INCIDENCE AND REPORTED CAUSES OF STILLBIRTHS IN ARIZONA

Fourth Annual Report
September 2008

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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. The Unexplained Infant Death Council recommended that analyses include a five-year cohort of stillbirths from 2003 through 2007. Birth certificate data was utilized to draw conclusions about the risks of stillbirth by women's age, race, education, 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 has declined slightly, but not significantly over the past five years. Unless the trend in the overall stillbirth rate experiences a significant decline in the 2008-2010 cohort, Arizona is unlikely to meet the Healthy People 2010 objective of 4.1 stillbirths per 1,000 live births plus stillbirths. Racial 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. Other risk markers such as lower education, teen pregnancy and pregnancy after 35 years of age, and timing of prenatal care remained consistent with data in previous reports. As expected Maricopa and Pima counties accounted for the vast majority of stillbirths (83%) over the five-year cohort.

Length of gestation and delivery weight were correlated with the incidence and causes of stillbirth, and also the use of autopsy. The majority of stillbirths (51.0%) occurred prior to 28 weeks of pregnancy and weighed less than 1,500 grams. Malformations were the reported as the leading cause of death for early term stillbirths, while cord problems were the leading cause of death in term/late term stillbirths. Autopsy was more likely to be conducted on later term stillbirths with greater delivery weight. Although autopsy is recognized as the most useful procedure in determining cause of death, autopsy was conducted on fewer than 14% of stillbirths in this cohort. This report did not examine the medical, legal or infrastructure barriers to increasing the autopsy rate for stillbirths in Arizona. Data reliability and completeness were issues that restricted a more in depth examination of the incidence and causes of stillbirth in Arizona from 2003 through 2007.

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. Because of the relatively small number of cases, the second annual report examined data from 2000 through 2004. The third annual report compared the 2006 cohort with the baseline cohort (2003). Based on the recommendation of the Unexplained Infant Death Council, the 2008 Incidence and Reported Causes of Stillbirths report presents a five-year cohort analysis of fetal deaths from 2003 through 2007.

Methodology

Arizona electronic fetal death certificate data for deaths occurring between 1st of January, 2003 and 31st of December 2007 are summarized in this report. To conduct the analyses, an electronic file was created merging data from the five-year cohort. Data obtained were from files generated by the Health Status and Vital Statistics Section of the Bureau of Public Health Statistics within the Arizona Department of Health Services. These files 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 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 weight, age, and geographic region of stillbirths. Finally, the reported causes of stillbirth are addressed and the limitations of these data are considered.

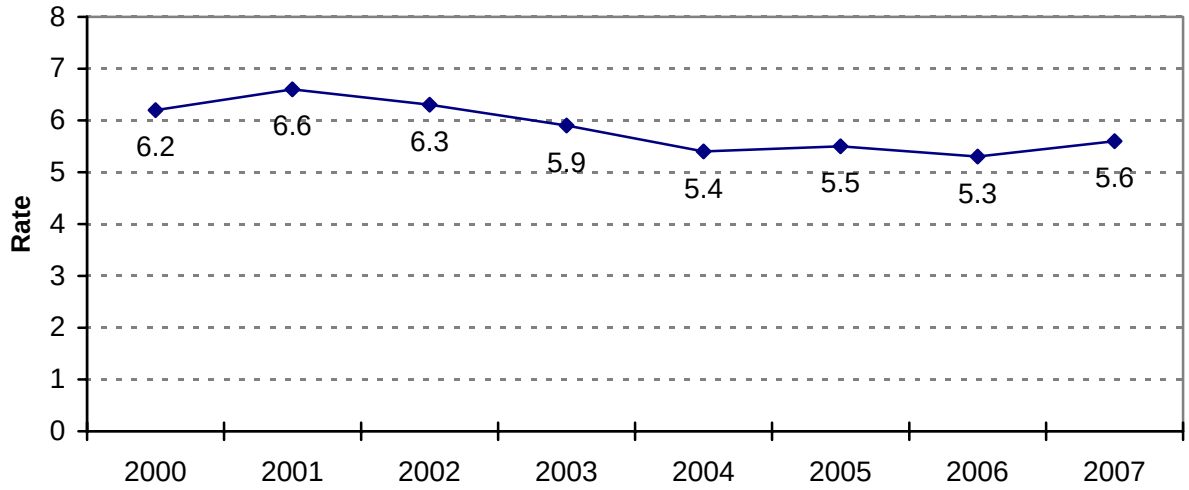
Arizona 2003-2007

As per the Arizona Vital Records Fetal Death Certificate database, there were a total of 2,702 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 of January 2003 through the 31st of December 2007. Figure 1 shows that the stillbirth rate ranged from a high of 6.6 per 1,000 live births and fetal deaths in 2001 to a low of 5.3 in 2006. Although the stillbirth rate increased from an “historic low” of 5.3 in 2006 to 5.6 in 2007, the rates were not significantly different.[*] The stillbirth rate in Arizona for the combined five-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 2004.[1] Nevertheless, the stillbirth rate in Arizona for 2007 remains above the Healthy People 2010 objective of 4.1 per 1,000 live births and fetal deaths.[2] If

[*] *P* =.22 (CI: -0.10 - 0.82)

Arizona had met the Healthy People 2010 standard from 2003 to 2007, approximately 700 stillbirths would have been averted.

Figure 1. Stillbirth Rates (per 1,000 live births + fetal deaths)
Arizona 2000-2007



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 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] Twenty-seven percent of women in the 2003-2007 stillbirth cohort reported between one and six previous spontaneous or induced terminations of pregnancy. It is unknown what proportion of these "terminations" met the definition of stillbirth; the spontaneous termination of pregnancy at 20 or more weeks gestation. In addition, it is likely that many of these women also delivered a live infant and are part of the 2003-2007 live birth cohort. Therefore, determining risk for stillbirth based on previous history of stillbirth is not possible in this report.

Multiple gestations have also been associated with stillbirth. Approximately ten 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] For multiparous women residing in Arizona, the rate of stillbirth was 14 per 1,000 live births and fetal deaths. The rate of stillbirth among singleton pregnancies (5.3 per 1,000 liver births and fetal deaths) was significantly less than for multiple pregnancies.[*] Although assisted reproductive technology (ART) has been associated with both multiple gestation and stillbirth, no data exist for women using ART in the fetal or birth certificate databases.

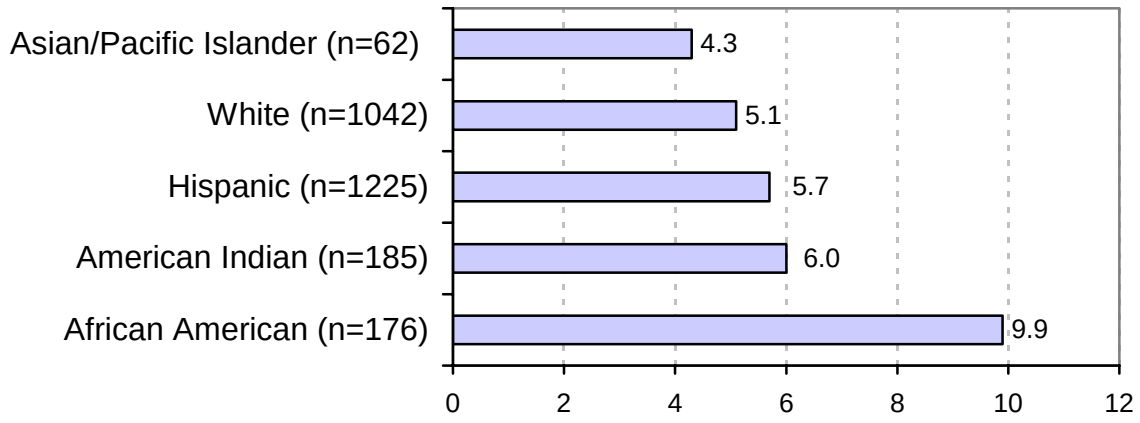
[*] *P*<0.0001(CI: 8.5 - 8.9)

Finally, uncertainty exists about whether multiple fetuses have additional risk because they were conceived with ART.[3]

Race/Ethnicity

Figure 2 shows the stillbirth rates by stillbirths with reported race/ethnicity for the 2003 through 2007 time period in Arizona. The stillbirth rate ranged from a low of 4.3 for Asian and Pacific Islander women to a high of 9.9 per 1,000 live births and fetal deaths for African American women. Stillbirth rates by race/ethnicity for the 2003-2007 cohort showed a decline across all racial and ethnic categories compared to the 2000-2004 cohort. However, a significant disparity in stillbirth rates remains between African American women and other racial/ethnic groups.* Pregnant African American women had 1.85 times the risk of having a stillbirth as non-African American women. This disparity is persistent in stillbirth rates across the United States.[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 Year and Race/Ethnicity, Arizona 2003-2007 (n=2,690)



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 adolescent and older women. Women under 20 years of age had a significantly greater risk for stillbirth than women 20 to 34 years old.** The risk of experiencing a stillbirth also increases for women 35 years of age and older. For these women, the risk for stillbirth was twice as great as women in their twenties.***

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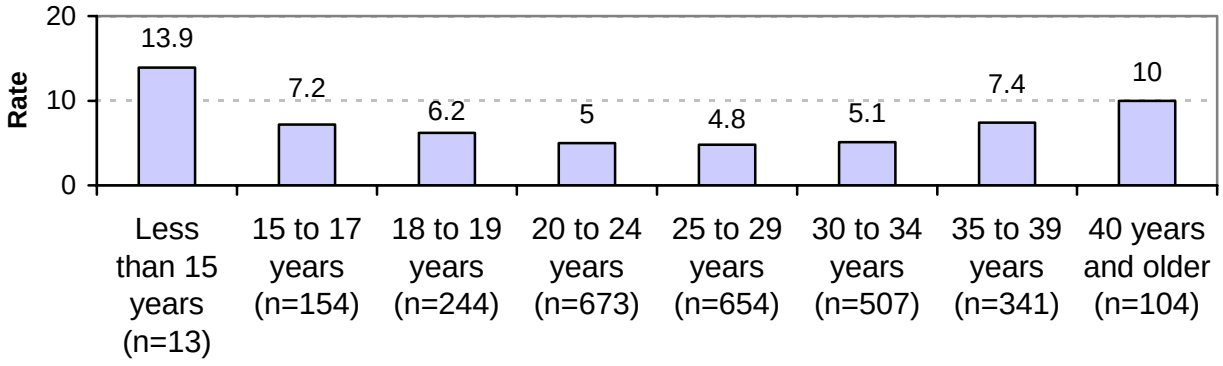
* *P*<0.0001 (CI: 3.0 - 5.9)
** *P*<0.0001 (CI: 1.5 - 1.96)
*** *P*<0.0001 (CI: 2.13 - 3.66)

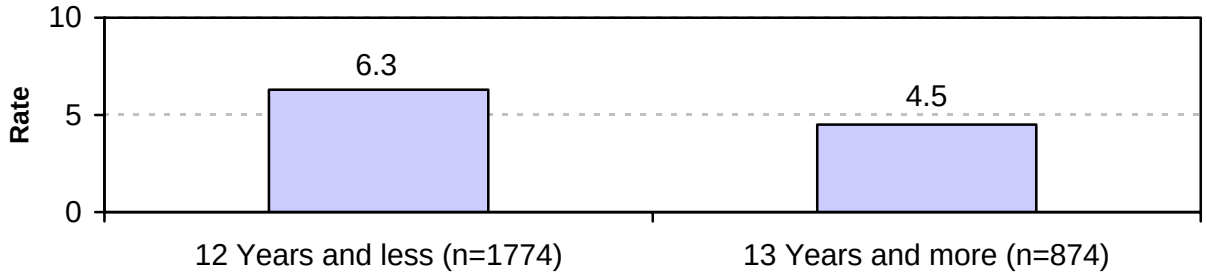
Figure 3. Stillbirth Rates (per 1,000 live births + fetal deaths) by Maternal Age
Arizona 2003-2007
(n=2,690)



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 (6.7 per 1,000 births and fetal deaths) experienced significantly higher rates of stillbirths than women with 13 years or more of education (4.8 per 1,000).*

Figure 4. Stillbirth Rates (per 1,000 live births + fetal deaths) by Level of Education
Arizona 2003-2007
(n=2,648)



Prenatal Care

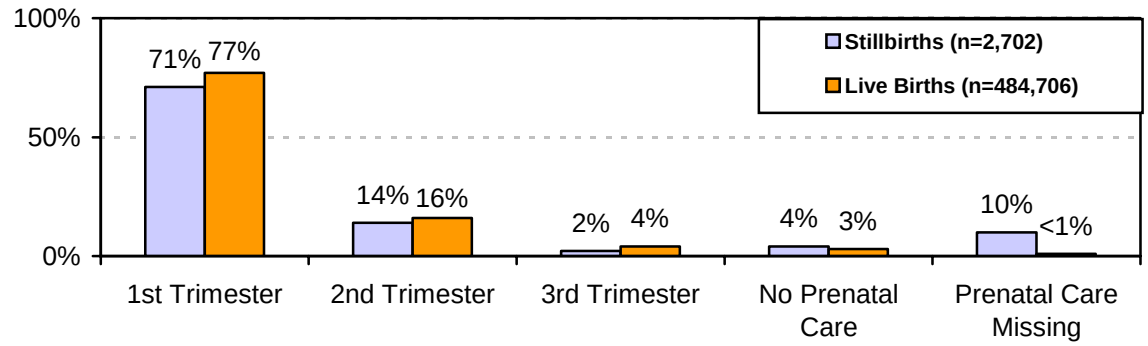
Determining the adequacy of prenatal care in stillbirths through a review of fetal death certificate data is complicated. Birth certificate data and fetal death certificate data do not contain any information on the quality or content of prenatal care. Methodologies for determining adequacy of prenatal 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,

*P<0.0001(CI: 1.5 - 2.1)

she may require more prenatal care visits than a woman without an identified risk factor, thus reducing her risk for a stillbirth. 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 addressed. Because of the difficulty in interpreting adequacy of prenatal care measures for fetal deaths, the analysis will not be presented in this report.

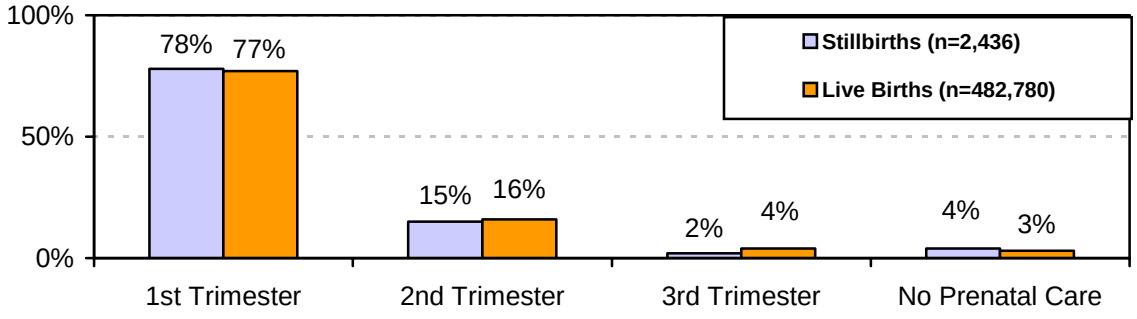
Figure 5 compares entry into prenatal care for women experiencing stillbirths and entry into prenatal care for women giving birth to live infants from 2003 through 2007. Women experiencing stillbirths entered prenatal care in the first trimester less frequently than women giving birth to live infants. However, 10 percent of the stillbirth cases were missing data for trimester of entry into prenatal care.

Figure 5. Women Entering Prenatal Care by Trimester
Arizona 2003-2007



In a similar analysis, the cases where month of entry into prenatal care was unknown or missing were removed. Figure 6 shows when these cases were excluded, timing of entry into prenatal care was very similar for mothers of stillborns and mothers delivering live infants. Although timing of entry into prenatal care is similar between the two groups, the limitations of the data prevent further exploration of hypothesized relationships between prenatal care and stillbirth.

Figure 6. Women Entering Prenatal Care by Trimester
Arizona 2003-2007
(excluding unknowns and missing cases)

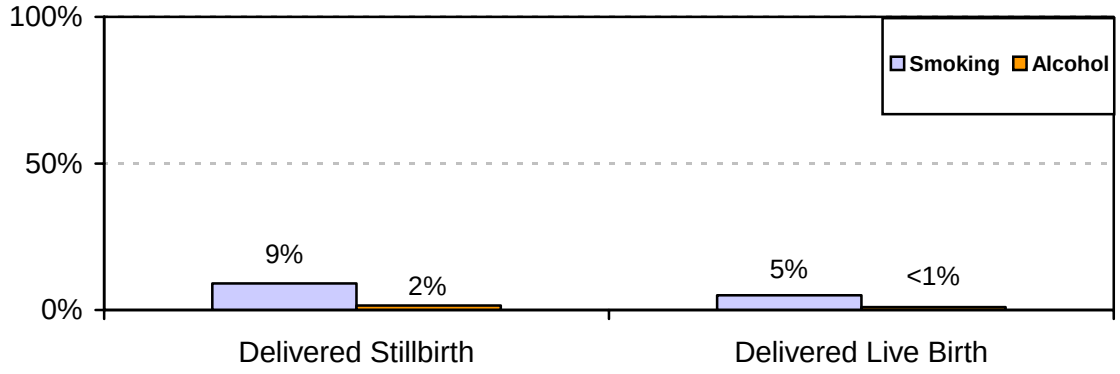


Behavioral Risk Markers

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. 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]

Although cigarette and alcohol use during pregnancy are recorded on the fetal death certificate, they were not analyzed in the three previous annual reports. The proprietor of the fetal death certificate data noted improved data quality obtained from hospitals over these two risk behaviors from 2006 onward. Therefore, this analysis is restricted to women with known responses to the questions of smoking or drinking in the 2006 through 2007 stillbirth cohort (n= 1,061 smoking responses; n= 1,056 drinking responses) and live birth cohort (n= 204,046 smoking responses; n= 203,634 drinking responses). The amount of cigarettes smoked each day and number of alcoholic drinks consumed each week is also collected on the fetal death certificate; however, more than 85 percent of cases lack data across these two fields. The Arizona fetal death certificate does not contain information about cigarette or alcohol use by trimester. Figure 7 shows the percentage of women who reported smoking cigarettes or drinking alcohol during pregnancy for 2006 through 2007.

Figure 7. Women Reporting Cigarette or Alcohol Use during Pregnancy by Birth Status
Arizona 2006-2007



Nine percent of women who had a stillbirth reported smoking and 2 percent reported drinking while pregnant. Only 5 percent of women delivering a live birth reported smoking and less than 1 percent reported drinking alcohol during pregnancy. Within this sample, the rate of stillbirth among women who reported smoking during pregnancy (9.3 per 1,000 live births + stillbirths) was significantly greater than the rate of stillbirth among non-smokers (5.0 per 1,000).* The rate of stillbirth for women who reported drinking alcohol during pregnancy is not presented because of the limited number of responses across this variable. 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 this data.

*P<0.0001(CI: 3.98 - 4.62)

CHARACTERISTICS OF STILLBIRTHS

Cases in the fetal death certificates are defined by gestational age, and when age is not available, delivery weight of at least 350 grams is used. Figure 8 shows the clinical breakdown of stillbirth by reported early, late, term, and post-term gestational ages.[7] Similar to national statistics,[3] 51 percent of stillbirths in Arizona occurred prior to 28 weeks gestation and 18 percent were "at term". It should be noted that gestational age is a physician's estimate (clinical estimate) and, therefore may have reliability and validity issues.[8]

Figure 8 Stillbirths by Gestational Age
Arizona 2003-2007
(n= 2,696)

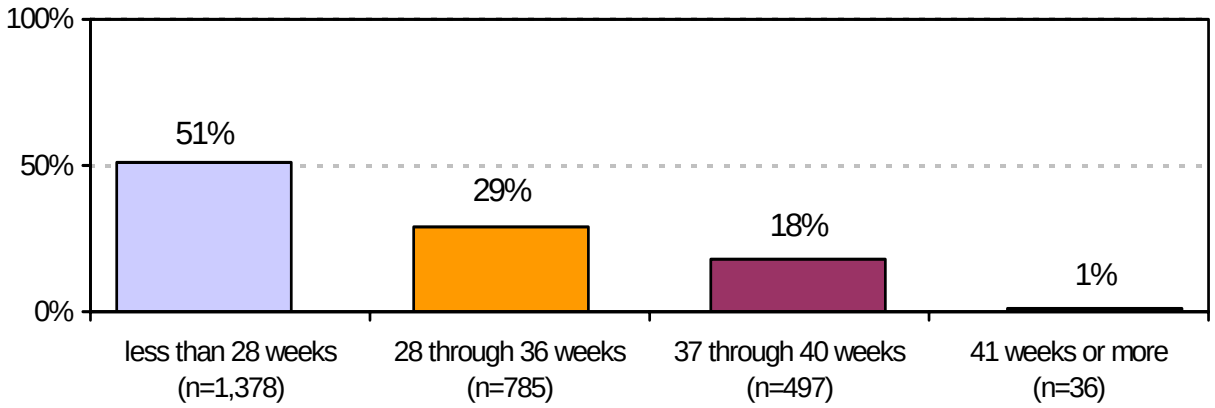
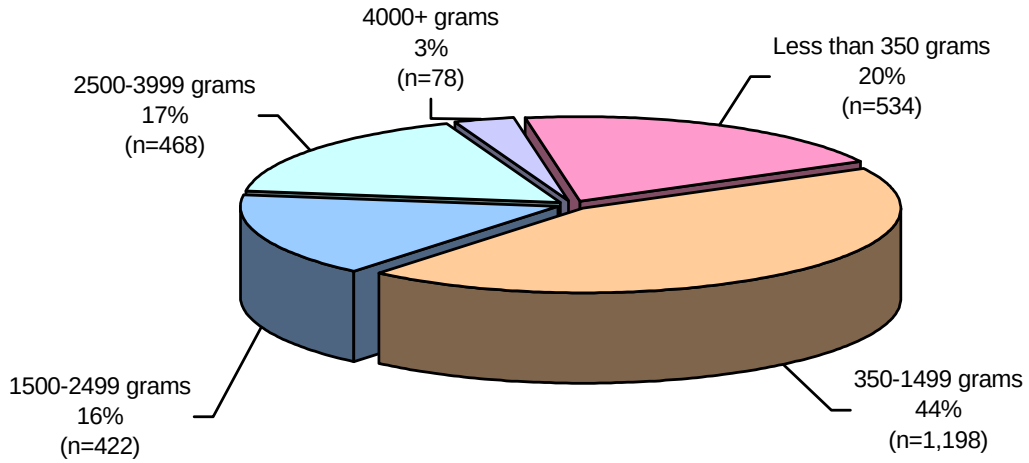


Figure 9 shows the reported weight of stillbirths from 2003-2007.

Figure 9. Reported Weight of Stillbirths
Arizona 2003-2007
(n=2,700)



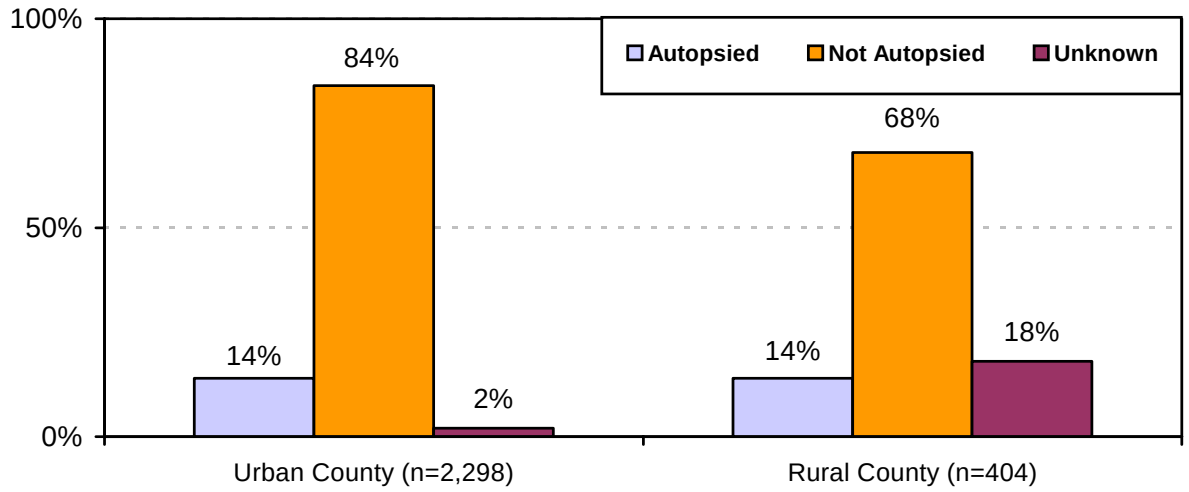
It is evident from Figure 9 that 44 percent of these stillbirths were reported to weigh between 350 to 1,499 grams, and 16 percent weighed between 1,500 and 2,499 grams. Another 20 percent were reported to weigh less than 350 grams and two cases were missing data for birth weight. Most fetuses that survive to 20 weeks gestation weigh over 350 grams.[9] Therefore, while some of these fetuses may have indeed weighed less than 350 grams, it is likely that some of the reported weights of less than 350 grams were data errors.

County of Occurrence and Frequency of Autopsy

Fetal autopsies are the most useful diagnostic procedure for information on the cause of death.[3] However, only 13.8 percent of all reported stillbirths from 2003-2007 (n=372) received an autopsy (see Appendix A). The proportion of stillbirths receiving an autopsy also declined each year from 2004 (16.2 percent) to 2007 (11.1 percent). Additionally, the quality of data declined each year over the reported autopsy field. Only 0.9 percent of cases were coded as "unknown" in 2003, but 6.7 percent coded as "unknown" in 2007.

One of the recommendations made by the Unexplained Infant Death Council for the fourth annual report was to review the proportion of stillbirths that were autopsied in urban versus rural areas. From 2003 through 2007, the majority of stillbirths occurred in urban counties (85 percent). Sixty-eight percent of those stillbirths were reported to have occurred in Maricopa County (n=1,840), 15 percent occurred in Pima county (n=407), and the remainder occurred in twelve other counties (n=455). Figure 10 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. Although more stillbirths were delivered in Maricopa County than in Pima County, the proportion of stillbirths autopsied was significantly lower in Maricopa County compared to Pima County.[*]

Figure 10. Stillbirths Autopsied by Urban and Rural Counties
Arizona 2003-2007
(n=2,702)



[*] Chi-square 70.39 (2), *P*<0.0001

The proportion of autopsies was also analyzed by race, ethnicity, gestational age, and reported weight of the fetus. In terms of ethnicity and race, the percentage of stillbirths delivered by non-Hispanic women that received an autopsy was 14.8 percent compared to 12.5 percent of stillbirths delivered by Hispanic women. The proportions of stillbirths autopsied for White (15.5 percent), Asian (14.5 percent), and African American (16.0 percent) women were all higher than for stillbirths autopsied for American Indian women (8.2 percent). However, the high percentage of 'unknown autopsy status' among American Indian stillbirths (12.4 percent) limits the interpretation of the disparity.

Figure 11 shows the percentage of stillbirths that were autopsied by reported gestational weight. In general, as the reported gestational weight increased, the percentage of stillbirths autopsied also increased. Just 8.6 percent of stillbirths weighing 1 to 349 grams were autopsied compared to 21.8 percent of stillbirths weighing 4,000 grams or more. Significantly more stillbirths occurring at or after 25 weeks gestation were autopsied (16.7 percent) than stillbirths occurring prior to 25 weeks (9.5 percent).*

Figure 11. Stillbirths Autopsied by Reported Weight
Arizona 2003-2007
(n= 2,587)

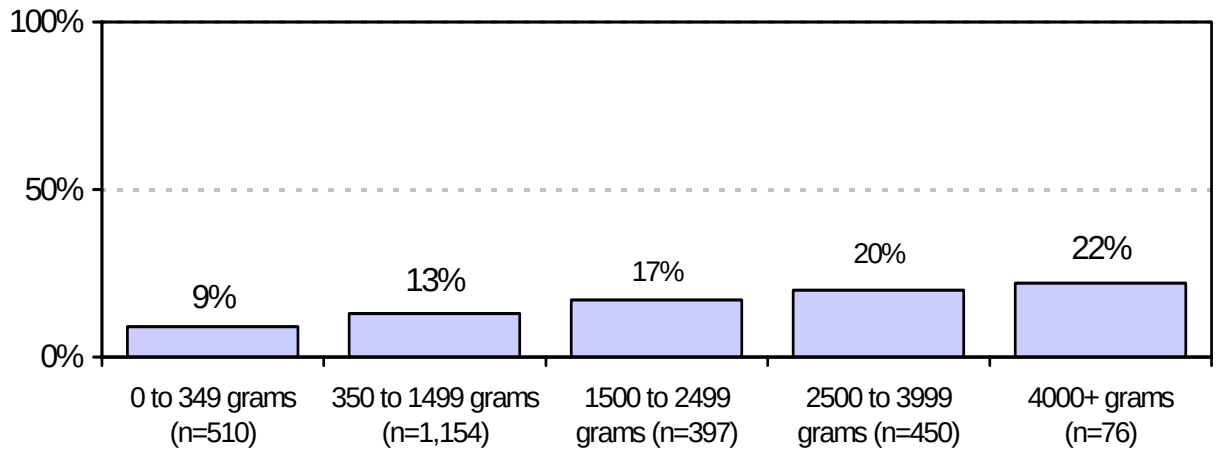
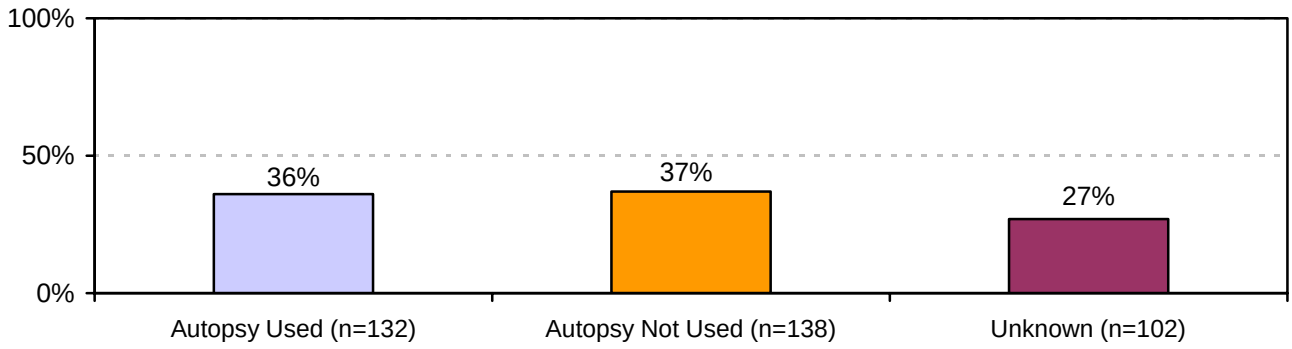


Figure 12 shows the percentage of autopsies that were actually used to determine the cause of death among stillbirths that received an autopsy. Although autopsy is considered the most useful procedure in determining the cause of stillbirth,[3] the procedure was only used slightly more than one-third of the time to ascertain the cause of death in Arizona. It should be noted that the large proportion of autopsied cases recorded as "unknown" makes further analysis of this variable unreliable.

*Chi-square 28.96 (2) *P*<0.0001

Figure 12. Autopsies Used in Determining Cause of Death among Stillbirths Receiving an Autopsy Arizona 2003-2007 (n=372)



Reported Cause of Death

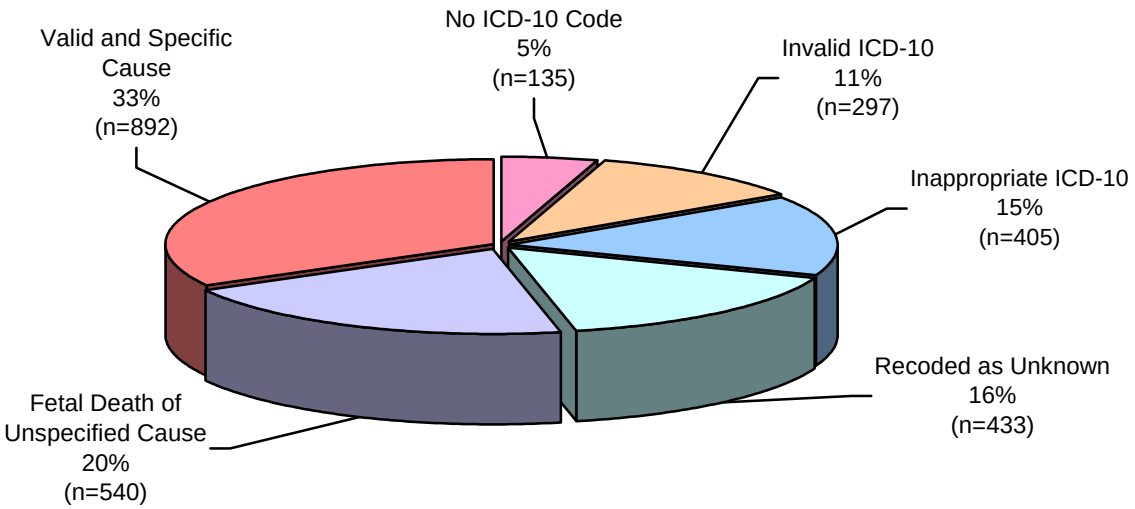
Most conditions that have been linked to stillbirth can be classified as associations rather than unequivocal causes.[3] As reported in the first Incidence and Reported Causes of Stillbirth Report, the cause of stillbirth often remains unknown, even when a concerted effort is made to determine the cause of death. Currently, 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.

Currently this coding 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. From 2003 to 2007, there were over 180 distinct ICD-10 codes used to classify cause of death in the fetal death certificate data. In order to group these causes into classifications for this report, 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 2003 through 2007 reporting period. As is true in many studies on the causes of stillbirths[3], the cause of death was unknown in the majority of stillbirths for this time period. In many cases, the lack of a definitive cause of death may be the result of data reporting issues. Five percent of the stillbirths reviewed for this report did not have an ICD-10 code listed in the fetal death file, 11 percent of the stillbirths had invalid ICD-10 codes, 15 percent of the stillbirths had inappropriate ICD-10 codes, 16 percent of the stillbirths were reclassified as "unknown cause" because the ICD-10 code listed in the death certificate file did not appear to be a valid ICD-10 code for a fetal death. Another 20 percent of the stillbirths were coded with an ICD-10 code of P95, or "fetal death of unspecified cause". The remaining 33 percent of fetal deaths had ICD-10 codes indicating valid and specific causes of fetal deaths.

[*]ICD-10 codes were reclassified according to a matrix created by Dr. Mike Clement of the Arizona Perinatal Trust in 2006.

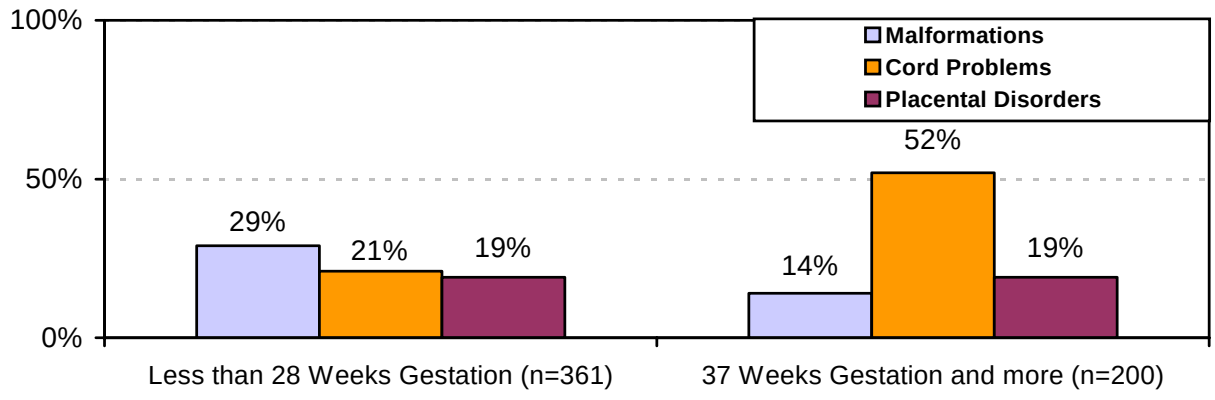
Figure 13. Causes of Stillbirth
Arizona 2003-2007
(n=2,702)



Of the 33 percent of stillbirths with a known cause of death, the most common cause was cord problems (30 percent), followed by malformations (22 percent), placenta disorders (20 percent), hypoxia (5 percent) and cardiovascular disease (5 percent). Infection or inflammation (4 percent), and hydrops fetalis or isoimmunization and hypertension (3 percent each) accounted for the remaining cases where cause of death was known. “Other causes” were listed for 7 percent of stillbirths.

Figure 14 illustrates the top three reported causes of death by early term (less than 28 weeks) and term/post-term (37 weeks or more) gestational age categories.

Figure 14. Top Three Causes of Stillbirth by Gestational Age
Arizona 2003-2007
(n=561)



Within these two gestational age categories, 29 percent of deaths had a reported known cause of death. The most common causes of death were cord problems, malformations and placental disorders for both age categories. For stillbirths delivered at less than 28 weeks gestation, malformations (29 percent) accounted for the greatest proportion of deaths, while cord problems (52 percent) was the most common cause of death for stillbirths at 37 weeks or more gestation.

DATA QUALITY

When the Incidence and Reported Causes of Stillbirths 2003 Report was presented to the Unexplained Infant Death Council in April of 2005, there were many concerns regarding the quality of the data. The Council recommended that the second annual stillbirth report include an analysis of the quality of the data including a review of problematic fields by facility or hospital. In response to the concerns regarding data quality and the Council's recommendations, a number of data elements are examined annually for data quality. The analysis for the 2008 Report 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 was 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 should 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 2,702 cases reported in these files, six did not have data in the reported gestational age field. All six of these cases had a weight of at least 350 grams indicating that they were an appropriate gestational age for inclusion in this report. The remaining 2,696 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] The calculation of gestational age by reported last menstrual period is complicated by missing and unreliable data over 17 percent of cases. Nevertheless, when using last menses to measure gestational age, approximately 3 percent (n=88) of stillbirths were less than 20 weeks old and half of these cases (n=44) also had reported 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. Three percent of the cases (n=69) were reported to weigh zero grams and

another 17 percent (n=465) were reported to weigh less than 350 grams. No association was found between zero gram stillbirths and particular delivery facilities.

Quality of Data Fields

The quality of data was examined across all selected variables used in this report. When more than 5 percent of data was missing, this was cited in the report. Additional variables that would be useful in the analysis of stillbirth include the amount of cigarettes smoked per week and the number of alcoholic drinks consumed per day by trimester, and the BMI of the mother. Although total smoking and alcohol consumption are recorded on the fetal death certificate, more than 85 percent of cases had no data on the amount consumed. Also, exposure to second hand smoke is not collected by the fetal death certificate. Weight gained during pregnancy is also collected on the fetal death certificate. Obesity is associated with stillbirth.[3,4] However, weight gain data was missing over 25 percent of cases, and neither baseline weight/height (commonly measured at first prenatal visit) nor BMI are collected on the fetal death certificates. Proposed revisions to the fetal death certificate (see http://www.azdhs.gov/plan/cert/pdf/fetal.pdf) include data fields for BMI, pre-pregnancy weight, and trimester of cigarette use. These revisions along with more reliable data collection at delivery facilities would bolster future analyses of the risks for stillbirth.

RECOMMENDATIONS FOR FURTHER STUDY

The Incidence and Reported Causes of Stillbirth Report for 2009 will utilize a one year cohort of stillbirths (2008) to analyze rates and proportions over the same variables. In addition, the 2009 Report should consider the following quality improvements;

- request the assistance of a qualified MD from the Arizona Perinatal Trust to complete the classification of the causes of stillbirth using Gardosi's ReCoDe classification system.[10]

- include an appendix of missing data fields that will be sent to the proprietors of the fetal death certificates as notification of the strengths and weaknesses of data collection.

- utilize a format that compares Arizona rates and proportions side-by-side with national rates and proportions.

- examine reports on stillbirth from other states in the attempt to include new analyses.

Appendix A

County of Delivery	AUTOPSY		
	Autopsied	**Not Autopsied**	**Unknown**
APACHE	0	20	10
	.0%	66.7%	33.3%
COCHISE	14	19	5
	36.8%	50.0%	13.2%
COCONINO	2	40	8
	4.0%	80.0%	16.0%
GILA	1	11	1
	7.7%	84.6%	7.7%
GRAHAM	0	14	3
	.0%	82.4%	17.6%
GREENLEE	0	0	1
	.0%	.0%	100.0%
MARICOPA	220	1597	23
	12.0%	86.8%	1.3%
MOHAVE	7	45	12
	10.9%	70.3%	18.8%
NAVAJO	4	30	16
	8.0%	60.0%	32.0%
PIMA	87	294	26
	21.4%	72.2%	6.4%
PINAL	6	24	3
	18.2%	72.7%	9.1%
SANTA CRUZ	1	5	1
	14.3%	71.4%	14.3%
YAVAPAI	13	31	1
	28.9%	68.9%	2.2%
YUMA	17	87	3
	15.9%	81.3%	2.8%
Total	372	2217	113
	13.8%	82.1%	4.2%

References

1. MacDorman, MF, Munson, ML, & Kirmeyer, S. Fetal and Perinatal Mortality, United States, 2004;56:1-20.

2. U.S. Department of Health and Human Services. Healthy People 2010. Retrieved June 12, 2008, from http://www.healthypeople.gov/document/html/objectives/16-01.htm

3. Sliver RM, Varner MW, Reddy U, Goldenberg R, Pinar H, Conway D, Bulkowski R, et al. Work-up of stillbirth: a review of the evidence. *American Journal of Obstetrics & Gynecology*, 2007;196:433-444.

4. Goldenberg, RL, Kirby, R, Culhane, JF. Stillbirth: a review. *The Journal of Maternal-Fetal and Neonatal Medicine,* 2004;16:79-94.

5. Ananth CV, Shiliang L, Kinzler WL, & Kramer MS. Stillbirths in the United States, 1981-2000: An Age, Period, and Cohort Analysis. *American Journal of Public* Health;2005:95:2213-2217.

6. Kotelchuck, M. An Evaluation of the Kessner Adequacy of Prenatal Care Index and a Proposed Adequacy of Prenatal Care Utilization Index. *American Journal of Public Health;* 1994:84:1414-1420.

7. The Centers for Disease Control and Prevention. Birth Defects: MADCP. Retrieved July 17, 2008, from the CDC Birth Defects website:http://www.cdc.gov/ncbddd/bd/stillbirths.htm

8. Wingate, MS, Alexander, GR, Buekens, P, & Vahratian, A. Comparison of Gestational Age Classifications: Date of Last Menstrual Period vs. Clinical Estimate. *Ann Epidemiology*;2007:17:425-430.

9. Alexander G, et.al. A United States National Reference for Fetal Growth. *Journal of Obstetrics and Gynecology*,1996:87:163-168.

10. Gardosi J, Kady SM, McGeown P, Francis A & Tonks A. Classification of stillbirth by relevant condition at death (ReCoDe): population based cohort study. *British Medical Journal*;2005:331:1113-1117.

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