

Obstetric and Non-Obstetric Indications for Admission in the Antepartum and Postpartum Periods of Pregnancy

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Abstract

Objective: To determine the most common non-obstetric indications for admission during the antepartum and postpartum period of pregnancy.

Methods: This is a population-based investigation of the primary diagnoses for admission in the antepartum and postpartum periods of pregnancy. Data was obtained from the Healthcare Cost and Utilization Project's State Inpatient Database for the state of California for 2005. The frequency of each primary diagnosis was determined. Diagnoses were classified as obstetric or non-obstetric and compared for differences in maternal race, age and insurance provider.

Results: 576,846 total maternal admissions were identified with 35,158 antepartum (6.1%), 536,415 intrapartum (93.0%) and 5273 postpartum (0.9%). Overall, 26.6% of admissions were non-obstetric in nature. The most common non-obstetric indication for antenatal admission was urinary tract infections. The most common postpartum non-obstetric indication for admission was psychiatric/substance abuse disorders.

Conclusions: Many admissions during pregnancy are non-obstetric in nature and may be amenable to outpatient screening.

Keywords: Antepartum; Postpartum; Hospitalizations

Background

While most women are healthy during pregnancy, many women will require hospitalization. According to data published from managed care organizations, a significant portion (8-27%) of pregnant women will be hospitalized at least once during pregnancy for a condition other than delivery [1,2]. The majority of these women will be discharged from the hospital prior to labor. These admissions potentially account for a substantial use of health care resources.

Previous investigations [3-5] have provided estimates of pregnancy-associated hospitalizations, with the most recent data based upon 1999-2000 maternal admissions [2]. This publication concluded that pregnancy-associated hospitalizations appeared to be on the decline [4]. Accurate estimates of maternal medical conditions complicating pregnancy are essential to determine optimal strategies and approaches to patient care [6]. While previous investigations have provided data regarding pregnancy-associated admissions, scant information has been published evaluating the antepartum and postpartum periods of pregnancy separately. The postpartum period of pregnancy has long been recognized as a distinct period of pregnancy with significant hormonal and physiologic changes that pose unique risks. However the majority of maternal admission data and reported associated maternal morbidity during pregnancy has focused on admissions that occur either prior to or for delivery. Investigations which have previously attempted to assess postpartum morbidity have focused on either the immediate complications that occur prior to discharge or morbidity associate with a particular mode of delivery. In order to develop potential strategies to prevent admission, or postpartum readmission, accurate data regarding the indications for admission are essential. Therefore, the purpose of this investigation was to provide current data regarding pregnancy-associated hospitalizations and to evaluate the antepartum and postpartum periods of pregnancy for indications for admission. Additionally, we sought to determine the most common obstetric and non-obstetric indications for admission in the antepartum and postpartum periods of pregnancy and evaluate the relative proportion of hospital charges attributable to each condition.

Materials and Methods

This is a population-based study of the primary diagnoses for admission in the antepartum and postpartum periods of pregnancy. All data was obtained from hospital discharge data from the Healthcare Cost and Utilization Project's (HCUP) State Inpatient Database (SID) for California. The HCUP is a federal/state/industry partnership sponsored by the Agency for Healthcare Research and Quality (AHRQ) to build a multi-state health care data system, with data obtained from state governments and state hospital associations. The SID contains comprehensive inpatient discharge abstracts from participating hospitals and encompasses approximately 90 percent of all community hospital discharges in participating States. For each discharge, it includes International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) codes, length of stay, total hospital charges and patient demographic information. The AHRQ secures the data from each state wide data organization and transforms each data set into a common format [7]. For this investigation, we choose to use the California State Inpatient Database for 2005 given the population size and diverse demographics of the state. From 2005 California hospital discharges, we identified all admission during pregnancy or the postpartum. Maternal admissions were stratified into three groups based on the patient's primary diagnosis and timing of delivery. For this investigation, only the primary admitting diagnosis was used for evaluation as secondary diagnosis codes may not accurately reflect the reason for admission. To estimate the timing

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of pregnancy when the admission occurred, we assigned patients in the following manner: antepartum (admitted during pregnancy but not delivered during the same admission), intrapartum (admitted and delivered during the same admission) and postpartum (admitted after delivery). Only antepartum and postpartum admissions were included in this investigation. Primary discharge diagnoses were placed into 55 mutually exclusive categories. Diagnoses were then grouped by obstetric or non-obstetric related conditions. Table 1 presents the complete list of ICD-9 groupings variables and if diagnosis was considered obstetric or non-obstetric. The designation of a primary discharge diagnosis variable as obstetric or non-obstetric did not change for antepartum or postpartum admissions except for anemia and diabetes mellitus. Antepartum anemia was considered a non-obstetric condition, but was categorized as an obstetric complication postpartum. Diabetes mellitus was labeled as an obstetric condition in the antepartum period, but non-obstetric in the postpartum. Analyses of antepartum and postpartum admissions were performed separately. The frequencies of each category, as well as the most common obstetric and non-obstetric indications for admission were determined. Additionally, the percent of each category by maternal age, race and insurance provider were calculated. Finally, total charges for all admissions were determined and the percent contribution of each diagnosis to all admissions and to obstetric or non-obstetric admissions was determined. Statistical analyses were performed using STATA version 8.2 (College Station, TX). Chi-square and t-test were performed where appropriate. A p-value <0.05 was considered significant. This project had the approval of the Metro Health Medical Center Institutional Review Board.

Results

We identified 576,846 maternal admissions in our data set. The distribution of admissions was as follows: 35,158 antepartum (6.1%), 536,415 intrapartum (93.0%) and 5273 postpartum (0.9%). Table 1 presents the 55 categories of primary diagnoses, the grouping variables used for all primary diagnoses, if a diagnosis was considered obstetric or non-obstetric in nature and the frequency of each diagnosis for the entire sample size. Overall, the most common obstetric indication for admission was preterm labor (22.4%) and the most common non-obstetric indication for admission was urinary tract infections (13.2%). Of 35,158 antepartum admissions, 26.7% (n=9,275) were for non-obstetrical indications. Total antepartum hospital charges were 524.8 million dollars with 36.9% (193.8 million dollars) for non-obstetrical indications. Table 2 presents the maternal characteristics of the antepartum admissions and the percent of admissions which occurred on a weekend sorted by obstetric and non-obstetric hospitalizations. In general, obstetric admissions were older, more often Caucasian, with a lower frequency of weekend admissions compared to non-obstetric hospitalizations. The distribution of all antepartum diagnoses along with the percent of total antepartum charges attributable to each diagnosis are presented in Table 3. Preterm labor was the most common condition requiring hospitalization (25.8%). However, urinary tract infections were the most-common non-obstetrical indication for admission and were the largest contributor to total (both obstetric and non-obstetric) antepartum hospital charges (22.4%). The frequency of the most common primary diagnoses sorted by obstetrical and non-obstetrical indications for admission are presented in Figures 1 and 2 respectively. We have also included the relative percent contribution of each diagnosis to all antepartum obstetric or non-obstetric charges.

For the 5,235 postpartum admissions, we determined that 28.7% (n=1,476) were for non-obstetric-related conditions. Total hospital charges for postpartum hospitalizations were 117.6 million dollars,

with 32.9% (38.7 million dollars) for non-obstetrical indications. The maternal characteristics of the postpartum admissions as well as the percent of admissions which occurred on a weekend by obstetric and non-obstetric indications for hospitalization are presented in Table 4. In general, non-obstetric related admissions were older, more often Caucasian, with a higher frequency of weekend admissions compared to obstetrical hospitalizations. Table 5 presents the frequency of each primary diagnosis variable for all postpartum admissions along with the percent of total postpartum charges attributable to each diagnosis. Infectious complications of delivery (endometritis: 16.0% and wound infection: 12.9%) accounted for the majority of total (both obstetric and non-obstetric) post-partum admissions and hospital charges. The most common non-obstetric indication for admissions was psychiatric/substance abuse disorders (6.9%), however cardiac conditions were the largest non-obstetric contributor to total postpartum charges (6.4%). The percentages of the most common obstetric and non-obstetric indications for hospitalization with associated charges are presented in Figures 3 and 4. While psychiatric/substance abuse disorders

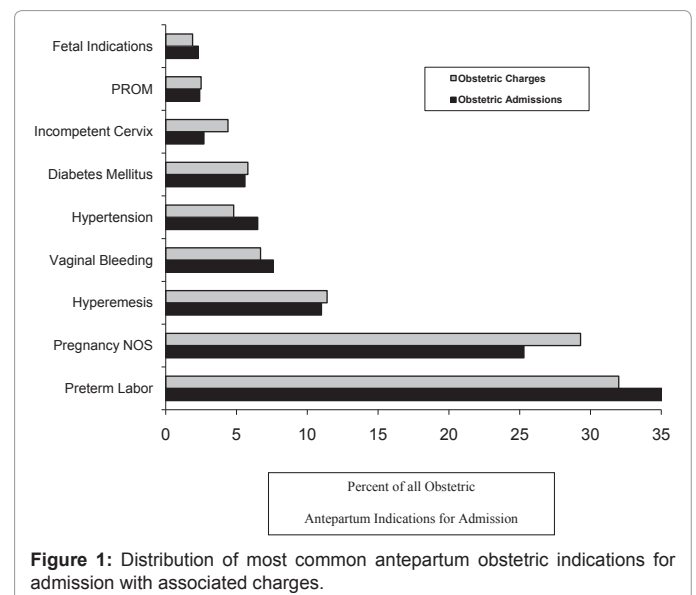


Figure 1: Distribution of most common antepartum obstetric indications for admission with associated charges.

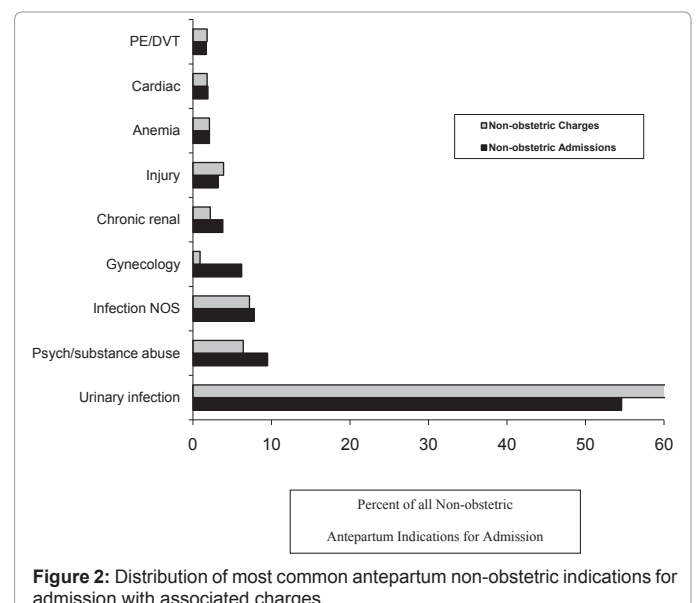


Figure 2: Distribution of most common antepartum non-obstetric indications for admission with associated charges.

Categories of Primary Diagnoses	Variable	Obstetric or Non-obstetric	Total N=40431	% All admissions
Preterm labor	Preterm labor*	Obstetric	9060	22.4
Pregnancy NOS	Pregnancy NOS	Obstetric	7401	18.3
Urinary tract infection	Pyelonephritis (58) Cystitis (n=5276)	Non-obstetric	5334	13.2
Hyperemesis	Hyperemesis*	Obstetric	2847	7.0
Vaginal bleeding	Vaginal bleeding	Obstetric	2541	6.3
Hypertension	Hypertension	Obstetric	2039	5.0
Diabetes mellitus	Diabetes mellitus	Obstetric*+	1483	3.7
Psychiatric/substance abuse	Substance abuse (n=91) Psychiatric (n=1160)	Non-obstetric	1251	3.1
Endometritis	Endometritis+	Obstetric	844	2.1
Infection NOS	Infection NOS	Non-obstetric	835	2.1
Wound infection	Wound infection+	Obstetric	678	1.7
Incompetent cervix	Incompetent cervix*	Obstetric	700	1.7
Gynecology	Fibroids (n=98) Ovarian mass/torsion (n=43) Gynecologic anomaly (n=450) Gynecology NOS (n=53)	Non-obstetric	644	1.6
PROM	PROM*	Obstetric	628	1.6
Fetal indications	Fetal indications*	Obstetric	584	1.4
Cardiac	Congestive heart failure (n=123) Myocardial infarction (n=3) Cardiac NOS (n=263)	Non-obstetric	389	1.0
Chronic renal disease	Chronic renal disease	Non-obstetric	358	0.9
Injury	Injury	Non-obstetric	314	0.8
PE/DVT	Pulmonary embolism (n=92) Deep venous thrombosis (n=186)	Non-obstetric	278	0.7
Anemia	Anemia	Non-obstetric**	286	0.7
Mastitis	Mastitis+	Obstetric	243	0.6
Abdominal pain/back pain	Abdominal pain (n=97) Back pain (n=51)	Non-obstetric	148	0.4
Pulmonary	Asthma (n=29) Pulmonary NOS (n=132)	Non-obstetric	161	0.4
Neurology	Neurology NOS	Non-obstetric	163	0.4
Multifetal pregnancy	Multifetal pregnancy*	Obstetric	162	0.4
Appendicitis	Appendicitis	Non-obstetric	119	0.3
GI	Gastroenteritis (n=43) GI NOS (n=61)	Non-obstetric	104	0.3
Postdates	Postdates*	Obstetric	114	0.3
Gallbladder/pancreas	Gallbladder (n=91) Pancreas (n=45)	Non-obstetric	136	0.3
Other medical conditions	Other medical conditions	Non-obstetric	130	0.3
Urinary non-infectious	Urinary non-infectious	Non-obstetric	78	0.2
Anesthesia complications	Anesthesia complications*	Obstetric	64	0.2
Version/malposition	Version/malposition*	Obstetric	71	0.2
Hematology	Hematology NOS	Non-obstetric	21	0.1
Sepsis	Sepsis NOS	Non-obstetric	24	0.1
CNS infection	CNS infection	Non-obstetric	23	0.1
Endocrine	Thyroid (n=42) Endocrinology NOS (n=18)	Non-obstetric	60	0.1
Breast NOS	Breast NOS	Non-obstetric	29	0.1
Cellulitis	Cellulitis	Non-obstetric	55	0.1
Cancer	Cancer	Non-obstetric	18	0.0
Intrauterine infection	Intrauterine infection*	Obstetric	12	0.0
Varicose veins	Varicose veins	Non-obstetric	2	0.0

*antepartum only

+post-partum only

**Antepartum anemia (n=93) was categorized as non-obstetric complications but was considered obstetric post-partum (n=193)

*+Antepartum diabetes mellitus (n=1456) was considered as obstetric complication but was considered non-obstetric post-partum (n=27)

¹ICD-9 codes for each group available upon request

Table 1: Primary discharge diagnosis grouping variables and sample size for all antepartum and post-partum admissions¹.

	Obstetric (N=25,791)	Non-obstetric (N=9,275)	P value
Maternal age (years)*	26.9 (5.9)	25.6 (6.2)	<0.001
Race			
African-American	10.6	9.4	<0.001
Caucasian	33.2	31.1	
Hispanic	47.8	53.7	
Asian	6.2	3.8	
Other	2.3	1.9	
Payer			<0.001
Private Insurance	40.5	30.7	
Medicaid	53.7	57.6	
Self-pay	3.4	6.3	
Other	2.4	5.4	
Weekend admission	20.0	24.1	<0.001

* Mean (standard deviation)

Table 2: Maternal characteristics of the antepartum hospitalizations and the frequency of weekend admissions by obstetric and non-obstetric indications.

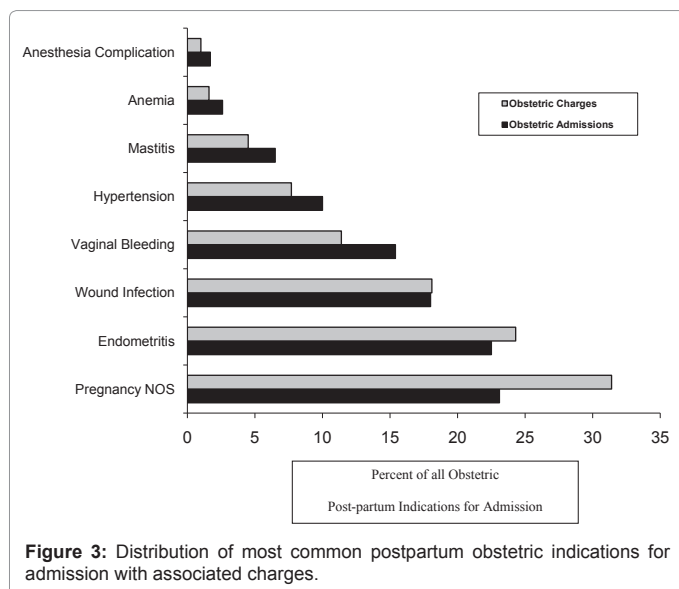


Figure 3: Distribution of most common postpartum obstetric indications for admission with associated charges.

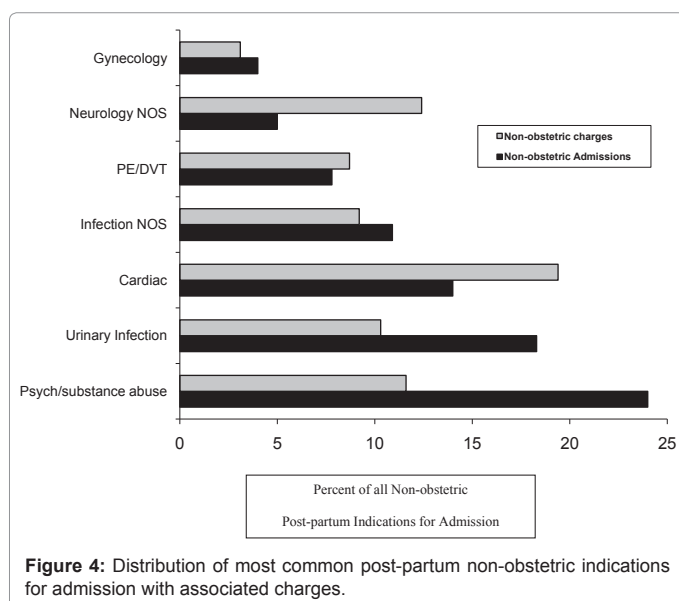


Figure 4: Distribution of most common post-partum non-obstetric indications for admission with associated charges.

and urinary tract infections were the most common non-obstetric conditions requiring postpartum hospitalization, other conditions with significant morbidity and mortality such as cardiac complications, pulmonary embolism/deep venous thrombosis and neurological complications were significant contributors to all non-obstetric postpartum hospitalizations and charges.

Conclusions

In this population-based investigation of the primary diagnoses for admission in the antepartum and postpartum periods of pregnancy, we found a significant proportion (26.6%) to be non-obstetric in nature. As expected, preterm labor was the most common antenatal indication for admission (22.4%) with urinary tract infections being the most common non-obstetric antenatal indication for admission (13.2%). In the analysis of postpartum admissions, psychiatric or substance abuse problems were a significant contributor to all admissions (7.0%) and

	N	Percent of total Antepartum admissions	Total charges in millions of dollars	Percent of total Antepartum charges
Preterm labor	9060	25.78	106.0	20.20
Pregnancy NOS	6531	18.59	97.0	18.48
Urinary tract infection	5057	14.39	117.3	22.36
Hyperemesis	2847	8.10	37.8	7.20
Vaginal bleeding	1963	5.57	22.3	4.25
Hypertension	1664	4.74	15.9	3.03
Diabetes mellitus	1456	4.14	19.1	3.64
Psychiatric/substance abuse	888	2.53	12.4	2.37
Incompetent cervix	699	1.99	14.7	2.80
Infection NOS	670	1.91	14.0	2.67
PROM	628	1.79	8.3	1.59
Gynecology	584	1.66	9.4	1.80
Fetal indications	584	1.66	6.1	1.17
Chronic renal disease	351	1.00	4.2	0.81
Injury	299	0.85	7.6	1.44
Anemia	193	0.55	4.1	0.78
Cardiac	177	0.50	3.4	0.66
Multifetal pregnancy	162	0.46	2.5	0.48
PE/DVT	160	0.46	3.5	0.67
Abdominal pain/back pain	136	0.39	2.0	0.38
Pulmonary	126	0.36	2.4	0.45
Postdates	114	0.32	0.4	0.08
Appendicitis	109	0.31	2.2	0.41
Gallbladder/pancreas	103	0.29	1.7	0.33
Other medical conditions	92	0.26	1.8	0.35
Neurology	87	0.25	1.4	0.26
GI	77	0.23	1.2	0.21
Urinary non-infectious	73	0.21	0.9	0.16
Version/malposition	71	0.20	0.5	0.10
Endocrine	40	0.15	1.2	0.22
Cellulitis	47	0.13	0.7	0.13
Breast NOS	19	0.05	0.3	0.05
Hematology NOS	18	0.05	0.3	0.06
CNS infection	18	0.05	0.7	0.14
Cancer	16	0.05	0.9	0.17
Intrauterine infection	12	0.03	0.2	0.04
Sepsis	12	0.03	0.3	0.06
Varicose veins	1	0.00	0.0	0.00

Table 3: Frequency of the primary antepartum diagnoses, total hospital charges for each primary diagnosis, and relative contribution of each primary diagnosis to total antepartum charges.

	Obstetric (N=3,759)	Non-obstetric (N=1,476)	P value
Maternal age (years)*	28.1 (6.9)	29.6 (7.3)	<0.001
Race			
African-American	9.3	12.9	<0.001
Caucasian	34.6	40.3	
Hispanic	46.7	38.1	
Asian	6.8	6.6	
Other	2.6	2.2	
Payer			<0.001
Private Insurance	47.4	44.8	
Medicaid	48.6	46.2	
Self-pay	2.1	4.0	
Other	1.8	5.0	
Weekend admission	20.0	24.1	<0.001

* Mean (standard deviation)

Table 4: Maternal characteristics of the postpartum hospitalizations and the frequency of weekend admissions by obstetric and non-obstetric indications.

were the most common non-obstetric indication for hospitalization (24.0%). Urinary tract infections were often the indication for admission in both the antepartum (14.4%) and postpartum periods of pregnancy (5.6%). Pregnancy can be associated with significant maternal morbidity and mortality. For many women, this can result in increased outpatient visits or hospitalization. As noted in previous publications, pregnancy-related hospitalizations are a significant contributor to health care costs and overall utilization of the health-care system (1-5). In this investigation, we found that the majority of maternal admissions (73.1%) and charges (63.8%) to be attributable to obstetrical conditions, however a significant proportion of charges were for non-obstetrical conditions in both the antepartum (36.9%) and postpartum periods of pregnancy (36.3%). In the postpartum period, we noted that a disproportionate amount of total hospital charges were for serious non-obstetric conditions including cardiac disorders, neurological complications and pulmonary embolism/deep venous thrombosis. The current investigation provides important information regarding current indications for hospitalization and healthcare utilization of resources during pregnancy. Our findings are consistent with previous publications that note preterm labor and urinary tract infections to be the most common obstetric and non-obstetric indications for antepartum admission [2,3]. Unlike previous reports, we attempted to determine the most common indications for admission according to when they occurred in pregnancy (antepartum or postpartum). Limited data is available about the indications for postpartum admission based upon large population data. As expected, endometritis, wound infection and vaginal bleeding constituted a large portion of obstetric related postpartum admissions. The contribution of psychiatric and substance abuse disorders to antepartum and postpartum admissions was surprising and warrants further investigation as this could be an area of focus to develop strategies to reduce their contribution to total admissions. Several limitations should be noted about our investigation. While we limited our analysis to only the primary discharge diagnosis reported with an admissions, several patients would be expected to have multiple indications for admission. As such, the primary diagnosis may not accurately reflect the indication for admission. However, given the limitations of secondary diagnosis codes, we felt only primary diagnoses should be used. Also, the stratification of admissions into antepartum and intrapartum are not ideal, particularly for those labeled as intrapartum admissions. Antepartum and intrapartum admissions were determined by the inclusion or absence of a delivery as part of the same

admission. We expect that many women with significant antepartum complications would be admitted for an indication and not discharged prior to the onset of labor. In this investigation, those women would be categorized as intrapartum and not be included in the analysis. Also, a large percentage of women were categorized as pregnancy not otherwise specified (NOS) and could significantly impact the relative contribution of several of the individual categories. However, we feel that the sample size of the investigation still allows for a reasonable estimate of indications for admissions. Finally, hospitalizations do not encompass the entire spectrum of maternal morbidity. As such, this study is biased to report only conditions which were severe enough to warrant inpatient management.

This study highlights the significant number of women who become sick during or after pregnancy, particularly with non-obstetric complications. Other authors have also highlighted the emerging burden of medical complications during pregnancy, particularly cardiovascular complications, on maternal morbidity and mortality [8]. However, we also observed that many of these conditions, such as urinary tract infections might be preventable or treatable on an outpatient basis and should be the focus of future research. Of concern is the relatively large number of women who are admitted with psychiatric or substance abuse problems in the postpartum period.

	N	Percent of total postpartum admissions	Total charges (millions of dollars)	Percent of total postpartum charges
Pregnancy NOS	870	16.50	24.8	21.08
Endometritis	844	16.00	19.2	16.32
Wound infection	678	12.86	14.3	12.16
Vaginal bleeding	578	10.96	9.0	7.66
Hypertension	375	7.11	6.1	5.14
Psychiatric/substance abuse	363	6.88	4.5	3.83
Urinary tract infection	277	5.25	4.0	3.39
Mastitis	243	4.61	3.5	3.00
Cardiac	212	4.02	7.5	6.40
Infection NOS	165	3.13	3.5	3.01
PE/DVT	118	2.24	3.4	2.85
Anemia	96	1.82	1.3	1.10
Neurology	76	1.44	4.8	4.06
Anesthesia complications	64	1.21	0.8	0.69
Gynaecology	60	1.14	1.2	1.03
Other medical conditions	38	0.72	1.2	1.01
Pulmonary	35	0.66	1.7	1.45
Gallbladder/pancreas	33	0.63	0.9	0.80
GI	27	0.51	0.7	0.62
Diabetes mellitus	27	0.51	0.5	0.46
Injury	15	0.28	0.9	0.73
Abdominal pain/back pain	12	0.23	0.6	0.53
Sepsis	12	0.23	1.0	0.84
Appendicitis	10	0.19	0.5	0.40
Breast NOS	10	0.19	0.1	0.17
Cellulitis	8	0.15	0.8	0.67
Chronic renal disease	7	0.13	0.1	0.08
Endocrine NOS	6	0.11	0.3	0.23
Urinary non-infectious	5	0.09	0.1	0.10
CNS infection	5	0.09	0.1	0.08
Cancer	2	0.04	0.1	0.09
Varicose veins	1	0.02	0.0	0.01

Table 5: Frequency of the primary postpartum diagnoses, total hospital charges for each primary diagnosis, and relative contribution of each primary diagnosis to total postpartum charges.

Additional investigations should focus on improved identification of at risk-women and early intervention.

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