



Improving Healthcare
for the Common Good



Commonwealth of Kentucky

Department for Medicaid Services

Division of Program Quality and Outcomes

Kentucky Postpartum Readmissions

Focused Study

FINAL REPORT

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EXECUTIVE SUMMARY

Background

The need to reduce maternal morbidity is a national priority (Bateman *et al.*, 2013; CMS, 2013; D’Alton *et al.*, 2013; Goff *et al.*, 2013; USDHHS, 2013). Postpartum utilization of inpatient services has been considered to be a marker of maternal morbidity. A 2009 study conducted on behalf of KDMS by IPRO analyzed postpartum readmissions within 14 days of discharge from the delivery hospitalization as part of a broader analysis of perinatal utilization patterns; however, only one Medicaid Managed Care Organization (MCO) was in operation in the state at the time of the study, while there are currently multiple MCOs operating in Kentucky. The current study aimed to focus on postpartum readmissions, to expand on the scope of the original study by analyzing 30-day readmission rates, and to identify risk factors for postpartum readmissions among this expanded population of Kentucky Medicaid Managed Care enrollees.

Some risk factors for readmission might be amenable to intervention and, therefore, be considered “actionable.” For example, women who deliver by cesarean section are at higher risk for complications, such as infections, and readmission (Galyean *et al.*, 2009; Ophir *et al.*, 2008). Comorbid conditions, such as hypertension and obesity, pose additional risks. In fact, as the prevalence of hypertension (Cutler *et al.*, 2008) and obesity (ACOG, 2005a) are increasing, there may be greater numbers of women at risk for readmission (Hamilton *et al.*, 2002).

In an effort to further expand upon the 2009 study, the current study included a chart review component in order to assess some elements of inpatient risk assessment and services, hospital discharge practices and MCO care management interventions among the vulnerable subpopulation of women with a postpartum readmission. The targeting of optimal discharge practices, such as those recommended by ACOG (Lockwood and Lemons, 2007), and care management for high-risk groups might also reduce postpartum readmissions.

Study Objectives

1. Describe characteristics of women with a postpartum readmission and summarize hospital care and discharge practices overall and by high-risk subgroups, e.g., cesarean delivery, hypertension and obesity;
2. Assess measures pertinent to clinical guidelines recommendations, e.g., weight management, preeclampsia education, and outpatient follow-up, including early follow-up for high-risk subpopulations, e.g., women with hypertension;
3. Assess MCO care management received by women requiring postpartum hospitalization;

4. Identify the number and timing of postpartum visits attended by women requiring postpartum hospitalization;
5. Identify the timing of postpartum readmission stay, the principal and secondary diagnoses, and principal and secondary procedures;
6. Compare women with and without postpartum readmissions with regard to postpartum outpatient visits, geographic region, health plan, delivery mode, age group, race/ethnicity and other possible risk factors.

Methods

This study entailed two parts:

Part I was a retrospective cohort study using administrative data to evaluate risk factors for postpartum readmission. Each of the four MCOs operating during the study timeframe, i.e., CoventryCares of Kentucky, Passport, Kentucky Spirit, and WellCare of Kentucky Health Plans, submitted electronic data files for the eligible population. The eligible population was comprised of Medicaid members enrolled in the MCO on the date of delivery through at least 56 days after delivery, with no gaps in enrollment, and who delivered a live baby on or between November 6, 2011 and September 5, 2012. Electronic data files were comprised of claims data containing ICD-9 diagnosis and procedure codes, demographic and service utilization data. MCOs also identified whether or not a member was readmitted within 30 days of delivery hospitalization. Statistical analysis was conducted using the *chi*-square test to evaluate differences in the distribution of members with and without postpartum readmissions among key clinical, demographic and service utilization factors. Multivariable binomial logistic regression, with separate models for key delivery (index) stay diagnoses (i.e., hypertension, drug abuse, asthma, hemorrhage, major infection/sepsis), and multivariable multinomial logistic regression for the outcomes of readmission within 4 days, between 5–11 days, and between 12–30 days post-delivery discharge, were conducted to evaluate risk factors for postpartum readmission.

Part II was a retrospective medical record review study. The eligible population derived from the electronic database submitted by the MCOs for Part I of the study was the source of the medical record review sample. From each MCO, a random sample of 100 members, plus an oversample of 10 (for MCOs with sufficient sample size), was selected using the criterion of members with a readmission within 30 days of the delivery discharge. A total of 262 medical records were requested and, of those, 247 (94%) were submitted electronically to IPRO's secure File Transfer Protocol (FTP) site from Passport Health Plan, CoventryCares of Kentucky, and WellCare of Kentucky. Of the 246 submitted records, 209 (82%) were confirmed eligible for the study based upon confirmation of a delivery stay with the outcome of a live birth and a

postpartum readmission within 30 days of the delivery stay discharge date. Study data elements were abstracted using a Microsoft Access database developed by IPRO and a data element instructional tool developed by IPRO and reviewed by KDMS.

Key Findings

Part I: Retrospective cohort study/administrative data: women with and without readmission

Overall Findings: The postpartum readmission rate for the total sample was 1.5% (310 of 20,374 members who delivered a live baby). Readmission for hypertension was the highest volume cause-specific readmission (n = 49), with most women being readmitted within 4 days following delivery discharge (n = 29), followed by readmission for cesarean or obstetric wound problem (n = 48), and readmission for infection (n = 41). The readmission rate for women with a delivery stay diagnosis of overweight or obesity (3.1%; 37/1,178) was significantly higher than those without (1.4%). There was also a significant difference in readmission rates by delivery type, with women who underwent cesarean section having the highest rate (2.4%; 172/7,150), whereas the rate for normal delivery was 1%. Readmission rates were also significantly greater for delivery stay diagnosis of hypertension (3.0%; 74/2,480), drug abuse (3.1%; 23/734), asthma (2.7%; 18/662), hemorrhage (2.7%; 14/522), and major infection/sepsis (8.3%; 5/60), relative to women without these diagnoses. The distribution of members with a postpartum readmission across MCOS was significantly different.

Multivariable Logistic Regression Findings: Any index stay diagnosis of hypertension was significantly associated with 80% greater odds for readmission (OR = 1.8; 95% CI = 1.4, 2.5), independent of age, race/ethnicity, urban/rural residence, MCO, postpartum visits, delivery type, overweight/obesity, and combined length of stay/transfer status. Any index stay diagnosis of drug abuse was significantly associated with more than twice the odds for readmission (OR = 2.3; 95% CI = 1.5, 3.5), asthma with 80% greater odds for readmission (OR = 1.8; 95% CI = 1.1, 3.0), and major infection/sepsis with the highest risk, albeit a wide confidence interval (OR = 3.9; 95% CI = 1.5, 10.2). Relative to women with a normal vaginal delivery, women with a cesarean delivery had a significantly greater risk for readmission, with more than twice the odds for readmission across all delivery stay diagnosis models (e.g., hypertension model: OR = 2.1; 95% CI = 1.2, 3.9). Overweight/obesity status was significantly associated with between 70% and 90% greater odds for readmission across all delivery stay diagnosis models (e.g., hypertension model: OR = 1.7; 95% CI = 1.2, 2.4). Comparing the risk for readmission within 5–11 days post-delivery discharge to no readmission, members with zero outpatient follow-up visits had 61% greater odds for readmission than members with one outpatient follow-up visit (OR = 1.6; 95% CI = 1.004, 2.581).

Interpretation: Common reasons for postpartum readmission include hypertension, wound problems and infection. Risk factors for postpartum readmission include a delivery stay

diagnosis of hypertension, drug abuse, asthma, sepsis, and overweight/obesity, as well as cesarean delivery and absence of postpartum follow-up. Findings provide evidence to suggest the opportunity to target case management interventions, e.g., facilitation of outpatient follow-up visits, to high-risk members for the prevention of postpartum readmission.

Part II: Medical Record Review: Random sample of members with a postpartum readmission

Prominent Readmission Diagnoses: Any readmission diagnosis (differentiated from principal readmission diagnosis) of hypertension was the most prominent specific readmission diagnosis (n = 49; 23%), with a readmission diagnosis of preeclampsia (n = 26) comprising the majority of hypertension readmission diagnoses, followed by gestational hypertension (n = 17), pre-existing hypertension (n = 12), and eclampsia (n = 6). The second most prominent readmission diagnosis was major infection (n = 26; 12%), which includes major puerperal infection, sepsis, fever, and other post-operative infection. Other prominent readmission diagnoses included gallbladder problems (n = 23; 11%), cesarean section wound problems (n = 22; 11%), anemia (n = 20; 10%), and urinary tract infection (UTI; n = 18; 9%).

Delivery type: The majority of women readmitted postpartum had undergone cesarean delivery (54%; n = 102 of 208). Of cesarean deliveries, primary cesarean deliveries (no prior cesarean delivery) were the most prevalent (n = 66), followed by cesarean delivery without trial of labor after prior cesarean delivery (n = 30). Women who underwent primary cesarean delivery comprised 68% (15 of 22) of those readmitted for cesarean section wound problems, and women with cesarean delivery without trial of labor after prior cesarean delivery comprised 18% (n = 4 of 22) of those readmitted for cesarean section wound problems. Women with a primary cesarean delivery accounted for 42% of readmissions for major infection, 39% of readmissions for hypertension, and 53% of readmissions for anemia.

Delivery Stay Comorbidities and Complications: Obesity was the most prevalent comorbid condition presenting at the delivery admission (n = 52; 25%), and comprised the greatest proportion of women readmitted for cesarean wound problems (45%), followed by women readmitted for hypertension (43%) and major infection (38%). The greatest proportion of women with a postpartum readmission and sufficient data to calculate both body mass index and weight gain during pregnancy was comprised of those who were obese and with a weight gain that exceeded the Institute of Medicine (IOM) recommendation (n = 38 of 141; 27%), followed by those who were overweight and also exceeded the IOM recommendation (n = 20; 14%). Documented blood pressure greater than or equal to 140/90 (elevated blood pressure), gestational hypertension, and preeclampsia were among the top 5 high-prevalence obstetrical complications during the delivery stay.

Care Management and Care Transitions: The majority of women with postpartum readmissions did not have any record of care management services submitted by the MCOs. Among all women in the chart review study either identified by the hospital as obese or identified by this study as obese based upon body mass index calculations, 85% were not engaged in care management. Among those with either a past history of hypertension or a delivery stay complication of hypertension, 89% were not engaged in care management. Moreover, health plan care management identified comorbid obesity in only 3 of the 52 hospital-identified members with this condition and identified gestational hypertension in only 5 of the 24 hospital-identified cases of gestational hypertension. The vast majority of all women in the chart review study had no health risk assessment conducted by managed care services at any time during the perinatal period. Next to tobacco use, drug use and depression were the discharge risk factors most frequently identified by hospitals. Although most of these transitional care needs were addressed by the hospitals, there were no referrals with documented MCO care management facilitation of either substance abuse treatment or tobacco cessation, and only 1 behavioral follow-up visit was facilitated by MCO care management.

Discharge education: The majority of women with a postpartum readmission did not receive education about preeclampsia (61%). Moreover, among women with blood pressure $\geq 140/90$ during the delivery stay who were readmitted with any diagnosis of hypertension, 44% did not receive preeclampsia education.

Outpatient Follow-up: The majority (81%) of women with a postpartum readmission had no follow-up visit. Providers advised scheduling, but did not schedule, an outpatient follow-up visit for 66% of women and, among these women, 79% had no outpatient follow-up visit. Among those for whom a follow-up visit was scheduled, 90% had no follow-up visit. Among women with both a delivery diagnosis and a readmission diagnosis of hypertension ($n = 22$), only 2 had a follow-up postpartum visit, and these women had been advised to schedule their appointment for after the first 6 days. Most were neither advised to schedule nor were scheduled for an appointment during the first six days.

Conclusion

Study findings revealed that women with obesity, hypertension, cesarean delivery, major puerperal infection or sepsis, and drug abuse were at increased risk for postpartum readmission; therefore, these women represent susceptible subpopulations. Lack of postpartum follow-up was also a risk factor for readmission and, together with findings that the vast majority of women with a postpartum readmission were not receiving care management services; findings suggest the potential to improve postpartum outcomes by better facilitating care transitions for vulnerable members. Such efforts would be further enhanced by initiation

of care management services during the preconception period (ACOG, 2005b; D'Alton *et al.*, 2013; US DHHS, 2013), as well as interconception period for ongoing improvements in continuity of care (Barfield and Warner, 2012; D'Angelo *et al.*, 2007). In addition, opportunities for MCO/hospital collaboration for targeted clinical care enhancements merit consideration.

Recommendations for MCOs

- Identify women of childbearing age with obesity, hypertension, or drug abuse, and assess them for engagement in care management during preconception, interconception and prenatal periods for facilitation of improvements in management of comorbidities, care coordination and transitions;
- Identify women with cesarean delivery, and assess them for engagement in care management during the delivery stay for facilitation of improvements in care coordination, patient education, and transitions;
 - Collaborate with hospitals for infection surveillance, and coordinate care for the prevention and treatment of infections;
- Disseminate IOM recommendations and toolkits for weight gain during pregnancy to prenatal providers and members;
- Collaborate with hospitals to educate providers about ACOG recommendations for obesity in pregnancy, including special considerations for obese women who undergo cesarean section, e.g., anesthesiology consultation early in labor, higher prophylactic antibiotic dosages, and suture closure of the subcutaneous layer after cesarean delivery;
- Collaborate with hospitals to educate providers about early detection of elevations in blood pressure ($\geq 140/90$) in order to identify these high-risk mothers and ensure appropriate postpartum monitoring and follow-up.

Recommendations for KDMS

- Future improvement initiatives could focus on collaborating with hospitals and other stakeholders to evaluate:
 - cesarean delivery indications for nulliparous, low-risk women;
 - MCO processes for identification and enrollment of pregnant women in care management services; and
 - postpartum visit timing and content.

INTRODUCTION

In support of the Kentucky Department for Medicaid Services' (KDMS) efforts to improve the quality of care for Medicaid Managed Care enrollees, Island Peer Review Organization (IPRO), the External Quality Review Organization (EQRO) for the Commonwealth of Kentucky, conducted a focused study to evaluate member characteristics and hospital and outpatient patterns of practice associated with postpartum hospital readmission.

The need to reduce maternal morbidity is a national priority (Bateman *et al.*, 2013; CMS, 2013; D'Alton *et al.*, 2013; Goff *et al.*, 2013; USDHHS, 2013). Postpartum utilization of inpatient hospital services is considered a marker of maternal morbidity, with the need to improve postpartum care transitions recently highlighted (D'Alton *et al.*, 2013). Hospital readmission has been shown to occur in 1–2% of women after discharge from delivery hospitalization, and is more likely for SSI recipients, as well as women who undergo cesarean delivery (Liu *et al.* 2005; Lydon-Rochelle *et al.* 2000). A 2009 study conducted by IPRO, on behalf of KDMS, "Perinatal Utilization Patterns Assessed Using MCO Encounter Data," identified that 2.3% of members who delivered a live baby from July 2007 through June 2008 were readmitted to the hospital in the fourteen days following discharge from the delivery hospitalization. The use of administrative data to conduct this study limited our ability to evaluate practice patterns associated with readmission, including hospital discharge practices, as well as consistency with clinical guideline recommendations. In addition, only one Medicaid Managed Care Organization (MCO) was in operation in the state at the time of the study, while there are currently five MCOs operating in Kentucky. The 2009 IPRO/KDMS study identified delivery characteristics and diagnoses associated with readmission that were consistent with those reported in the literature. Readmissions were found to be associated with cesarean deliveries, as well as the following conditions determined during the maternity delivery admission: fever-infection, hypertension, diabetes, and premature rupture of membranes (PROM). Major infection, wound problems, anemia, hypertension, and genitourinary (GU) infections were prominent readmission diagnoses. Early identification of women at risk for readmission and optimization of discharge practices, surveillance, support and follow-up can be of benefit to postpartum health and, therefore, potentially reduce postpartum readmissions.

Some risk factors for readmission might be amenable to intervention and, therefore, be considered "actionable." For example, women who deliver by cesarean section are at higher risk for complications and readmission, including infection (Galylean *et al.*, 2009; Ophir *et al.*, 2008). Ensuring adherence to American College of Obstetrics and Gynecology (ACOG) guidelines for preoperative antimicrobial prophylaxis for cesarean deliveries (ACOG, 2010a) can reduce

infectious complications and is an intervention that might also reduce readmissions. Further, cesarean delivery is not indicated for low-risk women (US DHHS, 2013; ACOG, 2013a), for example, primiparous women without medical indications. Therefore, initiatives to decrease the number of elective cesarean deliveries could also contribute to a reduction in associated complications, and thus, may also reduce readmissions. Moreover, a workshop recently convened by the Joint Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) concluded that a cesarean delivery performed in the absence of an accepted indication should be more accurately documented as a 'nonindicated cesarean delivery,' rather than 'elective,' and emphasized the importance of preventing nonindicated first, or primary, cesarean delivery as a means to reduce complications in current and subsequent pregnancies (Spong *et al.*, 2012).

Additional risk factors for postpartum readmission identified in the scientific literature include history of prior cesarean delivery, as well as current operative vaginal delivery, and postpartum hemorrhage (Galyean *et al.*, 2009; Liu *et al.*, 2005; Yeomans, 2010; ACOG, 2006a). Comorbid conditions such as hypertension (Cutler *et al.*, 2008) and obesity (ACOG, 2005a) pose additional risks and, as a consequence of the increasing prevalence of these conditions, there may be greater numbers of women at risk for readmission (Hamilton *et al.*, 2002). The targeting of optimal discharge practices, such as those recommended by ACOG (Lockwood and Lemons, 2007), and case management for high-risk groups might also reduce postpartum readmissions by improving care transition and post discharge surveillance.

STUDY OBJECTIVES

1. Describe characteristics of women with a postpartum readmission, and summarize hospital care and discharge practices overall and by high-risk subgroups, e.g., cesarean delivery, operative vaginal delivery, preterm delivery and comorbidities, e.g., hypertension and obesity;
2. Assess measures pertinent to clinical guideline recommendations, e.g., weight management, preeclampsia education, and outpatient follow-up, including early follow-up for high-risk subpopulations, i.e., women with hypertension;
3. Assess MCO care management received by women requiring postpartum rehospitalization;
4. Identify the number and timing of postpartum visits attended by women requiring postpartum rehospitalization;
5. Identify the timing of postpartum readmission stay, the principal and secondary diagnoses, and principal and secondary procedures;

6. Compare women with and without postpartum readmissions with regard to postpartum outpatient visits, geographic region, health plan, delivery mode, age group, race/ethnicity and other possible risk factors.

METHODS

Part I: Postpartum Readmissions Retrospective Cohort Study/Administrative Data

Study Sample: IPRO requested an eligible population electronic database with claims data containing ICD-9 diagnosis and procedure codes, demographic and service utilization data from each of the Kentucky Medicaid Managed Care Organizations (MCOs), including Kentucky Spirit, Passport Health Plan, WellCare of Kentucky, and CoventryCares of Kentucky, according to the following specifications:

Product Line: Medicaid

Continuous Enrollment Period: Enrolled in the MCO on the date of delivery through at least 56 days after delivery, with no gaps in enrollment

Anchor Date: Date of Delivery

Event: Delivered a live birth on or between November 6, 2011 and September 5, 2012

Geographic Region: All Kentucky enrollees who meet the above criteria should be included. Exclude Non-Kentucky enrollees.

Statistical Analysis: Statistical analysis was conducted using SAS (Cary, N.C.) version 9.3. The primary outcome variable evaluated was all-cause postpartum inpatient readmissions within 30 days of delivery (index) stay discharge. In addition, frequency distributions were assessed for cause-specific readmissions (defined by principal diagnosis in Appendix A) by timing of readmission, i.e., within 4 days of delivery discharge, between 5–11 days, and between 12 and 30 days post-delivery discharge, as well as by delivery index stay diagnosis (any of the first 9 ICD-9 diagnosis codes assigned during the index stay as defined in Appendix B). Potential risk factors evaluated for associations with all-cause postpartum readmissions included delivery stay diagnoses, member characteristics, i.e., age group, race/ethnicity, delivery type (defined using any of the first five procedure codes assigned during the index stay; see Appendix B), overweight/obesity (defined using any of the first 9 ICD-9 diagnosis codes assigned during the index stay as defined in Appendix B), urban/rural residence; and service/utilization factors, i.e., MCO, postpartum outpatient follow-up visits, and an acuity proxy defined by length of stay and transfer status. Prevalence rates were calculated by dividing the number of members with the potential risk factor by the total number of women in the study sample.

The *chi*-square test statistic was used to evaluate differences in the distribution of members with postpartum readmissions within 30 days of delivery discharge by potential risk factors.

Thus, notations regarding statistical significance in the descriptive statistics tables refer to readmission rates.

Logistic regression is a statistical method used to model the relationships between the outcome variable, i.e., postpartum readmission, and possible risk factors, such as clinical characteristics, demographic factors and health care utilization. Logistic regression models generate odds ratios to evaluate associations between the outcome variable and possible risk factors. This study generated five separate logistic regression models, each one unique in its inclusion of one of the following delivery stay diagnostic categories: hypertension, drug abuse, asthma, major infection/sepsis, and hemorrhage.

In the following explanation, the term “multivariable” refers to the measurement of the influence of multiple potential risk factors, the term “binomial” refers to an outcome measure with one reference group (not readmitted) and one comparison group (readmitted), and the term “multinomial” refers to an outcome category with one reference group (not readmitted) and three comparison groups. Multivariable binomial logistic regression is a type of statistical analysis in which the dependent variable, i.e., the postpartum readmission outcome variable, compares one category {readmission} to the reference group {no readmission} and statistically adjusts for multiple potential risk factors {delivery stay diagnoses, age, race/ethnicity, member residence, MCO, postpartum visits, delivery type and an acuity proxy}. Multivariable binomial logistic regression results are presented for statistically significant delivery stay diagnostic categories, i.e., hypertension, drug abuse, asthma, major infection/sepsis, and hemorrhage. Each model includes the “Common Model Factors,” i.e., age, race/ethnicity, member residence, MCO, postpartum visits, delivery type and an acuity proxy based upon delivery (index) length of stay and transfer status. A baseline model that included only the common model factors was also evaluated, and results were similar to the models presented.

Findings are also presented for a supplemental analysis using (multivariable) multinomial logistic regression; a type of statistical analysis in which the dependent variable, i.e., the postpartum readmission outcome variable, compares more than one category to the reference group {no readmission} in order to evaluate the relationship between outpatient visits and readmission status by differing time intervals from delivery discharge to readmission. The multinomial logistic regression analysis used the following multiple outcome categories relative to no readmission: readmitted within 4 days post-delivery discharge, readmitted between 5–11 days post-delivery discharge, readmitted between 12 and 30 days post-delivery discharge. This supplemental analysis evaluated the relationship between outpatient visits and readmission by differing time intervals from delivery discharge to readmission, independent of delivery type and overweight/obesity. Supplemental analysis findings are presented for statistically significant findings with sufficient sample size to generate stable confidence intervals. For both

binomial and multinomial multivariable logistic regression, odds ratios and 95% confidence intervals are presented as measures of estimated effects. Alpha significance levels were set a priori at 5 percent. Logistic regression model validity was assessed using the convergence criterion, model fit was assessed using the Hosmer-Lemeshow test, and multicollinearity was assessed using the tolerance statistic; these diagnostics were utilized to specify the logistic regression models.

Part II: Medical Record Review of a Random Sample of Women with Postpartum

Readmissions

Study Sample: The eligible population derived from the electronic database submitted by the MCOs for Part I of the study was the source of the medical record review sample. From each MCO, a random sample of 100 members, plus an oversample of 10 (for MCOs with sufficient sample size), was selected using the criterion of members with a readmission within 30 days of the delivery discharge. A total of 262 medical records were requested and, of those, 247 (94%) were submitted electronically to IPRO's secure File Transfer Protocol (FTP) site from Passport Health Plan, CoventryCares of Kentucky, and WellCare of Kentucky. Of the 246 submitted records, 209 (82%) were confirmed eligible for the study based upon confirmation of a delivery stay with the outcome of a live birth and a postpartum readmission within 30 days of the delivery stay discharge date. Study data elements were abstracted using a Microsoft Access database developed by IPRO and a data element instructional tool developed by IPRO and reviewed by KDMS.

RESULTS

Part I: Postpartum Readmissions Retrospective Cohort Study/Administrative Data – Findings

Descriptive Statistical Findings

Overview

The postpartum readmission rate for the total sample of women who delivered a live baby during the period from November 6, 2011 through September 5, 2012 was 1.5%, or 310 of 20,374 members (Table 1).

Demographics

Women aged 19–34 comprised the majority (86.4%) of the study sample, i.e., women who delivered a live baby during the study period. A greater proportion of women aged 35+ years were readmitted (1.9%; n = 23 with a postpartum readmission of 1,215 with a delivery stay admission) relative to adolescents (1.0%; n = 16 of 1,548) and women between the ages of 19–34 years (1.5%; n = 271 of 17,611); however, this difference was not statistically significant (Table 1). Similarly, although black women were disproportionately represented among readmissions (1.8%; n = 50 of 2,732) compared to white women (1.5%; n = 253 of 17,080), this difference was not statistically significant. Black women comprised 13.4% of the study sample and white women comprised 83.8%. Further, urban member residence compared to rural member residence was not significantly associated with readmissions; however, the postpartum readmission rate was statistically different across regions, with regions 7, 3, 1, and 8 showing the highest rates at 2.00%, 1.86%, 1.84% and 1.69%, respectively (Figure 1). Members residing in urban areas comprised a slightly greater percentage (51.1%) of the study sample than those residing in rural areas (48.8%).

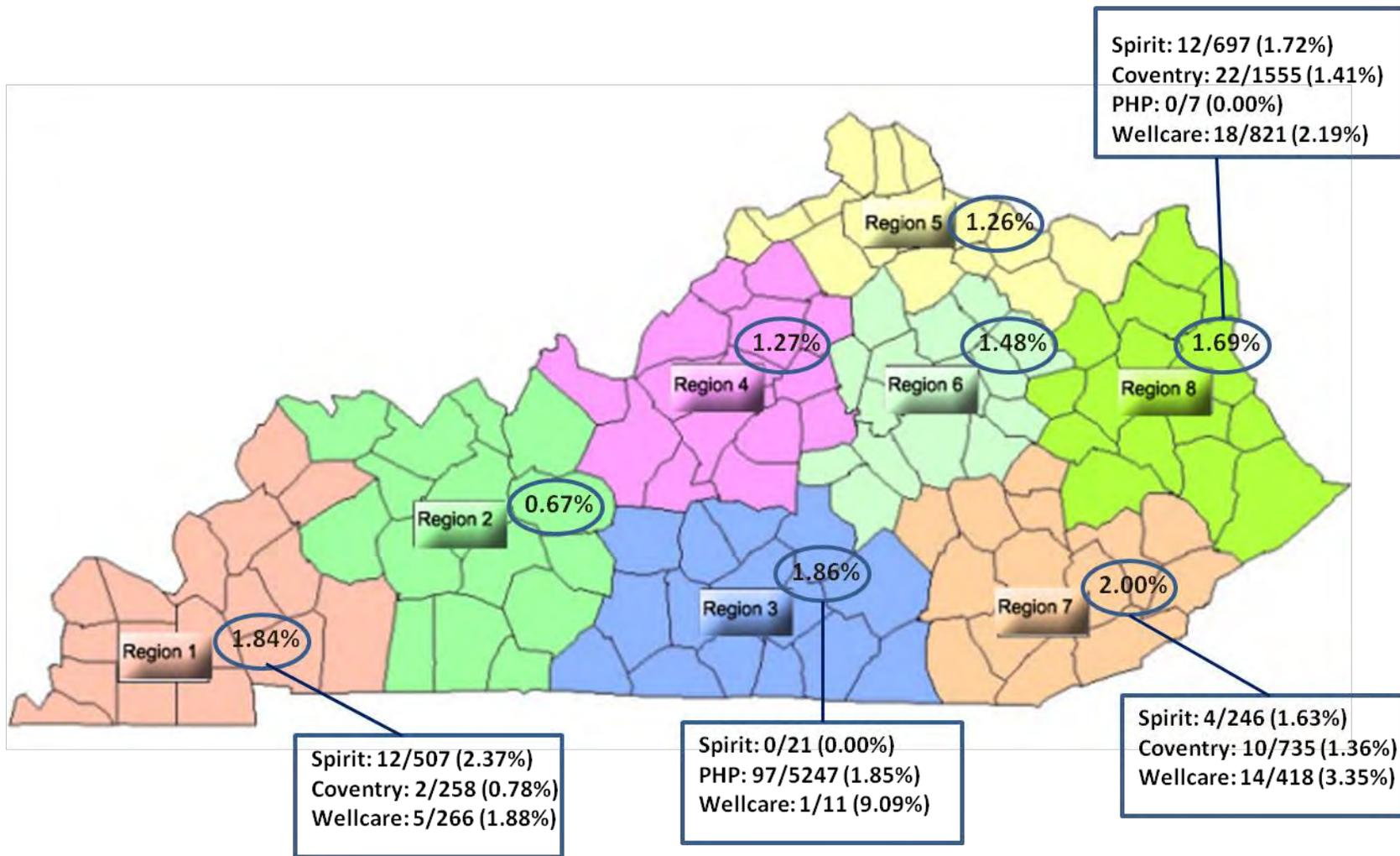


Figure 1. Postpartum Readmission Rate by Region. Postpartum readmission rates by region are indicated for each plan. The total readmission rate is 310 in 20,374, which is 1.5%. The postpartum readmission rate is statistically different across regions ($p \leq 0.05$)

Cause-Specific Readmission Diagnoses

Readmission for hypertension was the highest volume cause-specific readmission (n = 49), with most women being readmitted within 4 days following delivery discharge (n = 29), followed by readmission for cesarean/obstetric wound problem (n = 48), and readmission for infection (n = 41; Figure 2). Readmission for cesarean/obstetric wound problems and readmission for infections were comprised of 21 and 16 readmissions within 4 days, respectively; however, more readmissions for these causes occurred between postpartum days 5 and 30 (Figure 2).

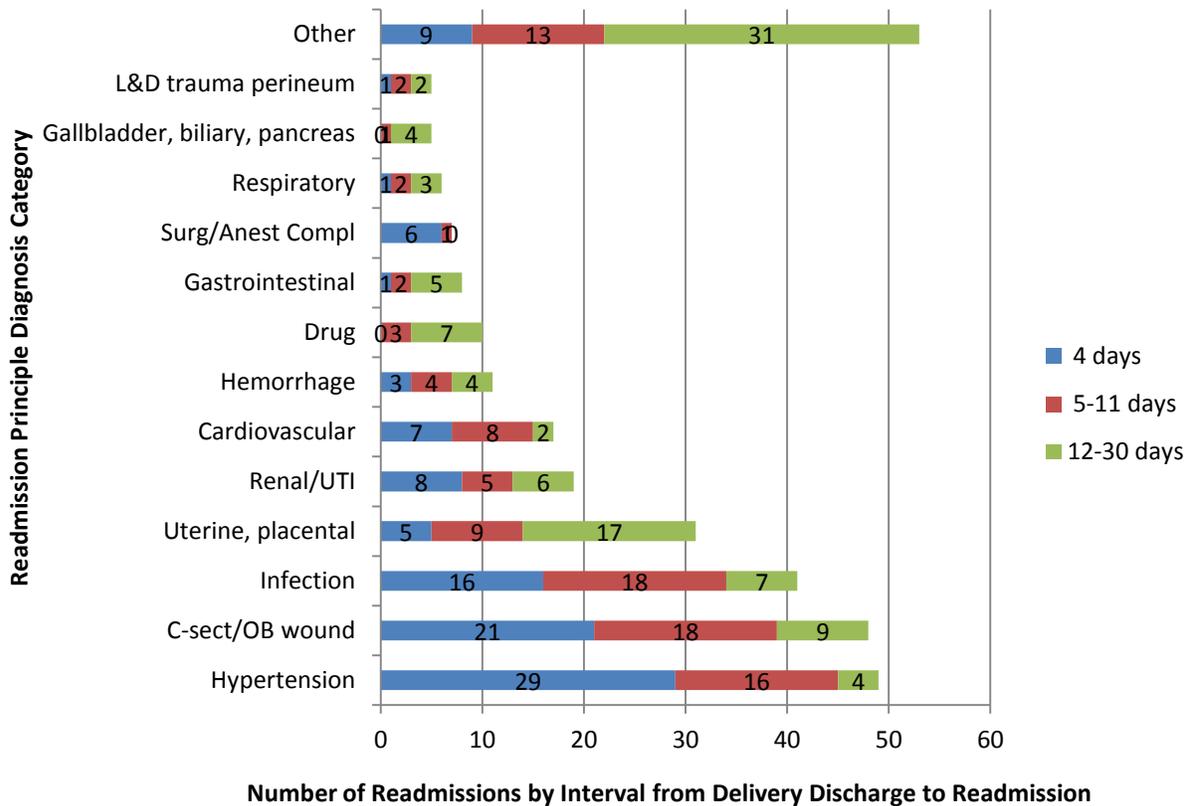


Figure 2. Postpartum Readmission Count by Readmission Timing Interval. Number of postpartum readmissions in 4 days, 5–11 days, or 12–30 days from delivery discharge for each readmission principal diagnosis category (n = 310).

Delivery Stay Diagnoses

Any delivery stay (index stay) diagnoses of hypertension, drug abuse, asthma, hemorrhage and major infection/sepsis were significantly associated with readmissions (Table 2). Any delivery stay diagnosis of hypertension was prevalent among 12.2% of the study sample, and their readmission rate was 3.0% (n = 74 of 2,480; Table 2). Of this subpopulation, the majority of cause-specific readmissions were for a principal diagnosis of hypertension (n = 26 of 74),

followed by cesarean/obstetrical wound problem (n = 12), infection (n = 9), and uterine/placental problems (n = 9; Figure 3). Women with any delivery stay diagnosis of drug abuse/poisoning comprised 3.6% of the study sample, and were readmitted at a rate of 3.1% (n = 23 of 734; Table 2). Among women with any delivery stay diagnosis of drug abuse/poisoning, predominant cause-specific readmissions were for cesarean/obstetric wound problems (n = 7 of 23), drug abuse/poisoning (n = 4), and infection (n = 3; Figure 4). The sample prevalence rate for asthma was 3.2%, and women with any delivery stay diagnosis of asthma had a readmission rate of 2.7% (n = 18 of 662); predominant cause-specific readmissions were for hypertension (n = 5), cesarean/wound problems (n = 4) and uterine/placental problems (n = 4; Figure 5). The sample prevalence rate for hemorrhage was 2.6%, and the readmission rate for women with a delivery stay diagnosis of hemorrhage was 2.7% (n = 14 of 522; Table 2); cause-specific readmissions were predominantly for infection (n = 4), followed by hypertension (n = 3), and uterine/placental problems (n = 2; Figure 6). Although there was only a 0.3% prevalence rate for women with a delivery stay diagnosis of major infection or sepsis, with only 5 members readmitted, this subpopulation had the highest readmission rate, at 8.3% (n = 5 of 60; Table 2). This readmission subpopulation was comprised of the following cause-specific readmission types: cesarean/obstetric wound problems (n = 2), hypertension, drug abuse/poisoning, labor and delivery trauma to the perineum (Figure 7). Of note, delivery stay diagnoses of perineal laceration and repair of obstetric laceration were both inversely associated with readmission (Table 2), and because these diagnoses are characteristic of vaginal delivery rather than cesarean delivery, it is reasonable to interpret this lower risk for readmission as attributable to non-cesarean deliveries (Table 1).

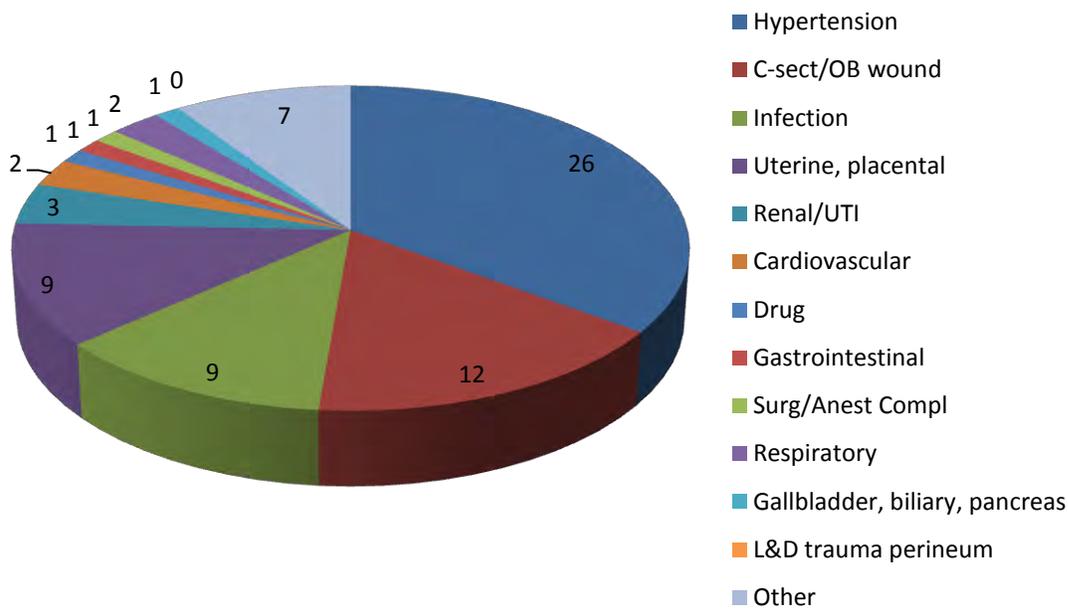


Figure 3. Postpartum Readmission Count – Hypertension Category. Postpartum readmission count of members with any delivery stay diagnosis of “Hypertension” readmission principal diagnosis category (n = 74).

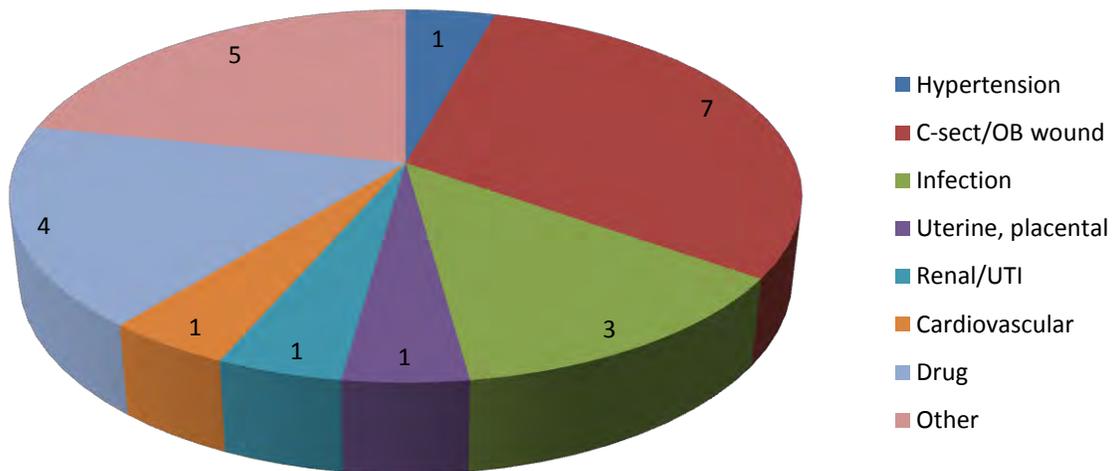


Figure 4. Postpartum Readmission Count – Drug Abuse/Poisoning Category. Postpartum readmission count of members with any delivery stay diagnosis of “Drug Abuse/Poisoning” readmission principal diagnosis category (n = 23).

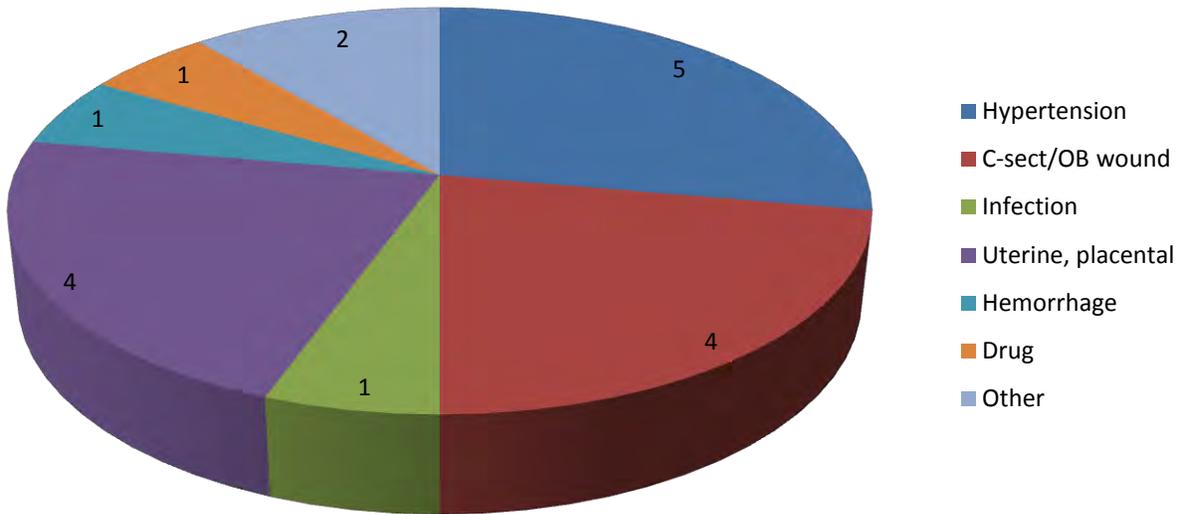


Figure 5. Postpartum Readmission Count – Asthma Category. Postpartum readmission count of members with any delivery stay diagnosis of “Asthma” readmission principal diagnosis category (n = 18).

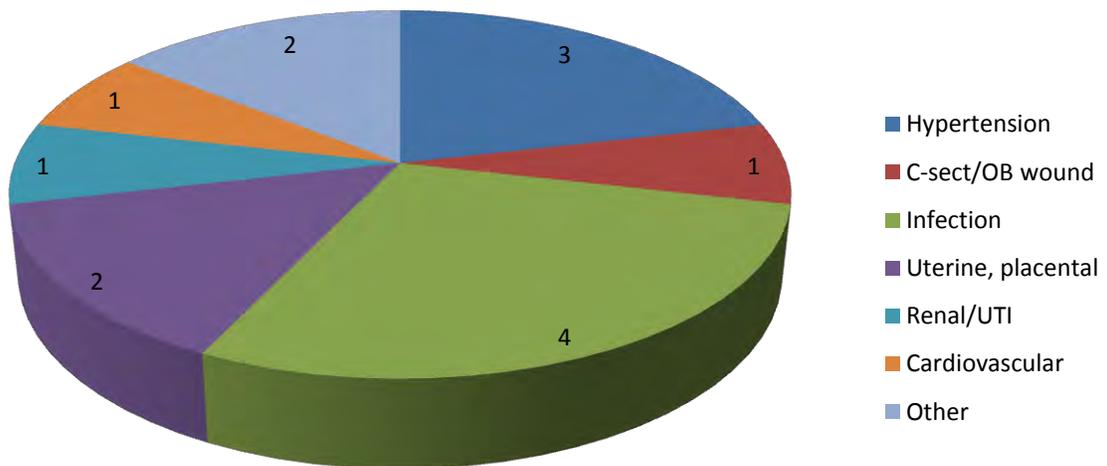


Figure 6. Postpartum Readmission Count – Hemorrhage Category. Postpartum readmission count of members with any delivery stay diagnosis of “Hemorrhage” readmission principal diagnosis category (n = 14).

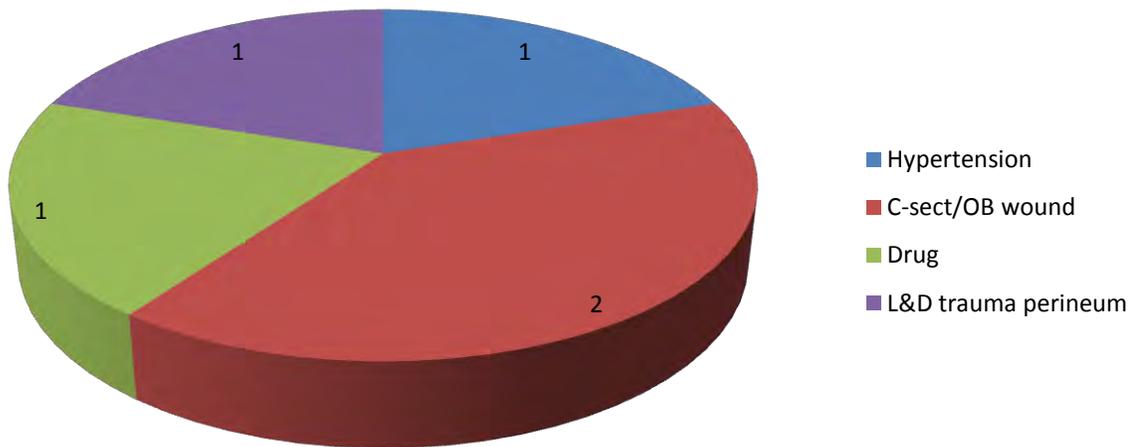


Figure 7. Postpartum Readmission Count – Major Infection or Sepsis Category. Postpartum readmission count of members with any delivery stay diagnosis of “Major Infection or Sepsis” readmission principal diagnosis category (n = 5).

Overweight/Obesity

Overweight/obesity prevalence was 5.8% among the study sample. The readmission rate for women with a delivery stay diagnosis of overweight or obesity (3.1%; n = 37 of 1,178) was significantly higher than those without (1.4%; n = 273 of 19,196; Table 1), and the majority of cause-specific readmissions attributable to this subpopulation were for a principal diagnosis related to cesarean section or obstetric wound problems (n = 9 of 37), followed by hypertension (n = 7), infection (n = 5) and uterine and placental problems (n = 5; Figure 8).

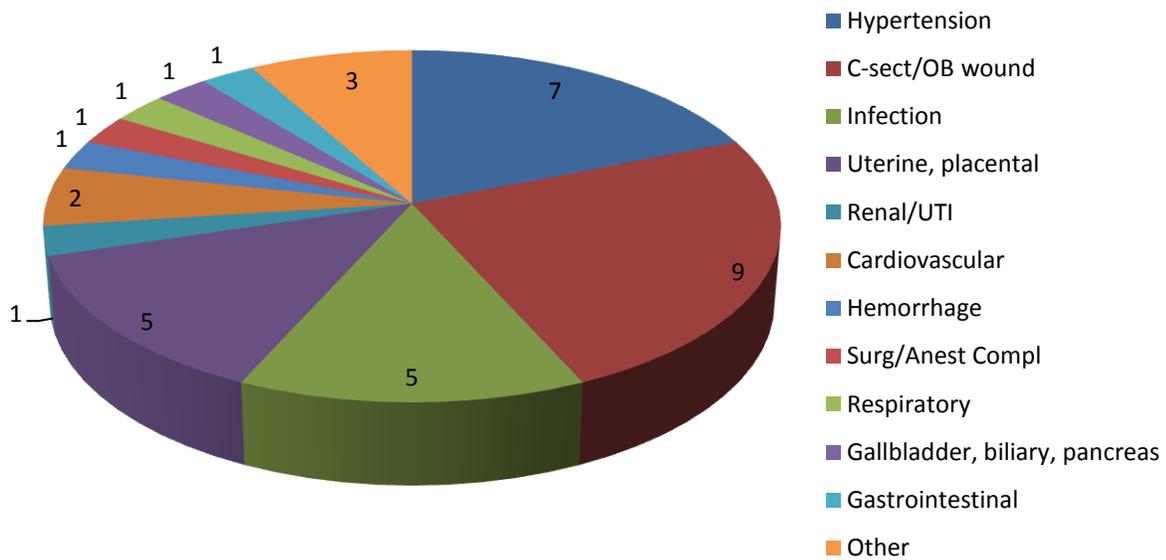


Figure 8. Postpartum Readmission Count – Overweight/Obesity Category. Postpartum readmission count of members with any delivery stay diagnosis of “Overweight/Obesity” readmission principal diagnosis category (n = 37).

Delivery Type

There was also a significant difference in readmission rates by delivery type; most notably, the readmission rate for cesarean delivery was 2.4% (n = 172 of 7,150), whereas the rate for normal delivery was 1% (n = 12 of 1,246; Table 1). Among members who underwent cesarean section, the majority of cause-specific readmissions were for cesarean and obstetric wound problems (n = 46 of 172), followed by hypertension (n = 29) and infection (n = 22; Figure 9). The sample prevalence rate for cesarean delivery was 35.1%.

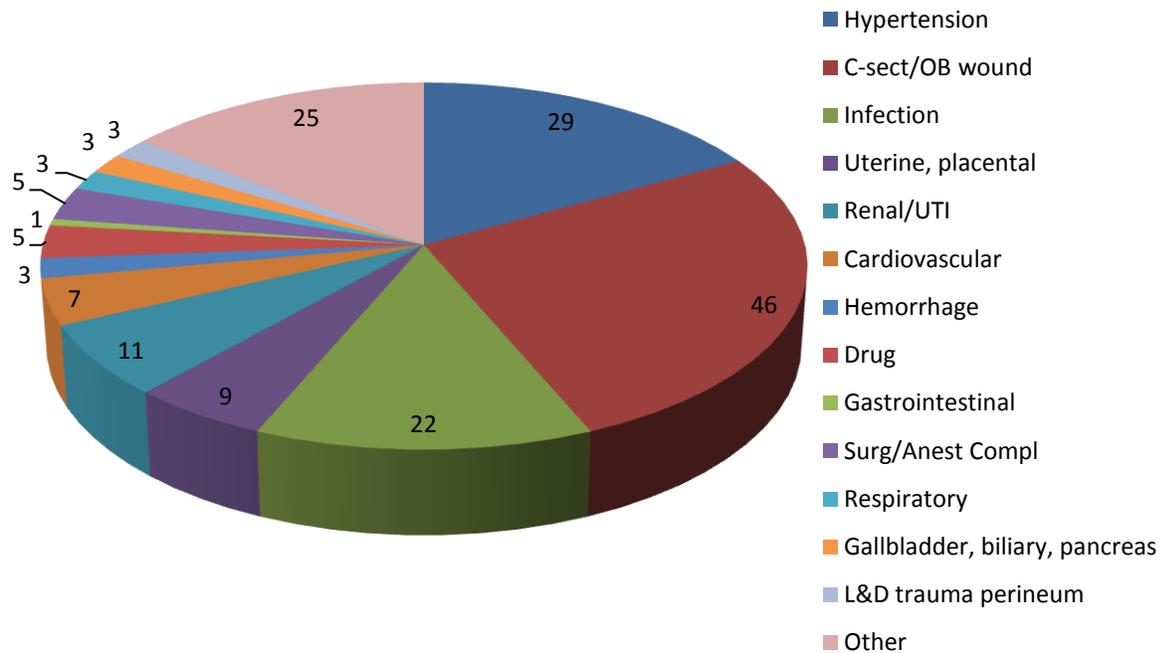


Figure 9. Postpartum Readmission Count – Cesarean Section Delivery Category. Postpartum readmission count of members with delivery stay diagnosis of “Cesarean Section Delivery” readmission principal diagnosis category (n = 172).

MCO/Utilization Factors

CoventryCares of Kentucky members comprised most of the study sample (29.9%), followed by Passport Health Plan (26.5%), Kentucky Spirit (23.5%), and WellCare of Kentucky (20.1%). The distribution of members with a postpartum readmission across MCOs was significantly different, with members of Passport Health Plan and WellCare of Kentucky showing the highest rates at 1.8% (n = 99 of 5,395) and 1.9% (n = 78 of 4,096), respectively (Table 1); however, since potential confounding variables were not statistically controlled for in this analysis, this finding should be interpreted with caution. Although small frequencies precluded significance testing by MCO within each region, WellCare of Kentucky showed the highest readmission rates in

regions 7, 3, and 8, whereas Kentucky Spirit had the highest readmission rate in region 1 (Figure 1).

Members with no postpartum follow-up visit comprised a significantly greater proportion of readmissions, at 1.8% (n = 234 of 12,672), relative to members with either one visit (1.1%; n = 54 of 4,976) or two or more visits (0.8%; n = 22 of 2,726; Table 1). The number of days between discharge and readmission also merits consideration, however, as the shorter the duration, the less opportunity to attend a postpartum visit; thus, causal inferences regarding lack of outpatient follow-up as a risk factor for readmission are limited by the possibility of reverse causation. For example, of women readmitted within 4 days post-delivery discharge, only 1 of 107 (< 1%) had one postpartum visit, compared to 23 of 102 (23%) women readmitted within 5–11 days, and 4,922 of 20,064 (25%) of women who were not readmitted within 30 days. Further, 20 of 101 (20%) of women readmitted within 12–30 days had two or more outpatient visits, compared to 13% of women who were not readmitted (Figure 10), raising the question of whether additional outpatient visits may be a consequence of postpartum complications (confounding by indication), rather than postpartum readmission being a consequence of lack of follow-up care. The acuity proxy, which combined length of stay and transfer status, was also significantly associated with postpartum readmission; of note, members with longer stays or those who were transferred to another hospital had higher readmission rates compared to those with delivery stays of two days who were not transferred (Table 1).

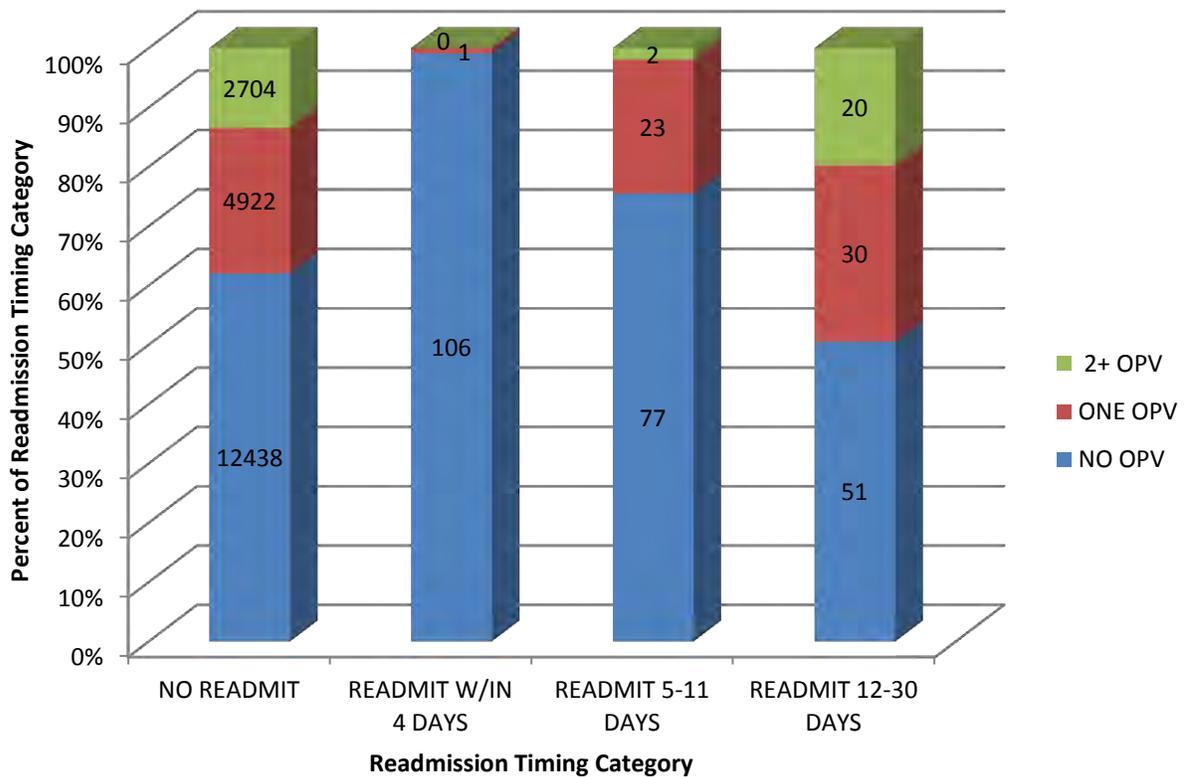


Figure 10. Members with Outpatient Visits by Readmission Timing. Number of members with 0, 1, or 2+ outpatient visits (OPVs) by readmission timing category of no readmission, readmission within 4 days, readmission within 5 to 11 days, and readmission within 12 to 30 days.

Table 1. Descriptive Statistics for Common Model Factors

Common Model Covariates ^a	# Admissions	Prevalence Rate	# Readmissions	Readmission Rate
TOTAL:	20,374	100%	310	1.5%
Age group:				
11–18 years	1,548	7.6%	16	1.0%
19–34 years	17,611	86.4%	271	1.5%
35+ years	1,215	6.0%	23	1.9%
Race/Ethnicity:				
White	17,080	83.8%	253	1.5%
Black	2,732	13.4%	50	1.8%
Other	562	2.8%	7	1.3%
Member Residence:				
Urban	10,404	51.1%	162	1.6%
Rural	9,947	48.8%	148	1.5%
Unknown	23	0.1%	0	-

Common Model Covariates ^a	# Admissions	Prevalence Rate	# Readmissions	Readmission Rate
MCO:^b				
Kentucky Spirit	4,786	23.5%	61	1.3%
CoventryCares of Kentucky	6,097	29.9%	72	1.2%
Passport Health Plan	5,395	26.5%	99	1.8%
WellCare of Kentucky	4,096	20.1%	78	1.9%
Postpartum Follow-up:^b				
No visit	12,672	62.2%	234	1.8%
One visit	4,976	24.4%	54	1.1%
Two or more visits	2,726	13.4%	22	0.8%
Delivery Type:^b				
Normal	1,246	6.1%	12	1.0%
Operative Vaginal	1,296	6.4%	14	1.1%
Cesarean Section	7,150	35.1%	172	2.4%
All else, with induction	2,841	13.9%	36	1.3%
All else, w/o induction	7,841	38.5%	76	1.0%
Overweight or Obese:^b				
Yes	1,178	5.8%	37	3.1%
No	19,196	94.2%	273	1.4%
Acuity Proxy:^b				
Delivery stay ≤ 2 days without transfer	11,519	56.5%	129	1.1%
Delivery stay = 3–4 days without transfer	7,889	38.7%	149	1.9%
Delivery stay ≤ 4 days with transfer	55	0.3%	1	1.8%
Delivery stay = 5–8 days with or without transfer	681	3.3%	23	3.4%
Delivery stay = 9+ days with or without transfer	230	1.1%	8	3.5%

^a Key demographic, service and member characteristics entered into all logistic regression models.

^b Statistically significant different readmission rates between subgroups; *chi-square* statistic *p*-value ≤ 0.05

Table 2. Descriptive Statistics for Key Delivery (Index) Stay Diagnoses

Key Index Stay Diagnoses ^a	# Admissions	Prevalence Rate	# Readmissions	Readmission Rate
TOTAL:	20,374	100%	310	1.5%
Hypertension + ^b	2,480	12.2%	74	3.0%
Hypertension -	17,894	87.8%	236	1.3%
Anemia +	2,271	11.1%	33	1.5%
Anemia -	18,103	88.9%	277	1.5%
Diabetes +	1416	7.0%	26	1.8%
Diabetes -	18,958	93.0%	284	1.5%
Asthma + ^b	662	3.2%	18	2.7%
Asthma -	19,712	96.8%	292	1.5%

Key Index Stay Diagnoses ^a	# Admissions	Prevalence Rate	# Readmissions	Readmission Rate
Hemorrhage + ^b	522	2.6%	14	2.7%
Hemorrhage -	19,852	97.4%	296	1.5%
Preterm PROM + ^c	253	1.2%	7	2.8%
Preterm PROM -	20,121	98.8%	303	1.5%
Coagulation Defect + ^c	268	1.3%	8	3.0%
Coagulation Defect -	20,106	98.7%	302	1.5%
Major Infection, Sepsis + ^b	60	0.3%	5	8.3%
Major Infection, Sepsis -	20,314	99.7%	305	1.5%
Viral, HIV, Hepatitis +	790	3.9%	14	1.8%
Viral, HIV, Hepatitis -	19,584	96.1%	296	1.5%
Liver, gallbladder, bile +	216	1.1%	5	2.3%
Liver, gallbladder, bile -	20,158	98.9%	305	1.5%
Preterm +	1,438	7.1%	26	1.8%
Preterm -	18,936	92.9%	284	1.5%
Lack of Prenatal Care +	556	2.7%	9	1.6%
Lack of Prenatal Care -	19,818	97.3%	301	1.5%
Psychiatric +	1,073	5.3%	19	1.8%
Psychiatric -	19,301	94.7%	291	1.5%
Drug Abuse + ^b	734	3.6%	23	3.1%
Drug Abuse -	19,640	96.4%	287	1.5%
Alcohol Abuse + ^b	20	0.1%	3	15.0%
Alcohol Abuse -	20,354	99.9%	307	1.5%
Tobacco Use +	4,129	20.3%	68	1.7%
Tobacco Use -	16,245	79.7%	242	1.5%
Perineal Laceration + ^d	5,099	25.0%	48	0.9%
Perineal Laceration -	15,275	75.0%	262	1.7%
Repair OB Laceration + ^d	4,996	24.5%	45	0.9%
Repair OB Laceration -	15,378	75.5%	265	1.7%
Episiotomy +	1,504	7.4%	16	1.1%
Episiotomy -	18,870	92.6%	294	1.6%
Sterilization +	1,465	7.2%	26	1.8%
Sterilization -	18,909	92.8%	284	1.5%

^a High readmission volume or high interest for postpartum risk and/or case management. Not restricted to principal diagnosis. Members may fall into more than one diagnostic category.

^b Statistically significant different readmission rates between subgroups; *chi*-square statistic *p*-value ≤ 0.05, or Fisher's Exact Test statistic *p*-value ≤ 0.05 for variables with 25% of cells with an expected count < 5.

^c Marginally statistically significant different readmission rates between subgroups; *p*-value > 0.05 and < 0.10.

^d Significant inverse association between readmission and delivery stay diagnosis.

Multivariable Logistic Regression Findings

Common Model Factors – Key Member Characteristics

Relative to women with a normal vaginal delivery, women with a cesarean delivery had a significantly greater risk for readmission, with more than twice the odds for readmission in all

models, i.e., with a covariate for any delivery stay diagnosis of hypertension (OR = 2.1; 95% CI = 1.2, 3.9); drug abuse (OR = 2.2; 95% CI = 1.2, 4.0); asthma (OR = 2.2; 95% CI = 1.2, 4.1); hemorrhage (OR = 2.3; 95% CI = 1.2, 4.1); and major infection, sepsis (OR = 2.3; 95% CI = 1.2, 4.1; Table 3). Overweight or obesity was significantly associated with between 70% and 90% greater odds for readmission across all delivery stay diagnosis models: hypertension (OR = 1.7; 95% CI = 1.2, 2.4); drug abuse (OR = 1.9; 95% CI = 1.3, 2.7); asthma (OR = 1.8; 95% CI = 1.3, 2.6); hemorrhage (OR = 1.9; 95% CI = 1.3, 2.7); and major infection, sepsis (OR = 1.9; 95% CI = 1.3, 2.7). Unlike delivery type, age group, race/ethnicity, and urban/rural residence were not significantly associated with readmission.

Common Model Factors – MCO/Utilization Factors

Compared to membership in Kentucky Spirit MCO, membership in Passport Health Plan and WellCare of Kentucky were associated with significantly increased risk for readmission, with 50% greater odds for readmission among Passport Health Plan members (OR = 1.5) and 60% greater odds for WellCare of Kentucky members (OR = 1.6) across all models (Table 3). This finding was independent of acuity level, as proxied by length of index stay and transfer status; the latter acuity proxy variable showed a statistically significant greater odds for readmission among women with longer delivery stays relative to women with a delivery stay of 2 days or less without a hospital transfer. The acuity proxy variable also showed a statistically significant trend of increasing risk from the shortest stay group (without transfer) through ascending severity categories to the longest stay group. MCO findings should be interpreted with caution, as unmeasured confounders such as specific hospital characteristics were not analyzed.

Compared to women who had one postpartum follow-up visit, women without any follow-up visits had greater than twice the odds for readmission across all delivery stay diagnosis models: hypertension (OR = 2.3; 95% CI = 1.7, 3.1); drug abuse (OR = 2.2; 95% CI = 1.6, 3.1); asthma (OR = 2.2; 95% CI = 1.6, 3.0); hemorrhage (OR = 2.2; 95% CI = 1.6, 3.0); and major infection, sepsis (OR = 2.2; 95% CI = 1.6, 3.1). As indicated in the descriptive statistical analysis, findings should be interpreted with caution in light of the possibility that early readmission due to illness severity (confounding by indication) might have precluded outpatient follow-up (reverse causation).

Separate Model Delivery (Index) Stay Diagnosis Factors

Any index stay diagnosis of hypertension was significantly associated with 80% greater odds for readmission, compared to women without this diagnosis, independent of age, race/ethnicity, urban/rural residence, MCO, postpartum visits, delivery type, overweight/obesity, or combined length of stay and transfer status (acuity proxy), with an odds ratio of 1.8 (95% CI = 1.4, 2.5; Table 3). Any index stay diagnosis of drug abuse was significantly associated with more than twice the odds for readmission (OR = 2.3; 95% CI = 1.5, 3.5); asthma with 80% greater odds for

readmission (OR = 1.8; 95% CI = 1.1, 3.0); and major infection/sepsis with almost four times greater odds for readmission (OR = 3.9; 95% CI = 1.5, 10.2). Of note, the odds ratio estimate for the latter is less precise, as indicated by the relatively wide confidence interval, and this instability is likely a consequence of the lower frequency of this diagnosis (n = 5 readmissions of 60 delivery stay admissions). Finally, any index stay diagnosis of hemorrhage showed a non-significant increased odds for readmission (OR = 1.6; 95% CI = 0.9, 2.9).

Table 3. Multiple Logistic Regression Results

	Separate Models for Key Index Stay Diagnoses (Not Restricted to Principal Diagnosis)				
	Hypertension Index Stay Model [‡]	Drug Abuse Index Stay Model [‡]	Asthma Index Stay Model [‡]	Hemorrhage Index Stay Model [‡]	Major Infection, Sepsis Index Stay Model [‡]
Index Stay Diagnosis:					
Hypertension	1.8 ^a (1.4, 2.5)	-	-	-	-
Drug Abuse	-	2.3 ^a (1.5, 3.5)	-	-	-
Asthma	-	-	1.8 ^c (1.1, 3.0)	-	-
Hemorrhage	-	-	-	1.6 (0.9, 2.9)	-
Infection, Sepsis	-	-	-	-	3.9 ^a (1.5, 10.2)
Common Model Factors:					
Age group:					
11–18 yrs	0.8 (0.5, 1.3)	0.8 (0.5, 1.4)	0.8 (0.5, 1.3)	0.8 (0.5, 1.3)	0.8 (0.5, 1.3)
19–34 yrs (referent)	1.0	1.0	1.0	1.0	1.0
35+ yrs	1.0 (0.7, 1.6)	1.1 (0.7, 1.7)	1.1 (0.7, 1.7)	1.1 (0.7, 1.7)	1.1 (0.7, 1.7)
Race/Ethnicity:					
White (referent)	1.0	1.0	1.0	1.0	1.0
Black	1.0 (0.7, 1.4)	1.1 (0.8, 1.5)	1.0 (0.7, 1.4)	1.0 (0.7, 1.5)	1.0 (0.8, 1.5)
Other	0.8 (0.4, 1.7)	0.8 (0.4, 1.8)	0.8 (0.4, 1.7)	0.8 (0.4, 1.8)	0.8 (0.4, 1.8)
Member Residence:					
Urban (referent)	1.0	1.0	1.0	1.0	1.0
Rural	1.1 (0.9, 1.5)	1.1 (0.9, 1.5)	1.2 (0.9, 1.5)	1.1 (0.9, 1.5)	1.1 (0.9, 1.5)
Unknown	-	-	-	-	-
MCO:					
Kentucky Spirit (referent)	1.0	1.0	1.0	1.0	1.0
CoventryCares of Kentucky	0.9 (0.6, 1.2)	0.9 (0.6, 1.2)	0.9 (0.6, 1.2)	0.9 (0.6, 1.2)	0.9 (0.6, 1.2)
Passport Health Plan	1.5 ^c (1.0, 2.1)	1.5 ^c (1.0, 2.1)	1.5 ^c (1.0, 2.1)	1.5 ^c (1.0, 2.1)	1.5 ^c (1.0, 2.1)
WellCare of Kentucky	1.6 ^b (1.1, 2.2)	1.6 ^b (1.1, 2.3)	1.6 ^b (1.1, 2.2)	1.6 ^b (1.1, 2.2)	1.6 ^b (1.1, 2.2)
Postpartum Visits:					
No visits	2.3 ^a (1.7, 3.1)	2.2 ^a (1.6, 3.1)	2.2 ^a (1.6, 3.0)	2.2 ^a (1.6,	2.2 ^a (1.6, 3.1)

	Separate Models for Key Index Stay Diagnoses (Not Restricted to Principal Diagnosis)				
	Hypertension Index Stay Model [‡]	Drug Abuse Index Stay Model [‡]	Asthma Index Stay Model [‡]	Hemorrhage Index Stay Model [‡]	Major Infection, Sepsis Index Stay Model [‡]
				3.0)	
One visit (referent)	1.0	1.0	1.0	1.0	1.0
Two or more visits	0.7 (0.4, 1.1)	0.7 (0.4, 1.1)	0.7 (0.4, 1.1)	0.7 (0.4, 1.1)	0.7 (0.4, 1.1)
Delivery Type:					
Normal (referent)	1.0	1.0	1.0	1.0	1.0
Operative Vaginal	1.0 (0.5, 2.2)	1.0 (0.5, 2.2)	1.0 (0.5, 2.3)	1.0 (0.5, 2.3)	1.1 (0.5, 2.3)
Cesarean Section	2.1 ^a (1.2, 3.9)	2.2 ^a (1.2, 4.0)	2.2 ^a (1.2, 4.1)	2.3 ^a (1.2, 4.1)	2.3 ^a (1.2, 4.1)
All else, with induction	1.1 (0.6, 2.1)	1.2 (0.6, 2.3)	1.2 (0.6, 2.3)	1.2 (0.6, 2.3)	1.2 (0.6, 2.4)
All else, w/o induction	0.9 (0.5, 1.7)	0.9 (0.5, 1.7)	0.9 (0.5, 1.7)	0.9 (0.5, 1.8)	1.1 (0.5, 1.8)
Overweight/Obese:					
No (referent)	1.0	1.0	1.0	1.0	1.0
Yes	1.7 ^b (1.2, 2.4)	1.9 ^a (1.3, 2.7)	1.8 ^a (1.3, 2.6)	1.9 ^a (1.3, 2.7)	1.9 ^a (1.3, 2.7)
Acuity Proxy:					
Index stay ≤2 days, no Tx (ref)	1.0	1.0	1.0	1.0	1.0
Index stay = 3–4 days, no Tx	1.3 ^c (1.0, 1.7)	1.4 ^c (1.1, 1.8)	1.4 ^c (1.1, 1.8)	1.4 ^c (1.1, 1.8)	1.4 ^c (1.1, 1.8)
Index stay ≤ 4 days, Tx	1.3 (0.2, 9.8)	1.3 (0.2, 9.6)	1.4 (0.2, 10.5)	1.4 (0.2, 10.2)	1.4 (0.2, 10.4)
Index stay = 5–8 days	1.8 ^c (1.1, 3.1)	2.2 ^a (1.4, 3.6)	2.3 ^a (1.4, 3.7)	2.3 ^a (1.4, 3.6)	2.2 ^a (1.4, 3.5)
Index stay = 9+ days	2.1 (0.9, 4.2)	2.4 ^c (1.1, 5.1)	2.4 ^c (1.1, 5.1)	2.3 ^c (1.1, 4.9)	2.3 ^c (1.1, 4.8)
<i>p</i> -value for trend:	≤ 0.01	≤ 0.001	≤ 0.001	≤ 0.001	≤ 0.01

[‡] Adjusted Odds Ratios (95% Confidence Interval) for the relationship between the outcome of postpartum readmission within 30 days of delivery discharge (n = 310) and independent covariates for key index stay diagnoses and common model factors for Medicaid Members who delivered a live infant during the period from November 6, 2011 through September 5, 2012 (n = 20,374).

^a *p* ≤ 0.001

^b *p* ≤ 0.01

^c *p* ≤ 0.05

Supplemental Analysis of the Relationship between Outpatient Visits and Timing of Readmission

This analysis addressed the above-mentioned limitations of possible reverse causality and confounding by indication with regard to the relationship between outpatient follow-up visits and readmission by stratifying readmission outcomes by timing, i.e., readmission within 4 days of delivery discharge, readmission between 5–11 days, and readmission within 12–30 days.

Comparing the risk for readmission within 5–11 days post-delivery discharge to no readmission, members with zero outpatient follow-up visits had 61% greater odds for readmission than members with one outpatient follow-up visit (OR = 1.6; 95% CI = 1.0, 2.6; $p = 0.048$), and members with multiple outpatient follow-up visits had 85% lesser odds for readmission than members with one outpatient follow-up visit (OR = 0.15; 95% CI = 0.04, 0.64; $p = 0.010$).

Part II: Medical Record Review of a Random Sample of Women with Postpartum Readmission – Findings

Overview

Medical records were reviewed for a random sample of 209 Kentucky Medicaid managed care members with a postpartum readmission within 30 days of delivery hospitalization discharge and who were enrolled in 3 MCOs: CoventryCares of Kentucky, Passport Health Plan, and WellCare of Kentucky. At the time Part II of this study was initiated by requesting medical records, Kentucky Spirit's contract had ended, so their members were not included in the medical record review. This sample represents 67% of total postpartum readmissions.

Demographic Characteristics

The majority of women readmitted postpartum were between the ages of 19 and 34 years (90%), white (80%), urban dwelling (55%), and single (60%); however, most reported a support status of either living with someone (51%) or having a significant other or family support (34%; Table 4). A minority (6%) were disabled. MCO membership included Passport Health Plan (44%), CoventryCares of Kentucky (33%), and WellCare of Kentucky (24%).

Table 4. Postpartum Readmissions Chart Review Study Results

	All-Cause Readmissions ^a (n = 209)	Readmitted With Hypertension ^b (n = 49)	Readmitted With Major Infection ^c (n = 26)	Readmitted With Gallbladder Problems ^d (n = 23)	Readmitted With C-Section Wound Problems ^e (n = 22)	Readmitted With Anemia (n = 20)	Readmitted With UTI (n = 18)
Age Group:							
16–18 years	7 (3%)	3 (6%)	1 (4%)	2 (9%)	0	2 (10%)	2 (11%)
19–34 years	188 (90%)	41 (84%)	25 (96%)	20 (87%)	21 (95%)	18 (90%)	16 (89%)
35–42 years	14 (7%)	5 (10%)	0	1 (4%)	1 (5%)	0	0
Marital Status:							
Divorced	8 (4%)	0	0	0	2 (9%)	0	1 (6%)
Married	66 (32%)	19 (39%)	7 (27%)	13 (57%)	4 (18%)	10 (50%)	6 (33%)
Separated	9 (4%)	1 (2%)	1 (4%)	1 (4%)	1 (5%)	1 (5%)	0
Single	125 (60%)	29 (59%)	18 (69%)	9 (39%)	15 (68%)	9 (45%)	11 (61%)
Not reported	1 (0.5%)	0	0	0	0	0	0
Support Status:							
Lives alone	7 (3%)	3 (6%)	2 (8%)	0	2 (9%)	1 (5%)	0
Lives with someone	106 (51%)	27 (55%)	10 (38%)	10 (43%)	8 (36%)	9 (45%)	8 (44%)
Significant other family – living arrangements unknown	71 (34%)	15 (31%)	13 (50%)	9 (39%)	11 (50%)	10 (50%)	8 (44%)
Not reported	25 (12%)	4 (8%)	1 (4%)	4 (17%)	1 (5%)	0	2 (11%)
Race/Ethnicity:							
Black	39 (19%)	19 (39%)	8 (31%)	1 (4%)	3 (14%)	3 (15%)	3 (17%)
White	168 (80%)	30 (61%)	18 (69%)	22 (96%)	19 (86%)	17 (85%)	15 (83%)
Other	2 (1%)	0	0	0	0	0	0
Place of Residence:							
Urban	115 (55%)	31 (63%)	17 (65%)	4 (17%)	10 (45%)	7 (35%)	6 (33%)
Rural	94 (45%)	18 (37%)	9 (35%)	19 (83%)	12 (55%)	13 (65%)	12 (67%)

	All-Cause Readmissions ^a (n = 209)	Readmitted With Hypertension ^b (n = 49)	Readmitted With Major Infection ^c (n = 26)	Readmitted With Gallbladder Problems ^d (n = 23)	Readmitted With C-Section Wound Problems ^e (n = 22)	Readmitted With Anemia (n = 20)	Readmitted With UTI (n = 18)
Medicaid Eligibility Status:							
Disabled	13 (6%)	3 (6%)	2 (8%)	0	0	2 (10%)	2 (11%)
Income-based	194 (93%)	46 (94%)	24 (92%)	23 (100%)	22 (100%)	17 (85%)	16 (89%)
Unknown	2 (1%)	0	0	0	0	1 (5%)	0
MCO Membership:							
CoventryCares of Kentucky	68 (33%)	16 (33%)	11 (42%)	10 (43%)	10 (45%)	8 (40%)	10 (56%)
Passport Health Plan	91 (44%)	24 (49%)	14 (54%)	2 (9%)	7 (32%)	5 (25%)	6 (33%)
WellCare of Kentucky	50 (24%)	9 (18%)	1 (4%)	11 (48%)	5 (23%)	7 (35%)	2 (11%)

^a Members may fall into one or more diagnostic categories which represent any readmission diagnosis and may or may not be the principal diagnosis.

^b Hypertension diagnoses include pre-existing hypertension, gestational hypertension, preeclampsia and eclampsia.

^c Major infection diagnoses include major puerperal infection and methicillin –resistant staphylococcus aureus (MRSA).

^d Gallbladder problems include gallbladder problems such as cholelithiasis (gallstones) or bile duct disease.

^e Cesarean wound problems include infection, hematoma, hemorrhage and other.

Clinical Characteristics

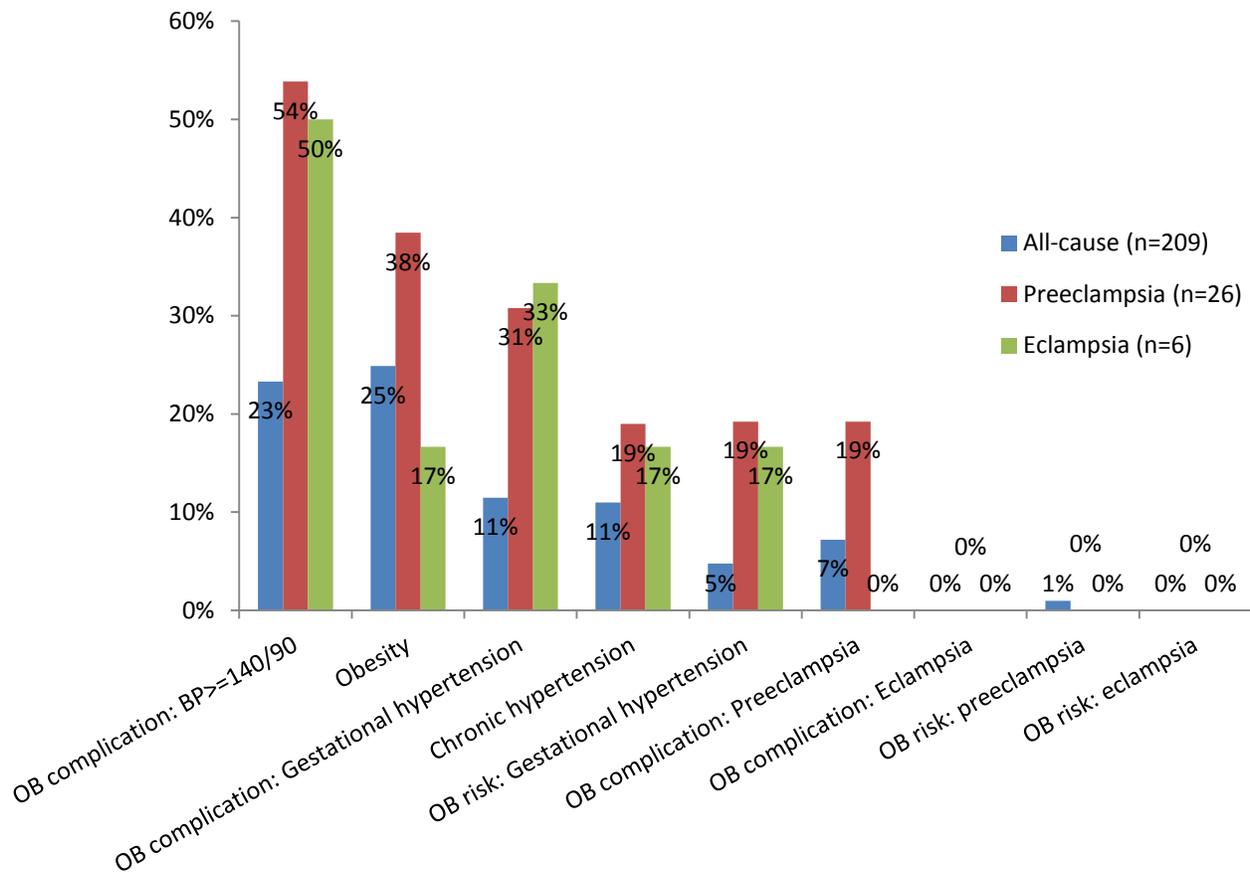
Overview

The vast majority of readmissions were comprised of singleton deliveries (98%), and a lesser majority were unscheduled deliveries (62%) or without induction of labor (63%; Table 5). In addition, most readmissions were comprised of women who did not undergo episiotomy (91%), transfusion (96%) or hysterectomy (98%; Table 5). Women without prenatal care comprised 3% of all-cause readmissions (Table 9). Nulliparous women comprised 39% of all-cause readmissions, 67% of readmissions with UTI, 57% of readmissions with gallbladder problems, and 50% of readmissions with cesarean section wound problems. Women with 3 or more prior pregnancies comprised 20% of readmissions with anemia, and women with a single prior pregnancy comprised 35% of readmissions with major infection (Table 5).

Profile of Readmission Diagnoses

Any readmission diagnosis (differentiated from principal readmission diagnosis) of hypertension was the most prominent readmission diagnosis (n = 49; 23%; Table 5), with a readmission diagnosis of preeclampsia (n = 26) comprising the majority of hypertension readmission diagnoses, followed by gestational hypertension (n = 17), pre-existing hypertension (n = 12), and eclampsia (n = 6; Table 6). Compared to the proportion of all-cause readmissions comprised by women with blood pressure greater than or equal to 140/90 during the delivery stay (23%), the proportions of diagnosis-specific readmissions for preeclampsia (54%) and eclampsia (50%) comprised by women with elevated blood pressure during the delivery hospitalization were substantially greater (Figure 11). Similarly, the obstetrical complication of gestational hypertension (prior to postpartum readmission) comprised 31% and 33% of diagnosis-specific readmissions with preeclampsia and eclampsia, respectively, compared to 25% of all-cause readmissions (Figure 11). The comorbid condition of obesity (prior to readmission) comprised 38% of readmissions with preeclampsia, compared to 11% of all-cause readmissions (Figure 11).

The second most prominent readmission diagnosis was major infection (n = 26; 12%; Table 5), which included 5 women with MRSA-specific infections (Table 10). Other prominent readmission diagnoses included gallbladder problems (n = 23; 11%), cesarean section wound problems (n = 22; 11%), anemia (n = 20; 10%), and urinary tract infection (UTI; n = 18; 9%; Table 5).



Delivery Complications, Co-morbidities, and OB Risk Factors

Figure 11. Obstetric Complications, Comorbidities, & Historical Obstetric Risk Factors and Readmission Diagnosis. The percentage of hospital-identified obstetric complications and comorbidities as a percentage of all-cause, preeclampsia, and eclampsia readmissions.

Profile by Delivery Type

The majority of women readmitted postpartum had undergone cesarean delivery (54%). Percentages by delivery subtype were as follows: non-operative vaginal delivery (41%), primary cesarean delivery (no prior cesarean delivery; 32%), cesarean delivery without trial of labor after prior cesarean delivery (15%), cesarean delivery with unknown trial of labor status after prior cesarean delivery (4%), operative vaginal delivery (4%), and cesarean delivery with trial of labor after prior cesarean delivery (3%; Table 5). Positive findings for medical record documentation during the delivery hospitalization of any comorbid condition, obstetric complication, or historical obstetric risk factor were found among 98% of women who underwent a primary (first) cesarean delivery and also among those who had a history of prior cesarean delivery (Table 7).

Women who underwent primary cesarean delivery (no history of prior cesarean delivery) comprised 68% (n = 15 of 22) of those readmitted with cesarean section wound problems, and women with cesarean delivery and a history of prior cesarean delivery who did not undergo a current trial of labor comprised 18% (n = 4 of 22) of those readmitted with cesarean section wound problems (Table 5). Women with a primary cesarean delivery accounted for 42% of readmissions with major infection, 39% of readmissions with hypertension, and 53% of readmissions with anemia (Table 5). Women with non-operative vaginal delivery comprised 57% of those who were readmitted with gallbladder problems (Table 5).

Profile by Gestational Status, Scheduled Delivery, and Induction

Gestational status at delivery, in decreasing order of prevalence was as follows: late term (39 weeks; 41%), early term (37–38 weeks; 31%), full term/post-term (40+ weeks; 12%), late pre-term (34–36 weeks; 8%), and early pre-term (8%; Table 8; Figure 12). Most of the sample was without a planned/scheduled cesarean section or induction (Table 12). Of those with a planned/scheduled cesarean section without induction, 47% were delivered at late term and 37% were delivered at early term (Table 8); most were not candidates for trial of labor after previous cesarean section (TOLAC), per the study proxy variable for TOLAC (Table 8). Only 4 of the 64 women who delivered at early term gestation and underwent planned/scheduled cesarean section were TOLAC proxy candidates (Figure 13). Among study women with a planned/scheduled induction without cesarean section, 78% delivered late term and 17% delivered early term (Table 8).

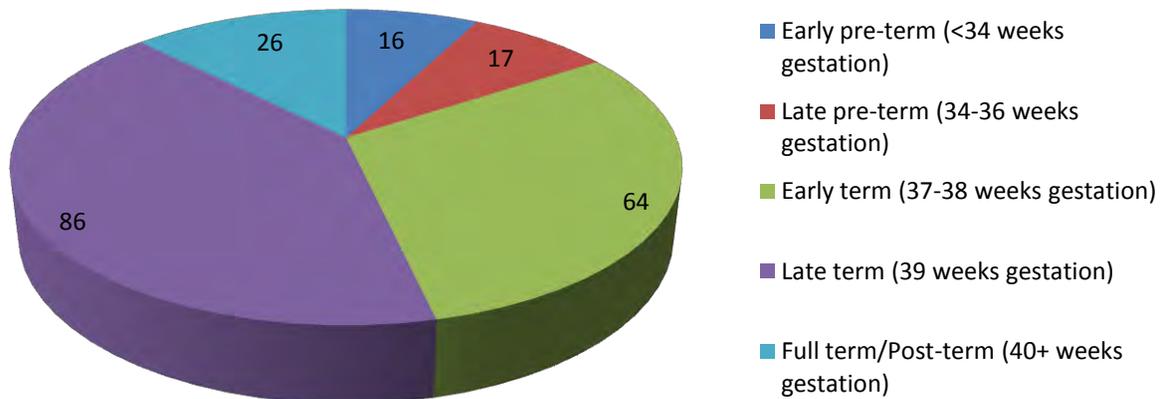


Figure 12. Gestational Status at Delivery. The frequency of gestational status at delivery for women readmitted within 30 days after delivery discharge (n = 209).

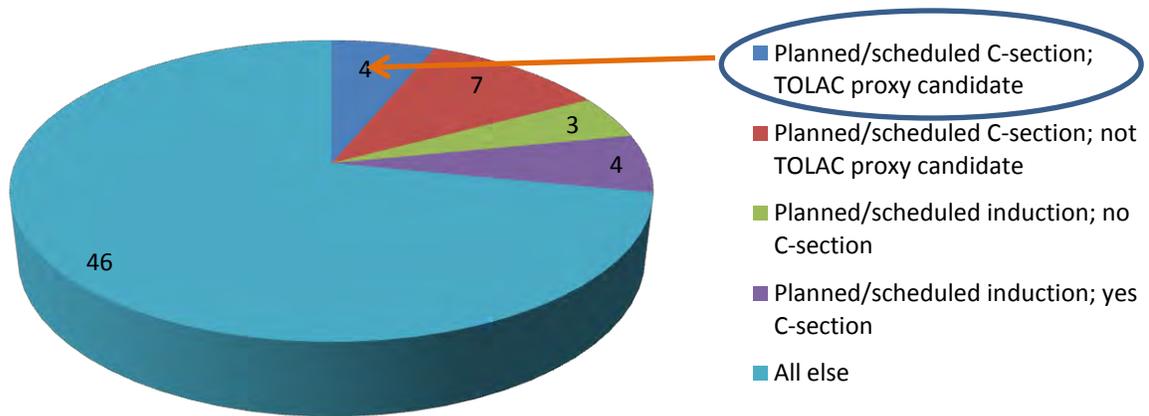


Figure 13. Planned/Scheduled C-Section and Induction for Women Who Delivered at Early Term Gestation. The frequency of planned/scheduled C-section and induction for women who delivered at early term gestation (37–38 weeks) among women who were readmitted within 30 days of delivery discharge (n = 64). Trial of labor after C-section (TOLAC) candidate proxy identifies women who underwent previous C-section without the following historical obstetric risk factors determined from prior pregnancy: preeclampsia, eclampsia, uterine surgery, placenta previa.

Profile of Delivery Stay Comorbid Conditions

Obesity was the most prevalent comorbid condition presenting at the delivery admission (n = 52; 25%), and comprised the greatest proportion of women readmitted with cesarean wound problems (45%), followed by women readmitted with hypertension (43%) and major infection (38%; Table 9). Obesity was prevalent among 32% of women who underwent primary cesarean delivery (n = 21 of 66), among 23% of women who underwent cesarean delivery with a history of prior cesarean delivery who did not undergo a current trial of labor (n = 7 of 30), and among 20% of women with a non-operative vaginal delivery (n = 17 of 85; Table 10). Sexually transmitted disease (STD; other than herpes) was the second most prevalent comorbid condition (n = 26; 12%) and comprised the greatest proportion of women readmitted with anemia (n = 5; 25%), followed by hypertension (16%) and major infection (15%; Table 9). Non-herpes STD comorbidity characterized 17% of women who underwent cesarean delivery with a history of prior cesarean delivery who did not undergo a current trial of labor (n = 5 of 30) and 9% of women who delivered vaginally (nonoperative; n = 8 of 85; Table 10). The third most prevalent comorbid condition was chronic hypertension (n = 23; 11%) which comprised 25% of readmissions with hypertension (Table 9). Chronic hypertension was prevalent among 13% of women who underwent non-operative vaginal delivery (n = 11 of 85), 11% who underwent primary cesarean delivery (n = 7 of 66), and 13% with cesarean delivery and a history of prior cesarean delivery who did not under a current trial of labor (n = 4 of 30; Table 10).

Profile of Delivery Stay Complications

Blood pressure greater than or equal to 140/90 (elevated blood pressure), gestational hypertension, and preeclampsia were among the top 5 high-prevalence obstetrical complications during the delivery stay (Table 11). Women with elevated blood pressure comprised 51% of those readmitted with hypertension, and women with gestational hypertension and preeclampsia comprised 35% and 20%, respectively, of hypertension diagnosis-specific readmissions (Table 11). Women with delivery stay complications of elevated blood pressure and preeclampsia comprised 29% and 17%, respectively, of women who underwent primary cesarean delivery (Table 12). Women with elevated blood pressure comprised 30% of women with a cesarean delivery and a history of prior cesarean delivery who did not undergo a current trial of labor (Table 12).

Nonreassuring fetal status and failure to progress were also high-prevalence delivery stay complications among women with a postpartum readmission, and comprised 14% and 13% of all-cause readmissions, respectively (Table 11). Women with these complications comprised 32% and 38% of primary cesarean deliveries, respectively (Table 12). Whereas only 3% of women who underwent primary cesarean delivery were without any documented complications, 27% of women who underwent cesarean delivery without trial of labor, and who had a history of prior cesarean delivery, were without any of documented complications.

Profile of Historical Obstetric Risk Factors

A history of prior pregnancy with fetal demise (unspecified, < 20 weeks, or \geq 20 weeks) and a history of prior cesarean section (type unknown, low-transverse, or classical) each comprised 22% of all-cause readmissions (Table 13). Women with these same historical risk factors comprised 30% and 90%, respectively, of women with a prior cesarean delivery in the readmission sample who underwent cesarean section delivery without trial of labor (Table 14). Women with a history of prior low transverse cesarean delivery comprised 37% (11 of 30) of women who underwent cesarean without trial of labor for the current delivery (Table 14). Women with a history of preterm delivery comprised 9% of all-cause readmissions (Table 13) and 23% of cesarean deliveries without a trial of labor (Table 14).

Profile of Historical or Presenting Behavioral Health Risk Factors

Among all-cause readmissions, considering the historical behavioral risk factors and those presenting at the delivery stay, current tobacco use was the most prevalent (44%), followed by past tobacco use (12%) and anxiety (12%), current depression (11%), depression history (10%), past drug use (10%), and current or unspecified period of drug use (10%; Table 15). Health plan care management identified 1 of the 8 hospital-identified cases of postpartum depression, 2 of the 30 hospital-identified current substance abuse cases, and 8 of the 91 hospital-identified current smokers (Table 15, Table 16). Among diagnosis-specific readmissions, tobacco use prevalence comprised the highest percentage of women readmitted with behavioral health diagnoses (70%), followed by women readmitted with anemia (55%), major infection (46%), cesarean section wound problems (45%) and gallbladder problems (43%; Table 15).

Clinical Guideline-Related Measures

Among women with a cesarean delivery who were readmitted within 30 days of delivery discharge (n = 114), 74 (65%) received antibiotics within 60 minutes prior to cesarean section; 11 (10%) received antibiotics, but not within 60 minutes; 22 (19%) received antibiotics with timing not documented; and 7 (6%) did not receive antibiotics (Figure 14, Table 17). Among women with premature rupture of membranes (PROM), who were readmitted within 30 days of delivery discharge and who are either known or unknown GBS carriers (n = 10), 5 (50%) received antibiotics within 4 hours of delivery; 1 (10%) received antibiotics, but not within 4 hours of delivery; and 4 (40%) did not receive intrapartum antibiotics (Figure 14, Table 17). The greatest proportion of women with a postpartum readmission and sufficient data to calculate both body mass index and weight gain was comprised of those who were obese and with a weight gain that exceeded the Institute of Medicine (IOM) recommendation (n = 38 of 141; 27%), followed by those who were overweight and also exceeded the IOM recommendation (n = 20; 14%; Figure 15; Table 18).

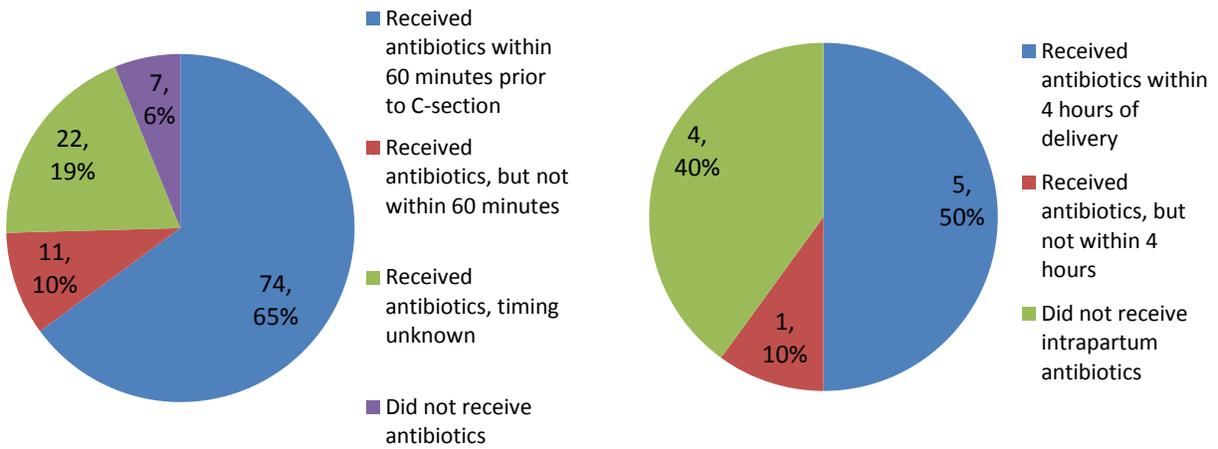


Figure 14. ACOG Performance Measures – Administration of Antibiotics. The frequency of administration of antibiotics for women admitted within 30 days of delivery discharge and who had a C-section delivery (left panel; n = 114) and those who had premature rupture of membranes who were either known or unknown Group B Streptococcus carriers (right panel; n = 10 who received intrapartum GBS antibiotics).

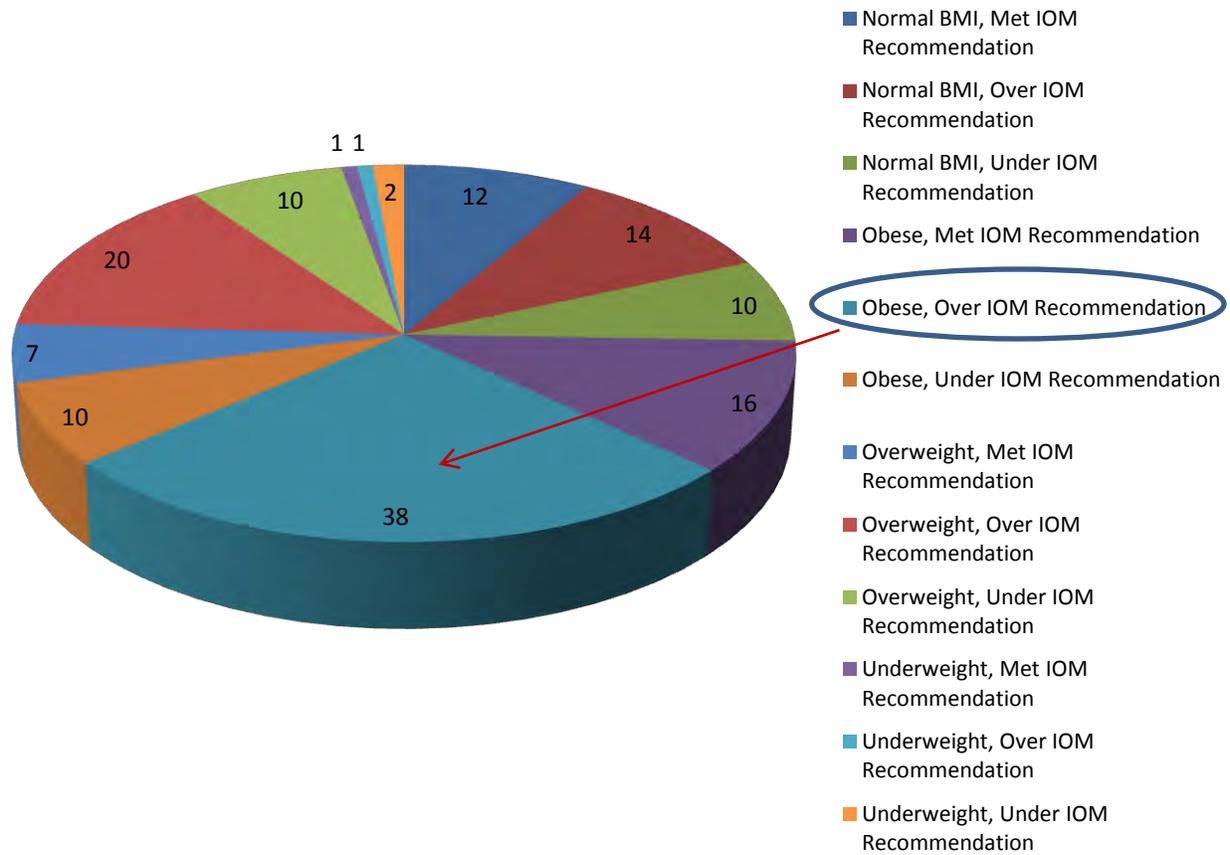


Figure 15. Baseline BMI Group and Weight Gain/Loss Status per IOM Recommendations. The frequency of baseline BMI group and weight gain/loss status by IOM recommendations. A total of 141 observations with data were needed to calculate BMI and weight gain/loss.

Table 5. Obstetric Characteristics of Readmitted Women by Readmission Diagnoses

	All-Cause Readmissions ^a (n = 208)	Readmitted With Hypertension ^b (n = 49)	Readmitted With Major Infection ^c (n = 26)	Readmitted With Gallbladder Problems ^d (n = 23)	Readmitted With C-Section Wound Problems ^e (n = 22)	Readmitted With Anemia (n = 20)	Readmitted With UTI (n = 18)
Prenatal Care:^f							
Yes	191 (92%)	46 (94%)	24 (92%)	22 (96%)	21 (95%)	17 (85%)	16 (89%)
No	7 (3%)	0	0	0	0	0	0
Unable to determine	10 (5%)	3 (6%)	2 (8%)	1 (4%)	1 (5%)	3 (15%)	2 (11%)
Parity:^g							
Nullipara	81 (39%)	19 (40%)	7 (27%)	13 (57%)	11 (50%)	7 (35%)	12 (67%)
1	54 (26%)	11 (23%)	9 (35%)	6 (26%)	6 (27%)	4 (20%)	4 (22%)
2	47 (23%)	14 (29%)	7 (27%)	3 (13%)	2 (9%)	5 (25%)	1 (6%)
3+	25 (12%)	4 (8%)	3 (12%)	1 (4%)	3 (14%)	4 (20%)	1 (6%)
Term Status:							
Early pre-term	16 (8%)	0	2 (8%)	1 (4%)	1 (5%)	3 (15%)	2 (11%)
Late pre-term	17 (8%)	7 (14%)	2 (8%)	2 (9%)	2 (9%)	1 (5%)	1 (6%)
Early term	64 (31%)	14 (29%)	7 (27%)	8 (35%)	6 (27%)	4 (20%)	4 (22%)
Late term	86 (41%)	23 (47%)	11 (42%)	8 (35%)	11 (50%)	10 (50%)	7 (39%)
Full/Post-term	26 (12%)	5 (10%)	4 (15%)	4 (17%)	2 (9%)	2 (10%)	4 (22%)
Singleton:^f							
Yes	203 (98%)	49 (100%)	26 (100%)	20 (87%)	22 (100%)	19 (95%)	18 (100%)
No	5 (2%)	0	0	3 (13%)	0	1 (5%)	0
Planned/Scheduled Delivery:^f							
Yes	70 (34%)	16 (33%)	11 (42%)	9 (39%)	8 (36%)	9 (45%)	9 (50%)
No	129 (62%)	30 (61%)	15 (58%)	14 (61%)	13 (59%)	11 (55%)	9 (50%)
Unable to determine	9 (4%)	3 (6%)	0	0	1 (5%)	0	0
Labor Induced:^f							
Yes	78 (38%)	22 (45%)	11 (42%)	10 (43%)	8 (36%)	12 (60%)	10 (56%)
No	130 (63%)	27 (55%)	15 (58%)	13 (57%)	14 (64%)	8 (40%)	8 (44%)

	All-Cause Readmissions ^a (n = 208)	Readmitted With Hypertension ^b (n = 49)	Readmitted With Major Infection ^c (n = 26)	Readmitted With Gallbladder Problems ^d (n = 23)	Readmitted With C-Section Wound Problems ^e (n = 22)	Readmitted With Anemia (n = 20)	Readmitted With UTI (n = 18)
Type of Delivery + Trial of Labor (TOL) Status:^f							
C-section, no prior C-section	66 (32%)	19 (39%)	11 (42%)	7 (30%)	15 (68%)	10 (53%)	8 (44%)
C-section, prior C-section, No TOL	30 (15%)	10 (20%)	5 (19%)	1 (4%)	4 (18%)	3 (16%)	1 (6%)
C-section, prior C-section, TOL	7 (3%)	2 (4%)	1 (4%)	-	2 (9%)	0	0
C-section, prior C-section, UTD	9 (4%)	1 (2%)	3 (12%)	1 (4%)	1 (5%)	0	0
Non-operative vaginal delivery	85 (41%)	17 (35%)	4 (15%)	13 (57%)	0	4 (21%)	6 (33%)
Operative vaginal delivery	8 (4%)	0	2 (8%)	1 (4%)	0	2 (11%)	3 (17%)
Episiotomy:^g							
None	189 (91%)	48 (98%)	25 (96%)	21 (91%)	22 (100%)	17 (85%)	16 (89%)
Yes – Median	11 (5%)	0	0	1 (4%)	0	2 (10%)	1 (6%)
Yes – Mediolateral	2 (1%)	0	0	0	0	0	0
Yes – Unspecified	6 (3%)	1 (2%)	1 (4%)	1 (4%)	0	1 (5%)	1 (6%)
Transfusion:^g							
Yes	8 (4%)	2 (4%)	0	0	1 (5%)	1 (5%)	1 (6%)
No	200 (96%)	47 (96%)	26 (100%)	23 (100%)	21 (95%)	19 (95%)	17 (94%)
Hysterectomy:^g							
Yes	4 (2%)	0	0	0	0	2 (10%)	0
No	204 (98%)	49 (100%)	26 (100%)	23 (100%)	22 (100%)	18 (90%)	18 (100%)

^a Members may fall into one or more diagnostic categories which represent any readmission diagnosis and may or may not be the principal diagnosis.

^b Hypertension diagnoses include pre-existing hypertension, gestational hypertension, preeclampsia and eclampsia.

^c Major infection diagnoses include major puerperal infection and methicillin –resistant staphylococcus aureus (MRSA).

^d Gallbladder problems include gallbladder problems such as cholelithiasis (gallstones) or bile duct disease.

^e Cesarean wound problems include infection, hematoma, hemorrhage and other.

^f Four observations in total sample were excluded due to missing data for delivery type or trial of labor status.

^g Two observations in total sample were excluded due to missing data.

Table 6. Specific Readmission Diagnoses by Condition

Condition	Readmission Diagnoses ^a
Hypertension:	
Pre-existing hypertension	12 (6%)
Gestational hypertension	17 (8%)
Preeclampsia	26 (12%)
Eclampsia	6 (3%)
Cesarean section wound problems:	
Infection	19 (9%)
Hemorrhage	2 (1%)
Hematoma	3 (1%)
Other	5 (2%)
Major puerperal infection, not MRSA	21 (10%)
MRSA infection	5 (2%)
Gallbladder disease	23 (11%)
Postpartum hemorrhage	5 (2%)
Anemia	20 (10%)
Urinary Tract Infection (UTI)	18 (9%)
Behavioral Health:	
Depression	8 (4%)
Bipolar disorder	3 (1%)
Drug use disorder	2 (1%)
Cardiovascular disorders	9 (4%)
Renal disease	8 (4%)
Cerebrovascular disorders	1 (0.5%)
Other wound problems:	
Infection	4 (2%)
Hemorrhage	0
Hematoma	2 (1%)
Other wound complications	3 (1%)
Cellulitis	9 (4%)
Inflammation uterus	3 (1%)
Mastitis	4 (2%)
Diabetes	1 (1%)

^a The frequency (%) of readmission diagnoses (n = 209). One person may have multiple diagnoses.

Table 7. Combined Historical Obstetric Risk Factor, Comorbidity, and Complication Status by Delivery Type

n = 205*	C-Section Delivery Without Prior C-Section # (Col. %)	C-Section Delivery, With Prior C-Section, No – Trial of Labor # (Col. %)	C-Section Delivery, With Prior C-Section, Yes – Trial of Labor # (Col. %)	C-Section Delivery, With Prior C-Section, Unknown – Trial of Labor # (Col. %)	Vaginal Delivery, Non-Operative # (Col. %)	Vaginal Delivery, Operative # (Col. %)
Negative findings for all 3: historical obstetric risk factor, and comorbidity, and obstetric complications (n = 12)	1 (2%)	0	0	0	11 (13%)	0
Positive findings for at least 1: historical obstetric risk factor, or comorbidity, or obstetric complications (n = 193)	65 (98%)	30 (100%)	7 (100%)	9 (100%)	74 (87%)	8 (100%)
Total:	66 (32%)	30 (15%)	7 (3%)	9 (4%)	85 (41%)	8 (4%)

* Women with a readmission within 30 days of post-delivery discharge (n = 205). Four observations were missing data for delivery type or trial of labor status.

Table 8. Planned/Scheduled Induction and/or C-Section Delivery Status by Term Status

	Early Pre-Term: < 34 Weeks Gestation at Delivery* # (Row %) (Col %)	Late Pre-Term: 34–36 Weeks Gestation at Delivery* # (Row %) (Col %)	Early Term: 37–38 Weeks Gestation at Delivery* # (Row %) (Col %)	Late Term: 39 Weeks Gestation at Delivery* # (Row %) (Col %)	Full/Post-Term: 40 + Weeks Gestation at Delivery* # (Row %) (Col %)
Planned/scheduled C-section without induction (n = 30)	3 (10%) (19%)	1 (3%) (6%)	11 ^a (37%) (17%)	14 ^b (47%) (16%)	1 (3%) (4%)
Planned/scheduled Induction without C-section (n = 18)	0	0	3 (17%) (5%)	14 (78%) (16%)	1 (6%) (4%)
Planned/scheduled Induction with C-section (n = 3)	0	0	4 (19%) (6%)	14 (67%) (16%)	3 (14%) (12%)
All else (n = 140)	13 (9%) (81%)	16 (11%) (94%)	46 (33%) (72%)	44 (31%) (51%)	21 (15%) (81%)
Total:	16 (8%)	17 (8%)	64 (31%)	86 (41%)	26 (12%)

* Women with a readmission within 30 days of delivery discharge (n = 209).

^a Seven of 11 were not a candidate for trial of labor after previous cesarean section, per study proxy variable, i.e., previous low-transverse cesarean section without the following historical obstetric risk factors (prior pregnancy): uterine rupture, preeclampsia, eclampsia, uterine surgery, placenta previa.

^b Twelve of 14 were not a candidate for trial of labor after previous cesarean section, per study proxy variable, i.e., previous low-transverse cesarean section without the following historical obstetric risk factors (prior pregnancy): uterine rupture, preeclampsia, eclampsia, uterine surgery, placenta previa.

Table 9. Medical Comorbidities at Time of Delivery Stay by Cause

	All-Cause Readmissions ^a (n = 209)	Readmitted With Hypertension (n = 49 ^b)	Readmitted With Major Infection (n = 26 ^c)	Readmitted With Gallbladder Problems (n = 23 ^d)	Readmitted With Cesarean Wound Problems (n = 22 ^e)	Readmitted With Anemia (n = 20)	Readmitted With UTI (n = 18)
Obesity	52 (25%)	21 (43%)	10 (38%)	5 (22%)	10 (45%)	4 (20%)	4 (22%)
Other STD	26 (12%)	8 (16%)	4 (15%)	1 (4%)	1 (5%)	5 (25%)	2 (11%)
Chronic Hypertension	23 (11%)	12 (25%)	2 (8%)	4 (17%)	1 (5%)	1 (5%)	1 (6%)
Pulmonary Disease	17 (8%)	4 (8%)	0	4 (17%)	1 (5%)	2 (10%)	0
UTI	15 (7%)	2 (4%)	3 (12%)	3 (13%)	0	2 (10%)	2 (11%)
Heart Disease	9 (4%)	3 (6%)	2 (8%)	1 (4%)	0	1 (5%)	0
Renal Disease	7 (3%)	2 (4%)	2 (8%)	0	1 (5%)	1 (5%)	1 (6%)
Diabetes	5 (2%)	0	1 (4%)	0	0	1 (5%)	0
Seizure Disorder	5 (2%)	0	0	2 (9%)	0	2 (10%)	0
Clotting Disorder	4 (2%)	0	1 (4%)	0	0	0	1 (6%)
Vascular Disease	2 (1%)	0	0	0	0	0	0
Herpes	2 (1%)	1 (2%)	0	0	0	0	0
Liver Disease	1 (0.5%)	0	0	0	0	0	1 (6%)
Bleeding Disorder	1 (0.5%)	0	0	0	0	0	0
HIV	1 (0.5%)	0	0	0	0	0	0
None of the above comorbidities	47 (22%)	8 (16%)	1 (4%)	5 (22%)	2 (9%)	2 (10%)	3 (17%)
No comorbidities noted at all	46 (22%)	8 (16%)	1 (4%)	5 (22%)	2 (9%)	2 (10%)	3 (17%)
No risk factors, complications or comorbidities	13 (6%)	1 (2%)	0	2 (9%)	0	0	0

^a One person may have more than one comorbid condition and more than one cause-specific readmission diagnosis.

^b Hypertension readmission diagnoses include pre-existing hypertension, gestational hypertension, preeclampsia and eclampsia.

^c Major infection readmission diagnoses include major puerperal infection and methicillin –resistant staphylococcus aureus (MRSA).

^d Gallbladder problems readmission diagnoses include gallbladder problems such as cholelithiasis (gallstones) or bile duct disease.

^e Cesarean wound problems readmission diagnoses include infection, hematoma, hemorrhage and other.

Table 10. Presenting or Pre-existing Maternal Medical Comorbidities at Delivery Stay by Delivery Type

n = 205 ^{a,b}	C-Section Delivery Without Prior C-Section # (Col. %) (n = 66)	C-Section Delivery, With Prior C-Section, No – Trial of Labor # (Col. %) (n = 30)	C-Section Delivery, With Prior C-section, Yes – Trial of Labor # (Col. %) (n = 7)	C-Section Delivery, With Prior C-Section, Unknown – Trial of Labor # (Col. %) (n = 9)	Vaginal Delivery, Non-Operative # (Col. %) (n = 85)	Vaginal Delivery, Operative # (Col. %) (n = 8)
Obesity	21 (32%)	7 (23%)	4 (57%)	2 (22%)	17 (20%)	0
Other STD	9 (14%)	5 (17%)	1 (14%)	1 (11%)	8 (9%)	0
Chronic Hypertension	7 (11%)	4 (13%)	0	0	11 (13%)	0
Pulmonary Disease	6 (9%)	2 (7%)	0	1 (11%)	7 (8%)	0
UTI	3 (5%)	3 (10%)	0	1 (11%)	7 (8%)	1 (13%)
Heart Disease	3 (5%)	2 (7%)	0	2 (22%)	2 (2%)	0
Renal Disease	2 (3%)	2 (7%)	0	0	3 (4%)	0
Diabetes	0	3 (10%)	0	0	2 (2%)	0
Seizure Disorder	3 (5%)	0	0	0	2 (2%)	0
Clotting Disorder	1 (2%)	1 (3%)	0	0	1 (1%)	1 (13%)
Vascular Disease	1 (2%)	0	0	0	0	1 (13%)
Herpes	2 (3%)	0	0	0	0	0
Liver Disease	1 (2%)	0	0	0	0	0
Bleeding Disorder	0	0	0	0	1 (1%)	0
HIV	1 (2%)	0	0	0	0	0
None of the above comorbidities ^d	9 (14%)	2 (7%)	2 (29%)	3 (33%)	28 (33%)	2 (25%)
No comorbidities noted at all ^e	9 (14%)	2 (7%)	2 (29%)	3 (33%)	27 (32%)	2 (25%)

^a One person may have more than one comorbid condition.

^b Women readmitted within 30 days of delivery discharge, with 4 observations missing data for delivery type or trial of labor status.

^c No observations with TOL following failed forceps or vacuum delivery.

^d Also excludes the following comorbidities: antiphospholipid syndrome, Tuberculosis (TB), cytomegalovirus (CMV).

^e No “other” comorbid conditions documented per chart review.

Table 11. Obstetrical Complications During Current Pregnancy and/or Labor/Delivery by Cause

	All-Cause Readmissions (n = 209 ^a)	Readmitted With Hypertension (n = 49 ^b)	Readmitted With Major Infection (n = 26 ^c)	Readmitted With Gallbladder Problems (n = 23 ^d)	Readmitted With Cesarean Wound Problems (n = 22 ^e)	Readmitted With Anemia (n = 20)	Readmitted With UTI (n = 18)
Blood Pressure \geq 140/90	50 (24%)	25 (51%)	10 (38%)	3 (13%)	4 (18%)	7 (35%)	5 (28%)
Non-reassuring Fetal Status	30 (14%)	6 (12%)	7 (27%)	0	4 (18%)	5 (25%)	3 (17%)
Failure to Progress	27 (13%)	7 (14%)	3 (12%)	1 (4%)	5 (23%)	2 (10%)	1 (6%)
Gestational Hypertension	24 (12%)	17 (35%)	2 (8%)	2 (9%)	1 (5%)	3 (15%)	2 (11%)
Preeclampsia	15 (7%)	10 (20%)	4 (15%)	2 (9%)	0	2 (10%)	2 (11%)
Premature Rupture of Membranes (PROM)	14 (7%)	2 (4%)	1 (4%)	1 (4%)	1 (5%)	2 (10%)	1 (6%)
Fetal Growth Restriction	13 (6%)	1 (2%)	6 (23%)	2 (9%)	0	2 (10%)	1 (6%)
Gestational Diabetes	11 (5%)	1 (2%)	4 (15%)	3 (13%)	2 (9%)	0	1 (6%)
Cephalopelvic Disproportion	10 (5%)	2 (4%)	1 (4%)	1 (4%)	5 (23%)	1 (5%)	0
Oligohydramnios	10 (5%)	2 (4%)	3 (12%)	0	1 (5%)	3 (15%)	0
UTI	8 (4%)	1 (2%)	1 (4%)	3 (13%)	1 (5%)	1 (5%)	1 (6%)
Hemorrhage	7 (3%)	2 (4%)	1 (4%)	1 (4%)	1 (5%)	3 (15%)	1 (6%)
Sexually Transmitted Disease (STD)	6 (3%)	3 (6%)	1 (4%)	0	0	1 (5%)	1 (6%)
Chorioamnionitis	5 (2%)	1 (2%)	0	0	0	0	1 (6%)
Polyhydramnios	5 (2%)	1 (2%)	2 (8%)	1 (4%)	0	1 (5%)	0
Macrosomia	4 (2%)	0	2 (8%)	0	2 (9%)	0	0
Placental Abruption	4 (2%)	0	2 (8%)	0	1 (5%)	0	1 (6%)
3 rd or 4 th Degree Laceration	4 (2%)	0	2 (8%)	0	0	2 (10%)	1 (6%)
Deep Vein Thrombosis (DVT)	3 (1%)	0	0	0	0	0	0
Cord Prolapse	2 (1%)	0	0	1 (4%)	0	1 (5%)	1 (6%)
Hemolysis, Elevated Liver Enzymes, Low Platelet Count (HELLP)	2 (1%)	1 (2%)	0	0	0	0	0
Shoulder Dystocia	2 (1%)	0	0	0	0	0	0
Cervical Insufficiency	2 (1%)	0	1 (4%)	0	0	0	0

	All-Cause Readmissions (n = 209 ^a)	Readmitted With Hypertension (n = 49 ^b)	Readmitted With Major Infection (n = 26 ^c)	Readmitted With Gallbladder Problems (n = 23 ^d)	Readmitted With Cesarean Wound Problems (n = 22 ^e)	Readmitted With Anemia (n = 20)	Readmitted With UTI (n = 18)
Placenta Previa	2 (1%)	0	0	0	0	0	0
Fetal Congenital Malformation	1 (0.5%)	0	1 (4%)	0	0	0	0
Herpes	1 (0.5%)	0	0	0	0	0	0
Post Dates (\geq 41 weeks gestation)	1 (0.5%)	0	0	0	0	0	0
Cholestasis	1 (0.5%)	0	0	1 (4%)	0	0	0
None of the above complications ^f	75 (36%)	9 (18%)	4 (15%)	9 (39%)	7 (32%)	4 (20%)	4 (22%)
No complications noted at all ^g	46 (22%)	8 (16%)	3 (12%)	5 (22%)	5 (23%)	0	1 (6%)
No risk factors, complications or comorbidities	13 (6%)	1 (2%)	0	2 (9%)	0	0	0

^a One person may have more than one complication and more than one cause-specific readmission diagnosis.

^b Hypertension readmission diagnoses include pre-existing hypertension, gestational hypertension, preeclampsia and eclampsia.

^c Major infection readmission diagnoses include major puerperal infection and methicillin –resistant staphylococcus aureus (MRSA).

^d Gallbladder problems readmission diagnoses include gallbladder problems such as cholelithiasis (gallstones) or bile duct disease.

^e Cesarean wound problems readmission diagnoses include infection, hematoma, hemorrhage and other.

^f Also excludes the following complications: eclampsia, placenta accreta, alloimmunization, cytomegalovirus (CMV), atony, infection.

^g No “other” complications documented per chart review.

Table 12. Obstetrical Complications During Current Pregnancy and/or Labor/Delivery by Delivery Type

n = 205 ^{a,b}	C-Section Delivery Without Prior C-Section # (Col. %) (n = 66)	C-Section Delivery, With Prior C-Section, No-Trial of Labor # (Col. %) (n = 30)	C-Section Delivery, With Prior C-Section, Yes-Trial of Labor # (Col. %) (n = 7)	C-Section Delivery, With Prior C-Section, Unknown-Trial of Labor # (Col. %) (n = 9)	Vaginal Delivery, Non-Operative # (Col. %) (n = 85)	Vaginal Delivery, Operative # (Col. %) (n = 8)
Blood Pressure \geq 140/90	19 (29%)	9 (30%)	2 (29%)	2 (22%)	16 (19%)	2 (25%)
Non-reassuring Fetal Status	21 (32%)	4 (13%)	0	1 (11%)	3 (4%)	0
Failure to Progress	25 (38%)	0	1 (14%)	0	1 (1%)	0
Gestational Hypertension	12 (18%)	2 (7%)	0	1 (11%)	9 (11%)	0
Preeclampsia	11 (17%)	2 (7%)	1 (14%)	0	1 (1%)	0
Premature Rupture of Membranes (PROM)	2 (3%)	5 (17%)	0	0	5 (6%)	0
Fetal Growth Restriction	7 (11%)	2 (7%)	0	0	4 (5%)	0
Gestational Diabetes	6 (9%)	1 (3%)	0	0	4 (5%)	0
Cephalopelvic Disproportion	10 (15%)	0	0	0	0	0
Oligohydramnios	5 (8%)	2 (7%)	0	0	3 (4%)	0
UTI	2 (3%)	1 (3%)	0	2 (22%)	3 (4%)	0
Hemorrhage	2 (3%)	1 (3%)	0	0	3 (4%)	0
Sexually Transmitted Disease (STD)	3 (5%)	1 (3%)	0	0	2 (2%)	0
Chorioamnionitis	1 (2%)	0	0	0	4 (5%)	0
Polyhydramnios	2 (3%)	0	0	2 (22%)	1 (1%)	0
Macrosomia	2 (3%)	0	0	0	2 (2%)	0
Placental Abruption	3 (5%)	0	0	0	1 (1%)	0
3 rd or 4 th Degree Laceration	0	0	0	0	2 (2%)	2 (25%)
Deep Vein Thrombosis	2 (3%)	0	0	0	1 (1%)	0
Cord Prolapse	1 (2%)	0	0	0	1 (1%)	0
Hemolysis, Elevated Liver Enzymes, Low Platelet Count (HELLP)	2 (3%)	0	0	0	0	0

n = 205^{a,b}	C-Section Delivery Without Prior C-Section # (Col. %) (n = 66)	C-Section Delivery, With Prior C-Section, No-Trial of Labor # (Col. %) (n = 30)	C-Section Delivery, With Prior C-Section, Yes-Trial of Labor # (Col. %) (n = 7)	C-Section Delivery, With Prior C-Section, Unknown-Trial of Labor # (Col. %) (n = 9)	Vaginal Delivery, Non-Operative # (Col. %) (n = 85)	Vaginal Delivery, Operative # (Col. %) (n = 8)
Shoulder Dystocia	0	0	0	0	2 (2%)	0
Cervical Insufficiency	1 (2%)	1 (3%)	0	0	0	0
Placenta Previa	1 (2%)	0	0	0	1 (1%)	0
Fetal Congenital Malformation	0	1 (3%)	0	0	0	0
Herpes	1 (2%)	0	0	0	0	0
Post-dates (\geq 41 weeks gestation)	1 (2%)	0	0	0	0	0
Cholestasis	0	1 (3%)	0	0	0	0
None of the above complications ^d	9 (14%)	10 (33%)	4 (57%)	4 (44%)	42 (49%)	4 (50%)
No complications noted at all ^e	2 (3%)	8 (27%)	3 (43%)	4 (44%)	26 (31%)	1 (13%)

^a One person may have more than one complication.

^b Four observations were missing data for delivery type or trial of labor status.

^c No observations with TOL following failed forceps or vacuum delivery.

^d Also excludes the following complications: eclampsia, placenta accreta, alloimmunization, cytomegalovirus (CMV), atony, infection.

^e No "other" complications documented per chart review.

Table 13. Historical Obstetric Risk Factors from Past Pregnancies by Cause

	All-Cause Readmissions (n = 209 ^a)	Readmitted With Hypertension (n = 49 ^b)	Readmitted With Major Infection (n = 26 ^c)	Readmitted With Gallbladder Problems (n = 23 ^d)	Readmitted With Cesarean Wound Problems (n = 22 ^e)	Readmitted With Anemia (n = 20)	Readmitted With UTI (n = 18)
Fetal Demise, Unspecified	32 (15%)	6 (12%)	1 (4%)	4 (17%)	1 (5%)	0	2 (11%)
C-Section, Type Unknown	27 (13%)	7 (14%)	6 (23%)	1 (4%)	2 (9%)	2 (10%)	0
Preterm Delivery	19 (9%)	2 (4%)	3 (12%)	4 (17%)	2 (9%)	2 (10%)	1 (6%)
C-section, low transverse	18 (9%)	5 (10%)	1 (4%)	2 (9%)	4 (18%)	2 (10%)	1 (6%)
Fetal Demise, < 20 wks	13 (6%)	2 (4%)	0	4 (17%)	2 (9%)	1 (5%)	1 (6%)
Gestational Hypertension	10 (5%)	8 (16%)	2 (8%)	0	0	1 (5%)	0
Gestational Diabetes	6 (3%)	0	2 (8%)	1 (4%)	0	1 (5%)	1 (6%)
Low Birth Weight	3 (1%)	0	0	1 (4%)	0	0	0
Preeclampsia	2 (1%)	0	0	0	0	1 (5%)	0
C-Section, Classical	1 (0.5%)	1 (2%)	0	0	0	0	0
Fast Labor (< 3 hrs)	1 (0.5%)	0	0	0	0	0	0
Fetal Demise, ≥ 20 wks	1 (0.5%)	0	0	0	1 (5%)	0	0
None of the above historical obstetric risk factors ^f	115 (55%)	26 (53%)	13 (50%)	12 (52%)	14 (64%)	10 (50%)	14 (78%)
No historical obstetric risk factors noted at all ^g	94 (45%)	19 (39%)	10 (38%)	12 (52%)	10 (45%)	9 (45%)	12 (67%)
No risk factors, complications, or comorbidities	13 (6%)	1 (2%)	0	2 (9%)	0	0	0

^a Women with a readmission within 30 days of delivery discharge. One person may have more than one risk factor and more than one cause-specific readmission diagnosis.

^b Hypertension readmission diagnoses include pre-existing hypertension, gestational hypertension, preeclampsia and eclampsia.

^c Major infection readmission diagnoses include major puerperal infection and methicillin –resistant staphylococcus aureus (MRSA).

^d Gallbladder problems readmission diagnoses include gallbladder problems such as cholelithiasis (gallstones) or bile duct disease.

^e Cesarean wound problems readmission diagnoses include infection, hematoma, hemorrhage and other.

^f Also excludes the following historical obstetric risk factors: poor pregnancy outcome, assisted reproductive therapy, fertility treatment, and placental problems.

^g No “other” complications documented per chart review.

Table 14. Historical Maternal Obstetric Risk Factors Documented During Delivery Stay by Delivery Type

n = 205 ^{a,b}	C-Section Delivery Without Prior C-Section # (Col. %) (n = 66)	C-Section Delivery, With Prior C-Section, No– Trial of Labor # (Col. %) (n = 30)	C-Section Delivery, With Prior C-Section, Yes– Trial of Labor # (Col. %) (n = 7)	C-Section Delivery, With Prior C-Section, Unknown– Trial of Labor # (Col. %) (n = 9)	Vaginal Delivery, Non-Operative # (Col. %) (n = 85)	Vaginal Delivery, Operative # (Col. %) (n = 8)
Fetal Demise, Unspecified	6 (9%)	9 (30%)	0	3 (33%)	12 (14%)	2 (25%)
C-Section, Type Unknown	0	15 (50%)	3 (43%)	8 (89%)	0	0
Preterm Delivery	3 (5%)	7 (23%)	0	1 (11%)	7 (8%)	0
C-Section, Low Transverse	1 (2%)	11 (37%)	4 (57%)	1 (11%)	1 (1%)	0
Fetal Demise, < 20 wks	5 (8%)	1 (3%)	0	1 (11%)	6 (7%)	0
Gestational Hypertension	2 (3%)	3 (10%)	0	1 (11%)	4 (5%)	0
Gestational Diabetes	0	1 (3%)	0	0	4 (5%)	1 (13%)
Low Birth Weight	0	0	0	1 (11%)	2 (2%)	0
Preeclampsia	0	0	0	0	2 (2%)	0
C-Section, Classical	0	1 (3%)	0	0	0	0
Fast Labor (< 3 hrs)	0	0	0	0	1 (1%)	0
Fetal Demise, ≥ 20 wks	0	1 (3%)	0	0	0	0
None of the above historical obstetric risk factors ^d	52 (79%)	1 (3%)	0	0	55 (65%)	5 (63%)
No historical obstetric risk factors noted at all ^e	43 (65%)	0	0	0	45 (53%)	4 (50%)

^a One person may have more than one historical obstetric risk factor.

^b Women with a readmission within 30 days of delivery discharge; four observations with missing data for delivery type or trial of labor status.

^c No observations with TOL following failed forceps or vacuum delivery.

^d Also excludes the following historical obstetric risk factors: poor pregnancy outcome, assisted reproductive therapy, fertility treatment, and placental problems.

^e No “other” historical obstetric risk factors documented per chart review.

Table 15. Presenting or Historical Behavioral Health Risk Factors by Cause of Readmission

	All-Cause Readmissions (n = 209 ^a)	Readmitted With Hypertension (n = 49 ^b)	Readmitted With Major Infection (n = 26 ^c)	Readmitted With Gallbladder Problems (n = 23 ^d)	Readmitted With Cesarean Wound Problems (n = 22 ^e)	Readmitted With Anemia (n = 20)	Readmitted With UTI (n = 18)	Readmitted With Behavioral Health Diagnoses ^f (n = 10)
Anxiety	26 (12%)	7 (14%)	6 (23%)	1 (4%)	2 (9%)	3 (15%)	4 (22%)	3 (30%)
Depression, Current	22 (11%)	6 (12%)	5 (19%)	0	3 (14%)	3 (15%)	3 (17%)	3 (30%)
Depression, History	21 (10%)	4 (8%)	2 (8%)	3 (13%)	1 (5%)	2 (10%)	2 (11%)	3 (30%)
Postpartum Depression	8 (4%)	3 (6%)	2 (8%)	0	0	0	0	1 (10%)
Bipolar Disorder	10 (5%)	2 (4%)	1 (4%)	0	0	1 (5%)	1 (6%)	4 (40%)
Schizophrenia	3 (1%)	0	0	0	0	0	0	2 (20%)
Other Psychiatric Illness	6 (3%)	0	1 (4%)	1 (4%)	0	2 (10%)	1 (6%)	2 (20%)
Tobacco Use, Past	26 (12%)	14 (29%)	2 (8%)	3 (13%)	0	2 (10%)	0	2 (20%)
Tobacco Use, Current, or Unspecified	91 (44%)	14 (29%)	12 (46%)	10 (43%)	10 (45%)	11 (55%)	6 (33%)	7 (70%)
Alcohol Use Past	6 (3%)	1 (2%)	2 (8%)	0	1 (5%)	1 (5%)	1 (6%)	0
Alcohol Use Current, or Unspecified	9 (4%)	1 (2%)	1 (4%)	0	0	0	1 (6%)	2 (20%)
Drug Use, Past	21 (10%)	3 (6%)	5 (19%)	0	2 (9%)	1 (5%)	0	1 (10%)
Drug Use Current, or	21 (10%)	1 (2%)	2 (8%)	1 (4%)	1 (5%)	1 (5%)	2 (11%)	2 (20%)

	All-Cause Readmissions (n = 209 ^a)	Readmitted With Hypertension (n = 49 ^b)	Readmitted With Major Infection (n = 26 ^c)	Readmitted With Gallbladder Problems (n = 23 ^d)	Readmitted With Cesarean Wound Problems (n = 22 ^e)	Readmitted With Anemia (n = 20)	Readmitted With UTI (n = 18)	Readmitted With Behavioral Health Diagnoses ^f (n = 10)
Unspecified								
No Behavioral Health Risk Factors	63 (30%)	16 (33%)	4 (15%)	8 (35%)	9 (41%)	2 (10%)	6 (33%)	0

^a Women with a readmission within 30 days of delivery discharge. One person may have more than one risk factor and more than one cause-specific readmission diagnosis.

^b Hypertension readmission diagnoses include pre-existing hypertension, gestational hypertension, preeclampsia and eclampsia.

^c Major infection readmission diagnoses include major puerperal infection and methicillin –resistant staphylococcus aureus (MRSA).

^d Gallbladder problems readmission diagnoses include gallbladder problems such as cholelithiasis (gallstones) or bile duct disease.

^e Cesarean wound problems readmission diagnoses include infection, hematoma, hemorrhage and other.

^f Includes the following abstracted readmission diagnoses: drug dependence, depression, bipolar disorder.

Table 16. Historical or Presenting Psychosocial Risk Factors Documented in Care Management Notes

Psychosocial Risk Factor	Number (Percentage)*
Postpartum Depression, Current	1 (2%)
Postpartum Depression, Past	0
Schizophrenia	0
Bipolar disorder	0
Other Psychiatric Illness	5 (12%)
Developmental or Cognitive Impairment	0
Chronic Physical Disability	0
Substance Abuse, Current	2 (5%)
Tobacco Use, Current	8 (20%)
Lack of Social Supports, Current	0
Lack of Partner Involvement, Current	2 (5%)
Domestic Violence, Current	0
Homelessness, or Other Housing Instability	1 (2%)
Food Insecurity	2 (5%)

* Women with a readmission within 30 days of delivery discharge with care management notes (n = 41).

Table 17. ACOG Proposed Performance Measures for Antibiotic Administration

ACOG Performance Measure	Numerator	Number (Percentage)
Among women with a cesarean delivery who were readmitted within 30 days of delivery discharge (denominator = 114), the percentage for whom antibiotics were administered within 60 minutes prior to start of cesarean section*	Received antibiotics within 60 minutes prior to cesarean	74 (65%)
	Received antibiotics, but not within 60 minutes	11 (10%)
	Received antibiotics, but timing unknown	22 (19%)
	Subtotal who received antibiotics	107 (94%)
	Did not receive antibiotics	7 (6%)
Among women with PROM who were readmitted within 30 days of delivery discharge and who are either known or unknown GBS carriers (denominator = 10), the percentage who received intrapartum GBS antibiotic prophylaxis**	Received antibiotics within 4 hours of delivery	5 (50%)
	Received antibiotics, but prior to the time period within 4 hours of delivery	1 (10%)
	Subtotal who received antibiotics	6 (60%)
	Did not receive intrapartum antibiotics	4 (40%)

*Does not include 2 observations with missing data for delivery type and 12 observations with missing data for antibiotic administration.

**Does not include 1 observation with missing data for GBS status and 14 observations with missing data for intrapartum GBS antibiotic prophylaxis.

Table 18. Women Meeting IOM Weight Gain Recommendations for Pregnancy

n = 141*	IOM Recommended Weight Gain Met # (Row %) (Col %)	Over IOM Recommended Weight Gain # (Row %) (Col %)	Under IOM Recommended Weight Gain # (Row %) (Col %)
Normal: BMI < 18.5 kg/m ²	12 (33%) (33%)	14 (39%) (19%)	10 (28%) (31%)
Obese: BMI ≥ 30 kg/m ²	16 (25%) (44%)	38 (59%) (52%)	10 (16%) (31%)
Overweight: BMI 25–29.9 kg/m ²	7 (19%) (19%)	20 (54%) (27%)	10 (27%) (31%)
Underweight: BMI < 18.5 kg/m ²	1 (25%) (3%)	1 (25%) (1%)	2 (50%) (6%)

* Based on baseline pregnancy weight category and/or BMI; n = 141 without missing data.

Care Coordination and Transitional Care

The majority of women with postpartum readmissions did not have any record of MCO care management services (Figure 16). CoventryCares of Kentucky had the greatest proportion of women with a postpartum readmission who were not in care management (91%; Figure 16), but among those who were in care management, this MCO had the greatest proportion who were engaged in care management (100%; Figure 17). Among the total subset with a care management record (n = 41), most initial outreach attempts were made during the prenatal period, followed by the post-readmission stay week (Figure 18). Of those successfully contacted, most were contacted during the prenatal period, and a substantial number were contacted after readmission (Figure 19). Of those not successfully contacted, most had fewer than 3 outreach attempts (Figure 19). Among members successfully contacted, most were engaged when contacted during the prenatal period. (Figure 20).

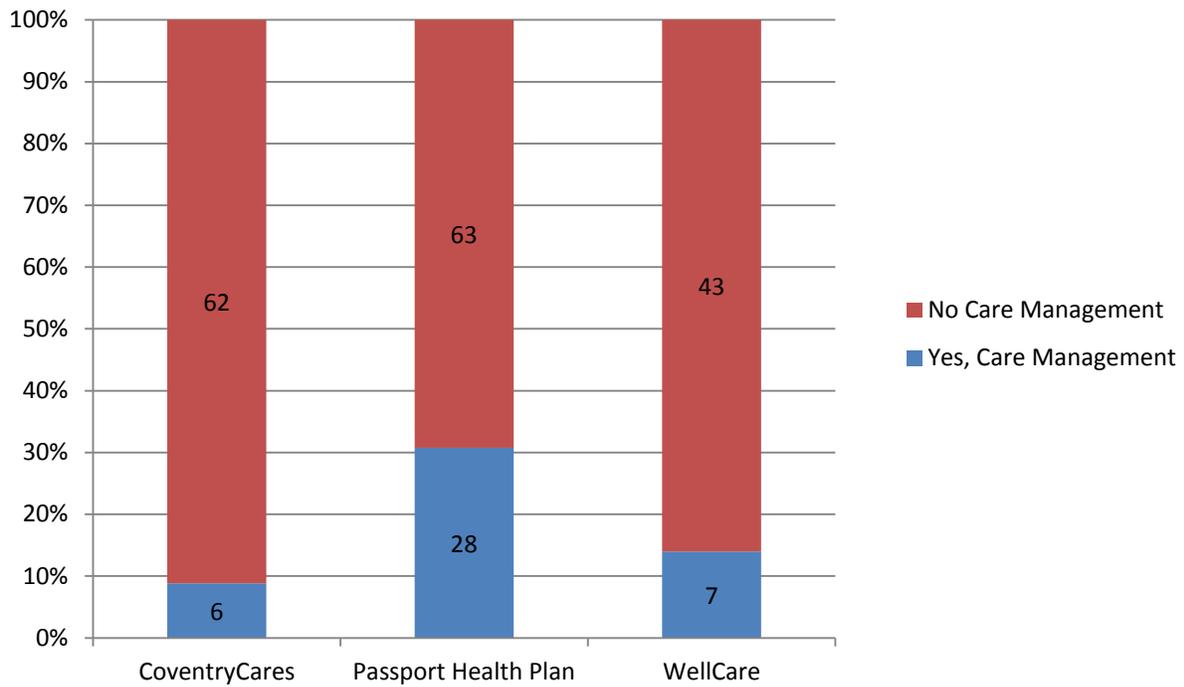


Figure 16. Care Management by MCO. Care management by MCO for women readmitted within 30 days after delivery discharge (n = 209). Two observations (1 Passport Health Plan, and 1 WellCare of Kentucky enrollee) with missing values were assigned to the “No Care Management” category.

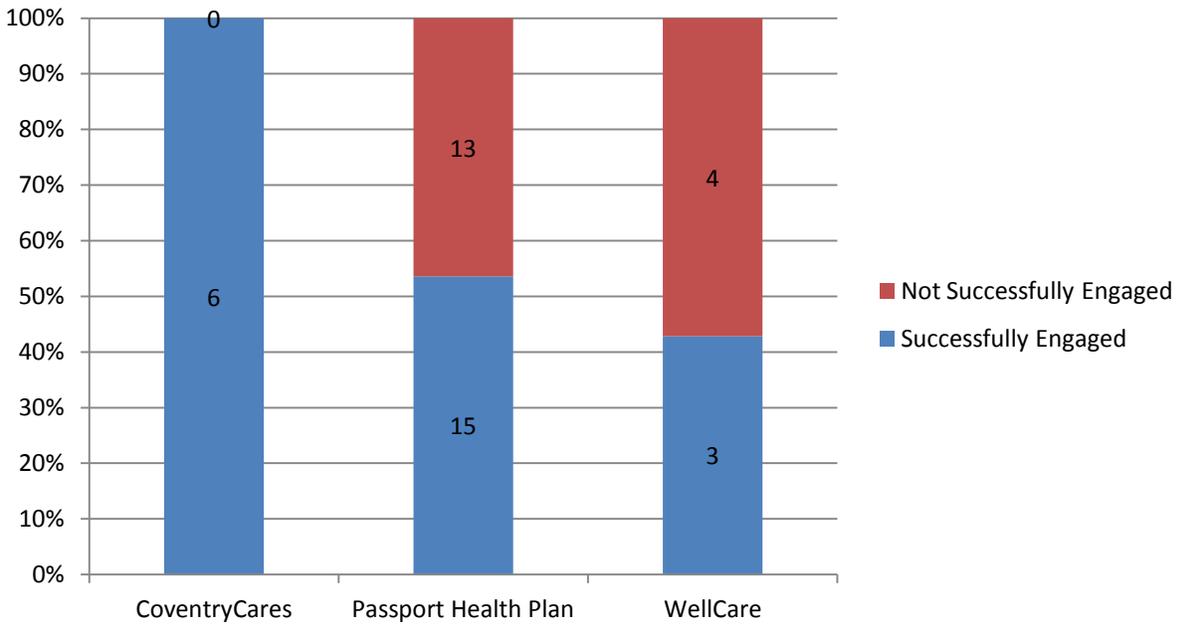


Figure 17. Engagement of Members in Care Management by MCO. The frequency of members successfully engaged in care management by MCO for women readmitted within 30 days after delivery discharge with care management notes (n = 41).

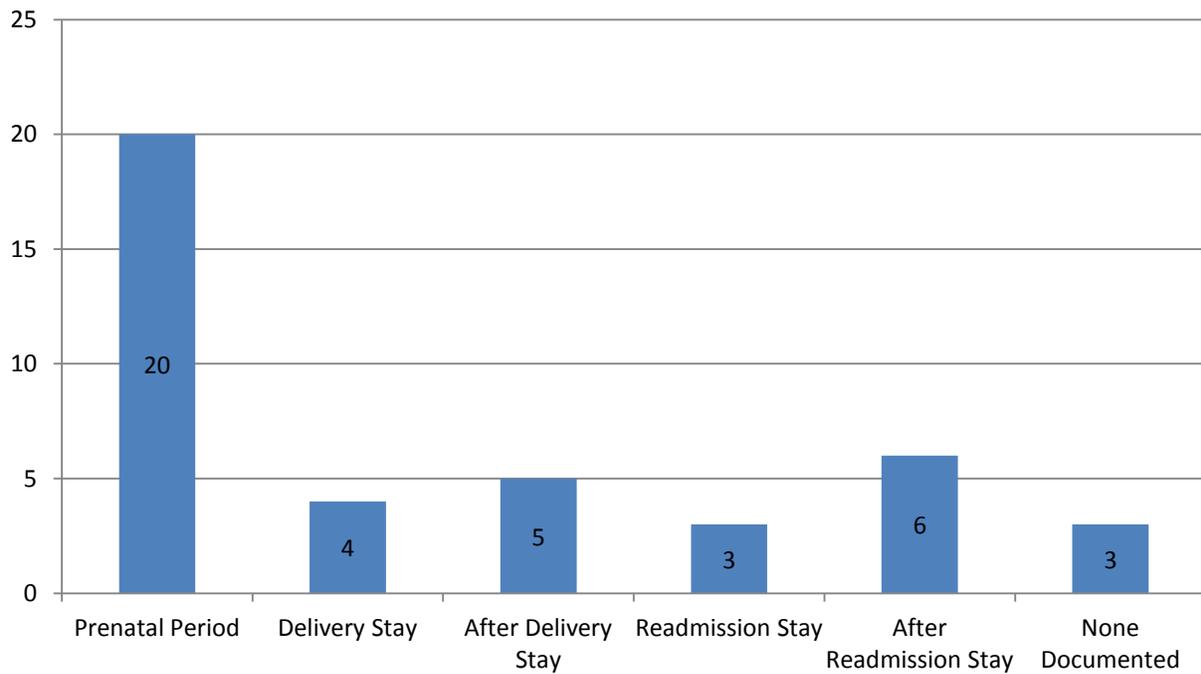


Figure 18. First Care Management Outreach Attempt by Perinatal Period. The frequency of patients outreached for the first time by perinatal period among the women readmitted within 30 days after delivery discharge with care management notes (n = 41).

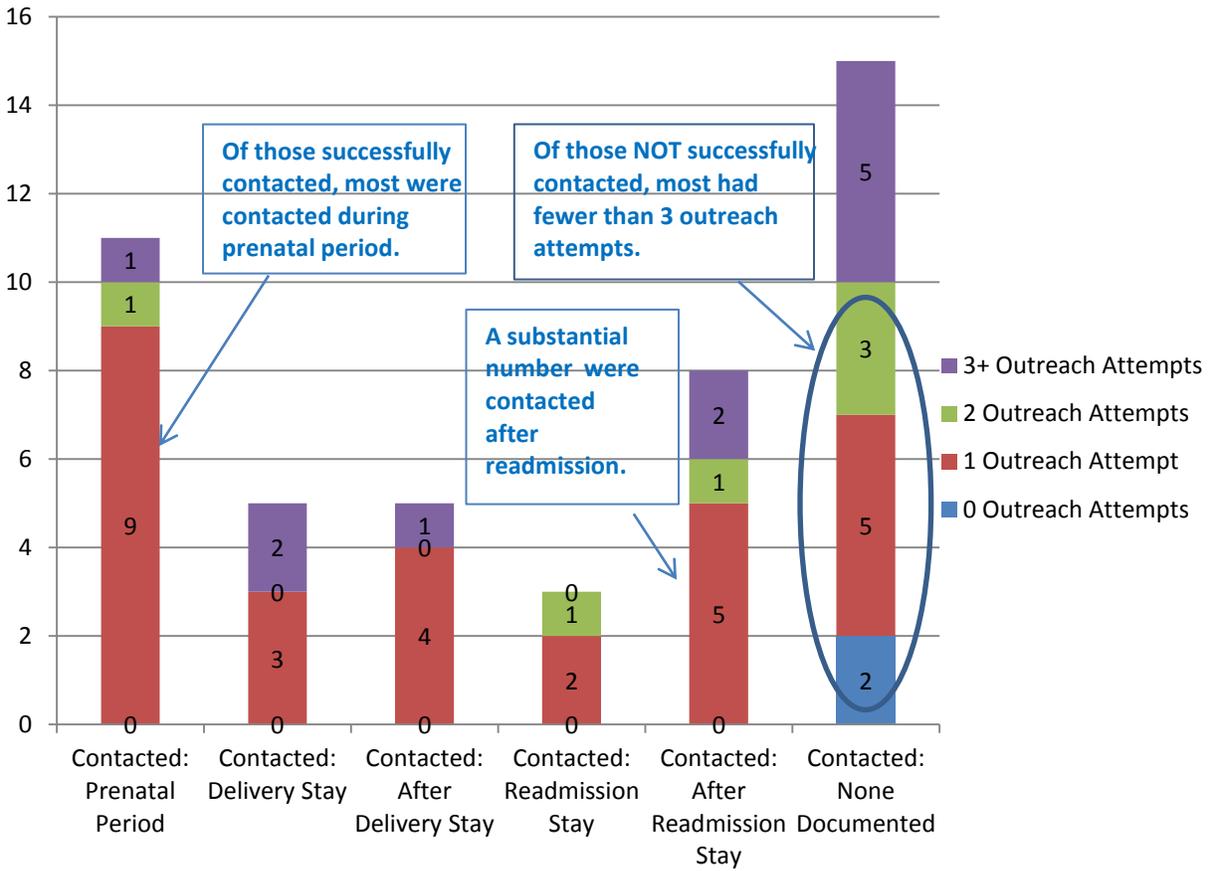


Figure 19. Care Management Outreach Attempts by Perinatal Period During Which Member Was Contacted Successfully. The frequency of number of care management outreach attempts by perinatal period, during which member was contacted successfully, for women readmitted within 30 days after delivery discharge with care management notes (n = 41).

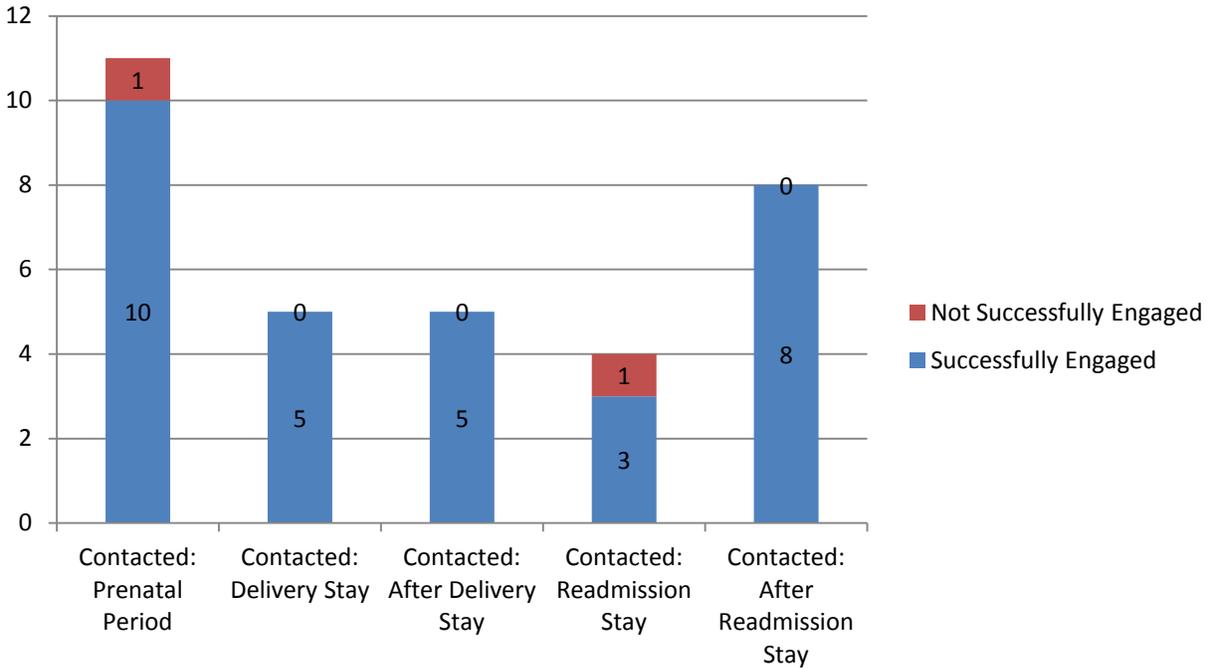


Figure 20. Member Engagement by Perinatal Period. The frequency of successful and unsuccessful member engagement upon successful member contact by perinatal period for women readmitted within 30 days after delivery discharge. Some members contacted/engaged during multiple perinatal periods.

Among all women in the chart review study either identified by the hospital as obese or identified by this study as obese based upon body mass index calculations, 85% were not engaged in care management (Figure 21). Among those with either a past history of hypertension or a delivery stay complication of hypertension, 89% were not engaged in care management (Figure 21). Moreover, health plan care management identified comorbid obesity in only 3 of the 52 hospital-identified members with this condition and identified gestational hypertension in only 5 of the 24 hospital-identified cases of gestational hypertension (Figure 22). The vast majority of all women in the chart review study had no health risk assessment conducted by managed care services at any time during the perinatal period (Figure 23).

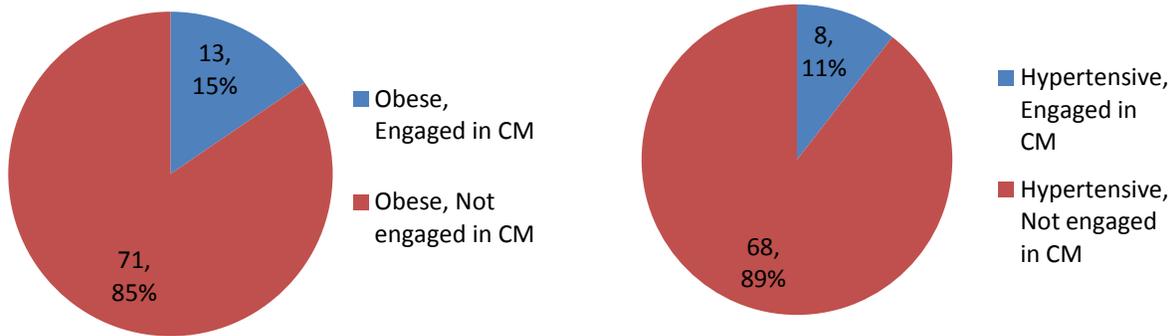


Figure 21. Care Management of Obese or Hypertensive Women. Number and percentage of women with obesity (n = 84), identified either by calculated BMI or during delivery stay, and women with hypertension (n = 76), based on past history or delivery stay complication, who were engaged in case management.

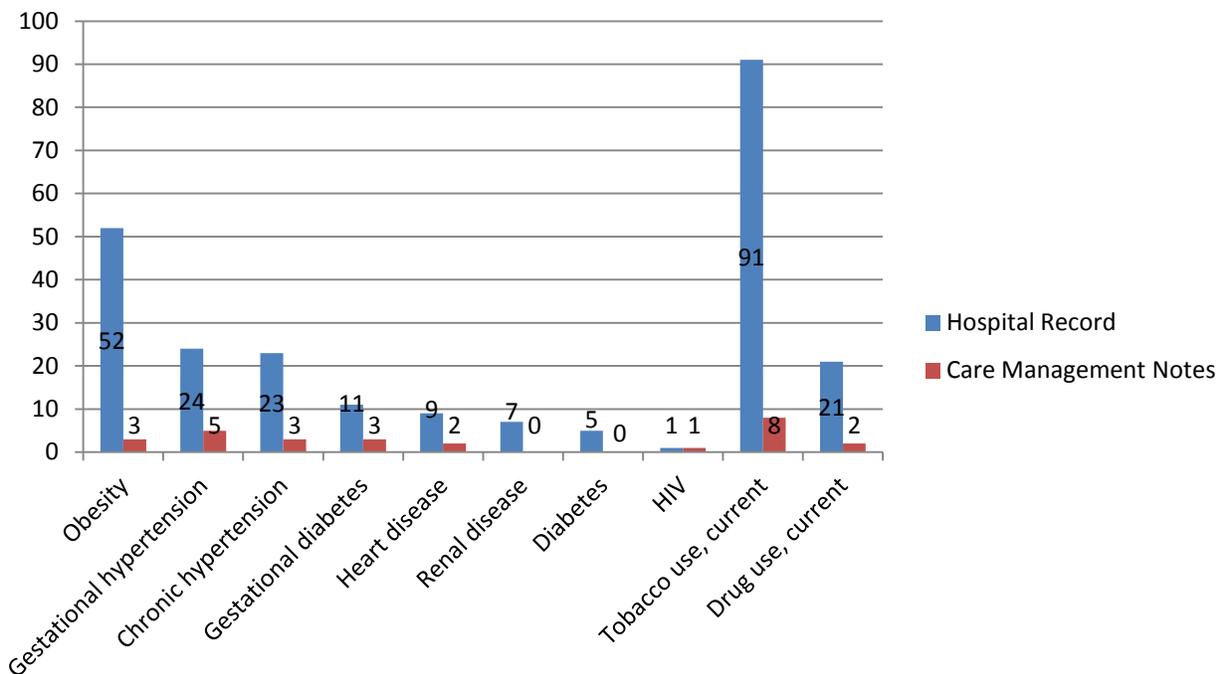


Figure 22. Comorbid Conditions Identified in Hospital Records vs. Care Management Notes. The frequency of comorbid condition identification in hospital delivery records (n = 209) and care management notes (n = 41) for women readmitted within 30 days of delivery discharge.

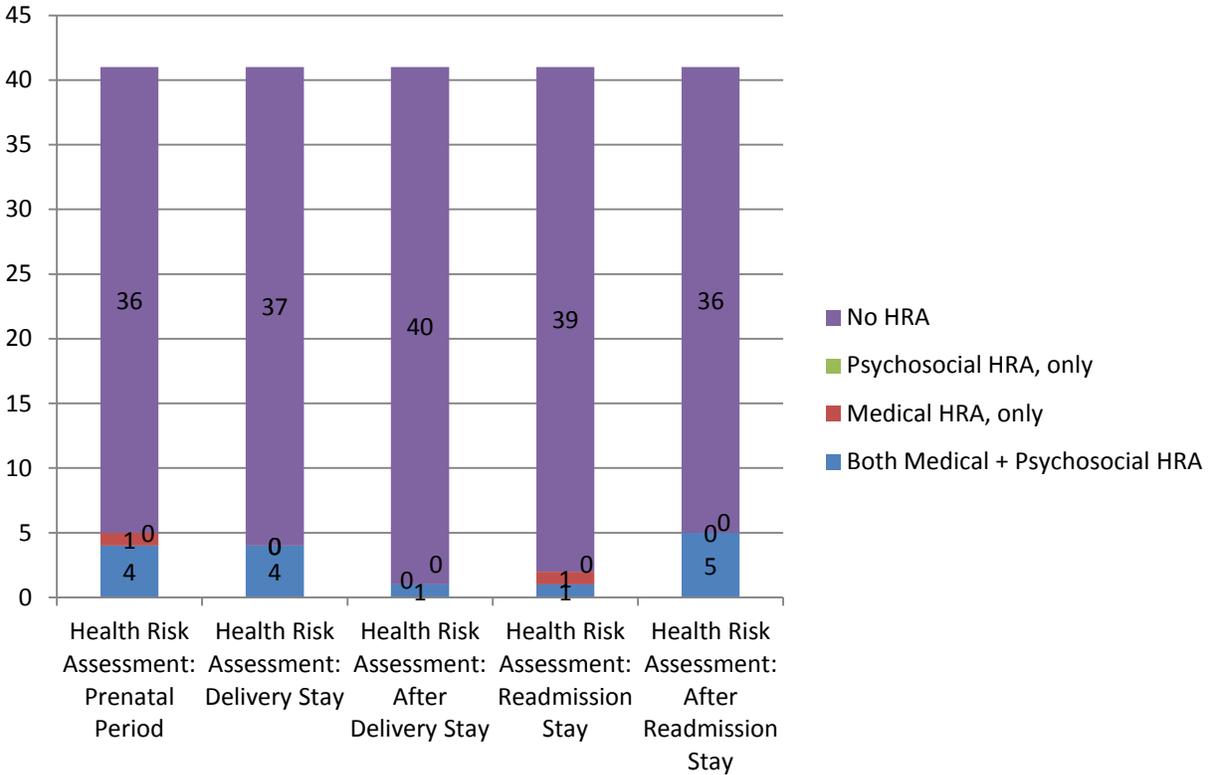


Figure 23. Health Risk Assessment (HRA) by Type and Perinatal Period. The frequency of health risk assessment (HRA) by HRA type and perinatal period for women readmitted within 30 days of delivery discharge with care management (n = 41).

Ninety-seven and ninety-six percent of women with a postpartum readmission were assessed by hospitals for tobacco use and drug abuse, respectively; however, 27% were not assessed for depression, 25% were not assessed for housing instability, 23% were not assessed for domestic violence, 12% were not assessed for partner involvement and/or social supports, 10% were not assessed for inadequate access to a regular postpartum provider, and 9% were not assessed for alcohol abuse (Table 19). Next to tobacco use, drug use and depression were the discharge risk factors most frequently identified by hospitals (Figure 24). Although most of these transitional care needs were addressed by the hospitals, there were no referrals facilitated by care management for either substance abuse treatment or tobacco cessation, and only 1 behavioral follow-up visit was facilitated by care management (Figure 24). Drug abuse was noted by hospitals as a problem upon readmission for 6% of readmissions (Table 20). Care management did make 4 community referrals and 7 Women, Infant, and Children’s Nutritional Program (WIC) referrals and facilitated 3 obstetric visits, 1 specialist visit, and 1 home visit (Figure 24). At readmission, hospital records indicated that 4% of readmissions did not have access to either a routine primary or postpartum provider (Table 20).

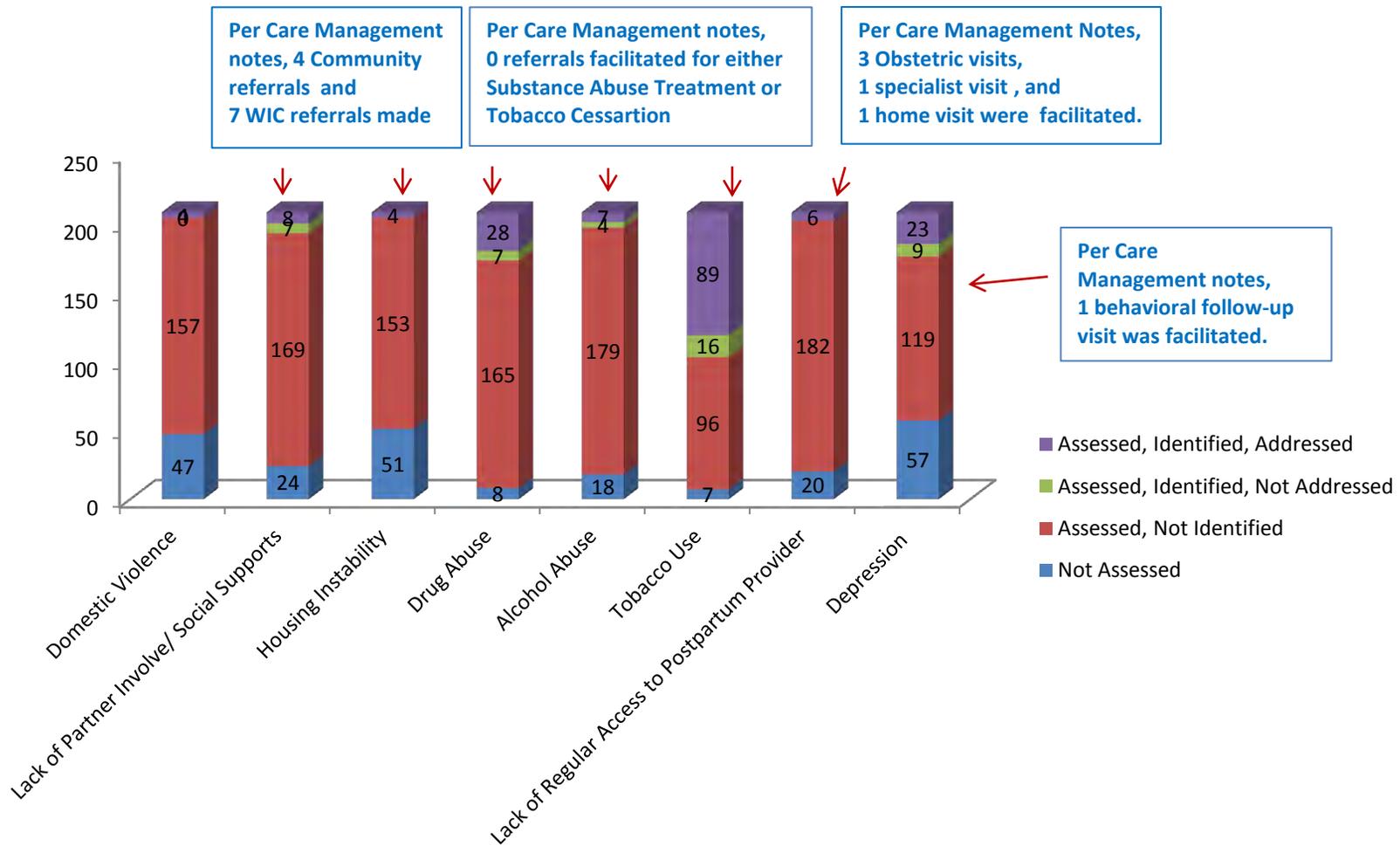


Figure 24. Hospital Discharge Planning and Intervention with Related Care Management Interventions. The frequency of hospital discharge planning and interventions (n = 208) with related care management interventions (n = 41). One observation in total sample was missing data on overall discharge.

Table 19. Discharge Planning

Discharge Planning Category	Frequency (%)*
Domestic Violence:	
Assessed	161 (77%)
Identified	4/161 = 2%
Addressed	4/4 = 100%
Lack of Partner Involvement or Social Support:	
Assessed	184 (88%)
Identified	15/184 = 8%
Addressed	8/15 = 53%
Housing Instability:	
Assessed	157 (75%)
Identified	4/157 = 3%
Addressed	4/4 = 100%
Drug Abuse:	
Assessed	200 (96%)
Identified	35/200 = 18%
Addressed	28/35 = 80%
Alcohol Abuse:	
Assessed	190 (91%)
Identified	11/190 = 6%
Addressed	7/11 = 64%
Tobacco Use:	
Assessed	201 (97%)
Identified	105/201 = 52%
Addressed	89/105 = 85%
Lack of Regular Access to Postpartum Provider:	
Assessed	188 (90%)
Identified	6/188 = 3%
Addressed	6/6 = 100%
Chronic Physical Disability:	
Identified	1 (0.5%)
Addressed	1/1 = 100%
Developmental/Cognitive Disability:	
Identified	0
Addressed	0
Transportation Barrier:	
Identified	4 (2%)
Addressed	3/4 = 75%

Discharge Planning Category	Frequency (%)*
Depression:	
Formal Screening Conducted	25 (12%)
Informal Screening Conducted	126 (61%)
Identified	32/151 = 21%
Addressed	23/32 = 72%

* The frequency (%) of discharge planning, i.e., risk assessed, risk identified, and risk addressed, received by women readmitted within 30 days post-delivery stay discharge, by all-cause readmission diagnoses (n = 208). One observation in total sample is missing data on overall discharge planning.

Table 20. Psychosocial Risk Factors or Barriers to Access Documented at Readmission

Psychosocial Risk Factors at Readmission:	Number (Percent)*
Drug Abuse	12 (6%)
Alcohol Abuse	1 (0.5%)
Lack of Partner Involvement	7 (3%)
Lack of Other Social Support	1 (0.5%)
Domestic Violence	1 (0.5%)
Housing Instability	1 (0.5%)
Food Insecurity	0
Barriers to Access at Readmission:	Number (Percent)*
No Routine Primary Care Provider	6 (3%)
No Routine Postpartum Provider	3 (1%)
Transportation	1 (0.5%)
Language	1 (0.5%)
No Time Off From Work	0
No Access to Telephone	0

* Women with a readmission within 30 days after delivery discharge (n = 209)

Discharge Education

Discharge education was documented for 97% of women with a postpartum readmission; however, 61% did not receive education about preeclampsia (Table 21). Although this proportion was lower among women readmitted with any diagnosis of hypertension (43%; Table 21), half of those prescribed antihypertensive medication did not receive discharge education about how to take the drug (Figure 25). Moreover, among women with blood pressure $\geq 140/90$ during the delivery stay who were readmitted with any diagnosis of hypertension, 44% did not receive preeclampsia education (Figure 26).

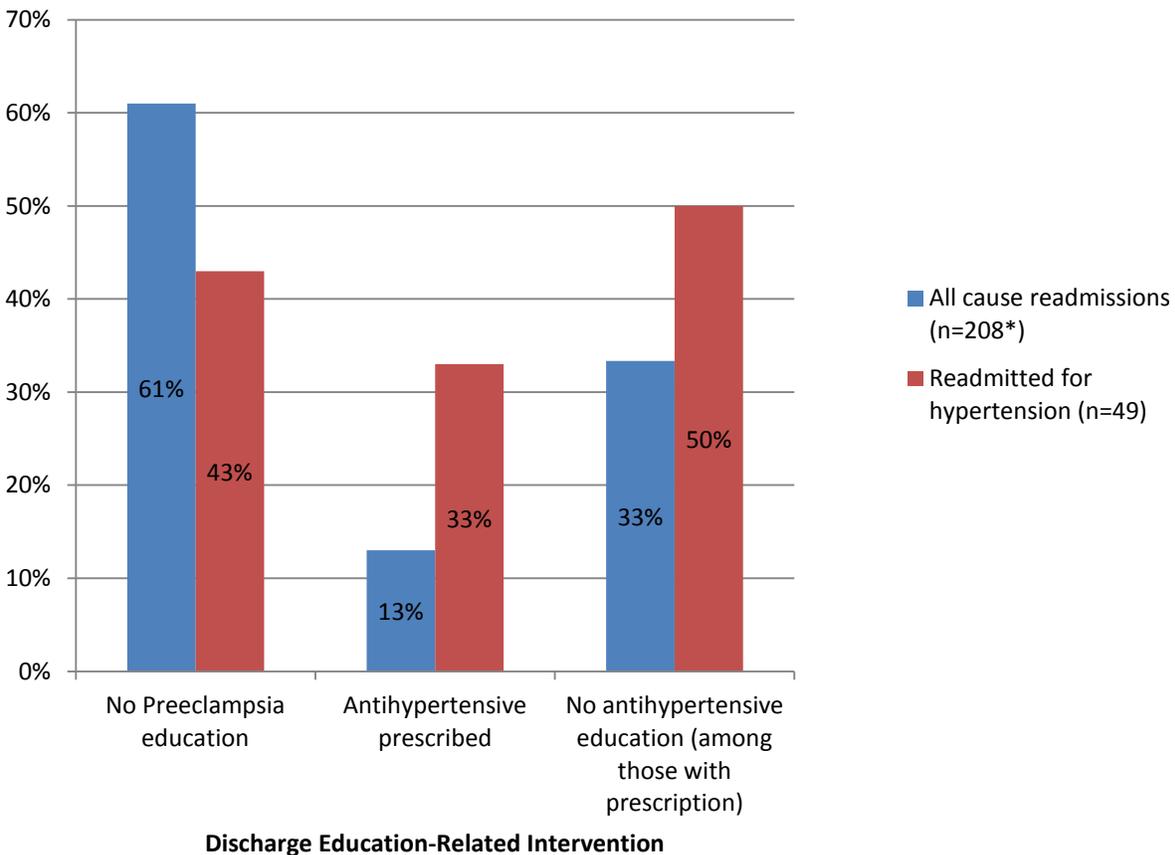


Figure 25. Hypertension Education at Delivery Discharge. The percentage of cases with hypertension education at delivery discharge including cases with all causes of readmission (n = 208) and among those readmitted for hypertension (n = 49). *One observation in total sample was missing data on discharge education.

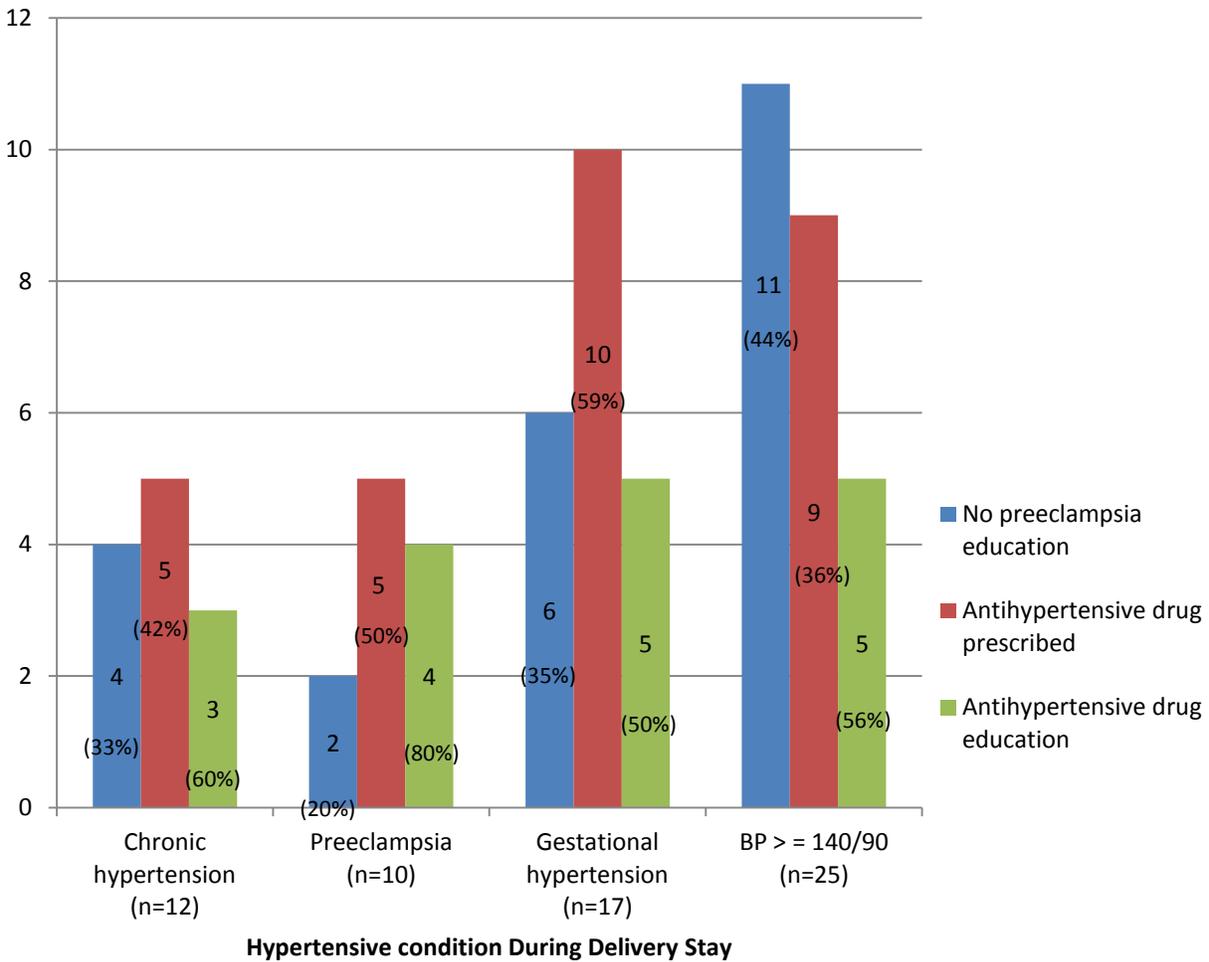


Figure 26. Preeclampsia Education, Antihypertensive Drug Prescription and Education by Hypertensive Condition. The frequency (%) of preeclampsia education, antihypertensive drug prescription, and antihypertensive drug education by hypertensive condition during delivery stay for women readmitted for a hypertensive diagnosis.

Whereas 68% of women readmitted with cesarean section wound problems received education about both routine wound care and follow-up with warning signs of wound problems, only 38% of women readmitted with any diagnosis of major infection received this comprehensive education (Table 21). The majority of women readmitted with major infection underwent cesarean delivery (77%; Table 5). In addition, among women readmitted with major infection, a minority received comprehensive hygiene education pertinent to care of breasts (27%), care of perineum (15%), and care of bladder (0%; Table 21). Only 5% of all-cause readmissions, 4% of readmissions with major infection, and 0% of readmissions with cesarean wound problems were prescribed an antibiotic at delivery discharge (Table 21).

Table 21. Educational Interventions at Discharge by Readmission Diagnoses

	All-Cause Readmissions ^a (n = 208 ^b)	Readmitted With Hypertension ^c (n = 49)	Readmitted With Major Infection ^d (n = 26)	Readmitted With Gallbladder Problems ^e (n = 23)	Readmitted With C-Section Wound Problems ^f (n = 22)	Readmitted With Anemia (n = 20)	Readmitted With UTI (n = 18)
Education received at discharge:							
Yes, and specific to subject areas	179 (86%)	44 (90%)	23 (88%)	18 (78%)	20 (91%)	17 (85%)	15 (83%)
Yes, but not specifically documented for subject areas	22 (11%)	5 (10%)	1 (4%)	4 (17%)	2 (9%)	2 (10%)	3 (17%)
No	7 (3%)	0	2 (7%)	1 (4%)	0	1 (5%)	0
Education about activity/exercise:							
Yes	193 (95%)	49 (100%)	24 (92%)	20 (100%)	22 (100%)	17 (89%)	17 (94%)
No	10 (5%)	0	2 (7%)	0	0	2 (11%)	1 (6%)
Education about maternal diet:							
Yes	175 (86%)	44 (90%)	22 (85%)	18 (90%)	21 (95%)	17 (89%)	17 (94%)
No	28 (14%)	5 (10%)	4 (15%)	2 (10%)	1 (5%)	2 (11%)	1 (6%)
Education about vaginal discharge:							
Routine care with instructions only	7 (3%)	1 (2%)	1 (4%)	2 (10%)	1 (5%)	0	1 (6%)
Follow-up with warning signs only	40 (20%)	10 (20%)	6 (23%)	2 (10%)	1 (5%)	3 (16%)	2 (11%)
Both	99 (49%)	27 (55%)	12 (46%)	7 (35%)	13 (59%)	12 (63%)	8 (44%)
Yes, but unable to determine above	14 (7%)	6 (12%)	0	3 (15%)	2 (9%)	0	3 (17%)
None	43 (21%)	5 (10%)	7 (27%)	6 (30%)	5 (23%)	4 (21%)	4 (22%)
Education about care of breasts:							
Routine care with instructions only	44 (22%)	13 (27%)	10 (38%)	3 (15%)	5 (23%)	5 (26%)	5 (28%)
Follow-up with warning signs only	5 (2%)	0	0	1 (5%)	1 (5%)	0	0

	All-Cause Readmissions ^a (n = 208 ^b)	Readmitted With Hypertension ^c (n = 49)	Readmitted With Major Infection ^d (n = 26)	Readmitted With Gallbladder Problems ^e (n = 23)	Readmitted With C-Section Wound Problems ^f (n = 22)	Readmitted With Anemia (n = 20)	Readmitted With UTI (n = 18)
Both	93 (46%)	27 (55%)	7 (27%)	8 (40%)	9 (41%)	9 (47%)	9 (50%)
Yes, but unable to determine above	21 (10%)	5 (10%)	3 (12%)	2 (10%)	4 (18%)	3 (16%)	3 (17%)
None	40 (20%)	4 (8%)	6 (23%)	6 (30%)	3 (14%)	2 (11%)	1 (6%)
Education about care of perineum:							
Routine care with instructions only	49 (24%)	15 (31%)	7 (27%)	6 (30%)	4 (18%)	5 (26%)	5 (28%)
Follow-up with warning signs only	16 (8%)	4 (8%)	2 (8%)	2 (10%)	1 (5%)	1 (5%)	1 (6%)
Both	63 (31%)	16 (33%)	4 (15%)	5 (25%)	4 (18%)	6 (32%)	4 (22%)
Yes, but unable to determine above	32 (16%)	8 (16%)	4 (15%)	2 (10%)	7 (32%)	2 (11%)	6 (33%)
None	43 (21%)	6 (12%)	9 (35%)	5 (25%)	6 (27%)	5 (26%)	2 (11%)
Education about care of bladder:							
Routine care with instructions only	11 (5%)	2 (4%)	0	1 (5%)	2 (9%)	0	2 (11%)
Follow-up with warning signs only	48 (24%)	14 (29%)	9 (35%)	3 (15%)	3 (14%)	3 (16%)	2 (11%)
Both	30 (15%)	6 (12%)	0	5 (25%)	3 (14%)	5 (26%)	3 (17%)
Yes, but unable to determine above	13 (6%)	4 (8%)	2 (7%)	1 (5%)	2 (9%)	1 (5%)	3 (17%)
None	101 (50%)	23 (47%)	15 (58%)	10 (50%)	12 (55%)	10 (53%)	8 (44%)
Education about wound care:							
Routine care with instructions only	19 (9%)	4 (8%)	4 (15%)	4 (20%)	1 (5%)	1 (5%)	4 (22%)
Follow-up with warning signs only	13 (6%)	3 (6%)	3 (12%)	1 (5%)	2 (9%)	2 (11%)	1 (6%)
Both	92 (45%)	24 (49%)	10 (38%)	7 (35%)	15 (68%)	11 (58%)	8 (44%)

	All-Cause Readmissions ^a (n = 208 ^b)	Readmitted With Hypertension ^c (n = 49)	Readmitted With Major Infection ^d (n = 26)	Readmitted With Gallbladder Problems ^e (n = 23)	Readmitted With C-Section Wound Problems ^f (n = 22)	Readmitted With Anemia (n = 20)	Readmitted With UTI (n = 18)
Yes, but unable to determine above	13 (6%)	3 (6%)	2 (8%)	1 (5%)	3 (14%)	0	2 (11%)
None	25 (12%)	6 (12%)	3 (12%)	3 (15%)	1 (5%)	3 (16%)	2 (11%)
Not Applicable – No wound	41 (20%)	9 (18%)	4 (15%)	4 (20%)	0	2 (11%)	1 (6%)
Education about preeclampsia:							
Follow-up with warning signs	80 (39%)	28 (57%)	9 (35%)	4 (20%)	8 (36%)	6 (32%)	5 (28%)
No preeclampsia education	123 (61%)	21 (43%)	17 (65%)	16 (80%)	14 (64%)	13 (68%)	13 (72%)
Education about mood:							
Signs and symptoms only	11 (5%)	2 (4%)	1 (4%)	1 (5%)	1 (5%)	2 (11%)	1 (6%)
Follow-up with warning signs only	29 (14%)	12 (24%)	6 (23%)	1 (5%)	4 (18%)	3 (16%)	1 (6%)
Both	71 (35%)	22 (45%)	4 (15%)	4 (20%)	6 (27%)	7 (37%)	5 (28%)
Yes, but unable to determine above	43 (21%)	7 (14%)	8 (31%)	4 (20%)	6 (27%)	4 (21%)	8 (44%)
None	49 (24%)	6 (12%)	7 (27%)	10 (50%)	5 (23%)	3 (16%)	3 (17%)
Antibiotic prescribed: Yes	11 (5%)	5 (10%)	1 (4%)	0	0	0	1 (6%)
Educated about antibiotic ^g	9/11 = 81%	2/5 = 40%	0	0	0	0	1/1 = 100%
Anticoagulant prescribed: Yes	9 (4%)	3 (6%)	0	0	1 (5%)	0	1 (6%)
Educated about anticoagulant ^g	9/9 = 100%	3/3 = 100%	0	0	1/1 = 100%	0	0
Antihypertensive prescribed: Yes	27 (13%)	16 (33%)	3 (12%)	5 (22%)	2 (9%)	3 (15%)	4 (22%)
Educated about antihypertensive ^g	18/27 = 67%	8/16 = 50%	2/3 = 67%	4/5 = 80%	0	2/3 = 67%	0
Narcotic prescribed: Yes ^h	152 (73%)	39 (80%)	20 (80%)	15 (65%)	21 (95%)	17 (85%)	12 (67%)
Educated about narcotic ^g	124/152 = 82%	31/39 = 79%	15/20 = 75%	12/15 = 80%	17/21 = 81%	13/17 = 76%	8/12 = 67%
Medication Reconciliation:							

	All-Cause Readmissions ^a (n = 208 ^b)	Readmitted With Hypertension ^c (n = 49)	Readmitted With Major Infection ^d (n = 26)	Readmitted With Gallbladder Problems ^e (n = 23)	Readmitted With C-Section Wound Problems ^f (n = 22)	Readmitted With Anemia (n = 20)	Readmitted With UTI (n = 18)
Yes	159 (76%)	38 (78%)	21 (81%)	18 (78%)	17 (77%)	14 (70%)	14 (78%)
No, but medications listed in discharge summary	39 (19%)	10 (20%)	4 (15%)	3 (13%)	5 (23%)	4 (20%)	4 (22%)
Neither	10 (5%)	1 (2%)	1 (4%)	2 (9%)	0	2 (10%)	0

^a Members may fall into one or more diagnostic categories which represent any readmission diagnosis and may or may not be the principal diagnosis.

^b One observation in total sample missing data on overall discharge education, and 6 observations in total sample missing data for specific education questions.

^c Hypertension diagnoses include pre-existing hypertension, gestational hypertension, preeclampsia and eclampsia.

^d Major infection diagnoses include major puerperal infection and methicillin –resistant staphylococcus aureus (MRSA).

^e Gallbladder problems include gallbladder problems such as cholelithiasis (gallstones) or bile duct disease.

^f Cesarean wound problems include infection, hematoma, hemorrhage and other.

^g Percentage of those prescribed the medication.

^h Two observations in total sample missing data on narcotic prescription at discharge.

Outpatient Follow-up

Among all-cause postpartum readmissions, at delivery stay discharge, the majority of women were either advised by providers to schedule a postpartum follow-up visit or one was scheduled; with timing of most visits for the period between 7–56 days postpartum (Table 22). The majority (81%) of women with a postpartum readmission had no follow-up visit (Table 22). Providers advised scheduling, but did not schedule, an outpatient follow-up visit for 66% of women and, among these women, 79% had no outpatient follow-up visit. Among those for whom a follow-up visit was scheduled, 90% had no follow-up visit.

Among women with both a delivery diagnosis and a readmission diagnosis of hypertension (n = 22), only 2 had a follow-up postpartum visit, and these women had been advised to schedule their appointment for after the first 6 days (Figure 27). Most were neither advised to schedule nor were scheduled for an appointment during the first six days. One woman was advised to schedule an appointment for the time period during the first 6 days, and 4 were scheduled for this time period; however, they did not have an actual visit (Figure 27).

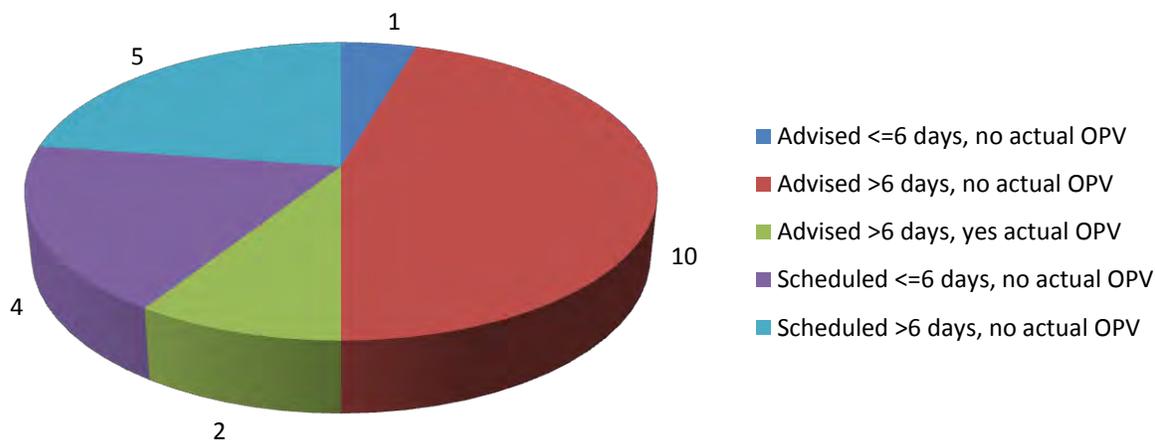


Figure 27. Appointment Advisement, Scheduling, Timing of Appointment, and Actual Visit; Members with Hypertension. The frequency of appointment advisement and scheduling, advised/schedules timing of appointment, and whether or not there was an actual OPV for women with both a delivery stay and a readmission stay diagnosis of hypertension (n = 23). There were no observations for “scheduled ≤ 6 days, yes, actual OPV,” “advised ≤ 6 days, yes, actual OPV,” and “scheduled > 6 days, yes, actual OPV” categories.

Table 22. Postpartum Outpatient Follow-up Visits (OPVs) by Scheduling Timing

	Advised to Schedule Only* n = 137 (66% of Total)		Scheduled* n = 61 (30% of Total)		Neither* n = 8 (4% of Total)		Total* n = 206 (100% of Total)	
	Yes Actual OPV n = 29 (21%)	No Actual OPV n = 108 (79%)	Yes Actual OPV n = 6 (10%)	No Actual OPV n = 55 (90%)	Yes Actual OPV n = 4 (50%)	No Actual OPV n = 4 (50%)	Yes Actual OPV n = 39 (19%)	No Actual OPV n = 167 (81%)
Between 21–56 days	10 (35%)	59 (55%)	1 (17%)	13 (24%)	0	0	11 (28%)	72 (43%)
Between 7–20 days	14 (48%)	40 (37%)	3 (50%)	24 (44%)	0	0	17 (44%)	64 (38%)
Within 6 or fewer days	5 (17%)	7 (6%)	2 (33%)	18 (33%)	0	0	7 (18%)	25 (15%)
No time frame	0	2 (2%)	0	0	4 (100%)	4 (100%)	4 (10%)	6 (4%)

* The number and frequency of postpartum outpatient follow-up visits (OPVs) that were advised vs. scheduled to take place by timing of scheduling for women admitted within 30 days after delivery discharge including all readmission diagnoses (n = 206). Three observations were missing data for obstetric follow-up. Percentages apply to each column, unless indicated as “% of total.”

DISCUSSION

The retrospective cohort study used claims-based administrative data provided by the MCOs to evaluate the relationship between the outcome of postpartum readmission and these risk factor domains: member characteristics, MCO/utilization factors, and delivery stay diagnoses. In contrast to the retrospective cohort study, which included both members with and without a postpartum readmission in order to quantify these comparisons and evaluate statistically significant differences, the medical record review was restricted to only those women with a postpartum readmission. Therefore, the retrospective cohort study is informative for risk factor identification, whereas the chart review study is useful to profile more specific aspects of study domains and to identify gaps in care. Readmission diagnoses that included hypertension, cesarean or other obstetric wound problems, and major infection were identified as high volume in both the administrative and chart review studies; therefore, findings lend support to the development of targeted interventions to reduce these cause-/diagnosis-specific readmissions. Taken together, both studies shed important insights regarding opportunities to improve the health care of KDMS members.

Hypertension diagnosis (coded during the delivery stay) was a significant risk factor for postpartum readmission, independent of obesity, delivery type, age, race/ethnicity, urban or rural residence, MCO membership, postpartum visits, or acuity level, as proxied by length of stay and transfer status, as well as the highest volume cause-specific readmission diagnosis. Yet chart review findings showed that the vast majority of women with either a past history or delivery stay complication of hypertension were not engaged in case management. Per the American College of Obstetricians and Gynecologists (ACOG), acute onset, severe hypertension can occur in postpartum women with hypertensive disorders during pregnancy (ACOG, 2011a). Further, women with preeclampsia can deteriorate in the postpartum period (ACOG, 2011a). The most prominent hypertension readmission diagnosis was preeclampsia. Of note, the conditions of severe preeclampsia or eclampsia were recently shown to pose the greatest risk for severe maternal morbidity (Bateman *et al.*, 2013). Al-Safi *et al.* (2011) suggest that the increased frequency of preeclampsia occurring in the postpartum period, i.e., delayed preeclampsia, may be attributable, in part, to unrecognized preeclampsia prior to delivery discharge. A recent update from the ACOG Task Force on Hypertension in Pregnancy concluded that diagnosis of preeclampsia no longer requires detection of high levels of protein in urine (proteinuria), and emphasized the importance of monitoring for blood pressure $\geq 140/90$ mmHg and patient report of cerebral or visual symptoms (ACOG, 2013a). Al-Safi *et al.* (2011) advise that all women be educated after delivery about the potential for delayed postpartum preeclampsia and eclampsia and associated symptoms. Thus, it is notable in the current study

that almost half of women with delivery stay documentation of blood pressure $\geq 140/90$ did not receive preeclampsia education. Moreover, although it is known that the majority of eclamptic seizures occur within one week of delivery discharge (Al-Safi *et al.*, 2011) and that peak postpartum blood pressure occurs between the third and sixth day after delivery (SOGC, 2008; NICE, 2010; SOMANZ, 2008), among women with both a delivery and readmission stay diagnosis of hypertension, most were neither advised to schedule nor were scheduled for an appointment during the first six days after discharge. Yet, consensus guidelines recommend that blood pressure should be measured at least once during the 3rd–6th postpartum day timeframe (SOGC, 2008; NICE, 2010; SOMANZ, 2008). Indeed, the retrospective cohort study showed that most postpartum readmissions for hypertension occurred within 4 days of delivery discharge, and only 2 of the 22 of the medical record review subjects with both a delivery and readmission stay diagnosis of hypertension had a follow-up postpartum office visit. Of note, lack of postpartum outpatient follow-up was a statistically significant risk factor in the retrospective cohort study, independent of delivery stay diagnosis.

Members who were overweight or obese (per coded delivery stay diagnosis) were at a significantly greater risk for postpartum readmission, independent of age, race/ethnicity, urban or rural residence, MCO membership, postpartum visits, delivery type, key delivery stay diagnoses (including hypertension), or acuity level, as proxied by length of stay and transfer status. Previous research has shown that obesity is associated with increased risk of gestational hypertension and preeclampsia, as well as higher cesarean section rates (ACOG, 2013b). In the current chart review study, obese women who gained greater than the IOM recommended weight gain amount comprised a substantial proportion of readmissions, yet few were identified by care management. A prime gap in care is the considerable lack of engagement of these members in MCO care coordination. In their updated guidelines, the American College of Obstetricians and Gynecologists recommends the following: preconception weight assessment and counseling regarding the risks of obesity, as well as encouragement to take part in a weight reduction program; BMI assessment at the first prenatal visit with discussion of IOM recommendations for weight gain then and throughout the pregnancy; offer nutritional and exercise counseling to all overweight and obese patients; consideration of higher antibiotic prophylaxis dosage for cesarean delivery among obese patients; as well as anesthesiology consultation early in labor for all obese patients (ACOG, 2013b).

Members who delivered by cesarean section were also at a significantly greater risk for postpartum readmission, independent of obesity, age, race/ethnicity, urban or rural residence, MCO membership, postpartum visits, key index stay diagnoses (including hypertension), or acuity level, as proxied by length of stay and transfer status. This finding is consistent with the scientific literature and the earlier IPRO/KDMS study. Although medical record review findings indicate that some women did not receive antibiotic prophylaxis with adequate timing prior to

cesarean section, most did receive antibiotic prophylaxis in accordance with ACOG guidelines recommendations (ACOG, 2010a). Therefore, although efforts consistent with updated recommendations to consider higher antibiotic prophylaxis dosage among obese patients are warranted, there is scant evidence from the current study to suggest inadequate routine prophylaxis. Further, in light of the small number of women in the chart review study who delivered early term by planned cesarean-section without trial of labor after cesarean delivery (TOLAC) and without the historical risk factors that contraindicate TOLAC, findings do not indicate a substantial problem with early term elective cesarean deliveries. However, overall, women who underwent primary cesarean delivery, i.e., without a history of prior cesarean delivery, comprised substantial proportions of all-cause readmissions, as well as high volume diagnosis-specific readmissions, as did women who did not undergo trial of labor after previous cesarean delivery. Consequently, further research is merited to assess the potential to enhance counseling about the benefits/risks of primary cesarean delivery and of TOLAC consent for appropriate candidates, consistent with NICHD and ACOG recommendations (Spong *et al.*, 2012; ACOG, 2010b). Another area for further research is closer examination of discharge education for hygiene-related postpartum needs, as a relatively small proportion of women readmitted for major infection received comprehensive hygiene education. Further, most women readmitted for major infection underwent cesarean delivery, yet comprehensive education about wound care was also relatively less frequently provided to women with this cause-specific readmission diagnosis. Finally, although only 5 postpartum readmissions had a delivery stay diagnosis of major puerperal infection or sepsis (in the retrospective cohort study), this complication was a statistically significant risk factor for readmission and, thus, highlights the need for care management and coordination for this vulnerable subpopulation.

Drug abuse (coded during the delivery stay) was a significant risk factor for postpartum readmission, independent of obesity, delivery type, age, race/ethnicity, urban or rural residence, MCO membership, postpartum visits, and acuity level; this subset's readmission rate was equal to that of women with an index stay diagnosis of hypertension. Drug abuse was the most frequent psychosocial risk factor documented in the medical record by the hospital upon readmission. Chart review findings indicate that most maternity patients did undergo a hospital assessment for drug abuse with an 18% identification rate, and 80% were addressed by referral, counseling or other related intervention; however, health plan care management identified a minority of hospital-identified cases, indicating an opportunity for enhanced case-finding practices. Further, care management did not facilitate any referrals for substance abuse treatment. The American Society of Addiction Medicine recommends universal screening, brief intervention, referral and treatment, as in the Screening, Brief Intervention, and Referral to Treatment (SBIRT) model, be conducted in all medical settings including obstetrician-gynecologists' offices with the overall aim of early case finding and intervention (ASAM, 2011). Further, in recognition of addiction as a chronic health disorder, Rose *et al.* (2013) emphasize

the importance of preconception counseling among women of childbearing age who are treated at addiction facilities.

Managed care plan of membership was also a significant risk factor for postpartum readmission per the retrospective cohort study. Although findings attributing more or less risk to specific MCOs should be interpreted with caution in light of limited information about hospital-specific influences, medical record review findings do indicate important opportunities for improvement across all MCOs. First and foremost, the vast majority of women with a postpartum readmission were not receiving care management services and, of those in care management, health risk assessments were rarely conducted. Consequently, opportunities were missed to engage high-risk maternity cases in care management, particularly those with comorbid conditions such as obesity, hypertension, and drug abuse. In addition, more persistent and early outreach attempts during the prenatal period have the greatest potential for successful member contact and engagement in care management services.

Study limitations include the potential for residual confounding in the retrospective cohort study, as in any observational study, and, in the medical record review study, the possibility that services were undocumented, rather than not rendered. In addition, retrospective review of either hospital-coded or medical record documented clinical indicators, e.g., obstetric risk factors, complications and comorbid conditions, does not equate to real time clinical interpretation and medical judgment regarding the risks and benefits of specific medical decisions, such as whether a cesarean delivery is indicated or contraindicated. Corresponding study strengths, however, are that potential confounders were statistically controlled for using multivariable logistic regression analysis, and medical record review sources were largely standard reporting items, e.g., labor and delivery progress report, operative/anesthesia reports, discharge summary, with medical record over-reads conducted by IPRO clinical staff to ensure reliability of data abstraction. In addition, the cohort study identification of lack of a postpartum visit as a risk factor for readmission should be interpreted with caution, as early readmission due to illness severity might have precluded an outpatient visit, i.e., confounding by indication and reverse causality. Multinomial logistic regression, however, examined timeframe-specific readmission outcomes and outpatient follow-up visits, and the association persisted. In addition, although acuity level was proxied based upon length of stay and transfer status, standardized severity-adjustment was not conducted, and the high volume of different hospitals of service precluded adjustment for hospital-specific influences; therefore, findings regarding MCO-associated risk for readmission should also be interpreted with caution.

CONCLUSION

Study findings revealed that women with obesity, hypertension, cesarean delivery, major puerperal infection or sepsis, and drug abuse were at increased risk for postpartum readmission; therefore, these women represent susceptible subpopulations. Lack of postpartum follow-up was also a risk factor for readmission and, together with findings that the vast majority of women with a postpartum readmission were not receiving MCO care management services, findings suggest the potential to improve postpartum outcomes by better facilitating care transitions for vulnerable members. Such efforts would be further enhanced by initiation in the preconception period (ACOG, 2005d; D’Alton *et al.*, 2013; US DHHS, 2013) and interconception period for ongoing improvements in continuity of care (Barfield and Warner, 2012; D’Angelo *et al.*, 2007). In addition, opportunities for MCO/hospital collaboration for targeted clinical care enhancements merit consideration.

RECOMMENDATIONS FOR MCOs

- Identify women of childbearing age with obesity, hypertension, or drug abuse, and assess for engagement in care management during preconception, interconception and prenatal periods for facilitation of improvements in management of comorbidities, care coordination and transitions;
- Identify women with cesarean delivery, and assess for engagement in care management during the delivery stay for facilitation of improvements in care coordination, patient education, and transitions;
 - Collaborate with hospitals for infection surveillance, and coordinate care for the prevention and treatment of infections;
- Disseminate IOM recommendations and tool kits for weight gain during pregnancy to prenatal providers and members;
- Collaborate with hospitals to educate providers about ACOG recommendations for obesity in pregnancy, including special considerations for obese women who undergo cesarean section, e.g., anesthesiology consultation early in labor, higher prophylactic antibiotic dosages, and suture closure of the subcutaneous layer after cesarean delivery;
- Collaborate with hospitals to educate providers about early detection of elevations in blood pressure ($\geq 140/90$) in order to identify these high-risk mothers and ensure appropriate postpartum monitoring and follow-up.

RECOMMENDATIONS FOR KDMS

- Future improvement initiatives could focus on collaborating with hospitals and other stakeholders to evaluate cesarean delivery for nulliparous, low-risk women; evaluation

of MCO processes for identification and enrollment of pregnant women in care management services; and evaluation of postpartum visit timing and content.

REFERENCES

Al-Safi Z, Imudia AN, Filetti LC, Hobson DT, Bahado-Singh RO, Awonuga AO. Delayed postpartum preeclampsia and eclampsia: demographics, clinical course, and complications. *Obstet Gynecol* 2011; 118: 1102-7.

American College of Obstetricians and Gynecologists (ACOG). Obesity in pregnancy. ACOG Committee Opinion No. 315. *Obstet Gynecol* 2005a; 106:671-5.

American College of Obstetricians and Gynecologists (ACOG). Committee Opinion: The importance of preconception care in the continuum of women's health care. ACOG Committee Opinion No. 313. *Obstet Gynecol* 2005b: 106, 665-6.

American College of Obstetricians and Gynecologists (ACOG). Practice Bulletin 76: Postpartum hemorrhage. *Obstet Gynecol* 2006a; 108:1039-1047.

American College of Obstetricians and Gynecologists (ACOG). Antimicrobial prophylaxis for cesarean delivery: timing of administration. *Obstet Gynecol* 2010a; 116: 791-2.

American College of Obstetricians and Gynecologists (ACOG). Vaginal birth after previous cesarean delivery. *Obstet Gynecol* 2010b; 116:450-463.

American College of Obstetricians and Gynecologists (ACOG). Committee Opinion: Emergent therapy for acute-onset, severe hypertension with preeclampsia or eclampsia. Committee on Obstetric Practice 2011a. Number 513.

American College of Obstetricians and Gynecologists (ACOG). Hypertension in pregnancy. Task Force on Hypertension in Pregnancy. 2013a.

http://www.acog.org/Resources_And_Publications/Task_Force_and_Work_Group_Reports/Hypertension_in_Pregnancy [Accessed 22 January 2014]

American College of Obstetricians and Gynecologists (ACOG). Committee Opinion 549: Obesity in pregnancy. *Obstet Gynecol* 2013b:121: 213-7.

American Society of Addiction Medicine (ASAM). Public policy statement on women, alcohol and other drugs, and pregnancy. Chevy Chase, American Society of Addiction Medicine, 2011.

Barfield WD, Warner L. Preventing chronic disease in women of reproductive age: opportunities for health promotion and preventive services. *Prev Chronic Dis* 2012; 9: E34.

Bateman BT, Mhyre JM, Hernandez-Diaz S, Huybrechts KF, Fischer MA, Creanga AA, *et al.* Development of a co-morbidity index for use in obstetric patients. *Obstet Gynecol* 2013; 122(5):957-965.

Centers for Medicare & Medicaid Services (CMS). Partnership for Patients. Centers for Medicare & Medicaid Services, 7500 Security Boulevard, Baltimore, MD, 21244.

<http://partnershipforpatients.cms.gov/about-the-partnership/aboutthepartnershipforpatients.html> [Accessed December 3, 2013]/

Cutler JA, Sorlie PD, Wolz M, Thom T, Fields LE, Rocella EJ. Trends in hypertension prevalence, awareness, treatment, and control rates in United States adults between 1988-1994 and 1999-2004. *Hypertension* 2008; 52:818-27.

D'Alton ME, Bonanno CA, Berkowitz RL, Brown HL, Copel JA, Cunningham FG, *et al.* Putting the "M" back in maternal-fetal medicine. *Am J Obstet Gyn.* June 2013: 442-448?

D'Angelo D, Williams L, Morrow B, Cox, S, Harris N, Harrison, L, *et al.* Preconception and interconception health status of women who recently gave birth to a live-born infant --- pregnancy risk assessment monitoring system (PRAMS), United States, 26 Reporting Areas, 2004. *Morbidity and Mortality Weekly Report.* Centers for Disease Control and Prevention. December 14, 2007/ 56(SS10); 1-35.

Gaylean AM, Lagrew DC, Bush MC, Kurtzman JT. Previous cesarean section and the risk of postpartum maternal complications and adverse neonatal outcomes in future pregnancies. *J Perinatol* 2009; 29: 726-30.

Goff SL, Pekow PS, Avrunin J, Lagu T, Markenson G, Lindenauer P. Patterns of obstetric infection rates in a large sample of US hospitals. *Am J Obstet Gynecol*, June 2013: 456.e1-456.e13?

Hamilton MS, Drooten Youngblut JM. High-risk pregnancy: postpartum hospitalization. *Journal of Perinatology* 2002; 22:566-571.

Liu S, Heaman M, Joseph KS, Liston RM, Huang L, Sauve R, *et al.* Risk of maternal postpartum readmission associated with mode of delivery. *Obstet Gynecol* 2005; 105: 836-42.

Lockwood CJ, Lemons JA, Eds. American Academy of Pediatrics (AAP), American College of Obstetricians and Gynecologists (ACOG). *Guidelines for Perinatal Care, Sixth Edition.* 2007.

Lydon-Rochelle M, Holt VI, Martin DP *et al.* Association between method of delivery and maternal rehospitalization. *JAMA* 2000; 283: 2411-2416.

National Institute for Health and Clinical Excellence (NICE). Clinical Guideline- Hypertension in pregnancy: the management of hypertensive disorders during pregnancy. August 2010.

Orphir E, Stulov A, Stolt I, Michlin R, Burynov I, Bornstein J. Delivery mode and maternal rehospitalization. Arch Gynecol Obstet 2008; 277(5):401-4.

Rose H, Rolland B, Subtil D, Vaiva G, Jardri R, Cottencin O. The need for developing preconception counseling in addiction medicine. Arch Women Ment Health 2013; 16:544-434.

Society of Obstetricians and Gynaecologists of Canada (SOGC). Clinical Practice Guideline – Diagnosis, evaluation and management of the hypertensive disorders of pregnancy. Royal College of Obstetricians and Gynaecologists. March, 2008.

Society of Obstetric Medicine of Australia and New Zealand (SOMANZ). Guidelines for the management of hypertensive disorders during pregnancy. 2008.

Spong CY, Berghella V, Wenstrom KD, Mercer BM, Saade GR. Preventing the first cesarean delivery. Obstet Gynecol 2012; 120, 1181-1193.

The Joint Commission. Specifications Manual for Joint Commission National Quality Measures (v2013A1). <http://manual.jointcommission.org/release/TJC2013A/MIF0166.html> [4 December 2012]

United States Department of Health and Human Services (US DHHS). Healthy People 2020; US Department of Health and Human Services. 200 Independence Avenue, S.W. Washington, DC 20201. Last updated August 28, 2013. <http://healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=26> [3 December 2013]

Yeomans ER. Operative vaginal delivery. Obstet Gynecol 2010; 115, 645-653.