 1st of January, 2010 and the 31st of December 2010 are summarized in this report. To conduct the analyses, a database was created with fetal death and live birth data from Oracle tables available through the Bureau of Public Health Statistics within the Arizona Department of Health Services. These tables contain data on stillbirths which are reported to occur at or after 20 weeks of gestation, and if gestational age is unknown, the deaths of fetuses of at least 350 grams. In this report, the cohort was limited to those cases that reported residence in Arizona.

This report focuses on the incidence of stillbirth, maternal risk markers/risk factors for stillbirth, and reported causes of stillbirths. The number of incident deaths and stillbirth rates are useful when looking at trends over time, comparing one geographic population to another and comparing subgroups within a population. In this report, live births from the birth certificate database and fetal deaths (excluding induced abortions) are combined as an estimate of the total pregnancies among Arizona residents that are at risk for a fetal loss. Stillbirth rates are expressed as the number of deaths per 1,000 live births and fetal deaths.

$$Stillbirth\ Rate = \frac{\#\ of\ fetal\ deaths}{\#\ live\ births + \#\ fetal\ deaths}\ x\ 1000$$

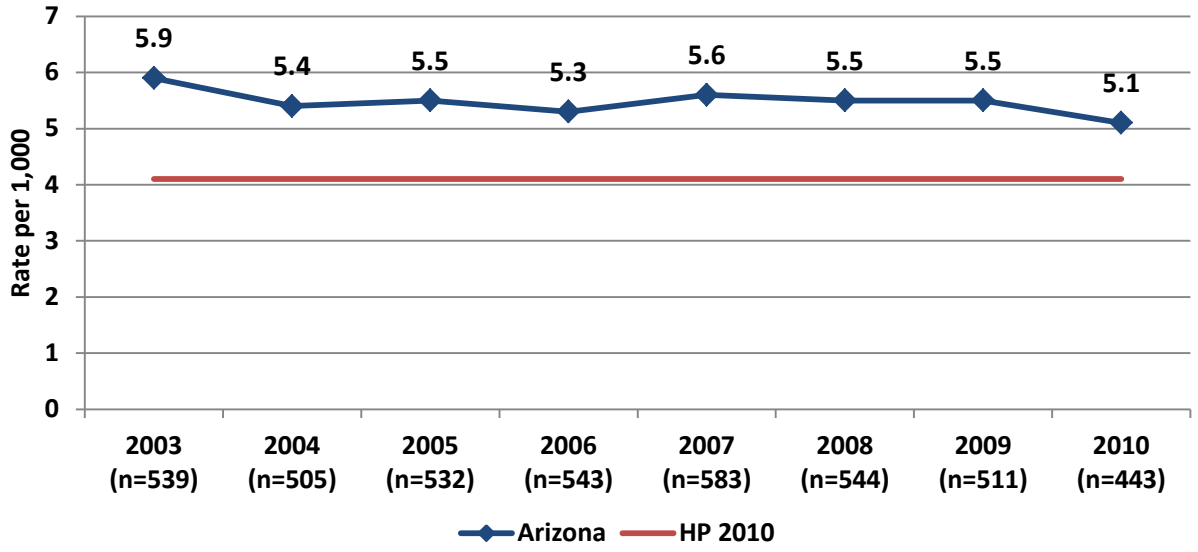
Stillbirth rates are presented in this report by race and ethnicity, maternal age, and education level. Two behavioral risk markers, smoking and alcohol consumption are analyzed in this report. The prevalence of autopsy is examined by birthweight, age, and geographic region of stillbirths. Geographic comparisons between rural /urban and border/non-border are examined. Finally, the reported causes of stillbirth are addressed, limitations of these data are considered, and input from national and international experts is presented.

Arizona 2010

As per the Arizona Vital Records Fetal Death Certificate database, there were a total of 443 stillbirths reported to have occurred at 20 weeks or more gestation (or if gestational age was unknown, the deaths of fetuses of at least 350 grams) during the 1st period between January 2010 through the 31st of December 2010. Figure 1 shows that in the eight year period from 2003-2010, the stillbirth rate ranged from a high of 5.9 per 1,000 live births and fetal deaths in 2003 to a low of 5.1 per 1,000 live births and fetal deaths seen in 2010. The 2010 rate is

significantly different from the baseline rate in 2003.* The stillbirth rate in Arizona for the combined eight-year period was 5.5 per 1,000 live births and fetal deaths, which was lower than the U.S. rate of 6.2 per 1,000 for 2005 (see Appendix B).[1] Nevertheless, the stillbirth rate in Arizona for 2010 remains 24 percent greater than the Healthy People 2010 objective of 4.1 per 1,000 live births and fetal deaths.[2] If Arizona had met the Healthy People 2010 standard from 2003 to 2010, approximately 1052 stillbirths would have been averted.

Figure 1. Stillbirth Rates (per 1,000 live births + fetal deaths)
Arizona, 2003-2010 (n=4,200)



Source: Arizona Birth and Fetal Death Certificates, 2003-2010

MATERNAL RISK MARKERS

Few hypothesized "risk factors" have been causally linked to stillbirth.[3] A more appropriate term to describe the many associations with stillbirth is a maternal risk marker. These physical, behavioral and environmental markers are used as proxies for unavailable causal data, or as yet to be discovered "risk factors" that actually cause stillbirth.

Pregnancy History

Previous history of stillbirth has been associated with a higher risk for future stillbirth.[4] Thirty-two percent of women with data on previous pregnancy in the 2010 stillbirth cohort reported between one and seven previous spontaneous or induced terminations of pregnancy. It is unknown what proportion of these terminations met the definition of stillbirth (spontaneous termination of pregnancy at 20 or more weeks gestation). In addition, it is possible that some women who delivered a stillborn in 2010 also delivered a live infant and are part of the 2010 live birth cohort. Therefore, determining risk for stillbirth based on previous history of stillbirth is not possible in this report.

* p =0.02, (CI: 0.11 - 1.45)

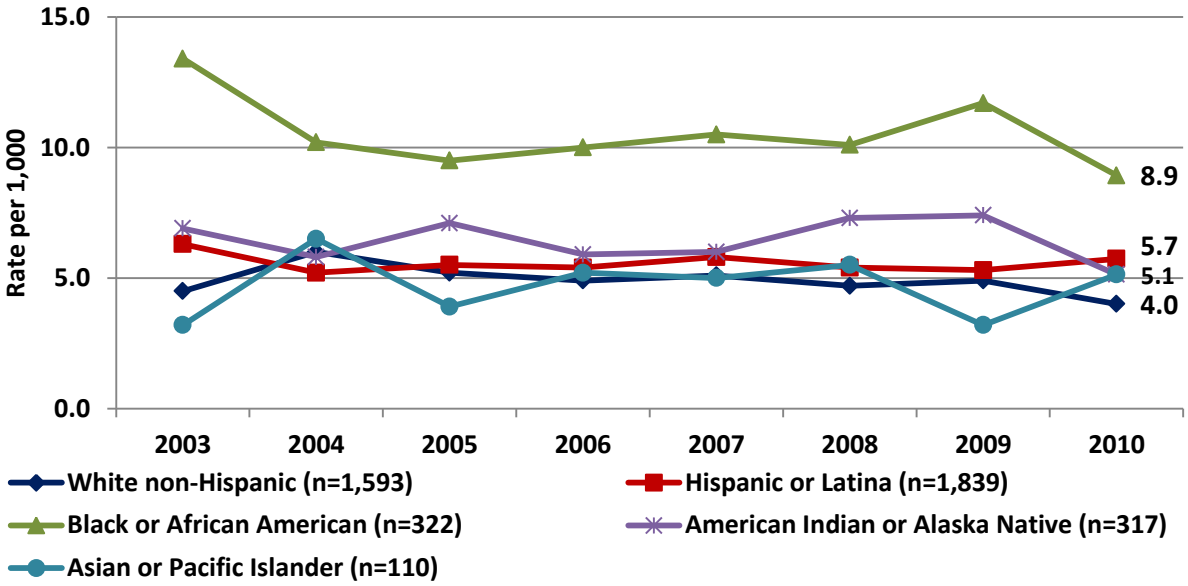
Multiple gestations have also been associated with stillbirth. Approximately 10 percent of all stillbirths in the United States are delivered by women carrying multiple fetuses. The risk for stillbirth increases with the number of fetuses carried during pregnancy.[3] In Arizona, the rate of multiple gestation stillbirth was 8.7 per 1,000 live multiple births and fetal deaths. The rate of stillbirth among multiple gestations was significantly greater than for singleton gestations (4.9 per 1,000 live singleton births and fetal deaths).[*]

Although assisted reproductive technology (ART) has been associated with both multiple gestation and stillbirth, the Arizona fetal and birth certificates do not include data about pregnancy though ART. There is no consensus about whether multiple fetuses are at additional risk because they were conceived with ART.[3]

Race/Ethnicity

Figure 2 shows rates of stillbirths by self-reported race and ethnicity for the 2003 through 2010 time period in Arizona. The stillbirth rate was lowest for White non-Hispanics women (4.0 per 1,000 live births and fetal deaths) and highest for Black or African American women (8.9 per 1,000 live births and fetal deaths) in 2010. A significant disparity in stillbirth rates persisted between Black or African American women and other racial/ethnic groups in 2010.[**] Pregnant Black or African American women had more than twice the risk of having a stillbirth as non-African American women. This disparity is also reflected in stillbirth rates across the United States (Appendix B).[5] Healthy People 2010 calls for a significant reduction in the disparity of stillbirth rates across all racial and ethnic groups.[3]

Figure 2. Stillbirth Rates (per 1,000 live births + fetal deaths) by Race/Ethnicity, Arizona 2003-2010 (n=4,181)*



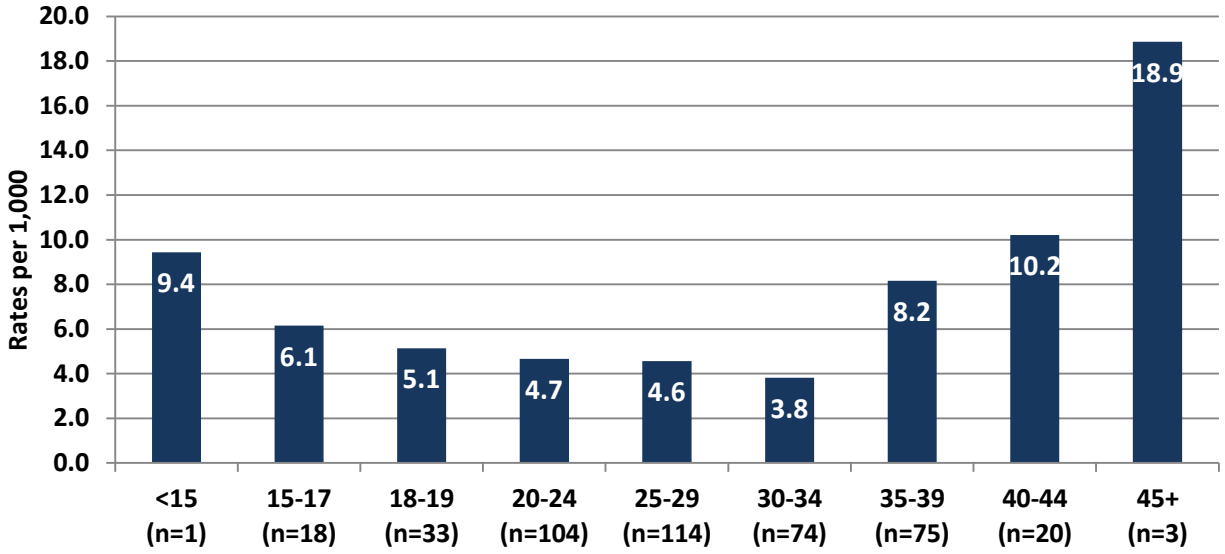
Excludes records with unknown race or ethnicity
Source: Arizona Birth and Fetal Death Certificates, 2003-2010

[*] p= 0.01,(CI: 0.14 - 7.5)
[**] p<0.0001, (CI:2.9 – 6.5)

Maternal Age

Age is a risk marker for stillbirth. Maternal age is used as a proxy measure of unknown and unmeasured biological changes that are causal for stillbirth.[3] Figure 3 indicates the relationship between reported maternal age and stillbirth. It is evident from figure 3 that the highest risks of stillbirth were for older women. The risk of experiencing a stillbirth was significantly greater for pregnant women 35 years of age and older (8.8 per 1,000 live births and fetal deaths) compared to women aged 20 to 34 years (4.1 per 1,000 live births and fetal deaths).*

Figure 3. Stillbirth Rates (per 1,000 live births + fetal deaths) by Maternal Age, Arizona 2010 (n=442)*



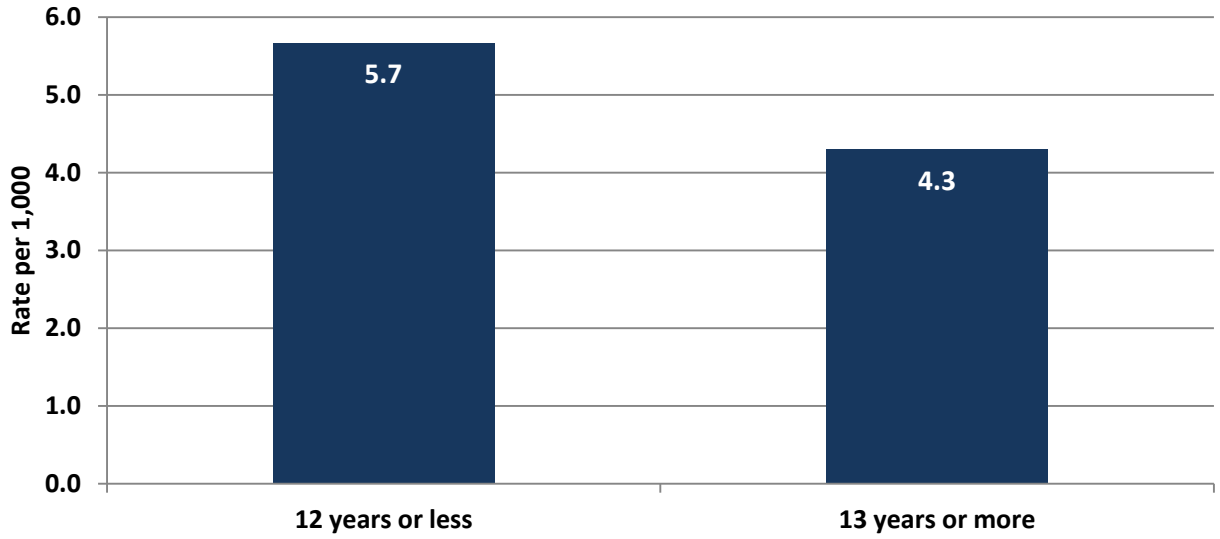
Excludes records with unknown maternal age
Source: Arizona Birth and Fetal Death Certificates, 2010

Maternal Education

Figure 4 shows the stillbirth rates by reported level of maternal education. High school education or less is a risk marker for stillbirth that may serve as a proxy measure for other causal risk factors, such as elevated stress associated with lower socio-economic status. Women with 12 years of education or less (5.7 per 1,000 births and fetal deaths) experienced significantly higher rates of stillbirth than women with 13 years or more of education (4.3 per 1,000 live births and fetal deaths).**

* p< 0.0001 (CI:2.9 – 6.5)
** p=0.03 (CI:0.14 – 2.0)

Figure 4 . Stillbirth Rates (per 1,000 live births and fetal deaths) by Years of Education, Arizona 2010 (n=404)*



***Excludes records with unknown education and maternal age less than 19**
Source: Arizona Birth and Fetal Death Certificates, 2010

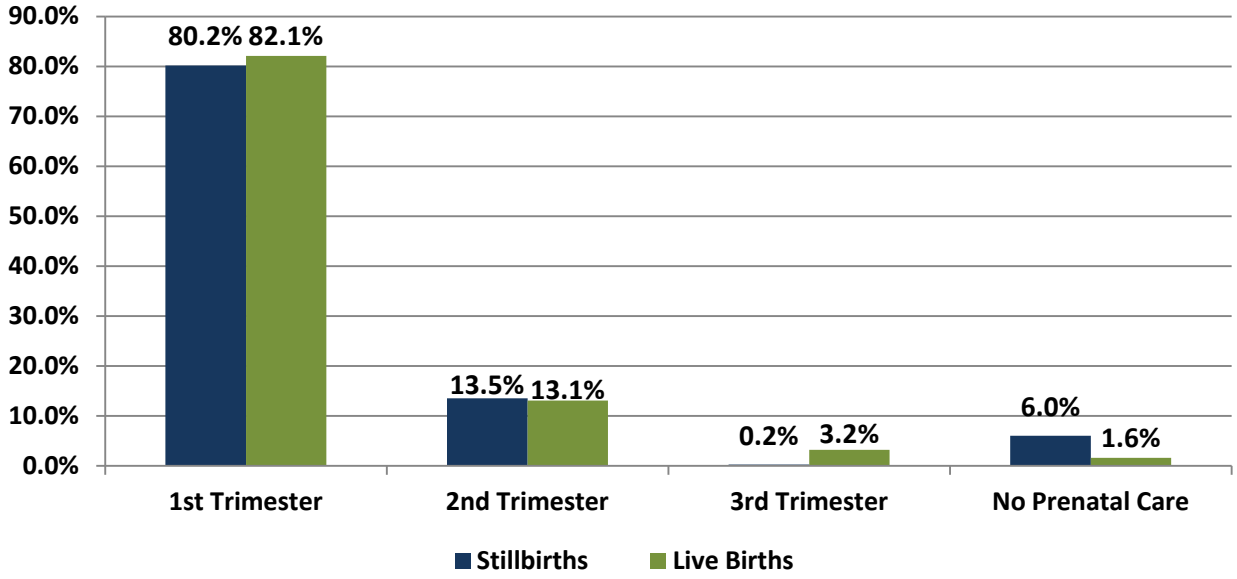
Prenatal Care

Determining the adequacy of prenatal care in stillbirths through a review of fetal death certificate data is complicated. Birth certificate data and fetal death certificate data do not contain any information on the quality or content of prenatal care. Methodologies for determining adequacy of prenatal care in live births, such as the Kotelchuck Index [6], look at both the timing of entry into care and the number of prenatal visits received. "Adequacy of care", in terms of the number of expected visits, may be different for women at risk of experiencing a stillbirth. If a woman enters prenatal care early and a risk factor is identified, she may require more prenatal care visits than a woman without an identified risk factor. Conversely, women who receive no prenatal care or enter prenatal care late in pregnancy may be at higher risk for delivering a stillborn infant because a preventable risk factor is not identified and addressed early enough to positively affect the health of the fetus. Therefore, interpreting adequacy of prenatal care measures for fetal deaths is not presented in this report.

Figure 5 compares trimester of entry into prenatal care for both women delivering stillbirths and women delivering live births in 2010. Delivery status (stillbirth or live birth) was not associated with first trimester prenatal care. However, no prenatal care was strongly associated with poor delivery outcome.*

* Chi-square=53.9(1), p<0.0001

Figure 5. Percent of Women Delivering a Live Birth or Stillbirth by Timing of Prenatal Care*, Arizona 2010



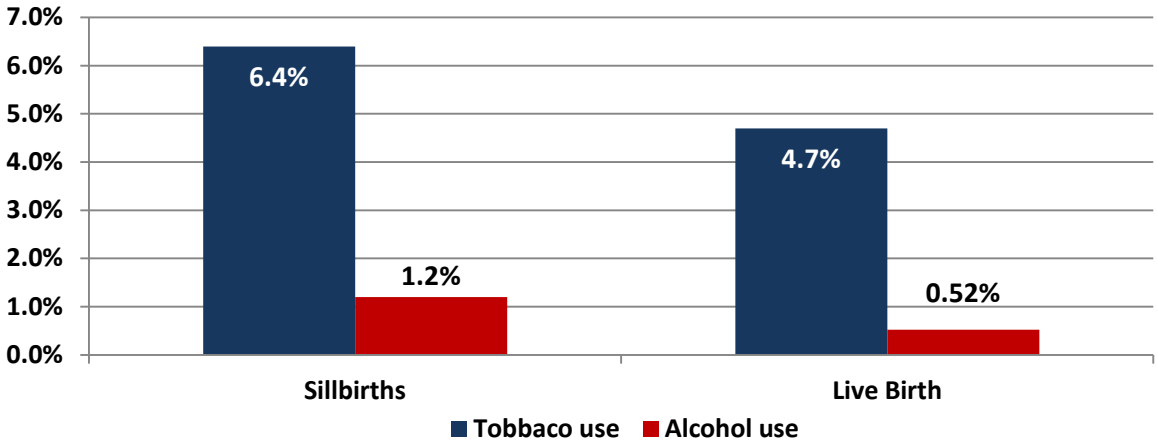
**Excludes misising records*
Source: Arizona Birth and Fetal Death Certificates, 2010

Behavioral Risk Markers

Cigarette use is the largest preventable cause of stillbirth. Cessation of smoking during the first trimester has been shown to lower the risk of stillbirth to equivalent rates found in non-smoking women.[3] The consumption of alcohol during pregnancy has been associated with stillbirth in some, but not all studies . As with tobacco use, the consumption of alcohol may play a larger role in stillbirth later in pregnancy.[3]

Cigarette and alcohol use during pregnancy are recorded on the fetal death certificate. This analysis is restricted to women with known responses to the questions of smoking or drinking in the 2010 stillbirth cohort (n= 422 smoking responses; n= 422 drinking responses) and live birth cohort (n= 86,873 smoking responses; n= 86,734 drinking responses). The Arizona fetal death certificate does not contain information about cigarette or alcohol use by trimester. Figure 6 shows the percentage of women who reported smoking cigarettes or drinking alcohol during pregnancy for the 2010 stillbirth and live birth cohorts.

Figure 6 . Percent of Women Reporting Cigarette Use or Drinking Alcohol During Pregnancy* by Delivery Status, Arizona 2010



Excludes records with missing data in tabacco and alcohol use questions
Source: Arizona Birth and Fetal Death Certificates, 2010

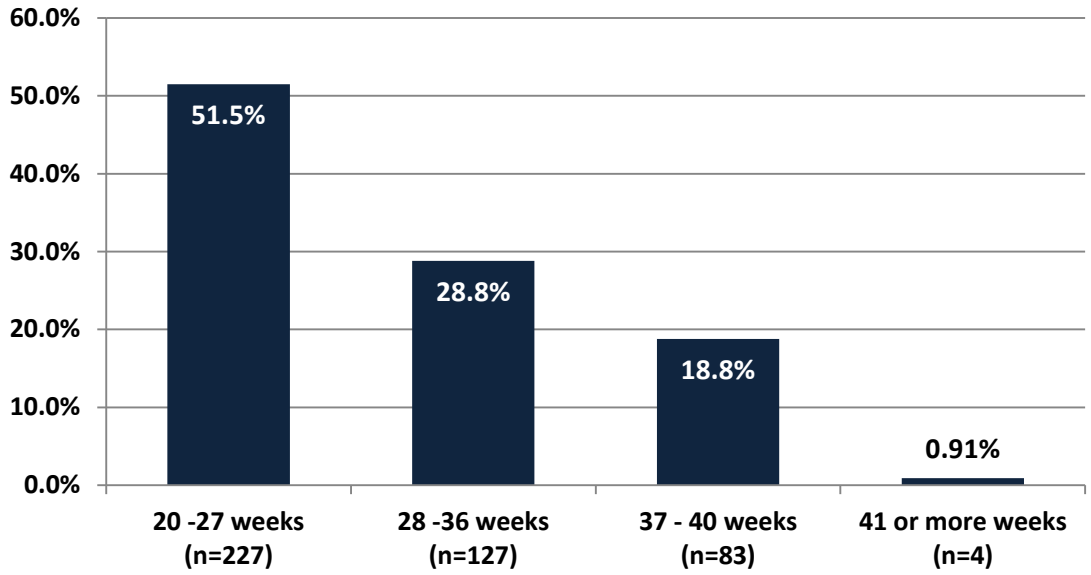
Approximately six percent (n=27) of women who had a stillbirth reported smoking and one percent (n=5) reported drinking while pregnant. Only five percent (n= 4,063) of women delivering a live birth reported smoking and less than one percent (n=453)reported drinking alcohol during pregnancy. Within this sample, the rate of stillbirth among women who reported smoking during pregnancy (6.6 per 1,000 live births and stillbirths) was not significantly greater than the rate of stillbirth among non-smokers (4.7 per 1,000).[*] The rate of stillbirth for women who reported drinking alcohol during pregnancy is not presented because of limited response size. Response bias due to the stigma of smoking and drinking during pregnancy likely resulted in underreporting of these two behaviors across both the stillbirth and live birth cohorts. If the behavior was stopped early in pregnancy, recall bias may also limit the reliability of these data. When Arizona adopts the U.S. Revised Fetal Death and Birth Certificates, information about alcohol use during pregnancy will no longer be collected.

CHARACTERISTICS OF STILLBIRTHS

Cases in the fetal death certificates are defined by gestational age, and when age is not available, birth weight of at least 350 grams is used. Figure 7 shows the breakdown of stillbirths by reported early, late, full term, and post-term gestational ages.[7] Similar to national statistics[3], approximately 52 percent of stillbirths in Arizona occurred prior to 28 weeks gestation and approximately 19 percent were 'at term' (37-40 weeks gestation). Although gestational age is determined by physician's estimate (clinical estimate) and not reported date of last menstrual period, reliability and validity issues persist.[8] Therefore, it is possible that some infants were delivered prior to 20 weeks and were misclassified miscarriages.

[*] p=0.09 (CI: -0.6 – 4.4)

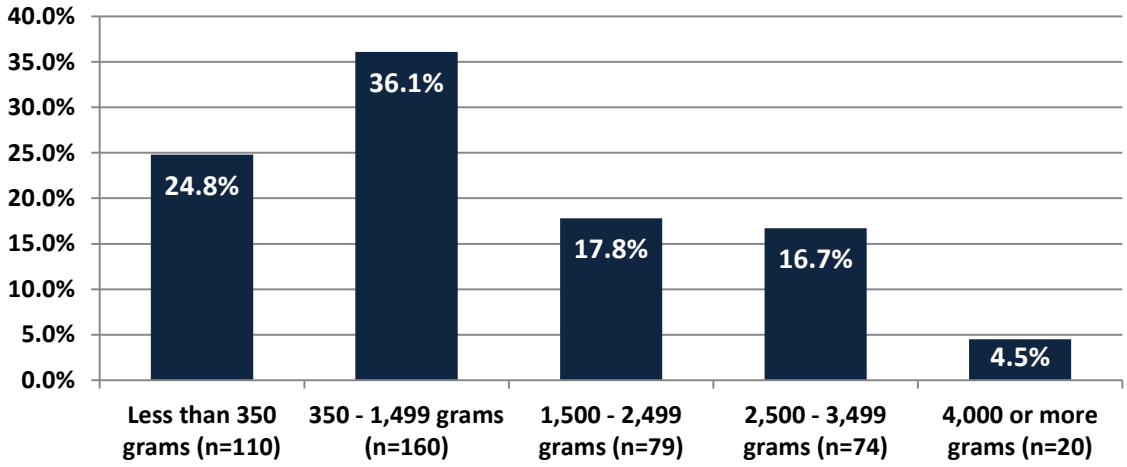
Figure 7. Percent of Stillbirths by Gestational Age, Arizona 2010 (n=441)*



**Excludes records with missing gestational age*
Source: Arizona Birth and Fetal Death Certificates, 2010

Figure 8 shows the reported weight of stillbirths from the 2010 cohort. It is evident from Figure 8 that approximately 36 percent of stillbirths delivered in 2010 were reported to weigh between 350 to 1,499 grams, 17.8 percent weighed between 1,500 and 2,499 grams, and 16.7 percent weighed 2,500 to 3,999 grams. Macrosomic stillbirths (4,000 grams or more) comprised 4.5 percent of the cohort. Another 24.8 percent were reported to weigh less than 350 grams.

Figure 8. Percent of Stillbirths by Delivery Weight, Arizona 2010 (n=441)*

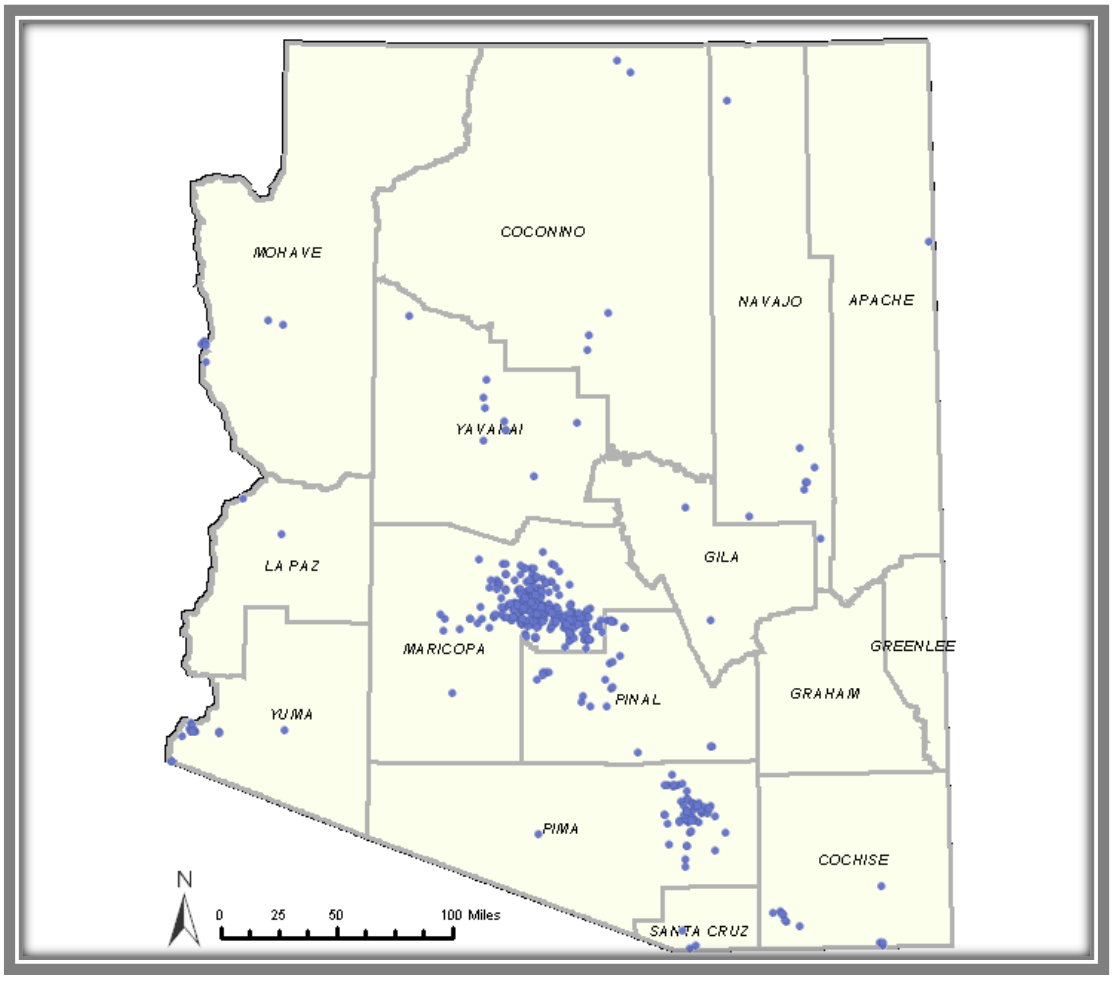


**Excludes records with missing weight*
Source: Arizona Birth and Fetal Death Certificates, 2010

Occurrence by County

In 2010, approximately 65 percent of stillbirths were delivered by residents of Maricopa County (n=289), 14 percent in Pima county (n=64), and the remainder of stillbirths with known maternal residence occurred in 11 other counties (n=90). Map 1 shows the distribution of 2010 stillbirths by county.

Map 1. Stillbirths in Arizona, 2010 (n=443)



Urban and Rural Region

Four counties are considered to be urban in Arizona, Maricopa, Pima, Pinal and Yuma.[15] The rest are rural. In 2010 the stillbirth rate in urban counties was 5.2 per 1,000 live births and stillbirths and for rural counties 4.0 per 1,000* (see Table 1). Although majority of stillbirths in 2010 continued to occur among female residents of urban counties, rates of stillbirth in each urban county varied due to the relatively small size of rural populations. For instance, stillbirths in rural counties ranged from 0.0 to 6.1 per 1,000 live births and stillbirths compared to urban counties that ranged from 4.6 to 5.3 per 1000 (see Appendix A).

* Not statistically significant difference (p-value= 0.08)

In urban counties, the majority of stillbirths where to Hispanics, 42.2% (n=187) followed by white women, 33.8% (n=133). In rural counties the majority of stillbirths where to white women, 46.0% followed by Hispanics (22%) and American Indians (22%). No significant difference was seen on stillbirth rates and maternal risk factors such as mother's education, age, prenatal care initiation, and smoking of stillbirths occurring between urban and rural counties. The small number of cases in rural region limits interpretation of maternal risk factors that may be associated with a stillbirth.

Border and Non-border Region

The U.S. Mexico border region was defined as counties within 100km south and north of the U.S.-Mexico international border line by the U.S.-Mexico La Paz Agreement in 1983.[13] The border region is culturally, economically and politically influenced by both countries due to the constant movement of the population across the border. [13] This fluidity creates a diverse and unique population that endures different health burdens than other regions in both countries. A greater proportion of inhabitants of the U.S. border region live below the federal poverty level compared to the rest of the United States, and women are significantly more likely to be living in poverty than men. United States border residents also have lower levels of education than the national average and they are also less likely to have health insurance.[13,14] Overall, the border region experiences higher rates of communicable and chronic diseases, than other areas of Mexico or the US.[14] Therefore is important to examine differences in health outcomes in the border counties.

In Arizona, four counties: Cochise, Pima, Santa Cruz and Yuma are considered part of the border region. The stillbirth rate in border counties was 5.2 per 1000 live births and stillbirths and in non-border counties was 5.0 per 1,000[*] (see Table 1). It is likely that there is under reporting of stillbirths in the border counties, because of women seeking healthcare in Mexico for a stillbirth due to the highly fluid population. The majority of stillbirths were among Hispanics in both border and non-border counties, 53.8% and 42.3% respectively. No significant difference was seen on stillbirth rates and maternal risk factors such as mother's education, age, prenatal care initiation, and smoking in stillbirths occurring in border and non-border counties. Underreporting and small number of cases in border counties limits interpretation of maternal risk factors associated with stillbirths.

Table 1: Number and Rate of Stillbirths by Regions, Arizona, 2010

	Number	Rate per 1,000*
Border Counties	93	5.2
Non-Border Counties	350	5.0
Urban Counties	393	5.2
Rural Counties	50	4.0

*Per 1,000 live births and stillbirths.
Note: Urban counties include Maricopa, Pima, Pinal and Yuma. All other counties are considered rural. Border Counties include Cochise, Pima, Santa Cruz, and Yuma. All other are considered non-border counties.

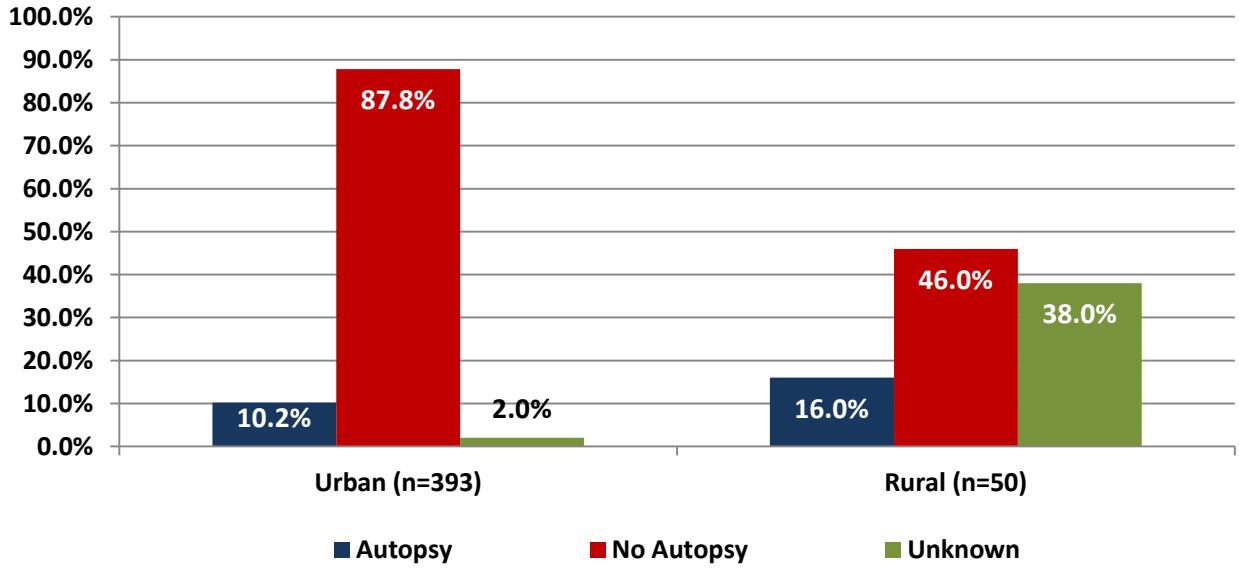
[*] Not statistically significant difference (p-value= 0.74)

Frequency of Autopsy

Fetal autopsies are the most useful diagnostic procedure for information on the cause of death.[3,9] However, only twelve percent (n=48) of stillbirths with complete data in 2010 received an autopsy. The proportion of stillbirths receiving an autopsy in 2010 has decreased from a high of 16.4 percent in 2004. Additionally, the quality of autopsy reporting has declined over the autopsy field in the fetal death certificates. Less than one percent of cases were coded as "unknown" in 2003, but six percent (n=27) were coded as "unknown" in 2010.

Figure 9 shows the proportion of stillbirths delivered in urban and rural counties that received an autopsy. The percentage of "unknown" autopsied cases in rural counties makes it impossible to determine if there was a significant urban/rural difference. The proportion of stillbirths autopsied was greater in Pima County compared to Maricopa County (12.7 percent compared to 10.5 percent), the difference was not significant.

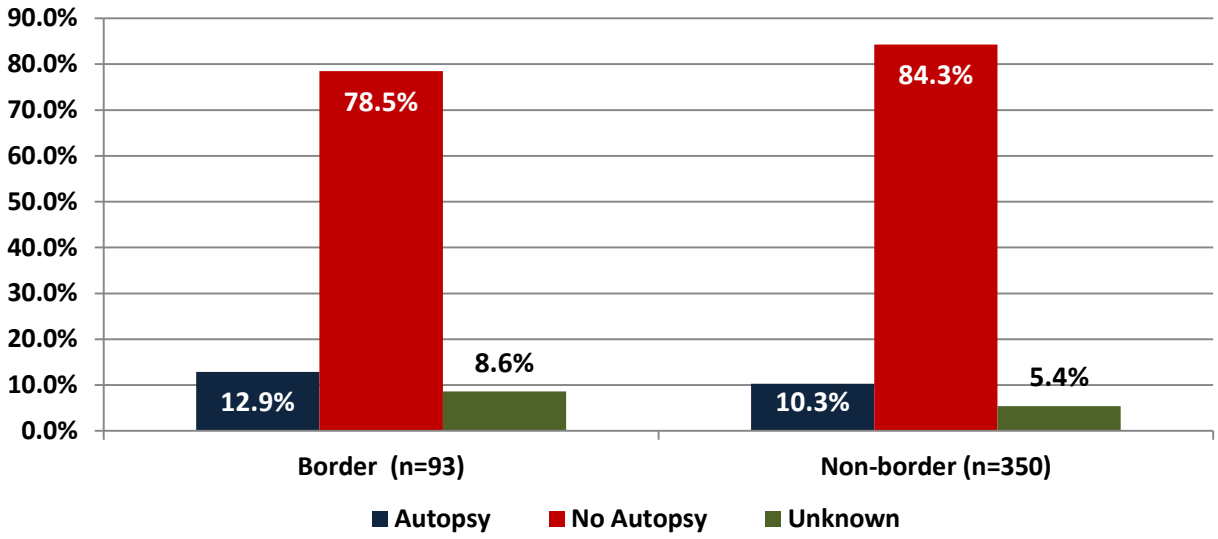
Figure 9. Percent of Stillbirths Receiving Autopsy by Urban and Rural Areas* Arizona 2010 (n=443)



**Urban areas include Maricopa, Pima, Pinal, and Yuma Counties. All other counties are considered rural.*
Source: Arizona Birth and Fetal Death Certificates, 2010

Figure10 shows the proportion of stillbirths delivered in border and non-border counties that received an autopsy. The border counties had a slight higher proportion of "unknown" autopsied cases (8.6 percent) than non-border counties (5.4 percent). Also, a slight higher proportion of stillbirths were autopsied in border counties(12.9 percent) than in non- border counties (10.3 percent). The difference seen between the border and non-border counties was not significant.

Figure 10. Percent of Stillbirths Receiving Autopsy by Border and Non-Border Areas* Arizona 2010 (n=443)



**Border areas include Cochise, Pima, Santa Cruz, and Yuma Counties. All other counties are considered non-border.*
Source: Arizona Birth and Fetal Death Certificates, 2010

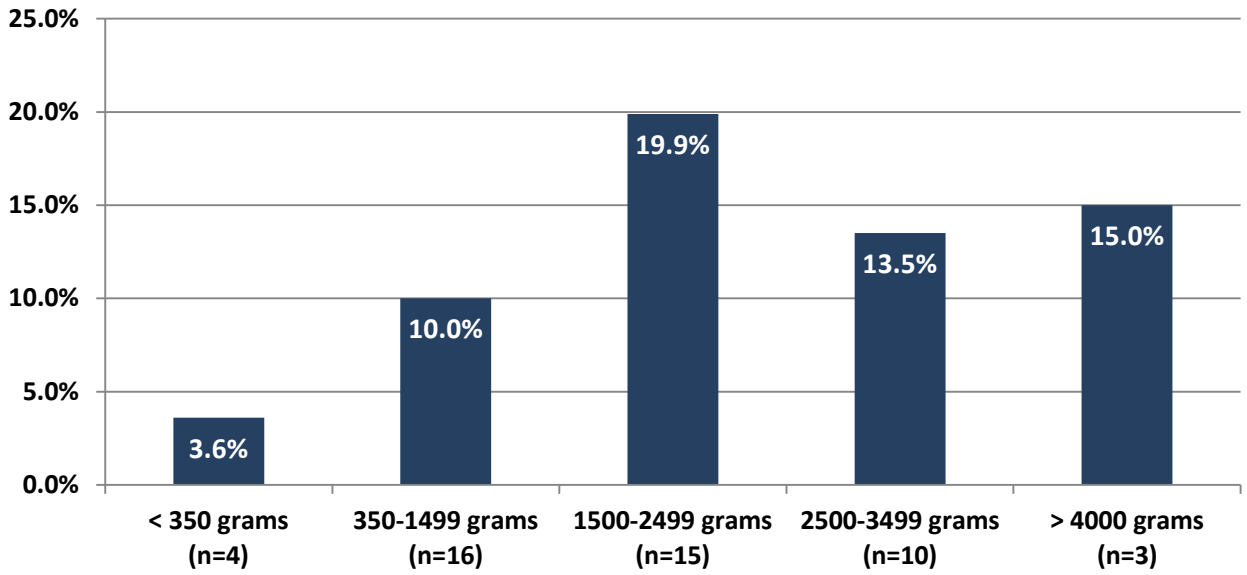
The proportion of autopsies for cases with complete data was also analyzed by race, ethnicity, gestational age, and reported weight of the fetus. In terms of race and ethnicity among stillbirths cases autopsied 14.1 percent where Hispanics, 5.8 percent White, 12.8 percent African American , 16.7 percent American Indian women, and 5.9 percent Asian or Pacific Islander. However, the high proportion of stillbirths with 'unknown autopsy status' limits interpretation of any disparity based on race or ethnicity.

Although half of all stillbirths were delivered prior to 28 weeks gestation in 2010, only 7.0 percent of these very early term stillbirths received an autopsy.* There was no significant difference in autopsy rates between stillbirths occurring at or after 28 weeks gestation (14 percent) and those occurring very early term.

Figure 11 shows the percentage of stillbirths that were autopsied by reported gestational weight. In 2010 there was no discernible trend in autopsy by weight of stillbirth.

* Includes only records with complete data over autopsy field.

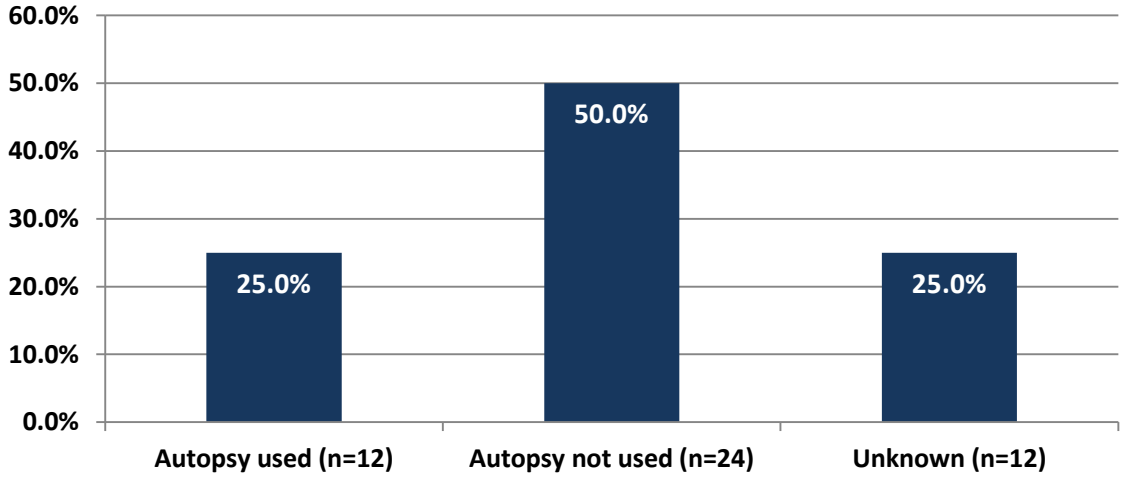
Figure 11. Percent of Stillbirths Autopsied by Delivery Weight Arizona 2010



Source: Arizona Birth and Fetal Death Certificates, 2010

Figure 12 shows the percentage of autopsies that were successful in determining the cause of death among stillbirths that received an autopsy. Although autopsy is considered the most useful procedure in determining the cause of stillbirth,[3,4] the procedure was only used one-third of the time to ascertain the cause of fetal demise in Arizona.

Figure 12. Percent of Autopsies Used to Determine Cause of Death among those Stilbirths Receiving Autopsy, Arizona 2010 (n=48)



Source: Arizona Birth and Fetal Death Certificates, 2010

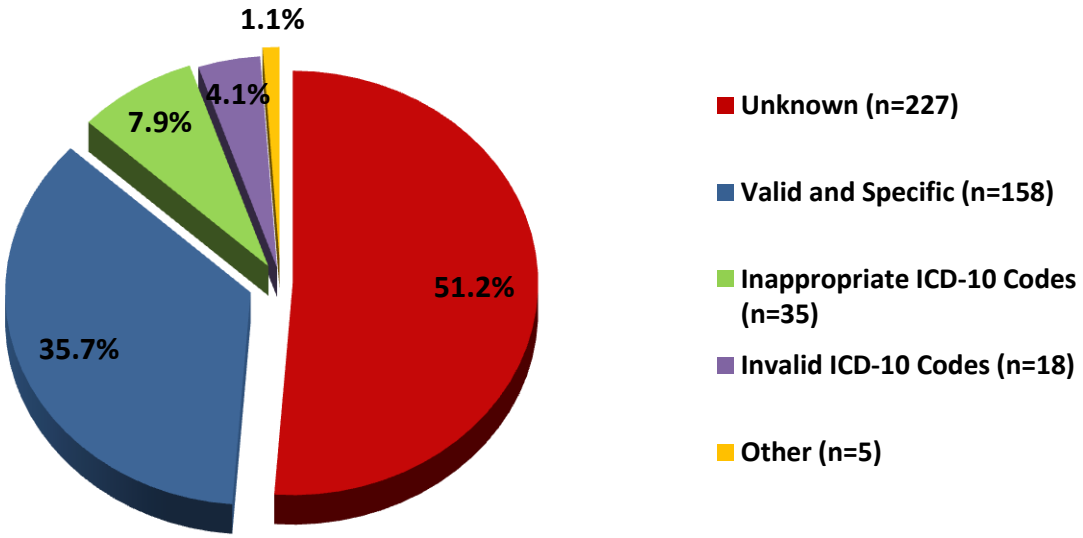
Reported Cause of Death

Most conditions that have been linked to stillbirth can be classified as associations rather than unequivocal causes.[3] As reported in the first Incidence and Reported Causes of Stillbirth Report (2005), the cause of stillbirth often remains unknown, even when a concerted effort is made to determine the cause of death. In Arizona, three causes of death can be entered onto the fetal death certificate – a primary cause of death and two contributing factors. Since 2000, the cause of death has been coded using ICD-10 codes in Arizona.

Coding for fetal death certificates is completed by Arizona Department of Health Services Vital Records staff. The staff person responsible for coding fetal deaths reviews a hard copy of the fetal death certificate and, using all three fields on the death certificate, makes a determination of the most appropriate ICD-10 code. In 2010 there were 44 distinct ICD-10 codes used to classify cause of death in the fetal death certificate data. Using methods developed by Dr. Mike Clement at Arizona Department of Health Services, the ICD-10 codes and their associated descriptions were reclassified into categories based on their similarities and potential prevention efforts.

Figure 13 shows causes of stillbirths for the 2010 reporting period. As is true in many studies on the causes of stillbirths[3], the cause of death was unknown in approximately 51 percent of stillbirths for this time period. The lack of a definitive cause of death is often the result of insufficient medical science regarding the etiology of stillbirth.[*] Additionally, data errors are common across this field as eight percent of the stillbirths had an inappropriate ICD-10 code, four percent of the stillbirths had an invalid ICD-10 code. The remaining 36 percent of fetal deaths had ICD-10 codes indicating a valid and specific cause of deaths.

Figure 13. Percent of Stillbirths by Recoded Cause of Death*
Arizona 2010 (n=443)

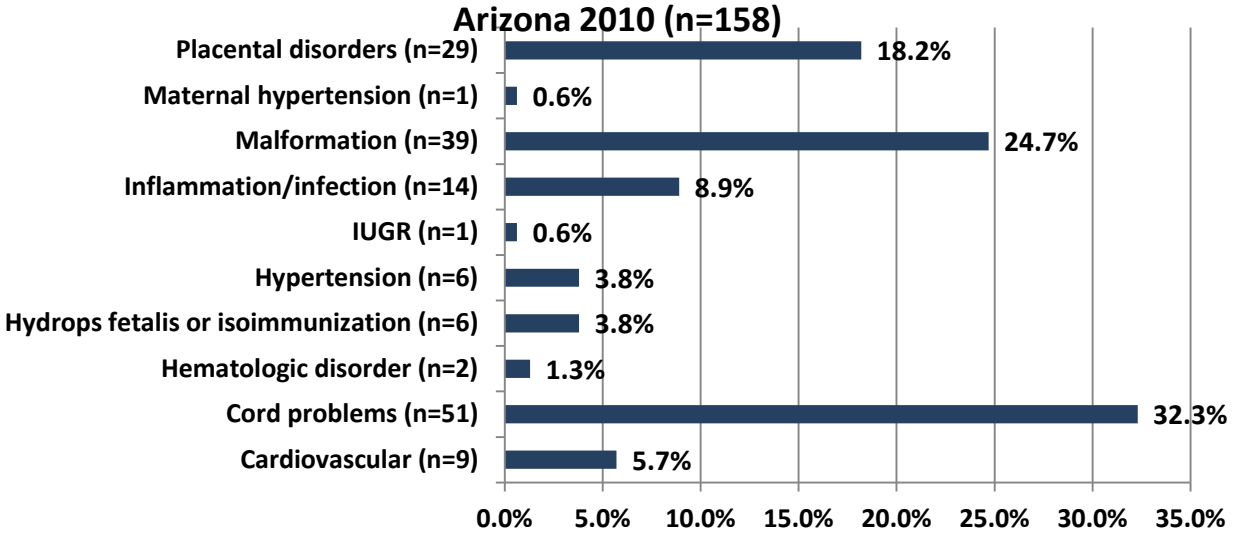


Recoded ICD-10 groups developed by Dr. Mike Clement at ADHS in 2006
Source: Arizona Fetal Death Certificates, 2010

[*] As per correspondence with Donna Hoyert, PhD, Division of Vital Statistics, NCHS, CDC, on November 25th, 2008

Of the stillbirths with a known and specific cause of death (Figure 14), the most common causes were cord problems (32.3 percent), malformation (24.7 percent), and placental disorders (18.2 percent). None of the other recoded causes of death accounted for more than nine percent of stillbirths with valid ICD-10 data.

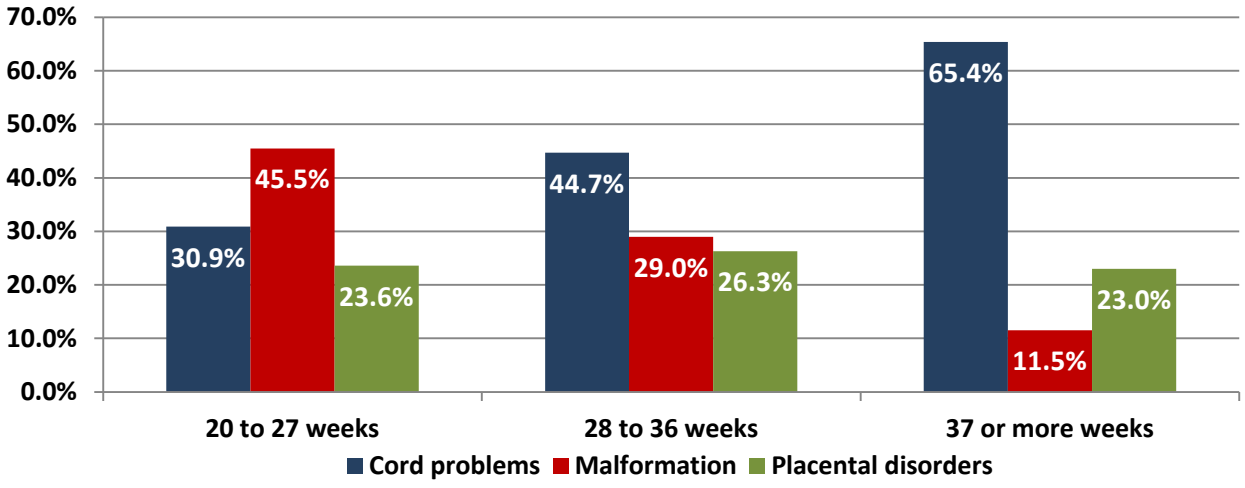
Figure 14. Specific and Valid Causes of Stillbirth
Arizona 2010 (n=158)



**Intrauterine growth restriction refers to a fetus whose weight is below the 10th percentile for its gestational age.*
Source: Arizona Fetal Death Certificates, 2010

Figure 15 shows the top three reported causes of death by gestational age categories.

Figure 15. Top Three Causes of Stillbirth by Length of Gestation
Arizona 2010 (n=119)*



***Exclude records with missing gestational length**
Source: Arizona Fetal Death Certificates, 2010

Forty percent of stillbirths delivered at term or late term had a specific cause of death, while only 35 percent did delivered at less than 28 weeks.[*] The most common causes of death were cord problems, malformations and placental disorders for both age categories. For stillbirths delivered at term or late term, cord problems (65.4 percent) accounted for the greatest proportion of deaths, while malformation (45.5 percent) was the most common cause of death for very early term stillbirths.

DATA QUALITY

The analysis for the 2010 Incidence and Reported Causes of Stillbirth in Arizona consisted of a review of frequencies of selected variables to determine the percentage of cases with out-of-range, invalid, and missing values. Fields were chosen for this analysis based on the likelihood that they would be used in an analysis of stillbirths. In addition to reviewing frequencies as described above, the data were reviewed to determine if the cases included in the fetal death files were appropriate for an analysis of fetal deaths.

Case Inclusion

ARS 36-2291 stipulates that a report on the incidences of stillborn infants and the reported causes of deaths will be produced each year. Fetal weights and reported gestational age were reviewed to determine if all records included in these files would be appropriate for a report on the incidence and causes of stillbirths. Of the 443 cases reported in these files, two records did not have data in the field for reported gestational age. These records had weights of at least 350 grams indicating that the stillbirths were likely of an appropriate gestational age for inclusion in this report. The remaining 441 cases had gestational ages of 20 weeks or more according to clinical estimates. Both clinical and calculated estimates of gestational age are subject to reliability issues.[8] Calculation of gestational age by reported last menstrual period is complicated by missing and unreliable data over 16 percent of cases. When using date of last menses to measure gestational age for those records with complete and reliable data, approximately two percent (n=9) of stillbirths were less than 20 weeks old and nearly two-third of these cases (n=6) also had reported delivery weights under 350 grams. These cases would not be included in this report had last menses been used instead of clinical estimate to determine gestational age.

Gestational age is the primary criteria used to determine case inclusion in this report. However, the reported weight of all cases was also reviewed to determine whether or not the case was appropriate for inclusion in an analysis of incidence and reported causes of stillbirth. Approximately 25 percent (n=110) of stillbirths in the data set were reported to weigh less than 350 grams and all records contained a delivery weight.

Quality of Available Data

Additional variables collected on a revised fetal death certificate would improve the quality of this report. These variables include; the amount of cigarettes smoked per week, self-reported exposure to second hand smoke, the number of alcoholic drinks consumed per day by trimester, and the weight and height (or calculated BMI) of the mother at first prenatal care visit. Although the prevalence of obesity has increased among reproductive aged women in

[*] Chi-square 0.491(1) p=0.48

Arizona[10] and has been demonstrated as a risk factor for stillbirth,[3,4,5] neither maternal baseline weight nor height is collected for the Arizona fetal death certificate. These missing variables limit the strength of this report.

The revised 2003 U.S. Standard Fetal Death Certificate (see http://www.azdhs.gov /plan/cert/ pdf/fetal.pdf) includes data fields for BMI, pre-pregnancy weight, and trimester/frequency of cigarette use. However, Arizona will not adopt this certificate until 2012. The 2003 Fetal Death Certificate will bolster future analyses of the risks for stillbirth. For instance, Gardosi's classification of stillbirth by relevant condition of death (ReCoDe) utilizes mother's first trimester BMI as a covariate to determine customized fetal delivery weight percentiles. If delivery weight for gestational age is extremely low (< 10^{th} percentile) and no valid cause of death is noted, then the fetal death is reclassified as due to fetal growth restriction. Use of the ReCoDe classification system has resulted in the valid coding of up to 85 percent of fetal deaths.[11,12] Improved classification systems that rely on data collected in the 2003 Fetal Death Certificate will improve the validity of this report.

Appendix A

Table 1: Stillbirth Number and Rates by County, Arizona, 2004-2010

	Total Number of Stillbirths*							Rate of Stillbirths**						
	2004	2005	2006	2007	2008	2009	2010	2004	2005	2006	2007	2008	2009	2010
ARIZONA	505	532	543	583	544	511	443	5.4	5.5	5.3	5.6	5.5	5.5	5.1
Apache	5	7	4	9	8	2	2	3.7	5.4	3.4	7.7	6.6	1.6	1.8
Cochise	10	14	12	13	7	16	11	5.5	7.9	6.6	7	3.9	8.7	6.1
Coconino	7	9	14	9	7	12	5	3.4	4.3	6.8	4.2	3.5	6.3	2.8
Gila	2	3	11	4	6	8	2	3	4.6	16.5	5.7	8.5	11	3.0
Graham	2	2	2	0	5	2	0	4.4	4.4	3.7	0	7.7	3.1	0.0
Greenlee	1	1	0	0	1	0	0	9.6	10	0	0	7.6	0	0.0
La Paz	4	0	0	0	2	0	1	17	0	0	0	8.1	0	5.0
Maricopa	339	330	351	360	350	312	290	5.6	5.3	5.3	5.4	5.6	5.4	5.3
Mohave	11	19	15	17	9	14	8	5	8.4	6.1	6.9	3.9	6.3	3.9
Navajo	12	15	13	15	15	11	8	6.7	7.8	6.9	7.4	7.7	5.8	4.6
Pima	54	68	79	88	73	68	64	4.1	5.2	5.7	6.3	5.4	5.3	5.2
Pinal	14	21	17	39	33	29	24	4.5	5.7	3.8	7.3	5.7	5.4	4.8
Santa Cruz	4	5	3	0	6	3	3	4.9	6.4	4	0	7.5	3.9	4.3
Yavapai	15	7	10	14	3	16	10	7.4	3.3	4.2	5.7	1.4	7.7	5.5
Yuma	25	30	12	14	18	18	15	7.5	9	3.6	4.3	5.3	5.5	4.6
Unknown	0	0	0	0	1	0	0	NA	NA	NA	NA	NA	NA	NA

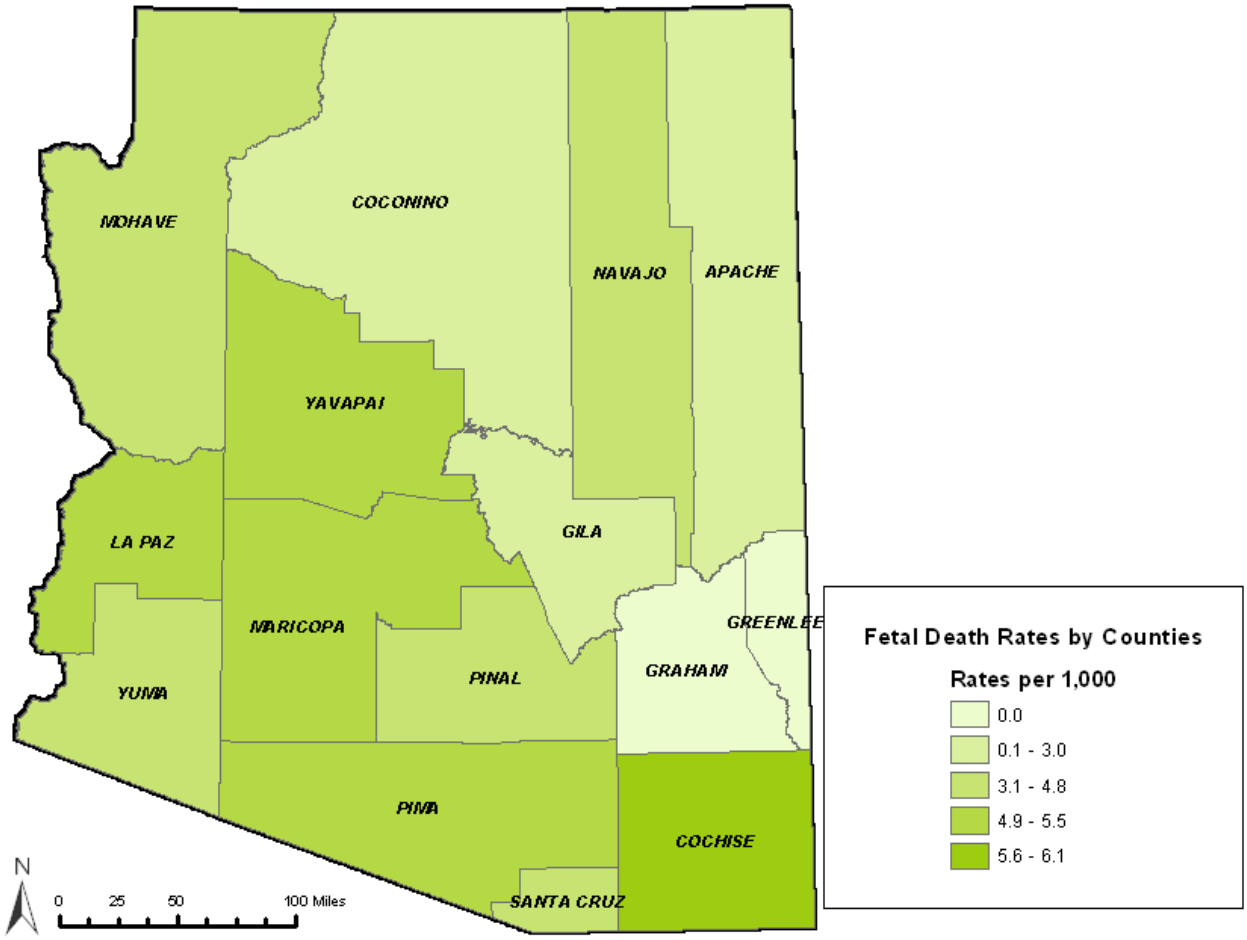
*Includes spontaneous terminations of pregnancy at 20 or more weeks of gestation (or if gestational age is unknown, the deaths of fetuses of at least 350 grams in weight). Excludes induced terminations of pregnancy.

**Per 1,000 live births and stillbirths.

Note: Urban counties include Maricopa, Pima, Pinal and Yuma. All other counties are considered rural. Border Counties include Cochise, Pima, Santa Cruz, and Yuma. All other are considered non-border counties.

Source: Arizona Birth and Fetal Death Certificates, 2004-2010

Map 2: Stillbirth Rates by County, Arizona, 2010



Appendix B

Table 2: Stillbirths: Arizona and the U.S.

Characteristic	Arizona 2010	U.S. 2005*
Total number	443	25,894
Total rate (per 1,000 live births and fetal deaths)	5.1	6.2
Rate by race:		
Black or African American	8.9	11.1
American Indian or Alaskan Native	5.1	6.2
Asian or Pacific Islander	5.1	4.8
Hispanic or Latina	5.7	5.4
White non-Hispanic	4.0	4.8
Rate by Plurality:		
Singleton	4.9	5.9
Twin	8.6	16.1
Triplet or more	24.3**	27.2
Rate by maternal age:		
< 15 years old	9.4**	12.2
15 thru 17 years old	6.1	7.5
20 thru 24 years old	4.7	5.9
25 thru 29 years old	4.6	5.5
30 thru 34 years old	3.8	5.8
35 thru 39 years old	8.2	7.3
40 thru 44 years old	10.2	11.1
45 years and older	18.9**	15.5

* most recent data available through the NCHS [1]

** interpret rate with caution due to low sample size

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