



HEALTHGRADES®

Maternity Care Methodology 2009/2010 (2005-2007 All-payer States Data)

To help consumers evaluate and compare hospital performance in maternity care, HealthGrades analyzed patient outcome data for virtually every hospital in the 19 states that make their data available. The state data contained inpatient records for all patients. The HealthGrades ratings are available on the Internet at www.HealthGrades.com.

Data Acquisition

HealthGrades purchased the initial patient-level data for all states that made their data available. The data represent three years of discharges (2005 – 2007). These data were chosen because they represent all discharges for the associated states. The 19 all-payer states evaluated were as follows:

- Arizona
- California
- Florida
- Iowa
- Maine
- Maryland
- Massachusetts
- Nevada
- New Jersey
- New York
- Pennsylvania
- Oregon
- Rhode Island
- Texas
- Utah
- Vermont
- Virginia
- Washington
- Wisconsin

Methodology for Maternity Care Ratings

Maternity Care ratings are based on the analysis of four factors:

- Volume of vaginal and cesarean section (C-section) single live-born deliveries
- Maternal complication rate among women undergoing single live born vaginal or C-section deliveries
- Maternal complication rate among women undergoing “patient-choice” or non-clinically indicated C-sections
- Newborn mortality rate stratified into eight birth weight categories

For each factor, hospitals are ranked and a percentile score is calculated. Volume is ranked high to low, complications are ranked low to high, and newborn mortality is ranked based on a combined z-score for the mortality rates of the eight birth weight categories.



Volume of Vaginal and C-section Deliveries

Vaginal and C-section delivery volumes were analyzed. To preserve the integrity of the data, HealthGrades conducted a series of quality checks. Based on the results of these checks, HealthGrades excluded a limited number of cases because they were inappropriate for inclusion. Examples of excluded patient records for delivery volume were:

- Patients with a code of V23.7 Insufficient Prenatal Care
- Patients under the age of 18 or over the age of 55 (except for California*)
- Patients whose sex were listed as male or unknown (except for California*)
- Patients who left against medical advice, were still in the hospital, were transferred to another acute care facility, or whose discharge status was unknown (except for California*)

*California data were treated differently due to intentional data masking done by the state.

Only single, live-born deliveries were counted. A list of the codes used by HealthGrades to identify patients can be found in *Appendix A*.

To derive a score for volume, HealthGrades ordered patient counts for combined vaginal and C-section single deliveries and calculated percentiles in descending order. The highest volume hospital received a percentile score of 0, and the lowest volume received a score of 100.

Maternal Complication Rate – Vaginal and C-section Single Live-born Deliveries

The same group of patients for the volume measurement was included for analysis in this complication measurement. Only major complications were considered. A list of the complication codes analyzed can be found in *Appendix B*.

To derive a score for this complication rate, HealthGrades calculated complication rates for vaginal and C-section births. Percentiles were then calculated for each measure (vaginal or C-section delivery complication rates). To derive the final ranking, the two percentiles were averaged and the average percentile reordered. Low complication rates produced low percentile rankings.

Maternal Complication Rate – Patient-choice C-sections

A patient-choice C-section patient was defined as a woman who:

- Received a cesarean section with no labor or induced labor prior to delivery,
- Had never had a previous C-section, and
- Did not have any of the 12 clinical conditions for a C-section delivery that HealthGrades identified using Gregory et al.'s methodology (presented in Health Services Research, October 2002).

Only major complications were considered. Codes for identifying the 12 conditions for clinically indicated C-section patients are found in *Appendix A*. Codes for major complications are found in *Appendix B*.

To derive a score for this complication rate, HealthGrades calculated complication rates for patient-choice C-section births. Percentiles were then calculated with low complication rates producing low percentile rankings.

Newborn Mortality

HealthGrades identified single live-born newborns that were not transferred in or out of the hospital. Codes are listed in *Appendix A*.

To preserve the integrity of the calculation for newborn mortality, HealthGrades conducted a series of data quality checks. Based on the results of these checks, HealthGrades excluded a limited number of cases because they were inappropriate for inclusion. Examples of excluded patient records for newborn mortality were:

- Patients over the age of 0 or whose age was unknown (except for California*)
- Patients who had multiple weights in two or more categories for the same admission
- Patients who left against medical advice, were still in the hospital, or whose discharge status was unknown (except for California*)
- Patients having diagnosis codes indicating congenital defects or other conditions that would be incompatible with a live birth (See *Appendix C*.)
- Patients with birth weights less than 500 grams
- Patients who were transferred to another acute care facility or from any facility (except for California*)

*California data were treated differently due to intentional data masking done by the state.

Newborn mortality rates were examined by birth weight and normal newborn categories. Newborn mortality rates were compared by examining the percentage of newborns that died while in the hospital with the national percentage of newborns that died while in the hospital for each of eight birth weight categories.

The birth weight categories were stratified as follows:

- (1) 500 to 749 grams
- (2) 750 to 999 grams
- (3) 1000 to 1249 grams
- (4) 1250 to 1499 grams
- (5) 1500 to 1749 grams
- (6) 1750 to 1999 grams
- (7) 2000 to 2499 grams
- (8) 2500 plus grams or normal newborns

The actual mortality rate was compared to a predicted rate based on the national mortality rate. To derive a z-score, HealthGrades summed the actual deaths and the predicted and compared the two using a combined standard deviation. (The standard deviation used in the z-score calculation adjusted for the different mortality rates of the different weight categories.)

The z-scores were ordered and percentiles were assigned based on the z-score. Low percentile rankings corresponded to the hospitals which had fewer deaths than expected, and the greatest statistical significance associated with this difference.

Newborn mortality outcomes are measured by Newborn Survival ratings:

- **Better than expected** – Fewer newborn mortalities than expected
- **As expected** – About the same newborn mortalities as expected
- **Worse than expected** – More newborn mortalities than expected

Assignment of Star Ratings for Maternity Care

The four factors were weighted using predetermined weights based on consensus from a physician panel. Each factor's percentile score was multiplied by its weight and then summed to create an overall score.

Based upon each hospital's overall score, HealthGrades applied the following rating system.

- ★★★★★ **Best** – Top 15% of all hospitals within 19 all-payer states
- ★★★ **As Expected** – Middle 70% of all hospitals within 19 all-payer states
- ★ **Poor** – Bottom 15% of all hospitals within 19 all-payer states

Limitations of the Data Models for Maternity Care and Women's Health

It must be understood that while these models may be valuable in identifying hospitals that perform better than others, one should not use this information alone to determine the quality of care provided at each hospital. The models are limited by the following factors:

- Cases may have been coded incorrectly or incompletely by the hospital.
- The models can only account for risk factors that are coded into the billing data—if a particular risk factor was not coded into the billing data, such as a patient's socioeconomic status and health behavior, then it was not accounted for with these models.
- Although Health Grades, Inc. has taken steps to carefully compile these data using its proprietary methodology, no techniques are infallible, and therefore some information may be missing, outdated, or incorrect.

Please note that a high ranking for a particular hospital is not a recommendation or endorsement by Health Grades, Inc. of a particular hospital; it means that the data associated with a particular hospital has met the foregoing qualifications. Only individual patients can decide whether a particular hospital is suited for their unique needs.

Also note that if more than one hospital reported under a single provider ID, HealthGrades analyzed patient outcome data for those hospitals as a single unit. Throughout this document, therefore, "hospital" refers to one hospital or a group of hospitals reporting under a single provider ID.

Appendix A. Patient Cohorts and Related ICD-9-CM Codes

Patient Definitions	ICD-9 Procedure/Diagnosis Codes and Criteria
Maternity Care	
Cesarean Section with Single Birth	<p>Procedure Codes: 74.0 74.1, 74.2, 74.4, 74.99</p> <p>Principal Diagnoses: 640.0 through 676.9 (where fifth digit is 1 or 2), excluding patients with diagnosis codes 651.00 through 651.93, 652.61, 660.50, 660.51, 660.53, V23.7, or V27.1 through V27.9; excluding patients with procedure codes: 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63</p>
Vaginal Delivery with Single Birth	<p>Principal Diagnoses: 640.0 through 676.9 (where fifth digit is 1 or 2), excluding patients with diagnosis codes 651.00 through 651.93, 652.61, 660.50, 660.51, V23.7, or V27.1 through V27.9; excluding patients with procedure codes: 37.5, 37.51, 37.52, 37.53, 37.54, 37.62, 37.63, or 74.0 through 74.99</p>
Patient-choice C-section	<p>Patients who had a cesarean section (cesarean procedure codes: 74.0 through 74.99); and did not labor (labor diagnosis codes like any of the following: 652.1*, 653*, 656.3*, 659.0*, 659.1*, 660*, 661*, 662*, or 663.0*); and did not have labor induction (procedure codes 73.0, 73.01, 73.09, 73.1, 73.4); and did not have a previous cesarean section (previous cesarean section diagnosis code: 654.21); and did not have any of the following diagnosis codes for these twelve clinical conditions:</p> <ul style="list-style-type: none"> • Malpresentation: 652 through 652.03, 652.2 through 652.43, 652.6 through 652.93 • Antepartum bleeding or placental abruption: like 641*, like 656.0* • Herpes: like 054*, like 647.6* • Severe hypertension: eclampsia and severe pre-eclampsia: like 642.5*, like 642.6* • Uterine scar unrelated to cesarean delivery: like 654.9* • Multiple gestation: like 651*, like 660.5**, V27.2 through V27.9 • Macrosomia: like 656.6* • Unengaged (high) fetal head: like 652.5* • Maternal soft tissue disorder (uterine abnormalities): like any of the following: 654.0*, 654.1*, 654.4*, 654.5*, 654.6*, 654.7* • Other types of hypertension: like 642* (where the fourth digit is not equal to 5 or 6) • Preterm gestation: 644.0 like 644.2* • Congenital fetal CNS anomaly or chromosomal abnormality: like 655.0*, like 655.1* <p>Exclusion criteria: Patients that have a stillborn diagnosis (stillborn diagnosis codes: V27.1, V27.3, V27.4, V27.6, V27.7, or between 651.30 and 651.63) or that had inadequate pre-natal care (diagnosis v237).</p>

Patient Definitions	ICD-9 Procedure/Diagnosis Codes and Criteria
Newborn Mortality	
500 to 749 grams	Diagnoses: 764.02 through 765.12 (where the fifth digit is 2), excluding patients with diagnosis codes 764.00, 764.10, 764.20, 764.90, 765.00, 765.10, v237, v31*, v32*, v33*, v34*, v35*, v36*, v37* or any code listed in Appendix C; excluding patients with procedure codes like 37.5*, 37.62, 37.63
750 to 999 grams	Diagnoses: 764.03 through 765.13 (where the fifth digit is 3), excluding patients with diagnosis codes 764.00, 764.10, 764.20, 764.90, 765.00, 765.10, v237, v31*, v32*, v33*, v34*, v35*, v36*, v37* or any code listed in Appendix C; excluding patients with procedure codes like 37.5*, 37.62, 37.63
1000 to 1249 grams	Diagnoses: 764.04 through 765.14 (where the fifth digit is 4), excluding patients with diagnosis codes 764.00, 764.10, 764.20, 764.90, 765.00, 765.10, v237, v31*, v32*, v33*, v34*, v35*, v36*, v37* or any code listed in Appendix C; excluding patients with procedure codes like 37.5*, 37.62, 37.63
1250 to 1499 grams	Diagnoses: 764.05 through 765.15 (where the fifth digit is 5), excluding patients with diagnosis codes 764.00, 764.10, 764.20, 764.90, 765.00, 765.10, v237, v31*, v32*, v33*, v34*, v35*, v36*, v37* or any code listed in Appendix C; excluding patients with procedure codes like 37.5*, 37.62, 37.63
1500 to 1749 grams	Diagnoses: 764.06 through 765.16 (where the fifth digit is 6), excluding patients with diagnosis codes 764.00, 764.10, 764.20, 764.90, 765.00, 765.10, v237, v31*, v32*, v33*, v34*, v35*, v36*, v37* or any code listed in Appendix C; excluding patients with procedure codes like 37.5*, 37.62, 37.63
1750 to 1999 grams	Diagnoses: 764.07 through 765.17 (where the fifth digit is 7), excluding patients with diagnosis codes 764.00, 764.10, 764.20, 764.90, 765.00, 765.10, v237, v31*, v32*, v33*, v34*, v35*, v36*, v37* or any code listed in Appendix C; excluding patients with procedure codes like 37.5*, 37.62, 37.63
2000 to 2499 grams	Diagnoses: 764.08 through 765.18 (where the fifth digit is 8), excluding patients with diagnosis codes 764.00, 764.10, 764.20, 764.90, 765.00, 765.10, v237, v31*, v32*, v33*, v34*, v35*, v36*, v37* or any code listed in Appendix C; excluding patients with procedure codes like 37.5*, 37.62, 37.63
2500 plus grams or normal newborns	Diagnoses: 764.09 through 765.19 (where the fifth digit is 9), V30.00, V30.01, excluding patients with diagnosis codes 764.00, 764.10, 764.20, 764.90, 765.00, 765.10, v237, v31*, v32*, v33*, v34*, v35*, v36*, v37* or any code listed in Appendix C; excluding patients with procedure codes like 37.5*, 37.62, 37.63; and excluding patients in any of the above weight categories as well as the under 500 grams category

* Includes all sub-codes related to the ICD-9 grouping.

Appendix B. Maternity Care Major Complications

Major Complications – Maternity Care – Vaginal Delivery			
287.4	2ND THROMBOCYTOPENIA	669.12	OB SHOCK-DEL, PP COMP
512.0	SPONT TENS PNEUMOTHORAX	669.14	OBSTETRIC SHOCK-PP
512.1	IATROGENIC PNEUMOTHORAX	785.51	CARDIOGENIC SHOCK
512.8	SPONT PNEUMOTHORAX NEC	785.59	SHOCK W/O TRAUMA NEC
518.4	ACUTE LUNG EDEMA NOS	996.31	MECH COMP URETHRAL CATH
518.81	AC RESPIRATORY FAILURE	996.60	INFECT DUE TO DEVICE NOS
584.5	ACUTE RENAL FAILURE	996.62	INFECT D/T VASC DEVICE
584.8	AC REN FAIL-PATH LES NEC	997.00	NERV SYST SURG COMP NOS
584.9	ACUTE RENAL FAILURE NOS	997.01	CNS SURG COMP
664.21	DEL W 3 DEGREE LAC-DEL	997.02	IATROGEN CV INFARCT/HEM
664.31	DEL W 4 DEGREE LAC-DEL	997.09	NERV SYST SURG COMP NEC
665.10	RUPTURE UTERUS NOS-NOS	997.1	SURG COMP-HEART
665.11	RUPTURE UTERUS NOS-DEL	997.3	SURG COMP-RESP NEC
665.22	INVERS UTER-DEL, PP COMP	997.4	SURG COMP-DIGESTIVE
665.31	LACERATION OF CERVIX-DEL	997.5	SURG COMP-URINARY NEC
665.41	HIGH VAGINAL LAC-DEL	997.91	SURG COMP-HYPERTENSION
665.51	OB INJ PELV ORG NEC-DEL	998.0	POSTOPERATIVE SHOCK
666.02	3RD STAGE PP HEMOR-DEL	998.11	HEMORRHAGE COMP PX
666.04	3RD STAGE PP HEMOR-PP	998.2	ACCIDENTAL OP LACERATION
666.10	IMMED PP HEMOR NEC-NOS	998.3	POSTOP WOUND DISRUPTION
666.12	IMMED PP HEMOR NEC-DEL	998.4	FB LEFT DURING PROCEDURE
666.14	IMMED PP HEMOR NEC-PP	998.59	POSTOP INFECTION NEC
666.20	DELAYED PP HEMOR-NOS	998.7	POSTOP FOREIGN SUBST RXN
666.22	DELAYED PP HEMOR-DEL PP	998.81	EMPHYSEMA DUE TO PX
666.24	DELAYED PP HEMOR-PP	998.83	NON-HEALING SURG WND
666.30	PP COAG DEFECT-NOS	998.9	SURGICAL COMP NOS
666.32	PP COAG DEFECT-DEL PP	999.1	AIR EMBOL COMP MED CARE
666.34	PP COAG DEFECT-PP	999.2	VASC COMP MED CARE NEC
667.02	RET PLAC S HEMOR-DEL PP	999.3	INFECT COMP MED CARE NEC
668.02	ANES PULM COMP DEL-DELPP	999.4	ANAPHYLACTIC SHOCK-SERUM
668.12	ANES CARD COMP DEL-DELPP	999.5	SERUM REACTION NEC
668.14	ANES CARD COMP DEL-PP	999.6	ABO INCOMPATIBILITY RXN
668.22	ANES CNS COMP DEL-DEL PP	999.7	RH INCOMPATIBILITY RXN
668.82	ANES COMP DEL NEC-DEL PP	999.8	TRANSFUSION REACTION NEC
670.02	MAJOR PP INFECT-DEL PP	999.9	COMP MED CARE NEC & NOS
674.32	OB SURG COMP NEC-DEL PP		

Major Complications – Maternity Care - C-section Delivery			
287.4	2ND THROMBOCYTOPENIA	785.51	CARDIOGENIC SHOCK
512.0	SPONT TENS PNEUMOTHORAX	785.59	SHOCK W/O TRAUMA NEC
512.1	IATROGENIC PNEUMOTHORAX	996.31	MECH COMP URETHRAL CATH
512.8	SPONT PNEUMOTHORAX NEC	996.60	INFECT DUE TO DEVICE NOS
518.4	ACUTE LUNG EDEMA NOS	996.62	INFECT D/T VASC DEVICE
518.81	AC RESPIRATORY FAILURE	997.00	NERV SYST SURG COMP NOS
584.5	ACUTE RENAL FAILURE	997.01	CNS SURG COMP
584.8	AC REN FAIL-PATH LES NEC	997.02	IATROGEN CV INFARCT/HEM
584.9	ACUTE RENAL FAILURE NOS	997.09	NERV SYST SURG COMP NEC
666.00	3RD STAGE PP HEMOR-NOS	997.1	SURG COMP-HEART
666.02	3RD STAGE PP HEMOR-DEL	997.3	SURG COMP-RESP NEC
666.04	3RD STAGE PP HEMOR-PP	997.4	SURG COMP-DIGESTIVE
666.10	IMMED PP HEMOR NEC-NOS	997.5	SURG COMP-URINARY NEC
666.12	IMMED PP HEMOR NEC-DEL	997.91	SURG COMP-HYPERTENSION
666.14	IMMED PP HEMOR NEC-PP	998.0	POSTOPERATIVE SHOCK
666.20	DELAYED PP HEMOR-NOS	998.11	HEMORRHAGE COMP PX
666.22	DELAYED PP HEMOR-DEL PP	998.2	ACCIDENTAL OP LACERATION
666.24	DELAYED PP HEMOR-PP	998.3	POSTOP WOUND DISRUPTION
666.30	PP COAG DEFECT-NOS	998.4	FB LEFT DURING PROCEDURE
666.32	PP COAG DEFECT-DEL PP	998.51	INFECTED POSTOP SEROMA
666.34	PP COAG DEFECT-PP	998.59	POSTOP INFECTION NEC
667.02	RET PLAC S HEMOR-DEL PP	998.7	POSTOP FOREIGN SUBST RXN
668.02	ANES PULM COMP DEL-DELPP	998.81	EMPHYSEMA DUE TO PX
668.04	ANES PULM COMP DEL-PP	998.83	NON-HEALING SURG WND
668.12	ANES CARD COMP DEL-DELPP	998.9	SURGICAL COMP NOS
668.14	ANES CARD COMP DEL-PP	999.1	AIR EMBOL COMP MED CARE
668.22	ANES CNS COMP DEL-DEL PP	999.2	VASC COMP MED CARE NEC
668.24	ANES CNS COMP DEL-PP	999.3	INFECT COMP MED CARE NEC
668.82	ANES COMP DEL NEC-DEL PP	999.4	ANAPHYLACTIC SHOCK-SERUM
669.42	OTH OB SURG COMP-DEL PP	999.5	SERUM REACTION NEC
669.44	OTH OB SURG COMP, PPCOND	999.6	ABO INCOMPATIBILITY RXN
670.02	MAJOR PP INFECT-DEL PP	999.7	RH INCOMPATIBILITY RXN
674.12	DISRUPT CD WND-DEL PP	999.8	TRANSFUSION REACTION NEC
674.32	OB SURG COMP NEC-DEL PP	999.9	COMP MED CARE NEC & NOS
785.50	SHOCK NOS		

Appendix C. Congenital Anomalies

Neonates with the following congenital anomalies were excluded from the analysis. These congenital anomalies are generally considered to be incompatible with life.

Central Nervous System	
740.0	Anencephalus
740.1	Craniorachischis
740.2	Inencephaly
742.1	Microcephalus
742.2	Reduction deformities of brain
Cardiac	
745.7	Cor biloculare
746.7	Hypoplastic left heart syndrome
746.82	Cor triatriatum
747.22	Atresia & stenosis of aorta
Renal	
753.0	Renal agenesis & dysgenesis (only if bilateral)
Chromosomal	
758.1	Patau's syndrome (trisomy 13)
758.2	Edward's syndrome (trisomy 18)
Respiratory	
748.5	Lung agenesis/Hypoplasia Aplasia of lung, Hypoplasia of lung (lobe), Sequestration of lung An argument can be made that not all are fatal (e.g., hypoplasia if unilateral). Due to the high frequency of associated malformations, the mortality rate is variable but high.
745.10	Complete transposition of great vessels