Tetanus, Diphtheria, Acellular Pertussis Vaccine during Pregnancy: Pregnancy and Infant Health Outcomes

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Objective To assess pregnancy and birth outcomes in infants born to women who did or did not receive tetanus, diphtheria, acellular pertussis (Tdap) vaccine during pregnancy.

Study design Retrospective cohort. Pregnant women 12-45 years of age who received Tdap at Intermountain Healthcare facilities and their infants were identified and compared with mother-infant pairs without documented Tdap from May 2005 through August 2009. Primary measures included pregnancy outcomes and infant health outcomes at birth through 12 months.

Results From 162 448 pregnancies we identified 138 women (0.08%) with documented Tdap administration during pregnancy (cases); 552 pregnant women without documented Tdap were randomly selected as controls. Of 138 immunized women, 63% received Tdap in the first trimester and 37% after. Tdap was given most commonly as wound prophylaxis. The incidence of spontaneous or elective abortion was no greater in Tdap cases than in controls. There were no significant differences in preterm delivery, gestational age, or birth weight between groups. One or more congenital anomaly was identified in 3.7% (95% CI 1.2%-8.5%) of case infants and 4.4% (95% CI 2.7%-6.5%) of control infants ($P = .749$). In infants born to women receiving Tdap during pregnancy, 3.6% (0.8%-10.2%) had *International Classification of Diseases, Ninth Revision*, Clinical Modification diagnoses consistent with complex chronic conditions within 12 months compared with 10.4% (95% CI 7.2%-14.4%) of infants of controls ($P = .054$).

Conclusions Documented Tdap administration during pregnancy was uncommon and occurred most often in the first trimester as prophylaxis following trauma. No increase in adverse outcomes was identified in infants born to women receiving Tdap compared with infants of controls. *(J Pediatr 2013;163:1422-26)*.

Pertussis is an endemic vaccine-preventable disease with the highest morbidity and mortality in the youngest infants.[1-6] In 2012, increased pertussis activity was reported in 49 states.[7] In the US, the primary pertussis immunization series is not completed until 6 months of age, leaving young infants vulnerable to pertussis. Of pertussis-related deaths reported to the US Centers for Disease Control from 2000-2006, 93% were in infants younger than 12 months.[2]

Several studies have confirmed the potential to provide protection from pertussis in newborns through passive transfer of maternal antibody during pregnancy.[8-13] In an effort to reduce the burden of pertussis disease in young infants, the Centers for Disease Control and Prevention's Advisory Committee on Immunization Practices (ACIP) approved recommendations for the use of tetanus, diphtheria, acellular pertussis (Tdap) vaccine after 20 weeks gestation in previously unimmunized pregnant women in June 2011.[1] These recommendations were endorsed by the American College of Obstetricians and Gynecologists.[14] In October 2012, ACIP recommended expansion of Tdap guidelines to include every pregnant woman during every pregnancy irrespective of previous history of Tdap immunization and optimally at between 27 and 36 weeks gestation to maximize passive antibody transfer to the infant.[15]

Few studies have examined pregnancy or infant outcomes for women receiving Tdap during pregnancy. A 2012 Vaccine Adverse Event Reporting System study of 132 pregnant women who received Tdap described no adverse event in 42%, spontaneous abortion in 16.7%, and 1 major congenital anomaly.[16] Among 518 prospective reports to the Adacel (Tdap) Pregnancy Registry from June 2005 through June 2011 with known pregnancy outcomes, the rate of spontaneous abortion was 12.6% and elective abortion was 1.6%; loss to follow-up for the registry was 67%.[17] Interpretation of passive surveillance data, particularly during pregnancy, is complex given the potential bias associated with reporting adverse events and the inability to determine a true adverse event rate.

We recognized an opportunity to use the electronic medical records of Intermountain Healthcare to (1) identify women who received Tdap during

ACIP	Advisory Committee on Immunization Practices
EDW	Enterprise Data Warehouse
ICD-9-CM	*International Classification of Diseases, Ninth Revision*, Clinical Modification
Tdap	Tetanus, diphtheria, acellular pertussis

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pregnancy (cases) and determine when and why administration occurred; (2) assess pregnancy and infant health outcomes in women who received Tdap during pregnancy compared with pregnant women without documentation of Tdap immunization during pregnancy (controls); and (3) identify the prevalence of complex chronic conditions in the first 12 months in infants born to cases compared with infants born to controls.

Methods

Approval to conduct this study was granted by the Institutional Review Boards of the University of Utah and Intermountain Healthcare in Salt Lake City, Utah. Waiver of informed consent was granted by both institutions.

Intermountain Healthcare is the largest vertically integrated system of health care facilities in Intermountain Healthcare West with more than 30 000 deliveries each year. All Intermountain Healthcare facilities share a single electronic medical record that captures vaccine administration. Data are stored in the Intermountain Healthcare Enterprise Data Warehouse (EDW). To retrospectively identify Tdap administration during pregnancies occurring from May 1, 2005, through August 31, 2009, we created a pregnancy episode table that included all women who had at least 1 *International Classification of Diseases, Ninth Revision*, Clinical Modification (ICD-9-CM) diagnosis code associated with pregnancy. During these years, Tdap was not recommended for pregnant women.

Pregnancy outcomes included spontaneous or elective abortions, stillbirths and live births, and a standard hierarchy was established to identify pregnancy start and end dates (**Appendix**; available at www.jpeds.com). The Intermountain Healthcare EDW was queried to identify all pregnant women with documented receipt of Tdap immunization within 280 days (40 weeks) of the pregnancy end date. Women who had documentation of Tdap vaccine within 3 days prior to the delivery outcome were excluded due to the likelihood that these encounters represented postpartum Tdap immunization. Four pregnant women without documentation of Tdap immunization were randomly identified from the Intermountain Healthcare EDW to serve as controls for each case. The electronic medical records for infants born to each case and control were identified and linked to maternal records.

The Intermountain Healthcare EDW database query ascertained pregnancy outcomes, including preterm (<37 weeks gestation) or term (≥37 weeks gestation) delivery, delivery of a live-born infant, stillbirth, spontaneous abortion, or elective abortion for all cases and controls in our cohort. The following data also was obtained for each maternal case: trimester of immunization, immunization date, and the type of encounter in which Tdap was administered (eg, acute care or health supervision). For infants, the following outcomes at time of delivery were identified: gestational age, birth weight, and the presence of ICD-9-CM diagnosis codes for congenital malformations or adverse perinatal events. Complex chronic conditions for infants who had at least 1 additional medical encounter at an Intermountain Healthcare facility during the first 12 months after delivery were identified and categorized using both inpatient and outpatient ICD-9-CM diagnosis codes as previously defined by Feudtner et al [18]

Statistical Analyses

Data were analyzed using Stata v. 12.1 (StataCorp, College Station, Texas). Descriptive statistics were used to characterize the proportion of women who received Tdap during pregnancy and reason for visit at the time of immunization by ICD-9-CM diagnosis. The independent sample *t* test was used to compare cases and controls and their infants by maternal age, gestational age, and birth weight after evaluating distributions for normality. Prematurity, congenital anomalies, and the presence of complex chronic conditions in infants born to cases and controls were compared by χ^2 test and 95% CIs were calculated around the point estimates.

Results

There were 162 448 pregnancies during the study period. We identified 138 (0.08%) women with documented Tdap during a pregnancy episode; 552 pregnancies in which there was no documentation of Tdap were randomly chosen for comparison of pregnancy and birth outcomes. The mean age of pregnant women was 27 years for both cases (range = 14-40) and controls (range = 14-43) ($P = .735$).

Visit Type and Trimester of Tdap Administration

Based on ICD-9-CM diagnosis codes, the primary reason and trimester at the visit Tdap administration occurred are shown in the **Figure**. The most common reasons women received Tdap were prophylaxis for open wounds or during acute care visits for trauma (47%) and routine health supervision (46%). Of the 138 immunized women, 87 (63%) received Tdap in the first trimester, 24 (17%) in the second, and 27 (20%) in the third.

Pregnancy and Infant Outcomes in Cases and Controls

Of the 138 women who received Tdap during a pregnancy, 4/138 (2.9%; 95% CI 0.9%-7.7%) had spontaneous or elective abortions compared with 49/552 (8.9%; 95% CI 6.7%-11.6%) of controls ($P = .019$). Even though no pregnancy in cases resulted in stillbirth, 5 (0.9%) control pregnancies resulted in a stillborn infant. Preterm delivery (<37 weeks) occurred in 8/134 (6.0%; 95% CI 2.8%-11.8%) of live born infants born to cases compared with 38/505 (7.5%; 95% CI 5.4%-10.3%) of infants born to controls ($P = .536$).

Mean gestational age for infants was 39 weeks for both cases (range = 29-41) and controls (range = 28-42) ($P = .578$). Mean birth weight for infants born to immunized women was 3384 g compared with 3305 g for infants born to controls ($P = .116$).

At birth, ICD-9-CM codes for congenital anomalies were present in 5/134 (3.7%; 95% CI 1.2%-8.5%) of infants

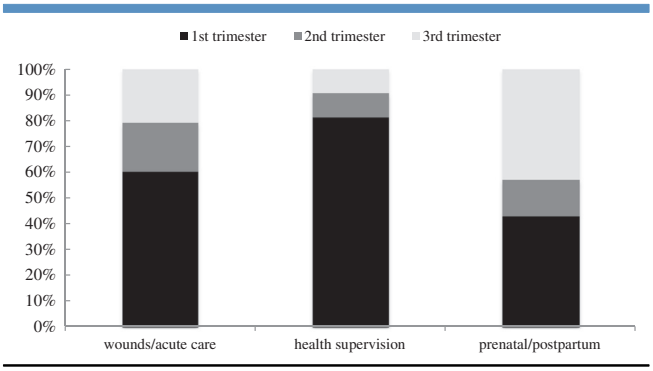

Figure. Reason for health care visit and trimester at time of Tdap vaccine administration.

born to cases and 4.4% (22/505) (95% CI 2.7%-6.5%) of infants born to controls ($P = .749$; Table). By 12 months of age, 62% (83/134) of infants born to women who had received Tdap and 61% (307/505) of infants born to controls had at least 1 additional health encounter at an Intermountain Healthcare facility. Of these infants, 3/83 (3.6%; 95% CI 0.8%-10.2%) born to cases had at least one ICD-9-CM diagnosis consistent with a complex chronic condition vs 32/307 (10.4%; 95% CI 7.2%-14.4%) of infants born to controls ($P = .054$; Table).

No infant in either group had an ICD-9-CM diagnosis code for pertussis in the year following birth.

Discussion

This retrospective study reports a large cohort of pregnant women immunized with Tdap during pregnancy. Although a small proportion of pregnant women overall (<0.1%) received Tdap immunization, we identified 138 women with documented Tdap during pregnancy. Pregnant women in our cohort most commonly received Tdap during acute care visits for wound prophylaxis during the first trimester of pregnancy, when the health care provider and the woman herself may have been unaware of the pregnancy. Our shared electronic medical record allowed us to capture multiple health encounters for mother-infant pairs that allowed us to identify ICD-9-CM diagnoses in infants born to cases and controls, congenital anomalies at birth, and complex conditions apparent by 12 months of age. Pregnancy outcomes for immunized women, the majority of whom were immunized in the first trimester, were good and similar to controls. Further, infants of cases were no more likely to be preterm, to be diagnosed with congenital malformations at birth, or to have complex chronic conditions diagnosed in the first year than infants of controls.

Tdap vaccine administration in this cohort of pregnant women was uncommon. Given that Tdap immunization during pregnancy was not yet recommended in any trimester of pregnancy during the study period, our finding of infrequent Tdap administration is not surprising. Routine immunization of pregnant women with the intent to provide transplacental protection to newborns from pertussis is now recommended by both ACIP and American College of Obstetricians and Gynecologists.[14,15] Although the current recommendations are for immunization between 27 and 36 weeks gestation, our data provide reassurance that pertussis immunization, even during the first trimester, is not associated with increases in the adverse events measured.

Many pregnant women in our study who received Tdap were immunized in the first trimester during acute care visits for a laceration repair or trauma. A significant proportion of immunized women also received Tdap vaccine early in pregnancy as part of a routine health supervision visit. It is likely that most healthcare providers, and perhaps the women themselves, were unaware of the pregnancy during the

Table. ICD-9-CM congenital anomalies and complex chronic conditions in Tdap exposed and unexposed infants

	Exposed infants (n = 5)	Unexposed infants (n = 22)
Congenital anomalies	7454 VENTRICULAR SEPT DEFECT 7455 SECUNDUM ATRIAL SEPT DEF 7786 CONGENITAL HYDROCELE 74763 UPPER LIMB VESSEL ANOMAL 75739 SKIN ANOMALY NEC	7450 COMMON TRUNCUS 75739 SKIN ANOMALY NEC 74689 CONG HEART ANOMALY NEC 76383 ABN FETAL HRT UNSPEC 75263 CONGENITAL CHORDEE 5968 BLADDER DISORDER NEC 7786 CONGENITAL HYDROCELE 75733 CONG SKIN PIGMENT ANOMAL 75261 HYPOSPADIAS 7786 CONGENITAL HYDROCELE 75569 LOWER LIMB ANOMALY NEC 7454 VENTRICULAR SEPT DEFECT 7455 SECUNDUM ATRIAL SEPT DEF 7560 ANOMAL SKULL/FACE BONES 75733 CONG SKIN PIGMENT ANOMAL 7455 SECUNDUM ATRIAL SEPT DEF 7503 CONG ESOPH FISTULA/ ATRES 7422 REDUCTION DEFORM, BRAIN 7455 SECUNDUM ATRIAL SEPT DEF 7515 INTESTINAL ANOMALY NEC 75529 LONGITUD DEFIC PHALANGES V293 OBS SUSP GENETIC METABOL 75329 OBST DEF RENAL PEL/URET
	Exposed infants (n = 3)	**Unexposed Infants (n = 32)**
Complex chronic conditions	Cardiovascular (2) Respiratory (1) Gastrointestinal (1)	Neuromuscular (2) Cardiovascular (14) Respiratory (6) Renal (4) Gastrointestinal (1) Metabolic (5) Genetic (6) Malignancy (1)

immunization encounter. Many pregnant women likely have received Tdap for valid medical indications even before the new recommendations for administration of Tdap during every pregnancy.

Our study demonstrates that women immunized during pregnancy and their infants were no more likely to experience adverse events than concurrent control mother-infant pairs in our population. In our cohort, 2.9% of women with documented Tdap during pregnancy had a spontaneous or elective abortion, 6.0% delivered preterm infants, and no pregnancy in this group resulted in stillbirth. A study conducted by Black et al to provide baseline rates of events for vaccine safety studies during mass immunization for pandemic influenza A virus reported background rates of spontaneous abortion from 1960-1980 in the US of 15.8% and preterm labor or delivery in 2008 of 10.4%-11.5%.[19] A report published by the Stillbirth Collaborative Research Network Writing Group reported that stillbirths occur in approximately 1 in 160 US pregnancies.[20] In women in our cohort with documented Tdap during pregnancy, rates of abortion, preterm delivery, and stillbirth were all lower than previously reported background rates. The rates of spontaneous abortion and preterm delivery among controls were slightly lower than those reported by Black et al. This may reflect differences in the population studied and the methods of ascertainment. The comparison of our findings and these studies demonstrate the complementary role of concurrently controlled studies and comparing background incidence of adverse outcomes when evaluating adverse events during pregnancy.

One of the strengths of our study is the unbiased detection of all women with documented Tdap administration in a large cohort of pregnant women and comparison with a concurrent control group drawn from the same population. Previous published data available on pregnancy outcomes in women receiving Tdap vaccine use passive surveillance that is subject to a number of potential biases including the increased likelihood of reporting adverse pregnancy outcomes. Another strength of this study is our ability to report on the more long-term outcomes in infants born to women receiving Tdap during the pregnancy. The robust electronic data available in the Intermountain Healthcare EDW also allowed us to track infant health encounters using ICD-9-CM codes during the first 12 months after delivery and we were able to capture data for a significant proportion of infants born to both cases and controls. Infants born to cases who received further care within the Intermountain Healthcare system were no more likely to be diagnosed with complex chronic conditions in the first year than infants born to controls. Although many chronic medical conditions are not related to in utero infection, these codes are likely to detect congenital anomalies or birth defects that are diagnosed after the postpartum period.

Our study has several limitations. Tdap administration was uncommon and our cohort was small. However, although only 138 cases were identified, this represents one of the largest cohorts of pregnant women receiving Tdap reported in the medical literature and includes many women immunized during the first trimester. It is also possible that miscoding in pregnancy and birth outcomes may have occurred, and other factors such as parity, previous pregnancy loss, and family history of congenital conditions could have affected the study findings. However, we rigorously reviewed outcomes, and we are satisfied that all pertinent outcomes are accurately represented. Finally, our data were observational and collected retrospectively. We, therefore, cannot accurately speculate on the reason for fewer spontaneous or elective abortions in cases compared with controls. This pregnancy outcome may be due to the small number of cases or to unmeasured factors. However, the absence of increased adverse outcomes in cases and their infants through 12 months of age provides further evidence to support the current recommendations for Tdap immunization in pregnant women.

The results of this retrospective study are encouraging. However, prospective trials will be required to confirm the safety and efficacy of Tdap immunization during pregnancy. Two trials are underway in the US and Canada to assess the safety of Tdap during pregnancy.[21,22] Both trials have recruited small cohorts of healthy women in the third trimester (30-32 weeks) of pregnancy to further evaluate safety and immunogenicity of Tdap immunization in the mother and diphtheria, tetanus, acellular pertussis immunization in the infant.[21,22] The new universal recommendations for immunization of pregnant women during second and third trimester will afford further opportunity to collect prospective safety data on large cohorts of women. ■

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Appendix. Pregnancy episode table

Inclusion Criteria
Admit Date between May 1, 2005 through August 31, 2009
Tdap vaccine administered between pregnancy start date (preg_start_dt) and pregnancy outcome admit date (preg_end_dt)
Exclusion Criteria
Preg_Misdiagnosis_flg = 1 during Pregnancy episode
"Pregnancy Episode" Creation for Cases
Step 1. Create all Intermountain Healthcare pregnancy episode table including early terminations
Step 2. Search all pregnancy episodes for mothers who received Tdap vaccine within 280 days of preg_end_dt
Step 3. For liveborn delivery, calculate preg_start_dt using gestational age (GA)
Step 4. For early termination, calculate preg_start_dt using pregnancy episode tables.
Hierarchy for determining GA = Ultrasound > CDR webform > Serum hCG > AFP
Step 5. Exclude mothers if unable to determine preg_start_dt.
Step 6. Determine mothers with vaccine_dt between preg_start_dt and preg_end_dt

Pregnancy Outcome Categories	ICD9_DX_DEC_CD	ICD9_DX_LONG_DSC
Spon_abt_flg		
	633	ECTOPIC PREGNANCY
	633.0	ABDOMINAL PREGNANCY
	633.00	ABD PREG W/O IUP
	633.01	ABD PREG W IUP
	633.1	TUBAL PREGNANCY
	633.10	TUBAL PREG W/O IUP
	633.11	TUBAL PREG W IUP
	633.2	OVARIAN PREGNANCY
	633.20	OVARIAN PREG W/O IUP
	633.21	OVARIAN PREG W IUP
	633.8	OTHER ECTOPIC PREGNANCY
	633.80	OTH ECTOPIC PREG W/O IUP
	633.81	OTH ECTOPIC PREG W IUP
	633.9	UNSPECIFIED ECTOPIC PREGNANCY
	633.90	UNSP ECTOPIC PRG W/O IUP
	633.91	UNSP ECTOPIC PRG W IUP
	634	SPONTANEOUS ABORTION
	634.0	SPONTANEOUS ABORTION COMPLICATED BY GENITAL TRACT AND PELVIC INFECTION
	634.00	SPONTANEOUS ABORTION, UNSPECIFIED, COMPLICATED BY GENITAL TRACT AND PELVIC INFECTION
	634.01	SPONTANEOUS ABORTION, INCOMPLETE, COMPLICATED BY GENITAL TRACT AND PELVIC INFECTION
	634.02	SPONTANEOUS ABORTION, COMPLETE, COMPLICATED BY GENITAL TRACT AND PELVIC INFECTION
	634.1	SPONTANEOUS ABORTION COMPLICATED BY DELAYED OR EXCESSIVE HEMORRHAGE
	634.10	SPONTANEOUS ABORTION, UNSPECIFIED, COMPLICATED BY DELAYED OR EXCESSIVE HEMORRHAGE
	634.11	SPONTANEOUS ABORTION, INCOMPLETE, COMPLICATED BY DELAYED OR EXCESSIVE HEMORRHAGE
	634.12	SPONTANEOUS ABORTION, COMPLETE, COMPLICATED BY DELAYED OR EXCESSIVE HEMORRHAGE
	634.2	SPONTANEOUS ABORTION COMPLICATED BY DAMAGE TO PELVIC ORGANS OR TISSUES
	634.20	SPONTANEOUS ABORTION, UNSPECIFIED, COMPLICATED BY DAMAGE TO PELVIC ORGANS OR TISSUES
	634.21	SPONTANEOUS ABORTION, INCOMPLETE, COMPLICATED BY DAMAGE TO PELVIC ORGANS OR TISSUES
	634.22	SPONTANEOUS ABORTION, COMPLETE, COMPLICATED BY DAMAGE TO PELVIC ORGANS OR TISSUES
	634.3	SPONTANEOUS ABORTION COMPLICATED BY RENAL FAILURE
	634.30	SPONTANEOUS ABORTION, UNSPECIFIED, COMPLICATED BY RENAL FAILURE
	634.31	SPONTANEOUS ABORTION, INCOMPLETE, COMPLICATED BY RENAL FAILURE
	634.32	SPONTANEOUS ABORTION, COMPLETE, COMPLICATED BY RENAL FAILURE
	634.4	SPONTANEOUS ABORTION COMPLICATED BY METABOLIC DISORDER
	634.40	SPONTANEOUS ABORTION, UNSPECIFIED, COMPLICATED BY METABOLIC DISORDER
	634.41	SPONTANEOUS ABORTION, INCOMPLETE, COMPLICATED BY METABOLIC DISORDER
	634.42	SPONTANEOUS ABORTION, COMPLETE, COMPLICATED BY METABOLIC DISORDER
	634.5	SPONTANEOUS ABORTION COMPLICATED BY SHOCK
	634.50	SPONTANEOUS ABORTION, UNSPECIFIED, COMPLICATED BY SHOCK
	634.51	SPONTANEOUS ABORTION, INCOMPLETE, COMPLICATED BY SHOCK
	634.52	SPONTANEOUS ABORTION, COMPLETE, COMPLICATED BY SHOCK
	634.6	SPONTANEOUS ABORTION COMPLICATED BY EMBOLISM
	634.60	SPONTANEOUS ABORTION, UNSPECIFIED, COMPLICATED BY EMBOLISM
	634.61	SPONTANEOUS ABORTION, INCOMPLETE, COMPLICATED BY EMBOLISM
	634.62	SPONTANEOUS ABORTION, COMPLETE, COMPLICATED BY EMBOLISM
	634.7	SPONTANEOUS ABORTION WITH OTHER SPECIFIED COMPLICATIONS
	634.70	SPONTANEOUS ABORTION, UNSPECIFIED, WITH OTHER SPECIFIED COMPLICATIONS
	634.71	SPONTANEOUS ABORTION, INCOMPLETE, WITH OTHER SPECIFIED COMPLICATIONS
	634.72	SPONTANEOUS ABORTION, COMPLETE, WITH OTHER SPECIFIED COMPLICATIONS
	634.8	SPONTANEOUS ABORTION WITH UNSPECIFIED COMPLICATION
	634.80	SPONTANEOUS ABORTION, UNSPECIFIED, WITH UNSPECIFIED COMPLICATION
	634.81	SPONTANEOUS ABORTION, INCOMPLETE, WITH UNSPECIFIED COMPLICATION
	634.82	SPONTANEOUS ABORTION, COMPLETE, WITH UNSPECIFIED COMPLICATION
	634.9	SPONTANEOUS ABORTION WITHOUT MENTION OF COMPLICATION
	634.90	SPONTANEOUS ABORTION, UNSPECIFIED, WITHOUT MENTION OF COMPLICATION
	634.91	SPONTANEOUS ABORTION, INCOMPLETE, WITHOUT MENTION OF COMPLICATION
	634.92	SPONTANEOUS ABORTION, COMPLETE, WITHOUT MENTION OF COMPLICATION

(*Continued*)

Appendix. Continued

Abt_flg	
632	MISSED ABORTION
635	LEGALLY INDUCED ABORTION
635.0	LEGALLY INDUCED ABORTION COMPLICATED BY GENITAL TRACT AND PELVIC INFECTION
635.00	LEGALLY INDUCED ABORTION, UNSPECIFIED, COMPLICATED BY GENITAL TRACT AND PELVIC INFECTION
635.01	LEGALLY INDUCED ABORTION, INCOMPLETE, COMPLICATED BY GENITAL TRACT AND PELVIC INFECTION
635.02	LEGALLY INDUCED ABORTION, COMPLETE, COMPLICATED BY GENITAL TRACT AND PELVIC INFECTION
635.1	LEGALLY INDUCED ABORTION COMPLICATED BY DELAYED OR EXCESSIVE HEMORRHAGE
635.10	LEGALLY INDUCED ABORTION, UNSPECIFIED, COMPLICATED BY DELAYED OR EXCESSIVE HEMORRHAGE
635.11	LEGALLY INDUCED ABORTION, INCOMPLETE, COMPLICATED BY DELAYED OR EXCESSIVE HEMORRHAGE
635.12	LEGALLY INDUCED ABORTION, COMPLETE, COMPLICATED BY DELAYED OR EXCESSIVE HEMORRHAGE
635.2	LEGALLY INDUCED ABORTION COMPLICATED BY DAMAGE TO PELVIC ORGANS OR TISSUES
635.20	LEGALLY INDUCED ABORTION, UNSPECIFIED, COMPLICATED BY DAMAGE TO PELVIC ORGANS OR TISSUES
635.21	LEGALLY INDUCED ABORTION, INCOMPLETE, COMPLICATED BY DAMAGE TO PELVIC ORGANS OR TISSUES
635.22	LEGALLY INDUCED ABORTION, COMPLETE, COMPLICATED BY DAMAGE TO PELVIC ORGANS OR TISSUES
635.3	LEGALLY INDUCED ABORTION COMPLICATED BY RENAL FAILURE
635.30	LEGALLY INDUCED ABORTION, UNSPECIFIED, COMPLICATED BY RENAL FAILURE
635.31	LEGALLY INDUCED ABORTION, INCOMPLETE, COMPLICATED BY RENAL FAILURE
635.32	LEGALLY INDUCED ABORTION, COMPLETE, COMPLICATED BY RENAL FAILURE
635.4	LEGALLY INDUCED ABORTION COMPLICATED BY METABOLIC DISORDER
635.40	LEGALLY INDUCED ABORTION, UNSPECIFIED, COMPLICATED BY METABOLIC DISORDER
635.41	LEGALLY INDUCED ABORTION, INCOMPLETE, COMPLICATED BY METABOLIC DISORDER
635.42	LEGALLY INDUCED ABORTION, COMPLETE, COMPLICATED BY METABOLIC DISORDER
635.5	LEGALLY INDUCED ABORTION COMPLICATED BY SHOCK
635.50	LEGALLY INDUCED ABORTION, UNSPECIFIED, COMPLICATED BY SHOCK
635.51	LEGALLY INDUCED ABORTION, INCOMPLETE, COMPLICATED BY SHOCK
635.52	LEGALLY INDUCED ABORTION, COMPLETE, COMPLICATED BY SHOCK
635.6	LEGALLY INDUCED ABORTION COMPLICATED BY EMBOLISM
635.60	LEGALLY INDUCED ABORTION, UNSPECIFIED, COMPLICATED BY EMBOLISM
635.61	LEGALLY INDUCED ABORTION, INCOMPLETE, COMPLICATED BY EMBOLISM
635.62	LEGALLY INDUCED ABORTION, COMPLETE, COMPLICATED BY EMBOLISM
635.7	LEGALLY INDUCED ABORTION WITH OTHER SPECIFIED COMPLICATIONS
635.70	LEGALLY INDUCED ABORTION, UNSPECIFIED, WITH OTHER SPECIFIED COMPLICATIONS
635.71	LEGALLY INDUCED ABORTION, INCOMPLETE, WITH OTHER SPECIFIED COMPLICATIONS
635.72	LEGALLY INDUCED ABORTION, COMPLETE, WITH OTHER SPECIFIED COMPLICATIONS
635.8	LEGALLY INDUCED ABORTION WITH UNSPECIFIED COMPLICATION
635.80	LEGALLY INDUCED ABORTION, UNSPECIFIED, WITH UNSPECIFIED COMPLICATION
635.81	LEGALLY INDUCED ABORTION, INCOMPLETE, WITH UNSPECIFIED COMPLICATION
635.82	LEGALLY INDUCED ABORTION, COMPLETE, WITH UNSPECIFIED COMPLICATION
635.9	LEGALLY INDUCED ABORTION WITHOUT MENTION OF COMPLICATION
635.90	LEGALLY INDUCED ABORTION, UNSPECIFIED, WITHOUT MENTION OF COMPLICATION
635.91	LEGALLY INDUCED ABORTION, INCOMPLETE, WITHOUT MENTION OF COMPLICATION
635.92	LEGALLY INDUCED ABORTION, COMPLETE, WITHOUT MENTION OF COMPLICATION
636	ILLEGAL ABORTION
636.0	ILLEGAL ABORTION COMPLICATED BY GENITAL TRACT AND PELVIC INFECTION
636.00	ILLEGAL ABORTION, UNSPECIFIED, COMPLICATED BY GENITAL TRACT AND PELVIC INFECTION
636.01	ILLEGAL ABORTION, INCOMPLETE, COMPLICATED BY GENITAL TRACT AND PELVIC INFECTION
636.02	ILLEGAL ABORTION, COMPLETE, COMPLICATED BY GENITAL TRACT AND PELVIC INFECTION
636.1	ILLEGAL ABORTION COMPLICATED BY DELAYED OR EXCESSIVE HEMORRHAGE
636.10	ILLEGAL ABORTION, UNSPECIFIED, COMPLICATED BY DELAYED OR EXCESSIVE HEMORRHAGE
636.11	ILLEGAL ABORTION, INCOMPLETE, COMPLICATED BY DELAYED OR EXCESSIVE HEMORRHAGE
636.12	ILLEGAL ABORTION, COMPLETE, COMPLICATED BY DELAYED OR EXCESSIVE HEMORRHAGE
636.2	ILLEGAL ABORTION COMPLICATED BY DAMAGE TO PELVIC ORGANS OR TISSUES
636.20	ILLEGAL ABORTION, UNSPECIFIED, COMPLICATED BY DAMAGE TO PELVIC ORGANS OR TISSUES
636.21	ILLEGAL ABORTION, INCOMPLETE, COMPLICATED BY DAMAGE TO PELVIC ORGANS OR TISSUES
636.22	ILLEGAL ABORTION, COMPLETE, COMPLICATED BY DAMAGE TO PELVIC ORGANS OR TISSUES
636.3	ILLEGAL ABORTION COMPLICATED BY RENAL FAILURE
636.30	ILLEGAL ABORTION, UNSPECIFIED, COMPLICATED BY RENAL FAILURE
636.31	ILLEGAL ABORTION, INCOMPLETE, COMPLICATED BY RENAL FAILURE
636.32	ILLEGAL ABORTION, COMPLETE, COMPLICATED BY RENAL FAILURE
636.4	ILLEGAL ABORTION COMPLICATED BY METABOLIC DISORDER
636.40	ILLEGAL ABORTION, UNSPECIFIED, COMPLICATED BY METABOLIC DISORDER
636.41	ILLEGAL ABORTION, INCOMPLETE, COMPLICATED BY METABOLIC DISORDER
636.42	ILLEGAL ABORTION, COMPLETE, COMPLICATED BY METABOLIC DISORDER
636.5	ILLEGAL ABORTION COMPLICATED BY SHOCK
636.50	ILLEGAL ABORTION, UNSPECIFIED, COMPLICATED BY SHOCK
636.51	ILLEGAL ABORTION, INCOMPLETE, COMPLICATED BY SHOCK
636.52	ILLEGAL ABORTION, COMPLETE, COMPLICATED BY SHOCK
636.6	ILLEGAL ABORTION COMPLICATED BY EMBOLISM
636.60	ILLEGAL ABORTION, UNSPECIFIED, COMPLICATED BY EMBOLISM
636.61	ILLEGAL ABORTION, INCOMPLETE, COMPLICATED BY EMBOLISM
636.62	ILLEGAL ABORTION, COMPLETE, COMPLICATED BY EMBOLISM

(*Continued*)

Appendix. Continued

636.7	ILLEGAL ABORTION WITH OTHER SPECIFIED COMPLICATIONS
636.70	ILLEGAL ABORTION, UNSPECIFIED, WITH OTHER SPECIFIED COMPLICATIONS
636.71	ILLEGAL ABORTION, INCOMPLETE, WITH OTHER SPECIFIED COMPLICATIONS
636.72	ILLEGAL ABORTION, COMPLETE, WITH OTHER SPECIFIED COMPLICATIONS
636.8	ILLEGAL ABORTION WITH UNSPECIFIED COMPLICATION
636.80	ILLEGAL ABORTION, UNSPECIFIED, WITH UNSPECIFIED COMPLICATION
636.81	ILLEGAL ABORTION, INCOMPLETE, WITH UNSPECIFIED COMPLICATION
636.82	ILLEGAL ABORTION, COMPLETE, WITH UNSPECIFIED COMPLICATION
636.9	ILLEGAL ABORTION WITHOUT MENTION OF COMPLICATION
636.90	ILLEGAL ABORTION, UNSPECIFIED, WITHOUT MENTION OF COMPLICATION
636.91	ILLEGAL ABORTION, INCOMPLETE, WITHOUT MENTION OF COMPLICATION
636.92	ILLEGAL ABORTION, COMPLETE, WITHOUT MENTION OF COMPLICATION
637	UNSPECIFIED ABORTION
637.0	UNSPECIFIED ABORTION COMPLICATED BY GENITAL TRACT AND PELVIC INFECTION
637.00	UNSPECIFIED TYPE OF ABORTION, UNSPECIFIED, COMPLICATED BY GENITAL TRACT AND PELVIC INFECTION
637.01	UNSPECIFIED ABORTION, INCOMPLETE, COMPLICATED BY GENITAL TRACT AND PELVIC INFECTION
637.02	UNSPECIFIED ABORTION, COMPLETE, COMPLICATED BY GENITAL TRACT AND PELVIC INFECTION
637.1	UNSPECIFIED ABORTION COMPLICATED BY DELAYED OR EXCESSIVE HEMORRHAGE
637.10	UNSPECIFIED TYPE OF ABORTION, UNSPECIFIED, COMPLICATED BY DELAYED OR EXCESSIVE HEMORRHAGE
637.11	UNSPECIFIED ABORTION, INCOMPLETE, COMPLICATED BY DELAYED OR EXCESSIVE HEMORRHAGE
637.12	UNSPECIFIED ABORTION, COMPLETE, COMPLICATED BY DELAYED OR EXCESSIVE HEMORRHAGE
637.2	UNSPECIFIED ABORTION COMPLICATED BY DAMAGE TO PELVIC ORGANS OR TISSUES
637.20	UNSPECIFIED TYPE OF ABORTION, UNSPECIFIED, COMPLICATED BY DAMAGE TO PELVIC ORGANS OR TISSUES
637.21	UNSPECIFIED ABORTION, INCOMPLETE, COMPLICATED BY DAMAGE TO PELVIC ORGANS OR TISSUES
637.22	UNSPECIFIED ABORTION, COMPLETE, COMPLICATED BY DAMAGE TO PELVIC ORGANS OR TISSUES
637.3	UNSPECIFIED ABORTION COMPLICATED BY RENAL FAILURE
637.30	UNSPECIFIED TYPE OF ABORTION, UNSPECIFIED, COMPLICATED BY RENAL FAILURE
637.31	UNSPECIFIED ABORTION, INCOMPLETE, COMPLICATED BY RENAL FAILURE
637.32	UNSPECIFIED ABORTION, COMPLETE, COMPLICATED BY RENAL FAILURE
637.4	UNSPECIFIED ABORTION COMPLICATED BY METABOLIC DISORDER
637.40	UNSPECIFIED TYPE OF ABORTION, UNSPECIFIED, COMPLICATED BY METABOLIC DISORDER
637.41	UNSPECIFIED ABORTION, INCOMPLETE, COMPLICATED BY METABOLIC DISORDER
637.42	UNSPECIFIED ABORTION, COMPLETE, COMPLICATED BY METABOLIC DISORDER
637.5	UNSPECIFIED ABORTION COMPLICATED BY SHOCK
637.50	UNSPECIFIED TYPE OF ABORTION, UNSPECIFIED, COMPLICATED BY SHOCK
637.51	UNSPECIFIED ABORTION, INCOMPLETE, COMPLICATED BY SHOCK
637.52	UNSPECIFIED ABORTION, COMPLETE, COMPLICATED BY SHOCK
637.6	UNSPECIFIED ABORTION COMPLICATED BY EMBOLISM
637.60	UNSPECIFIED TYPE OF ABORTION, UNSPECIFIED, COMPLICATED BY EMBOLISM
637.61	UNSPECIFIED ABORTION, INCOMPLETE, COMPLICATED BY EMBOLISM
637.62	UNSPECIFIED ABORTION, COMPLETE, COMPLICATED BY EMBOLISM
637.7	UNSPECIFIED ABORTION WITH OTHER SPECIFIED COMPLICATIONS
637.70	UNSPECIFIED TYPE OF ABORTION, UNSPECIFIED, WITH OTHER SPECIFIED COMPLICATIONS
637.71	UNSPECIFIED ABORTION, INCOMPLETE, WITH OTHER SPECIFIED COMPLICATIONS
637.72	UNSPECIFIED ABORTION, COMPLETE, WITH OTHER SPECIFIED COMPLICATIONS
637.8	UNSPECIFIED ABORTION WITH UNSPECIFIED COMPLICATION
637.80	UNSPECIFIED TYPE OF ABORTION, UNSPECIFIED, WITH UNSPECIFIED COMPLICATION
637.81	UNSPECIFIED ABORTION, INCOMPLETE, WITH UNSPECIFIED COMPLICATION
637.82	UNSPECIFIED ABORTION, COMPLETE, WITH UNSPECIFIED COMPLICATION
637.9	UNSPECIFIED ABORTION WITHOUT MENTION OF COMPLICATION
637.90	UNSPECIFIED TYPE OF ABORTION, UNSPECIFIED, WITHOUT MENTION OF COMPLICATION
637.91	UNSPECIFIED ABORTION, INCOMPLETE, WITHOUT MENTION OF COMPLICATION
637.92	UNSPECIFIED ABORTION, COMPLETE, WITHOUT MENTION OF COMPLICATION
Abt_Comp_flg	
639	COMPLICATIONS FOLLOWING ABORTION OR ECTOPIC AND MOLAR PREGNANCIES
639.0	GENITAL TRACT AND PELVIC INFECTION FOLLOWING ABORTION OR ECTOPIC AND MOLAR PREGNANCIES
639.1	DELAYED OR EXCESSIVE HEMORRHAGE FOLLOWING ABORTION OR ECTOPIC AND MOLAR PREGNANCIES
639.2	DAMAGE TO PELVIC ORGANS AND TISSUES FOLLOWING ABORTION OR ECTOPIC AND MOLAR PREGNANCIES
639.3	KID FLR FOL ABR/ECT/MOL6
639.4	METABOLIC DISORDERS FOLLOWING ABORTION OR ECTOPIC AND MOLAR PREGNANCIES
639.5	SHOCK FOLLOWING ABORTION OR ECTOPIC AND MOLAR PREGNANCIES
639.6	EMBOLISM FOLLOWING ABORTION OR ECTOPIC AND MOLAR PREGNANCIES
639.8	OTHER SPECIFIED COMPLICATIONS FOLLOWING ABORTION OR ECTOPIC AND MOLAR PREGNANCIES
639.9	UNSPECIFIED COMPLICATION FOLLOWING ABORTION OR ECTOPIC AND MOLAR PREGNANCIES
Stillbirth_flg	
651.30	TWIN PREGNANCY WITH FETAL LOSS AND RETENTION OF ONE FETUS, UNSPECIFIED EPISODE OF CARE
651.31	TWIN PREGNANCY WITH FETAL LOSS AND RETENTION OF ONEFETUS, DELIVERED
651.33	TWIN PREGNANCY WITH FETAL LOSS AND RETENTION OF ONEFETUS, ANTEPARTUM CONDITION OR COMPLICATION
651.40	TRIPLET PREGNANCY WITH FETAL LOSS AND RETENTION OF ONE OR MORE FETUS (ES), UNSPECIFIED EPISODE OF CARE
651.41	TRIPLET PREGNANCY WITH FETAL LOSS AND RETENTION OF ONE OR MORE FETUS (ES), DELIVERED
651.43	TRIPLET PREGNANCY WITH FETAL LOSS AND RETENTION OF ONE OR MORE FETUS (ES), ANTEPARTUM CONDITION OR COMPLICATION
651.50	QUADRUPLET PREGNANCY WITH FETAL LOSS AND RETENTION OF ONE OR MORE FETUS(ES), UNSPECIFIED EPISODE OF CARE

(*Continued*)

Appendix. Continued

651.51	QUADRUPLET PREGNANCY WITH FETAL LOSS AND RETENTION OF ONE OR MORE FETUS(ES), DELIVERED
651.53	QUADRUPLET PREGNANCY WITH FETAL LOSS AND RETENTION OF ONE OR MORE FETUS(ES), ANTEPARTUM CONDITION OR COMPLICATION
651.60	OTHER MULTIPLE PREGNANCY WITH FETAL LOSS AND RETENTION OF ONE OR MORE FETUS(ES), UNSPECIFIED EPISODE OF CARE
651.61	OTHER MULTIPLE PREGNANCY WITH FETAL LOSS AND RETENTION OF ONE OR MORE FETUS(ES), DELIVERED
651.63	OTHER MULTIPLE PREGNANCY WITH FETAL LOSS AND RETENTION OF ONE OR MORE FETUS(ES), ANTEPARTUM CONDITION OR COMPLICATION
656.4	INTRAUTERINE DEATH AFFECTING MANAGEMENT OF MOTHER
656.40	INTRAUTERINE DEATH, AFFECTING MANAGEMENT OF MOTHER, UNSPECIFIED AS TO EPISODE OF CARE
656.41	INTRAUTERINE DEATH, AFFECTING MANAGEMENT OF MOTHER, DELIVERED
656.42	*INTRAUTERINE DEATH, AFFECTING MANAGEMENT OF MOTHER, DELIVERED, *WITH MENTION OF POSTPARTUM COMPLICATION
656.43	INTRAUTERINE DEATH, AFFECTING MANAGEMENT OF MOTHER, ANTEPARTUM
656.44	*INTRAUTERINE DEATH, AFFECTING MANAGEMENT OF MOTHER, POSTPARTUM
Delivery_flg	
V27.0	MOTHER WITH SINGLE LIVEBORN
V27.1	MOTHER WITH SINGLE STILLBORN
V27.2	MOTHER WITH TWINS, BOTH LIVEBORN
V27.3	MOTHER WITH TWINS, ONE LIVEBORN AND ONE STILLBORN
V27.4	MOTHER WITH TWINS, BOTH STILLBORN
V27.5	MOTHER WITH OTHER MULTIPLE BIRTH, ALL LIVEBORN
V27.6	MOTHER WITH OTHER MULTIPLE BIRTH, SOME LIVEBORN
V27.7	MOTHER WITH OTHER MULTIPLE BIRTH, ALL STILLBORN
V27.9	MOTHER WITH UNSPECIFIED OUTCOME OF DELIVERY
Preg_Misdiagnosis_flg	
630	HYDATIDIFORM MOLE
631	OTHER ABNORMAL PRODUCT OF CONCEPTION