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Complications of Pregnancy and Childbirth in Orange County

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Background

The purpose of this report is to describe the characteristics of maternal morbidity and complications related to pregnancy and childbirth. Maternal morbidity in Orange County was examined in terms of the mother's demographics (e.g., age, race/ethnicity), where she lives, at which hospital she delivered her baby, and the type of delivery. The length of hospital stay and hospitalization charges are also described.

Maternal morbidity includes preexisting medical conditions that are aggravated by pregnancy or the labor and delivery process. It also includes medical conditions and complications that arise after the woman becomes pregnant. Complications can range from mild to severe (CDC, 2010) and can include complications that occur during pregnancy, during the birthing process, or those occurring during the postpartum period (Vallely, et al., 2005). According to Danel et al (2003) hospitalizations due to complications related to pregnancy occurs in approximately 15 to 25 percent of all deliveries in the US. Researchers have found that increasing rates of several severe complications of labor and delivery are occurring in parallel with the increasing rate of cesarean delivery (Wax, 2006; Berg et al, 2009; Kuklina et al, 2009). Moreover, in 2011, the California Pregnancy-Associated Mortality Review reported that 17% of 65 maternal deaths in California during a two-year time period (2002-2003) experienced complications attributed to the current or prior cesarean that the reviewers determined to be one of the contributing factors in the mother's death. Cesarean deliveries are major surgical procedures with inherent risks (maternal morbidities) not associated with vaginal births.

The use of cesarean as a method of delivery has dramatically increased over the past 50 years. Since the mid 1960's when cesarean rates were first measured, the rate nationwide has increased more than 7 fold, from 4.5% in 1965 to 31.5% in 2007. In Orange County, the percentage of women having a cesarean delivery has increased 47.5% since 1999, from 22.5% of all births up to the current rate of 33.2% in the current report (2008 Orange County Birth Files).

The growing number of cesarean deliveries cannot be fully explained by reported increases in the number of births to older women, multiple births, or in the use of in-vitro fertilization (IVF) methods (Declercq et al., 2005). A recent Canadian study argued that the increase in elective primary cesarean deliveries was influenced by the widespread perception that the procedure is of little or no risk to healthy women (Lui et al., 2007). Nationally, researchers have estimated elective cesarean rates as high as 28% of all cesareans (Meikle et al, 2005).

This study examined the characteristics of those women who gave birth within the study period including their demographic and geographic distribution, antenatal morbidity and complications associated with labor and delivery. We also explored differences in complications associated with the method of delivery, where the mother lives and at which hospital she delivered her baby. This report examined the likelihood of undergoing a cesarean delivery after having experienced at least one antepartum comorbidity. We also examined the likelihood of experiencing one or more major complication(s) during labor and delivery depending upon the method of delivery (vaginal or cesarean). In order to determine the likelihood of an event, odds ratios (OR's) with a 95% confidence interval were calculated using logistic regression models.

Study Methods

The data utilized in this report were from the California Office of Statewide Health Planning and Development (OSHPD) for hospitalizations related to pregnancy, labor and delivery for the years 2006 through 2008. This analysis included residents and non-residents who gave birth at hospitals in Orange County, as well as a small number of county residents who delivered at a hospital outside of the county.

Those hospitalizations that did not result in a delivery were not included in this analysis – specifically, 11,878 hospitalizations for pregnant women for a medical condition but they did not deliver, and 1,602 postpartum hospitalizations.

Women who were pregnant with more than one baby (i.e., multiparous) were included in the present study in order to document the full impact of all pregnancies on the birthing hospitals in Orange County. It is important to note that multiparous cases accounted for only 1.7% (n=2,479) of all deliveries. The final analysis was therefore based on a total of 144,584 cases from 2006-2008.



Eight antepartum comorbidity categories were identified based on the published peer-reviewed research of Burrows *et al* (2004) and Gregory *et al* (2002). These researchers identified and validated the codes used through chart review by obstetricians. Comorbidities are defined here as the presence of one or more disorders (or diseases) in addition to the primary reason for the hospitalization (i.e., childbirth), or the effect of such additional disorders or diseases. Antepartum

comorbidities (conditions existing prior to labor and delivery) were identified based on ICD-9 for the primary and up to 24 other diagnosis codes associated with each record (**Table 1**). A woman who presents with one of these conditions, such as, chronic hypertension or pregestational diabetes, will likely have a more complicated delivery than a woman who does not. This in turn might require that a cesarean delivery be performed.

Table 1: ICD-9 CM Codes Used to Identify Antepartum Comorbidities

Pregestational Diabetes:	250.00 – 250.33, 250.40 – 250.93, 648.00 – 648.09
Gestational Diabetes:	648.80 – 648.89
Chronic Hypertension:	401.0, 401.1, 401.9, 402.00 – 405.99, 437.2, 642.00 – 642.29, 642.90 – 642.99
Preeclampsia/Eclampsia:	642.40 – 642.74
Pregnancy Induced Hypertension:	642.30 – 642.39
Systemic Lupus Erythematosus:	710.0
Sickle Cell Disease:	282.60 – 282.69
Premature Onset of Labor/Delivery:	644.20 – 644.23

The selection of major complications associated with labor and delivery followed the World Health Organization model (WHO, 1998) guidelines, which included disease and management-based classifications. Additionally, the indicators used in the model or a variation of the WHO model and utilized in previous research (Kuklina et al., 2009).

Table 2: ICD-9 CM Codes used to Identify Major Complications Associated with Labor and Delivery

Anesthesia Complications:	668.00 – 668.29
Uterine Rupture:	665.10, 665.11
Adult Respiratory Distress Syndrome:	518.5, 518.81, 518.82, 518.84, 799.1
Pulmonary Embolism:	673.00 – 673.84, 415.10 – 415.19
Pulmonary Edema:	518.4, 428.1
Renal Failure:	669.30 – 669.39, 584.0 – 584.9
Heart Failure:	669.40 – 669.49, 427.5, 428.1, 428.21, 428.31, 428.41, 997.1
Puerperal Cerebrovascular Disorders:	674.00 – 674.04, 671.50 – 671.59, 430, 431, 436, 432.0 – 432.9, 433.00 – 433.99, 434.00 – 434.99, 437.0 – 437.9, 997.2, 999.2
Deep Vein Thrombosis:	671.30 – 671.39, 671.40 – 671.49, 671.90 – 671.99, 451.0, 451.10 – 451.19, 451.2, 451.80 – 451.89, 451.9, 452, 453.0, 453.3, 453.40 – 453.49, 453.5 – 453.9
Disseminated Intravascular Coagulation:	286.6, 286.9, 666.30 – 666.39
Shock:	669.10 – 669.19, 998.0, 995.0, 995.4, 785.50 – 785.59
Sepsis:	38.0, 38.10 – 38.19, 38.2, 038.3, 038.40 – 038.49, 038.8, 038.9, 995.91, 995.92
Hemorrhage Resulting in Hysterectomy:	666.00 – 666.34, must also include one of the following (Procedure Codes) 683, 683.1, 683.9, 684, 684.1, 684.9, 685, 685.1, 685.9, 686, 686.1, 686.9, 687, 687.1, 687.9, 688, 689
Hemorrhage Resulting in Blood Transfusion:	666.00 – 666.34, must also included one of the following (Procedure Codes) 990.0 – 990.9
Major Infections during the Puerperium Period:	670.00 – 670.99, 672.00 – 672.99
Ventilation:	939.0, 960.1 – 960.5, 967.0 – 967.2
Died:	Disposition code = Died

The method of delivery identified for cases examined in this study was based on diagnosis related group (DRG) codes. These codes assign cases based on the type of encounter and include diagnosis and procedure codes from the International Classification of Disease 9th Edition (ICD-9), age, discharge status, and the presence of complications/comorbidities (Burrows, 2004). For example, the DRG code 765 designates a cesarean delivery with major complications/comorbidities.

Using DRG codes, those hospital records associated with birth were identified. Next, these records were further narrowed to create the two categories used in this study (vaginal and cesarean deliveries). Initially, vaginal births were disaggregated into primary and vaginal birth after having had a cesarean delivery (VBAC) and cesarean deliveries were broken down into primary and repeat. However, there were too few cases across some of the four groups to analyze any patterns in the data. Therefore, these analyses report outcomes based on all vaginal and all cesarean deliveries. In the end, a total of 17 major maternal complications associated with labor and delivery were utilized (**Table 2**). Further, maternal death was added to the model as possible outcome.

Findings

During the three-year study period, 144,584 births were identified and included in the analysis.

Antepartum Comorbidities

Antepartum or prenatal comorbidities were conditions that either existed prior to the pregnancy or developed sometime during the pregnancy (but prior to labor and delivery). During the study period, 16.1% of all pregnant women had what could be classified as a serious antepartum comorbidity (n=23,265 of 144,584; **Table 3**). See endnotes for additional discussion of multiparous cases.¹

The eight antepartum comorbidities examined in this study are presented below in **Table 3** for all cases and by the method of delivery, vaginal or cesarean. Mothers presenting with at least one prenatal comorbidity more than doubled their likelihood of having a cesarean delivery (OR=2.1, CI: 2.1-2.2).



Table 3: Antepartum Comorbidities by Delivery Type (2006-2008)

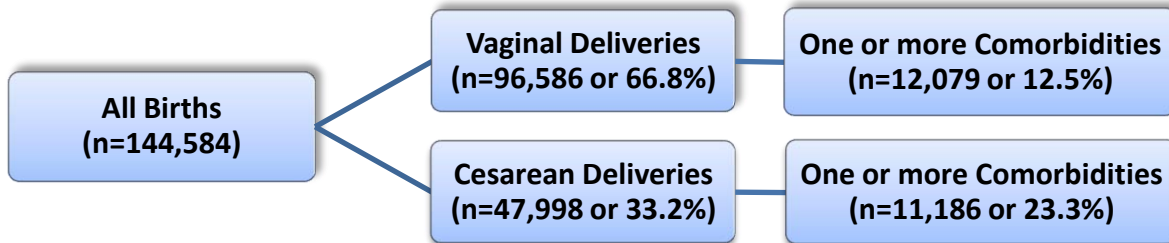
Comorbidities	Total (n=144,584)		Vaginal (n=96,586)		Cesarean (n=47,998)		OR	95% CI	
	n	%	n	%	n	%			
Gestational Diabetes	9,321	6.4%	5,032	5.2%	4,289	8.9%	1.8	1.7	1.9
Early Onset of Labor/Delivery (< 37 weeks)	8,689	6.0%	4,357	4.5%	4,332	9.0%	2.1	2.0	2.2
Preeclampsia	3,321	2.3%	1,331	1.4%	1,990	4.1%	3.1	2.9	3.3
Pregnancy-Induced Hypertension	2,718	1.9%	1,418	1.5%	1,300	2.7%	1.9	1.7	2.0
Chronic Hypertension♦	1,931	1.3%	848	0.9%	1,083	2.3%	2.6	2.4	2.9
Pre-Gestational Diabetes♦	1,064	0.7%	370	0.4%	694	1.4%	3.8	3.4	4.3
Systemic Lupus Erythematosus♦	161	0.1%	72	0.1%	89	0.2%	2.5	1.8	3.4
Sickle Cell Disease♦	12	<0.01%	7	<0.01%	5	<0.01%	1.4**	0.5	4.5
Total Number of Comorbidities	27,217*		13,435		13,782				
Women with One or More Chronic Conditions	2,874	2.0%	1,684	1.7%	1,190	2.5%	2.9	2.7	3.1
Women with One or More Pregnancy-Induced Conditions	21,445	14.8%	10,192	10.6%	11,253	23.4%	1.9	1.8	1.9
Women with One or More Comorbidities	23,265	16.1%	12,079	12.5%	11,186	23.3%	2.1	2.1	2.2

*Note: this number is based on the total number of incidents of comorbidities not the number of individuals.

**Not significant at the 95% confidence interval. ♦Denotes chronic conditions, not necessarily pregnancy-induced.

Antepartum comorbidities can be viewed as risk factors for more serious complications during the perinatal period and may in turn influence the method of delivery chosen by a woman and her physician. Indeed, nearly one in four women (23.3%, n=11,186) who had a cesarean delivery experienced at least one antepartum comorbidity (**Fig. 1**). By comparison, 12.5% (n=12,079) of women having a vaginal delivery experienced at least one antepartum comorbidity.

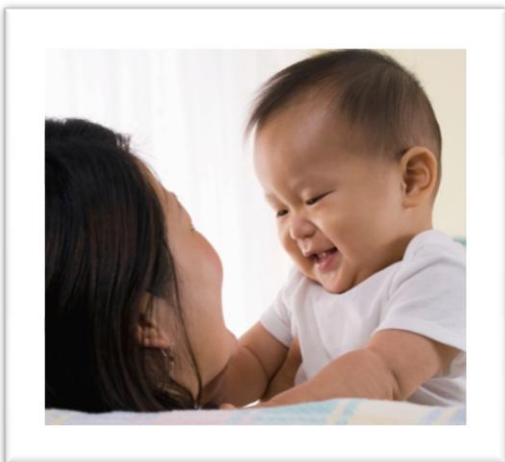
Figure 1: Antepartum Comorbidities by Type of Birth



Antepartum comorbidities could be grouped into the conditions that were either preexisting chronic conditions or those that arose during the pregnancy (i.e., pregnancy-induced; **Table 3**). Women with such a preexisting chronic condition were overall almost three times more likely to have a cesarean delivery (OR=2.9, CI: 2.7-3.1) compared to two times more likely for pregnancy-induced conditions (OR=1.9, CI: 1.8-1.9).



The two most common pre-existing conditions were chronic hypertension (n=1,931 or 1.3%) and pre-gestational diabetes (n=1,064 or 0.7%). Women with chronic hypertension were almost three times (OR=2.6, CI: 2.4-2.9), while those with pre-gestational diabetes were almost four times (OR=3.8, CI: 3.4-4.3) more likely to have a cesarean delivery. While a relatively rare condition, women who had a diagnosis of systemic lupus erythematosus were two and a half times more likely to have a cesarean delivery (OR=2.5, CI: 1.8-3.4).



The two most common pregnancy-induced antepartum conditions included gestational diabetes (n=9,321 or 6.4%) and early onset of labor/delivery (n=8,689 or 6.0%). Both of these conditions about doubled the odds of having a cesarean. Women diagnosed with preeclampsia, the 3rd most common prenatal condition, had a three times greater chance of having a cesarean delivery (OR=3.1, CI: 2.9-3.3; **Table 3**).

Geographic Distribution of Antepartum Comorbidities

The percentage of women giving birth with one or more antepartum comorbidity are presented in the map in **Figure 2** based on their city of residence and by birthing hospital (indicated by numbers in the map that correspond to the hospitals listed in **Table 4**).

Mother's City: The countywide rate for antepartum comorbidities, which includes only Orange County women, was 16.0% (n=19,835). Residents from Laguna Hills (18.7%; n=197) and San Juan Capistrano (18.4%; n=272) had the highest percentage of antepartum comorbidities within the county. Conversely, women from Laguna Beach (11.0%; n=54) and Villa Park (11.8%; n=9) had the lowest percentage of prenatal comorbidities (see **Table 11** in appendix for antepartum comorbidity percentages by city).

Hospitals: The countywide rate for antepartum comorbidities by hospital (residents and non-residents) was 16% (n=22,258). The highest percentage of births to women who had one or more prenatal comorbidities (34.8%; n=1,416) occurred at UCIMC. Nearly one-in-four women giving birth at Kaiser Foundation Hospital in Anaheim had at least one comorbidity (23.9%; n=2,622). Western Medical Center-Santa Ana was the third highest at 19.3% (n=1,968; **Table 4**). Table 4 shows that each of these birthing hospitals has a neonatal intensive care unit. The lowest percentage of antepartum comorbidities was seen at Anaheim General (4%; n=57), La Palma Intercommunity Hospital (8.3%; n=104), and Coastal Community Hospital (9.6%; n=638).

Figure 2: Percentage of Antepartum Comorbidities by City of Residence and Hospital

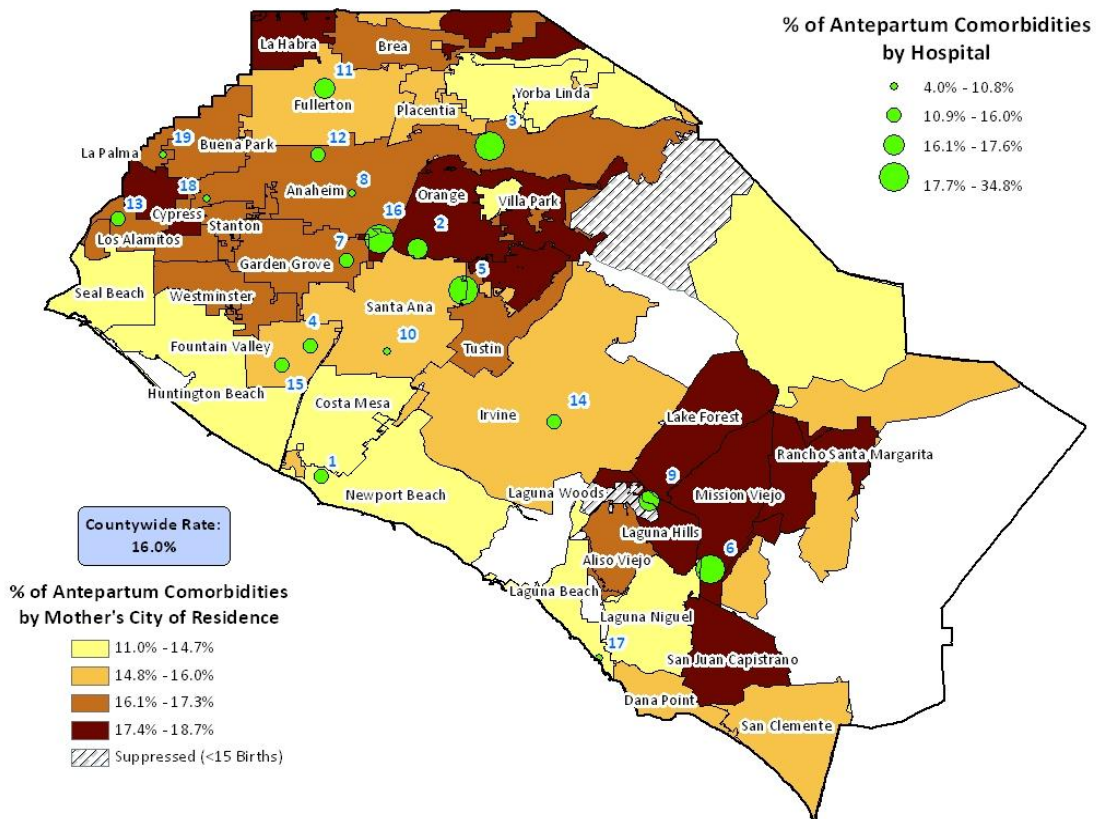


Table 4: Percentage of Antepartum Comorbidities by Hospital (2006-2008)

ID	Hospital	All Births at OC Hospitals		Comorbidities by Hospital	
		n	%	n	%
1	Hoag Memorial Hospital Presbyterian♦	15,387	11.1%	2,044	13.3%
2	St. Joseph Hospital – Orange♦	15,005	10.8%	2,640	17.6%
3	Kaiser Foundation Hospital – Anaheim♦	10,963	7.9%	2,622	23.9%
4	Fountain Valley Regional Hospital & Medical Center♦	10,680	7.7%	1,631	15.3%
5	Western Medical Center - Santa Ana♦	10,188	7.3%	1,968	19.3%
6	Mission Hospital Regional Medical Center♦	9,322	6.7%	1,667	17.9%
7	Garden Grove Hospital And Medical Center	8,959	6.4%	1,049	11.7%
8	Western Medical Center Hospital – Anaheim♦	8,377	6.0%	903	10.8%
9	Saddleback Memorial Medical Center♦	8,276	6.0%	1,451	17.5%
10	Coastal Communities Hospital	6,647	4.8%	638	9.6%
11	St. Jude Medical Center♦	6,308	4.5%	1,047	16.6%
12	Anaheim Memorial Medical Center♦	5,682	4.1%	831	14.6%
13	Los Alamitos Medical Center	5,418	3.9%	742	13.7%
14	Irvine Regional Hospital♦	4,902	3.5%	687	14.0%
15	Orange Coast Memorial Medical Center♦	4,525	3.3%	600	13.3%
16	University Of California Irvine Medical Center♦	4,071	2.9%	1,416	34.8%
17	Mission Hospital Laguna Beach	1,589	1.1%	160	10.1%
18	Anaheim General Hospital	1,423	1.0%	57	4.0%
19	La Palma Intercommunity Hospital	1,251	0.9%	104	8.3%
20	Anaheim Regional Medical Center	2	--	1	--
OC Hospitals*		138,975	96.1%	22,258	16.0%
OC Resident Births at Non-OC Hospitals		5,609	3.9%	1,007	18.0%
Total (All Births)		144,584	100%	23,265	16.1%

*Includes both residents and non-residents. ♦Indicates birthing hospitals with a Neonatal Intensive Care Unit. (Note: Irvine Regional Hospital is now Hoag Hospital Irvine)

Cesarean Deliveries

One in three babies (33.2% or 47,998) of 144,584 births during the 3-year study period was delivered via cesarean section.² Approximately twelve percent (12.6%, n=6,059 of 47,998) of cesarean deliveries were performed after a failed trial of labor. In such cases, the birth mother intended to have a vaginal delivery, but for medical reasons required a cesarean delivery. Additionally, there were a small number of women who successfully had a vaginal birth after a previous cesarean delivery (VBAC; n=1,628 or 1.1%). Approximately half of all cesarean deliveries were repeat cesareans (n=21,877).

The mean length of stay for women who underwent a cesarean delivery (3.8 days) was almost double that of women who had a vaginal delivery (2.0 days). Similarly, the mean cost of a cesarean delivery (\$20,228) was almost twice that of those who delivered vaginally (\$11,114). Of those who had a cesarean delivery, almost half (47.3%, n=22,679) were scheduled at least 24 hours in advance. By comparison, only 37.6% of vaginal deliveries (n=36,301) were scheduled at least 24 hours in advance.

Geographic Distribution of Cesarean Deliveries

The percentage of women having cesarean deliveries are presented in the map in **Figure 3** based on their city of residence and by birthing hospital (indicated by numbers in the map that correspond to the hospitals listed in **Table 5**).

Mother's City: The countywide rate for cesarean deliveries for women residing in Orange County was 33.3% during the study period (2006-2008, n=127,321). Residents from Seal Beach (41.7%; n=168) and Villa Park (40.8%; n=31) had the highest percentage of cesarean deliveries within the county. Conversely, women from Placentia (29.1%; n=609) and La Palma (29.6%; n=131) had the lowest percentage of cesarean deliveries (see **Table 11** in appendix for cesarean delivery percentages by city).

Hospitals: The rate of cesarean deliveries across all OC hospitals, which includes both residents and non-residents, was 33.1% (n=46,003). Coastal Community Hospital had the highest percentage of births to women who had a cesarean delivery (43.2%; n=2,874). Similarly, more than one-in-three women giving birth at Hoag Memorial Hospital in Newport Beach had a cesarean delivery (37.9%; n=5,836; **Table 5**). The lowest percentage of cesarean deliveries were seen at La Palma Intercommunity Hospital (26.6%; n=333) and Anaheim Memorial Hospital (27.3 %; n=1,550).

Figure 3: Percentage of Cesarean Deliveries by City of Residence and Hospital

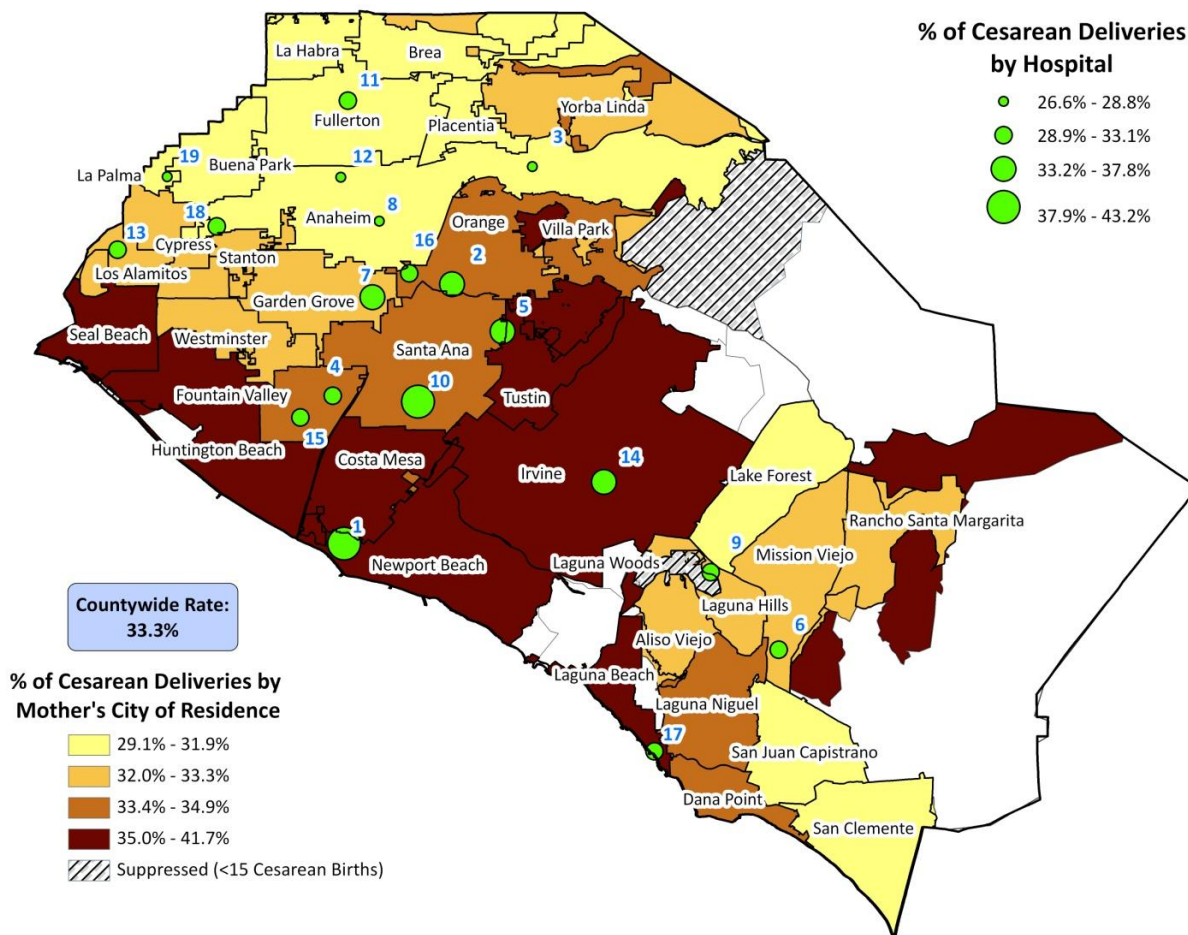


Table 5: Cesarean Deliveries by Hospital and Delivery Type (2006-2008)

ID	Hospital	Vaginal Deliveries			Cesarean Deliveries	
		All Births n	n	%	n	%
1	Hoag Memorial Hospital Presbyterian	15,387	9,551	62.1%	5,836	37.9%
2	St. Joseph Hospital Orange	15,005	9,738	64.9%	5,267	35.1%
3	Kaiser Foundation Hospital Anaheim	10,963	7,865	71.7%	3,098	28.3%
4	Fountain Valley Regional Hospital & Medical Center	10,680	7,365	69.0%	3,315	31.0%
5	Western Medical Center - Santa Ana	10,188	6,555	64.3%	3,633	35.7%
6	Mission Hospital Regional Medical Center	9,322	6,261	67.2%	3,061	32.8%
7	Garden Grove Hospital And Medical Center	8,959	5,821	65.0%	3,138	35.0%
8	Western Medical Center Hospital - Anaheim	8,377	5,962	71.2%	2,415	28.8%
9	Saddleback Memorial Medical Center	8,276	5,794	70.0%	2,482	30.0%
10	Coastal Communities Hospital	6,647	3,773	56.8%	2,874	43.2%
11	St. Jude Medical Center	6,308	4,362	69.2%	1,946	30.9%
12	Anaheim Memorial Medical Center	5,682	4,132	72.7%	1,550	27.3%
13	Los Alamitos Medical Center	5,418	3,814	70.4%	1,604	29.6%
14	Irvine Regional Hospital	4,902	3,193	65.1%	1,709	34.9%
15	Orange Coast Memorial Medical Center	4,525	3,072	67.9%	1,453	32.1%
16	University Of California Irvine Medical Center	4,071	2,731	67.1%	1,340	32.9%
17	South Coast Medical Center	1,589	1,081	68.0%	508	32.0%
18	Anaheim General Hospital	1,423	983	69.1%	440	30.9%
19	La Palma Intercommunity Hospital	1,251	918	73.4%	333	26.6%
20	Anaheim Regional Medical Center	2	1	50.0%	1	50.0%
OC Hospitals		138,975	92,972	66.9%	46,003	33.1%
OC Resident Births at Non-OC Hospitals		5,609	3,614	64.4%	1,995	35.6%
Total (All Births)		144,584	96,586	66.8%	47,998	33.2%*

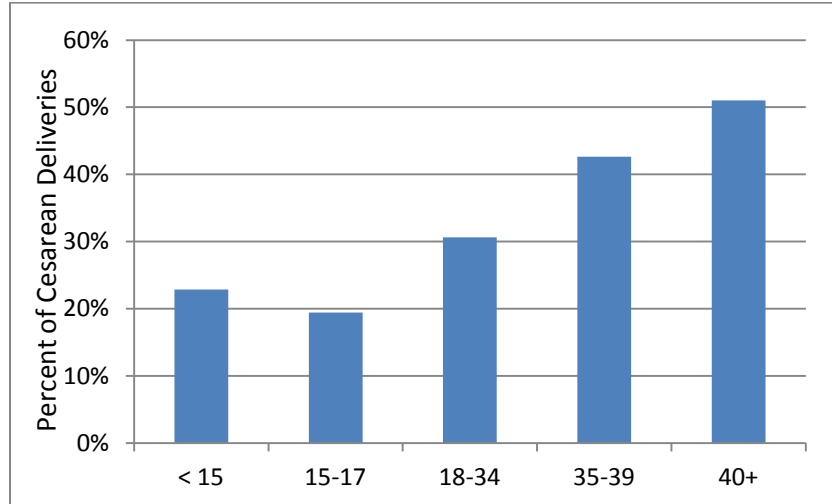
*Note that the percentage will vary slightly depending on the specific breakout reported (e.g., resident vs. non-resident; OC hospital vs. resident birth at non-OC hospital): 33.3% is the countywide hospital rate and includes only OC residents birthing at OC and non-OC hospitals. 33.1% is the countywide rate for hospitals and includes both OC residents and non-OC residents birthing in OC hospitals, while 33.2% (pg. 10) includes all cases in the data.



Demographic Characteristics of Mothers who Delivered by Cesarean

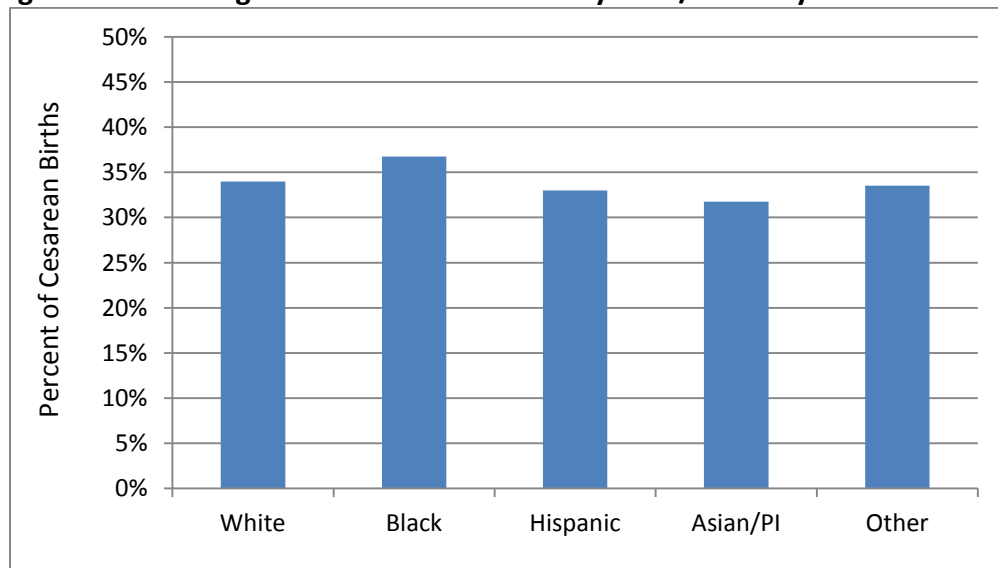
The percentage of women within each age group who delivered by cesarean systematically increased with age (Fig. 4). Approximately 19% to 23% of teens (i.e., <15 & 15-17 years) delivered by cesarean and the percentage increased to 31% of 18 to 34 year olds, 43% of 35 to 39 year olds, and half (51%) of all women 40 years and older.

Figure 4: Percentage of Cesarean Deliveries by Age Group



The probability of having a cesarean delivery was almost identical for all race/ethnicities. Namely, the percentage of women within each race/ethnicity who delivered by cesarean was relatively level around one in three (Fig. 5; white, 34%; black, 37%; Hispanic, 33%; Asian/Pacific Islander, 32%; Other, 34%).

Figure 5: Percentage of Cesarean Deliveries by Race/Ethnicity of Birth Mother



Major Complications Associated with Labor & Delivery

During the study period, there was one or more major complication present for 1.3% of all deliveries (n=1,818 out of 144,584 mothers).³ Of the women who had a cesarean, 2.5% (n=1,213 out of 47,998) presented with or developed at least one major complication (**Fig. 6**). By comparison, there was a major complication present for only 0.6% of mothers who had a vaginal delivery (n=605 out of 96,586).

Figure 6: Presence of Major Complications by Birth Type (2006-2008)



The most common major complications present are shown in the first column of **Table 6**. Major infections during the puerperium period (n=801 or 0.6%) were present most often, followed by a hemorrhage resulting in the need for a blood transfusion (n=391 or 0.3%). Anesthetic complications (n=15 or 0.01%) and death (n=4 or 0.003%), were the least common complications out of all 144,584 births that occurred during the study period.

These 17 major complications were examined across all cases and by method of delivery (**Table 6**). These major complications were associated four times more often with cesarean (OR=4.1, CI: 3.7-4.5) compared to vaginal deliveries. Cesarean deliveries were associated with increased incidence of all but one of the 17 major complications. The cesarean may have been needed because of a complication or the cesarean itself may have contributed to a major complication.

For cesarean deliveries, the most frequent major complications were major infection during the puerperium period (n=488; 1.0%), heart failure (n=322; 0.7%), hemorrhage resulting in blood transfusion (n=209; 0.4%), and disseminated intravascular coagulation (n=120; 0.3%). The probability (i.e., odds ratio, OR) of a mother presenting with or developing a major complication in cesarean cases was compared to those mothers who delivered vaginally.

While a cesarean delivery was associated with an increased likelihood of a major complication by four times (OR=4.1, CI: 3.7-4.5), the association with major complications was even higher for certain specific conditions. For example, women who experienced heart failure were found to be 34 times (OR=34.3, CI: 21.6-54.5) more likely have had or needed a cesarean delivery. While very rare (i.e., 16 cases present in cesarean cases compared to one in vaginal delivery cases), pulmonary edema, the accumulation of fluid in the lungs that can lead to respiratory failure, was 32 times more likely to be associated (OR=32.2, CI: 4.3-242.9) with a cesarean delivery. Note, however, that because of the large confidence interval this finding should be interpreted with caution.

Table 6: Major Complications Associated with Labor & Delivery Type (2006-2008)

<i>Complication</i>	Total Births (n=144,584)		Vaginal (n=96,586)		Cesarean (n=47,998)		OR	95% CI	
	n	%	n	%	n	%		Lower	Upper
Major Infections during the Puerperium Period	801	0.6%	313	0.3%	488	1.0%	3.2	2.7	3.6
Hemorrhage Resulting in Blood Transfusion	391	0.3%	182	0.2%	209	0.4%	2.3	1.9	2.8
Heart Failure	341	0.2%	19	0.0%	322	0.7%	34.3	21.6	54.5
Disseminated Intravascular Coagulation	187	0.1%	67	0.1%	120	0.3%	3.6	2.7	4.9
Hemorrhage Resulting in Hysterectomy	98	0.1%	19	<0.1%	79	0.2%	8.4	5.1	13.8
Adult Respiratory Distress Syndrome	70	<0.1%	10	<0.1%	60	0.1%	12.1	6.2	23.6
Deep Vein Thrombosis	66	<0.1%	26	<0.1%	40	0.1%	3.1	1.9	5.1
Ventilation	61	<0.1%	11	<0.1%	50	0.1%	9.2	4.8	17.6
Uterine Rupture	43	<0.1%	6	<0.1%	37	0.1%	12.4	5.2	29.4
Renal Failure	42	<0.1%	8	<0.1%	34	0.1%	8.6	4.0	18.5
Shock	38	<0.1%	15	<0.1%	23	<0.1%	3.1	1.6	5.9
Puerperal Cerebrovascular Disorders	37	<0.1%	11	<0.1%	26	0.1%	4.8	2.4	9.6
Sepsis	35	<0.1%	11	<0.1%	24	0.1%	4.4	2.2	9.0
Pulmonary Embolism	22	<0.1%	12	<0.1%	10	<0.1%	1.7*	0.7	3.9
Pulmonary Edema	17	<0.1%	1	<0.1%	16	<0.1%	32.2	4.3	242.9
Anesthesia Complications	15	<0.1%	3	<0.1%	12	<0.1%	8.1	2.3	28.5
Died	4	<0.1%	0	<0.1%	4	<0.1%	--	--	--
Total Complications	2,268		714		1,554				
Individuals with One or More Complications	1,818	1.3%	605	0.6%	1,213	2.5%	4.1	3.7	4.5

*Not significant at the 95% confidence interval. Note that these data include both resident and non-resident births.

Women undergoing a cesarean were also about twelve times more likely to have a ruptured uterus (OR=12.4, CI: 5.2-29.4) or adult respiratory distress syndrome (OR=12.1, CI: 6.2-23.6) relative to mothers who delivered their baby vaginally. Additionally, cesarean deliveries were more than eight times more likely to be associated with renal failure (OR=8.6, CI: 4.0-18.5), hemorrhage resulting in hysterectomy (OR=8.4, CI: 5.1-13.8), and/or anesthesia complications (OR=8.1, CI: 2.3-28.5).

Repeat Cesarean Deliveries

As described earlier in this report, about half of all cesarean deliveries were repeat cesareans (n=21,877). Importantly, we found that women having a repeat cesarean delivery were almost half as likely to have a major complication (1.7%) compared to 3.2% of primary cesareans. Women having a repeat cesarean also had fewer prenatal comorbidities (19% for repeats vs. 27% for primary cesareans). This would suggest that having had a previous cesarean predisposed a mother to have a second or subsequent cesarean despite having fewer prenatal conditions and/or complications associated with the current labor and delivery. These findings are corroborated by the very low number of VBAC deliveries observed in Orange County. Future studies will need to explore the underlying factors that influence repeat cesareans.

Geographic Distribution of Major Vaginal Delivery Complications

The percentage of women with complications associated with vaginal delivery is shown in the map in **Figure 7** by the mother's city of residence and by birthing hospitals (indicated by numbers in the map that correspond to the hospitals listed in **Table 7**).

Mother's City: Countywide, there was at least one major complication in 0.6% of all women (n=530), who delivered vaginally. Albeit rare, complications were highest for women residing in Laguna Beach (1.3%, n=4), Lake Forest (1.3%, n=25), and Laguna Niguel (1.1%, n=13), with an additional nine cities ranking above the countywide rate. There were no major complications present for women residing in the cities of Seal Beach, Los Alamitos, or Villa Park. See **Table 13** in the appendix for the percentage of women with major complications who delivered vaginally by city (or unincorporated area) of residence.

Hospitals: The University of California, Irvine Medical Center, which specializes in high risk births, had the highest percentage of women with complications present who had vaginal births (2.3%; n=63). This was followed by Saddleback Memorial (1.2%; n=70) and Fountain Valley Regional Hospital Regional Hospital (0.9%; n=65). La Palma Intercommunity Hospital (0.1%; n=1) and Orange Coast Memorial Hospital (0.2%; n=6) had the lowest percentages of women with complications present (**Table 7**).

Figure 7: Percentage of Women with Major Complications who Delivered Vaginally by City of Residence and Hospital

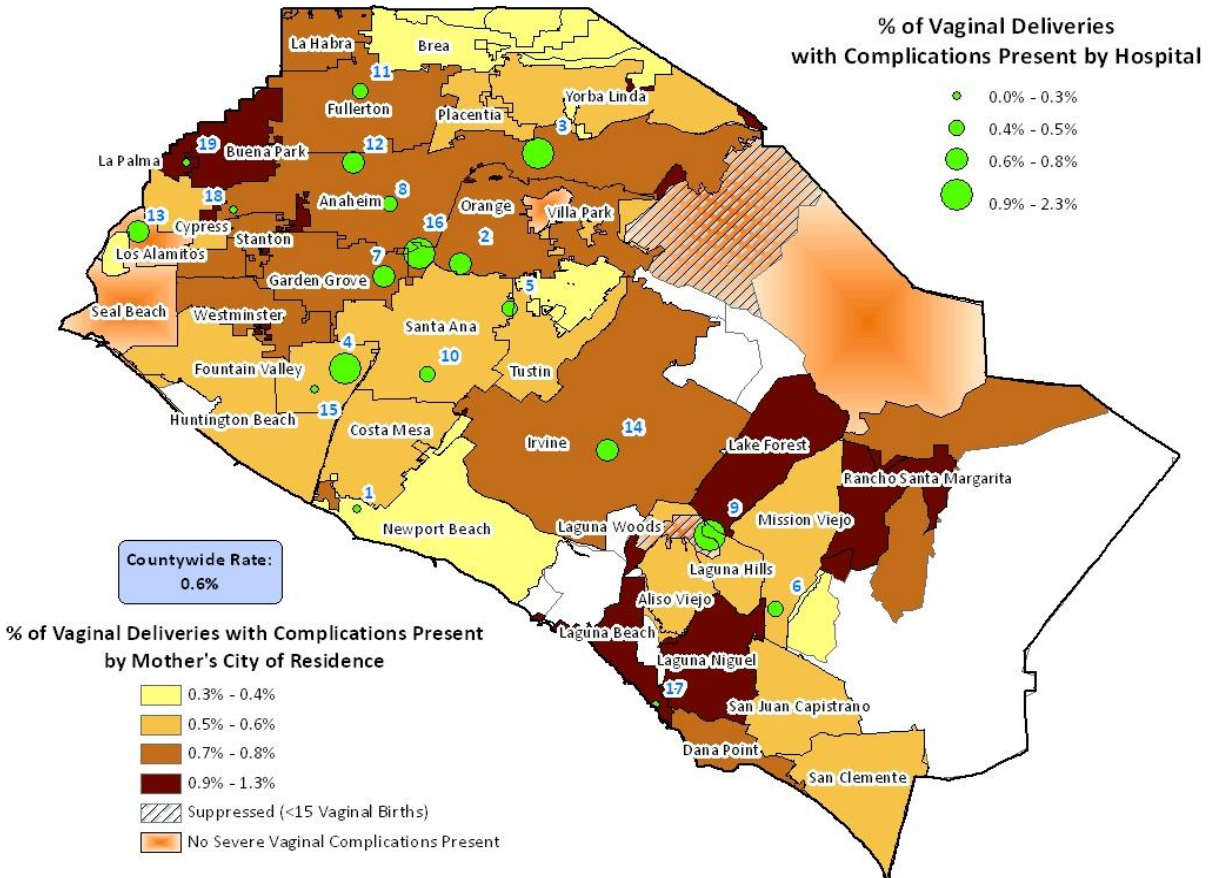
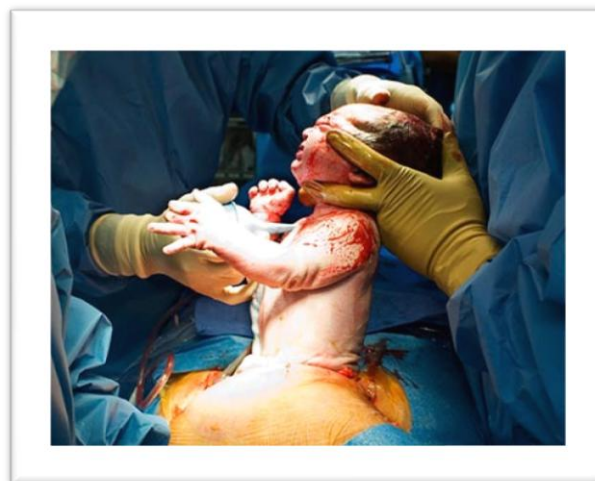


Table 7: Presence of Major Complications by Hospital and Delivery Type (2006-2008)

ID	Hospital	All Births n	Vaginal Deliveries n	Cesarean Deliveries n	Complications Present: Vaginal		Complications Present: Cesarean	
					n	%	n	%
1	Hoag Memorial Hospital Presbyterian	15,387	9,551	5,836	30	0.3%	68	1.2%
2	St. Joseph Hospital - Orange	15,005	9,738	5,267	51	0.5%	251	4.8%
3	Kaiser Foundation Hospital - Anaheim	10,963	7,865	3,098	67	0.9%	116	3.7%
4	Fountain Valley Regional Hospital And Medical Center	10,680	7,365	3,315	65	0.9%	80	2.4%
5	Western Medical Center - Santa Ana	10,188	6,555	3,633	31	0.5%	92	2.5%
6	Mission Hospital Regional Medical Center	9,322	6,261	3,061	29	0.5%	78	2.5%
7	Garden Grove Hospital And Medical Center	8,959	5,821	3,138	32	0.5%	53	1.7%
8	Western Medical Center Hospital - Anaheim	8,377	5,962	2,415	28	0.5%	23	1.0%
9	Saddleback Memorial Medical Center	8,276	5,794	2,482	70	1.2%	94	3.8%
10	Coastal Communities Hospital	6,647	3,773	2,874	16	0.4%	48	1.7%
11	St. Jude Medical Center	6,308	4,362	1,946	14	0.3%	32	1.6%
12	Anaheim Memorial Medical Center	5,682	4,132	1,550	22	0.5%	24	1.5%
13	Los Alamitos Medical Center	5,418	3,814	1,604	21	0.6%	19	1.2%
14	Irvine Regional Hospital	4,902	3,193	1,709	25	0.8%	49	2.9%
15	Orange Coast Memorial Medical Center	4,525	3,072	1,453	6	0.2%	18	1.2%
16	University Of California Irvine Medical Center	4,071	2,731	1,340	63	2.3%	111	8.3%
17	Mission Hospital Laguna Beach	1,589	1,081	508	3	0.3%	4	0.8%
18	Anaheim General Hospital	1,423	983	440	0	0.0%	1	0.2%
19	La Palma Intercommunity Hospital	1,251	918	333	1	0.1%	6	1.8%
20	Anaheim Regional Medical Center	2	1	1	--	--	--	--
OC Hospitals*		138,975	92,972	46,003	574	0.6%	1,167	2.5%
OC Resident Births at Non-OC Hospitals		5,609	3,614	1,995	30	0.8%	45	2.3%
Total (All Births)		144,584	96,586	47,998	605	0.6%	1,213	2.5%

*These data include both resident and non-resident births at OC hospitals.



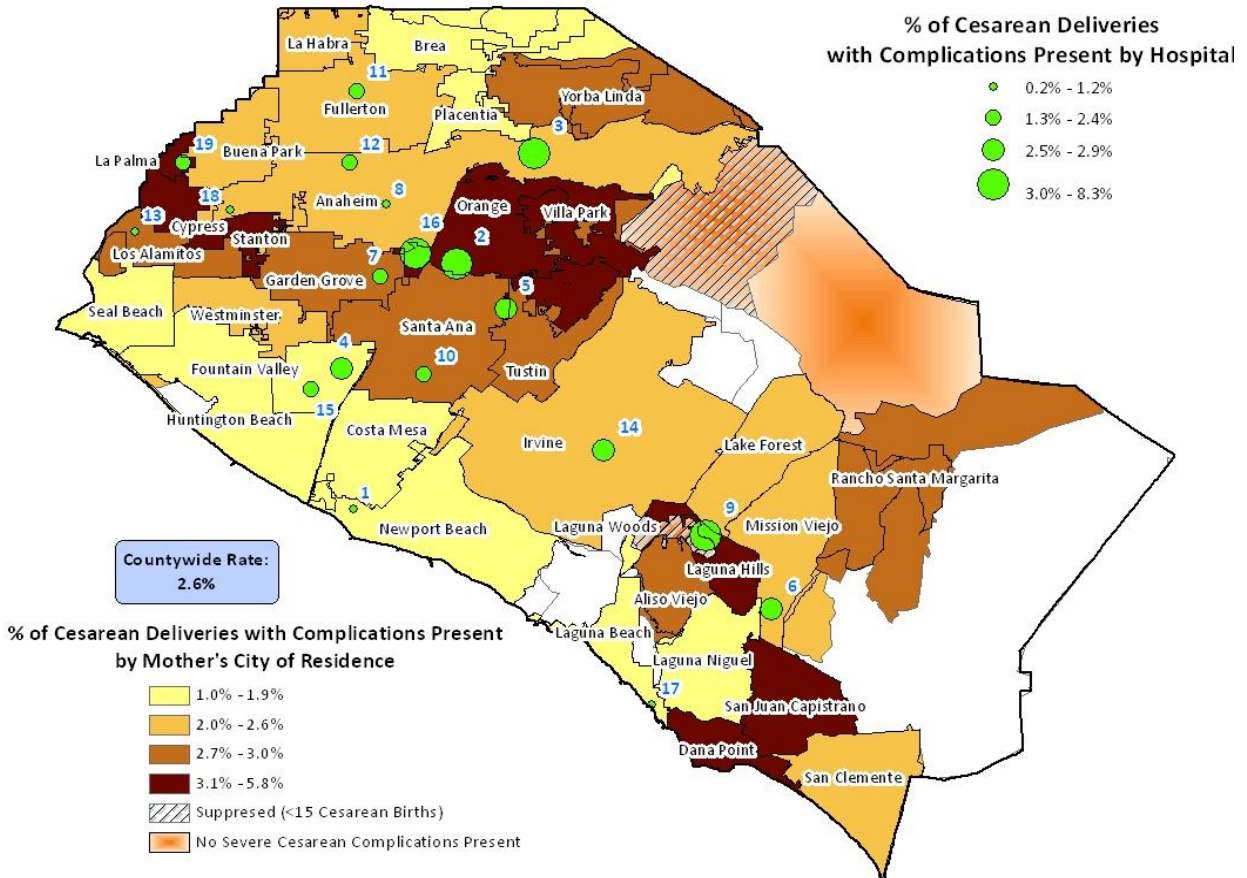
Geographic Distribution of Major Complications Associated with Cesarean Deliveries

The percentage of women who experienced complications associated with cesarean deliveries is shown in the map in **Figure 8** by the mother’s city of residence and by birthing hospital (indicated by numbers in the map that correspond to the hospitals listed in **Table 7**).

Mother’s City: Countywide, 2.6% of all resident mothers (n=1,098) who delivered by cesarean presented with or developed at least one major complication. Mothers residing in Laguna Hills (5.8%, n=20), La Palma (4.6%, n=6), Dana Point (4.0%, n=14), and San Juan Capistrano (3.8%, n=17) had the highest percentage of major complications. Eleven other OC cities had percentages above the countywide rate. Conversely, the cities of Laguna Beach (1.0%, n=2) and Laguna Niguel (1.1%, n=7) had the lowest percentage of major complications. See **Table 14** in the appendix for the percentage of complications by city (or unincorporated area) of residence.

Hospitals: The University of California, Irvine Medical Center, which specializes in high risk births, had the highest percentage of women with complications present who had cesarean deliveries (8.3%; n=111). This was followed by St Joseph’s Hospital (4.8%; n=251) and Saddleback Memorial Hospital (3.8%; n=94). Two additional hospitals were above the countywide major complication rate for those with a cesarean. Anaheim General Hospital (0.2%; n=1) and Mission Hospital Laguna Beach (0.8%; n=4) had the lowest percentage of complications (see **Table 7** on previous page).

Figure 8: Percentage of Women with Major Complications who had Cesarean Deliveries by City of Residence and Hospital



Length of Stay

The average length of hospital stay varied depending on the method of delivery and on the occurrence of major complications (**Table 8**). On either extreme, a cesarean delivery associated with a major complication resulted in 5.6 inpatient days compared to just 2.0 days for a vaginal delivery not associated with a major complication.

Table 8: Average Length of Stay (2006-2008)

<i>Type of Delivery</i>	<i>No Complications</i>	<i>Major Complications</i>	<i>3-Yr Average All Deliveries</i>
Cesarean Delivery	3.7 days	5.6 days	3.7 days
Vaginal Delivery	2.0 days	3.8 days	2.0 days

Hospital Charges

The charges associated with the labor and delivery varied markedly depending on the method of delivery and on the occurrence of major complications. On average, a cesarean delivery with no major complications present cost nearly twice as much as a vaginal delivery with no major complications present (\$19,700 vs. \$10,980; **Table 9**). This was similar for all deliveries over the three-year period with an average of \$20,228 for cesarean deliveries, compared to the \$11,114 average for vaginal deliveries. Mothers who had a major complication and had a cesarean averaged \$40,599 in charges – twice as much as a women who had no major complications and had a cesarean. Similarly, charges soared when a mother had a major complication and had a vaginal delivery (average = \$32,405).

Table 9: Average Hospitalization Charges (2006-2008)

<i>Average Charge/ Hospitalization</i>	<i>No Complications</i>	<i>Major Complications</i>	<i>3-Yr Average All Deliveries</i>
Cesarean Delivery	\$19,700	\$40,599	\$20,228
Vaginal Delivery	\$10,980	\$32,405	\$11,114

Each year, over \$681 million in hospitalization charges are made in Orange County delivering about 48,000 babies (**Table 10**). Cesareans accounted for 33.2% of all deliveries, and the charges for cases who had a cesarean comprised nearly half (47.5%) of all charges or nearly \$324 million annually. Cases where there was a cesarean associated with a major complication accounted over \$16 million or 2.5% of all charges. By comparison, cases where there was a vaginal delivery associated with a major complication accounted for 1% of all charges or a little over \$6.5 million per year.

Table 10: Average Annual Hospitalization Charges (2006-2008)

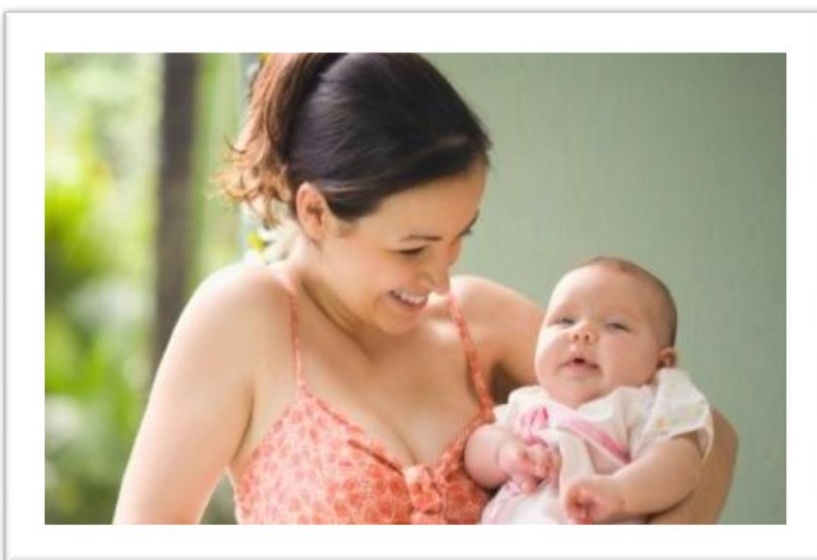
<i>Annual Hospitalization Charges</i>	<i>No Complications</i>	<i>Major Complications</i>	<i>3-Yr Average All Deliveries</i>
Cesarean Delivery	\$307,227,657	\$16,415,660	\$323,643,317
Vaginal Delivery	\$351,296,162	\$6,535,080	\$357,831,241
Annual Total	\$658,523,819	\$22,950,739	\$681,474,558

Conclusions

The results of this study show that a sixteen percent of pregnant women in Orange County had serious antepartum comorbidities. Importantly, such preexisting chronic and/or pregnancy-induced comorbidities more than doubled likelihood of having a cesarean delivery. Of the women who had a cesarean, 2.5% (n=1,213 out of 47,998) presented with or developed at least one major complication. By comparison, there was a major complication present for only 0.6% of mothers who had a vaginal delivery (n=605 out of 96,586). The risk of certain specific types of major complications were from two to 34 times more often associated with cesarean deliveries compared to a vaginal childbirth. This is a concern as the rate of cesarean deliveries in the county has increased 48% over the past decade to 33% in the study period (2006-2008).

Mothers in our study who had an antepartum comorbidity and delivered via cesarean were more than seven times more likely to have a major complication associated with delivery, compared to those who delivered vaginally with no antepartum comorbidities (OR=7.4; CI 6.5-8.5). We found that one of the most common antepartum comorbidities in Orange County was gestational diabetes, which accounted for 6.4% (n=9,321) of all prenatal comorbidities. Researchers have reported that the risk for developing gestational diabetes increased substantially as the mother's body mass index (BMI) increased (Chu et al, 2007). While we do not have data on the prevalence of obese pregnant women in Orange County, it is estimated that 18.5% of adult females in the county were obese during the study period (CHIS, 2007). Similarly, a recent study across nine states found that 1 of 5 women were obese at the beginning of pregnancy (Kim et al, 2007).

Moreover, a recent report by the California Pregnancy-Associated Mortality Review (2011) found there were high rates of obesity among the pregnancy-related deaths reported in California from 2002 to 2003. Maternal obesity can also lead to hypertension and other cardiovascular problems (Carpenter, 2007; Jain et al, 2007). Efforts to improve the body mass of women planning to become pregnant could significantly reduce the risk of such comorbidities and a subsequent cesarean delivery.

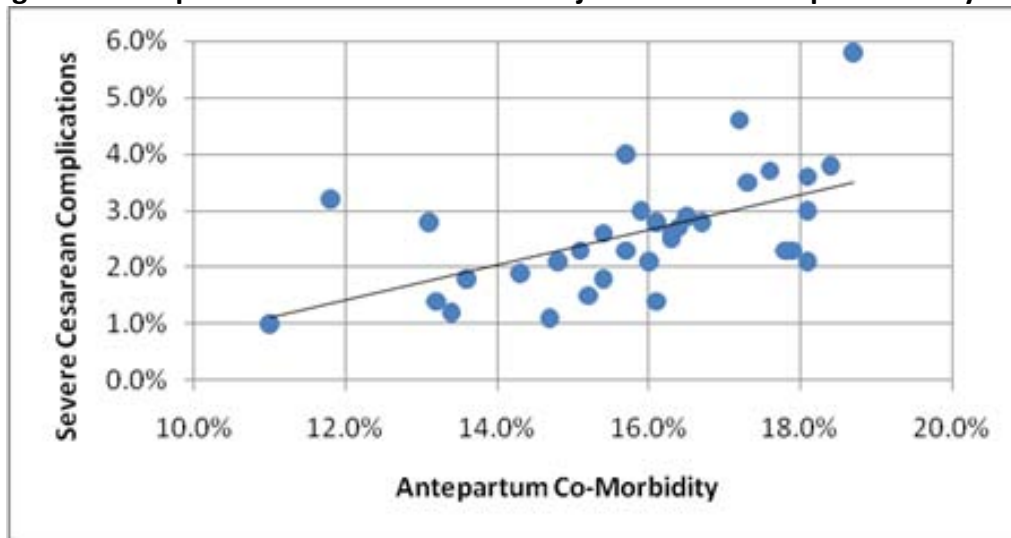


One in three, or an average of 16,000 babies are delivered by cesarean each year in Orange County. During the study period, 3,730 cesarean deliveries (23.3%) were performed to mothers who had an antepartum comorbidity such as gestational diabetes or premature labor that may have contributed to the medical necessity for a cesarean delivery.

Conversely, during the study period there were 12,270 cesareans per year where no antepartum comorbidity was reported. Women who did not present with an antepartum comorbidity and underwent a cesarean delivery were almost four times more likely to have a major complication present as compared to women who had a vaginal delivery (OR=3.8; CI 3.4-4.3).

In examining the geographic distribution of deliveries, we found that cities with higher percentages of women with antepartum comorbidities had a higher percentage of major complications associated with a cesarean ($r^2=0.57$, $p<0.01$; **Fig. 9**).

Figure 9: Antepartum Comorbidities and Major Cesarean Complications by City



We also found that the cities with the highest percentages of cesarean deliveries did not necessarily have the highest rates of major complications associated with cesarean deliveries. The cities with the highest percentages of mothers having cesareans were found in coastal areas running contiguously from Seal Beach in the north to Laguna Beach in the south, and inland to Irvine and Tustin. Coastal Community and Hoag, two hospitals with the highest percentage of cesarean births, are also located in these areas. So despite having relatively high rates of cesarean deliveries, the coastal cities also had lower rates of antepartum comorbidities and of major complications associated with a cesarean. The low rate of comorbidities in these areas suggests that other non-medical factors may be responsible for the higher incidence of cesarean deliveries in these cities. Nationally, researchers have estimated elective cesarean rates as high as 28% of all cesareans (Meikle et al, 2005). Additional research is needed to determine exactly what proportion of cesarean deliveries for these Orange County mothers may be elective. Future studies could also investigate in more detail how geographic, demographic (e.g., race/ethnicity, age), and health factors (e.g., maternal weight gain, prenatal care) might influence the method of delivery and birth outcomes.

Cesarean deliveries resulted in significantly longer lengths of stay and higher hospitalization charges. The 16,000 annual cesarean deliveries in OC resulted in total hospital charges of about \$323,643,317 per year (almost a billion dollars during the 3-year study period: \$970,929,951). Women, who had a major complication present and delivered by cesarean, averaged \$40,599 in charges, twice as expensive as a cesarean without a complication present. This was almost four times more costly than a vaginal delivery without a complication present.

There has been a significant rise in the number of cesarean deliveries throughout the US and more specifically, in Orange County. Studies have noted the increasing rate of major complications of labor and delivery is paralleled by the increasing rate of cesarean delivery (Wax, 2006; Kuklina et al, 2009; Berg et al, 2009). Consequently, avoiding and/or properly managing antepartum comorbidities such as gestational diabetes is important for reducing the possible risk of major complications of labor and delivery. Efforts to reduce prenatal comorbidities that can lead to a cesarean, as well as a reduction in elective cesareans can help improve birth outcomes, reduce the risk of maternal morbidity, and reduce costs.



Table 11: Antepartum Comorbidities by City of Residence (2006-2008)

	OC Resident	Antepartum	
	Births	Comorbidities	
	n	n	%
Laguna Hills	1,053	197	18.7%
San Juan Capistrano	1,476	272	18.4%
Orange	6,094	1,105	18.1%
Lake Forest	2,847	514	18.1%
Rancho Santa Margarita	1,907	346	18.1%
Mission Viejo	2,782	499	17.9%
La Habra	3,020	538	17.8%
Cypress	1,393	245	17.6%
Stanton	1,706	295	17.3%
La Palma	442	76	17.2%
Los Alamitos	544	91	16.7%
Aliso Viejo	2,285	377	16.5%
Garden Grove	8,276	1,357	16.4%
Anaheim	18,786	3,061	16.3%
Westminster	3,633	591	16.3%
Tustin	3,661	588	16.1%
Brea	1,332	214	16.1%
Buena Park	3,477	558	16.0%
Santa Ana	22,896	3,634	15.9%
Fullerton	5,380	842	15.7%
Dana Point	1,042	164	15.7%
Placentia	2,092	322	15.4%
Fountain Valley	1,556	236	15.2%
Irvine	6,697	1,011	15.1%
San Clemente	2,547	377	14.8%
Laguna Niguel	1,835	269	14.7%
Huntington Beach	6,048	864	14.3%
Costa Mesa	4,887	666	13.6%
Seal Beach	403	54	13.4%
Newport Beach	1,982	262	13.2%
Yorba Linda	1,732	227	13.1%
Villa Park	76	9	11.8%
Laguna Beach	492	54	11.0%
Laguna Woods	13	1	7.7%
Unincorporated	2,929	452	15.4%
OC Residents	127,321	20,368	16.0%
Non-OC Residents	16,126	3,430	21.3%
Out of State	1,137	0	0.0%
Total	144,584	23,798	16.5%

Table 12: Births & Method of Delivery by City of Residence (2006-2008)

City of Residence	All OC Resident Births		Vaginal Deliveries		Cesarean Deliveries	
	n	%	n	%	n	%
Santa Ana	22,896	15.2%	14,933	65.2%	7,963	34.8%
Anaheim	18,786	12.9%	12,908	68.7%	5,878	31.3%
Garden Grove	8,276	6.1%	5,537	66.9%	2,739	33.1%
Irvine	6,697	5.0%	4,335	64.7%	2,362	35.3%
Orange	6,094	4.6%	4,007	65.8%	2,087	34.2%
Huntington Beach	6,048	4.5%	3,914	64.7%	2,134	35.3%
Fullerton	5,380	4.1%	3,710	69.0%	1,670	31.0%
Costa Mesa	4,887	3.7%	3,179	65.1%	1,708	34.9%
Tustin	3,661	2.8%	2,354	64.3%	1,307	35.7%
Westminster	3,633	2.9%	2,458	67.7%	1,175	32.3%
Buena Park	3,477	2.3%	2,385	68.6%	1,092	31.4%
La Habra	3,020	2.4%	2,096	69.4%	924	30.6%
Lake Forest	2,847	2.2%	1,944	68.3%	903	31.7%
Mission Viejo	2,782	2.1%	1,887	67.8%	895	32.2%
San Clemente	2,547	2.0%	1,773	69.6%	774	30.4%
Aliso Viejo	2,285	1.8%	1,531	67.0%	754	33.0%
Placentia	2,092	1.6%	1,483	70.9%	609	29.1%
Newport Beach	1,982	1.5%	1,198	60.4%	784	39.6%
Rancho Santa Margarita	1,907	1.5%	1,280	67.1%	627	32.9%
Laguna Niguel	1,835	1.4%	1,207	65.8%	628	34.2%
Yorba Linda	1,732	1.4%	1,166	67.3%	566	32.7%
Stanton	1,706	1.3%	1,141	66.9%	565	33.1%
Fountain Valley	1,556	1.2%	1,026	65.9%	530	34.1%
San Juan Capistrano	1,476	1.2%	1,033	70.0%	443	30.0%
Cypress	1,393	1.1%	933	67.0%	460	33.0%
Brea	1,332	0.9%	908	68.2%	424	31.8%
Laguna Hills	1,053	0.8%	706	67.0%	347	33.0%
Dana Point	1,042	0.8%	690	66.2%	352	33.8%
Los Alamitos	544	0.4%	363	66.7%	181	33.3%
Laguna Beach	492	0.4%	299	60.8%	193	39.2%
La Palma	442	0.3%	311	70.4%	131	29.6%
Seal Beach	403	0.3%	235	58.3%	168	41.7%
Villa Park	76	0.1%	45	59.2%	31	40.8%
Laguna Woods*	13	0.1%	7	53.8%	6	46.2%
Unincorporated	2,929	2.2%	1,911	65.2%	1,018	34.8%
OC Residents	127,321		84,893	66.7%	42,428	33.3%
Non-OC Residents	16,126		10,913	67.7%	5,213	32.3%
Out of State	1,137		780	68.6%	357	31.4%
Total	144,584		96,586	66.8%	47,998	33.2%

*Note that with very small number of births results should be interpreted with caution.

Table 13: Women with Major Complications Who Had a Vaginal Delivery by City of Residence (2006-2008)

	Vaginal Births		Complications Present for Vaginal Births	
	n	%	n	%
	Lake Forest	1,944	68.3%	25
Laguna Beach	299	60.8%	4	1.3%
Laguna Niguel	1,207	65.8%	13	1.1%
La Palma	311	70.4%	3	1.0%
Buena Park	2,385	68.6%	22	0.9%
Rancho Santa Margarita	1,280	67.1%	12	0.9%
Anaheim	12,908	68.7%	98	0.8%
Garden Grove	5,537	66.9%	36	0.7%
Irvine	4,335	64.7%	30	0.7%
Orange	4,007	65.8%	27	0.7%
Westminster	2,458	67.7%	18	0.7%
La Habra	2,096	69.4%	14	0.7%
Stanton	1,141	66.9%	8	0.7%
Fullerton	3,710	69.0%	22	0.6%
San Clemente	1,773	69.6%	10	0.6%
Laguna Hills	706	67.0%	4	0.6%
Dana Point	690	66.2%	4	0.6%
Santa Ana	14,933	65.2%	78	0.5%
Huntington Beach	3,914	64.7%	20	0.5%
Costa Mesa	3,179	65.1%	16	0.5%
Aliso Viejo	1,531	67.0%	8	0.5%
Yorba Linda	1,166	67.3%	6	0.5%
San Juan Capistrano	1,033	70.0%	5	0.5%
Fountain Valley	1,026	65.9%	5	0.5%
Tustin	2,354	64.3%	10	0.4%
Mission Viejo	1,887	67.8%	8	0.4%
Placentia	1,483	70.9%	6	0.4%
Cypress	933	67.0%	4	0.4%
Newport Beach	1,198	60.4%	3	0.3%
Brea	908	68.2%	3	0.3%
Los Alamitos	363	66.7%	0	0.0%
Seal Beach	235	58.3%	0	0.0%
Villa Park	45	59.2%	0	0.0%
Laguna Woods	7	<0.1%	0	0.0%
Unincorporated	1,911	65.2%	8	0.4%
OC Residents	84,893	66.7%	530	0.6%
Non-OC Residents	10,913	67.7%	71	0.7%
Out of State	780	68.6%	4	0.5%
Total	96,586	66.8%	605	0.6%

Table 14: Women with Major Complications Who Had a Cesarean Delivery by City of Residence (2006-2008)

	Cesarean Births		Complications Present for Cesarean Births	
	n	%	n	%
	Laguna Hills	347	33.0%	20
La Palma	131	29.6%	6	4.6%
Dana Point	352	33.8%	14	4.0%
San Juan Capistrano	443	30.0%	17	3.8%
Cypress	460	33.0%	17	3.7%
Orange	2,087	34.2%	76	3.6%
Stanton	565	33.1%	20	3.5%
Villa Park	31	40.8%	1	3.2%
Santa Ana	7,963	34.8%	240	3.0%
Rancho Santa Margarita	627	32.9%	19	3.0%
Aliso Viejo	754	33.0%	22	2.9%
Tustin	1,307	35.7%	36	2.8%
Yorba Linda	566	32.7%	16	2.8%
Los Alamitos	181	33.3%	5	2.8%
Garden Grove	2,739	33.1%	75	2.7%
Westminster	1,175	32.3%	30	2.6%
Anaheim	5,878	31.3%	147	2.5%
Irvine	2,362	35.3%	54	2.3%
Fullerton	1,670	31.0%	38	2.3%
La Habra	924	30.6%	21	2.3%
Mission Viejo	895	32.2%	21	2.3%
Buena Park	1,092	31.4%	23	2.1%
Lake Forest	903	31.7%	19	2.1%
San Clemente	774	30.4%	16	2.1%
Huntington Beach	2,134	35.3%	41	1.9%
Costa Mesa	1,708	34.9%	31	1.8%
Placentia	609	29.1%	11	1.8%
Fountain Valley	530	34.1%	8	1.5%
Newport Beach	784	39.6%	11	1.4%
Brea	424	31.8%	6	1.4%
Seal Beach	168	41.7%	2	1.2%
Laguna Niguel	628	34.2%	7	1.1%
Laguna Beach	193	39.2%	2	1.0%
Laguna Woods	6	0.1%	0	0.0%
Unincorporated	1,018	34.8%	26	2.6%
OC Residents	42,428	33.3%	1,098	2.6%
Non-OC Residents	5,213	32.3%	106	2.0%
Out of State	357	31.4%	9	2.5%
Total	47,998	33.2%	1,213	2.5%

Endnotes:

1. Six in ten multiparous moms experienced a prenatal comorbidity. The most common condition was preterm labor (n=1,186), followed by preeclampsia (n=298), and gestational diabetes (n=248).
2. Multiparous moms were more likely to deliver by cesarean (82.9%, n=2056).
3. Four percent of multiparous moms (n=98) experienced a major complication during labor and delivery. The most common were major infections (n=29), hemorrhage resulting in a blood transfusion (n=28), and heart failure (n=25).

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