Effects of a Pregnancy Management Program On Birth Outcomes in Managed Medicaid

Low-birth-weight outcome was reduced when women participated in a managed maternity program, compared with nonparticipants

Mary V. Mason MD, MBA, FACP, senior vice president, chief medical officer, Centene Corp.; Amy Poole-Yaeger MD, FAAP, vice president of medical affairs, Centene Corp.; Brad Lucas MD, MBA, FACOG, national medical director, Centene Corp.; Cathie R. Krueger, RN, BSN, director of quality improvement, Centene Corp.; Tamim Ahmed, Ph.D, MBA, vice president, Solucia Consulting; and Ian Duncan, FSA, FIA, FCIA, MAAA, department of probability and applied statistics, University of California–Santa Barbara

ABSTRACT

Objective: Examine the effect of a prenatal program on birth outcomes, specifically birth weight, in a managed Medicaid pregnant population, and identify the potential barriers to obtaining the risk screening information required for successful interventions.

Design: Retrospective propensity-adjusted cohort comparison.

Methods: Retrospective propensity-adjusted comparison of pregnant women in a managed Medicaid plan enrolled in a prenatal program and pregnant women who were not enrolled. Program enrollment was initiated by receipt of a Notification of Pregnancy (NOP) risk screening assessment.

Results: We demonstrate a statistically significant improvement in delivery outcomes in the women who participate in the pregnancy management program (NOP group) compared with those who do not (non-NOP group). The incidence of low-birth-weight infants was lower in the NOP group compared to the non-NOP group. Odds ratio estimates indicate that the NOP participants are likely to have 7.9% lower adverse event frequency for delivery weights <2500 g; 20% lower adverse event frequency for delivery weights <1500 g; and 31.2% lower adverse event frequency for delivery weights <1000 g. All p values are statistically significant.

Conclusion: Participation in a pregnancy management program improves birth outcomes in women who are at risk of low-birth-weight deliveries. Early identification of pregnant women and their risk factors for the purpose of enrollment in a managed Medicaid prenatal program is an important factor in improving birth outcomes, specifically birth weight. Our results indicate that this is an important area for investment if birth outcomes are to be improved.

INTRODUCTION

As evidence developed in the early 1980s, lack of access to prenatal care was identified as the major barrier for improving adverse pregnancy outcomes. Two Institute of Medicine (IOM) reports (IOM 1985, IOM 1988) clearly identified the most important barrier to prenatal care access as financial (amongst other like systems, organizational, and cultural) (Handler 2008). As a result of these two reports, Congress expanded access to prenatal care through state Medicaid programs in the 1986–1990 period. By 2003, more than 40% of births in the United States were to mothers who received their prenatal care benefits under Medicaid (Kaiser Family Foundation 2011) and currently over 70% of Medicaid beneficiaries are enrolled in managed care programs that frequently offer prenatal case management as a benefit (March of Dimes 2011).

Centene Corporation is a Medicaid managed care organization (MCO) that provides Medicaid managed care programs for low-income populations and currently serves over 1.5 million members in 10 states. Centene's prenatal program, Start Smart for Your Baby (Start Smart), focuses on more than 70,000 pregnant members annually. The program identifies and stratifies high-risk pregnant women through a notification of pregnancy (NOP) process and provides them with the tools and education to effectively reduce their risk of adverse pregnancy outcomes.

Admissions to the NICU (neonatal intensive care unit) and poor birth outcomes are significant cost drivers for any managed Medicaid organization covering the TANF (Temporary Assistance to Needy Families) popu-

Author correspondence
Mary V. Mason MD, MBA, FACP
Centene Corp.
7700 Forsyth Blvd.
St. Louis, MO 63105
(314) 725-4477
Email: mmason@centene.com

DISCLOSURE
Drs. Mason, Poole-Yaeger, and Lucas and Ms. Krueger disclose they are employees of Centene Corp. Tamim Ahmed and Ian Duncan disclose no financial arrangements with organizations mentioned in this article.

lation. The March of Dimes Foundation estimates that the annual societal economic burden associated with preterm birth in the United States translates to more than $64,000 per infant born preterm based on 2008 data (March of Dimes 2008). This cost, estimated by Thomson Reuters, includes combined newborn and maternal costs.

The objective of this study was to examine the effect that a targeted program within a managed Medicaid plan can have on birth outcomes and to analyze the barriers that managed Medicaid plans face in identifying and assessing the risk of pregnant women. Analysis of the cost, benefits, and barriers to management of the population allows the health plan to maximize its use of resources in achieving the targeted results.

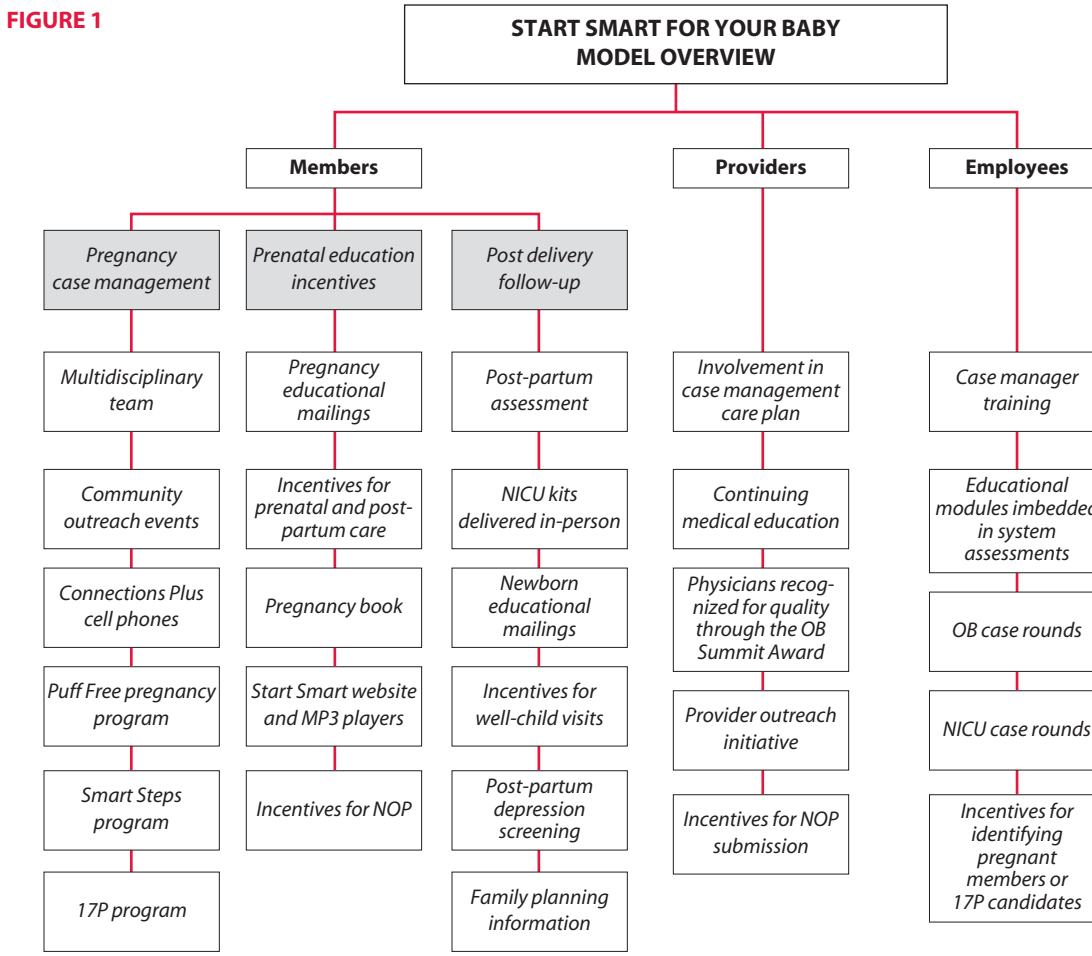
PROGRAM DESCRIPTION

Start Smart incorporates the concepts of case management, care coordination, and disease management in an effort to improve the health of mothers and their newborns. The program's multi-faceted approach to improving prenatal and post-partum care includes enhanced member outreach and incentives, wellness materials, intensive case management, provider incentives, and support of the appropriate use of medical resources to extend the gestational period and reduce the risks of pregnancy complications, premature delivery, and infant disease.

The prenatal program incorporates tools that are used by case management teams across all states. The process and tools complement the Start Smart program, specify the actions of all parties, support data collection, and facilitate the measurement and tracking of outcomes.

One of the essential components of the program is the NOP process, which identifies pregnant members and their risk factors as early in pregnancy as possible in order to establish a relationship between the member, provider, and health plan staff. Receipt of an NOP screening assessment automatically enrolls a pregnant member in the Start Smart program. The NOP form indicates the member's current contact information,

FIGURE 1



provider information, estimated date of confinement (EDC), and obstetric history. Based on this information, a risk score is assigned that determines the course of action taken in regard to the member's pregnancy.

The program components that make up the Start Smart model are shown in Figure 1. This program has three stakeholders — pregnant mothers who enroll, providers who care for them, and employees of the MCO who manage both, particularly high-risk pregnant women.

Providers are critical stakeholders in the program. Providers are exposed to the latest protocols in care through emphasizing evidence-based medicine and optimum-treatment protocols and are involved in care plan development. Providers are also encouraged to identify high-risk pregnant women and enroll them in the NOP program.

The third stakeholder in the program is the health plan's operation staff. Nurses, administrators, and health care specialists are all trained to manage this population, particularly in areas of obstetrics. Health plan staff are also involved in OB and NICU case rounds, and are encouraged to identify pregnant mothers or 17P (injected form of the hormone treatment progesterone) candidates.

DATA ANALYSIS

Targeted outcomes of the Start Smart program are birth weight, complications of pregnancy, and reduction in premature delivery and repeat premature delivery. Some of these outcomes may only be assessed from administrative claims data, and are the subject of a future paper. For the purposes of this study, we analyzed qualitative data collected at the point of care management by case managers who managed the care of individual mothers. The data were collected during the interventions using a standard protocol automated by Care Enhance Clinical Management Software, a system provided by McKesson Corporation.

Authorization and case management birth outcomes data were analyzed on 76,735 deliveries from January 1, 2008, through August 31, 2009. At the start, we included all deliveries with a documented birth weight between 500 and 6000 g for this study.

Babies under 500 g were excluded because they were presumed to be previable or weights documented in error. Demographic characteristics and birth outcomes of pregnant members who delivered in 2008 and 2009 were derived from the Start Smart (Care Enhance) database. Birth weight data were gathered from information received from hospital notification of deliveries.

Table 1 compares the population characteristics of women participating and not participating in Centene's NOP program.

Table 1 shows the distribution of participating and non-participating mothers by several risk factors (state, race, age and multiple births). Differences between the characteristics of the two populations could confound the measured outcomes.

The effect of regional variations in birth outcomes has not been studied or documented. Variation in birth outcomes due to differences in racial composition are well known, with adverse birth outcomes being more likely among blacks and Hispanics. Among different age groups, women <20 years (and perhaps in their teens) are considered to be a high-risk group, as is the cohort in the 40–50 years age group. Women over 35 tend to be at a higher risk of adverse pregnancy outcomes.

Another important risk factor for low birth weights is multiple births. The likelihood of low birth weight increases exponentially for pregnancies resulting in multiple births.

Other risk factors could have been important determinants of participation in the program. Risk factors include education, income level, marital status, life style choices (e.g., smoking, drug use, obesity, etc.) and disease comorbidities (Baldwin 1998, Lopez 2002). While data were collected on these factors for the NOP group, complete information was not available for the non-NOP group. Claims data to understand details of the antenatal care, care rendered (e.g., blood pressure monitoring, height and weight recording, urine and blood testing) and pelvic exam (Herbert 2007) and complications of delivery were made available subsequently and will be analyzed in a future paper.

Most of the differences between NOP and non-NOP participants are statistically significant (p value < 0.05), except for the (small) populations in South Carolina, and Asian/ Pacific and Native American/ Alaskan races. Age distributions of all but the youngest and oldest women (members 20–29 and 40–50 years of age) are different, at a statistically significant level.

To discern any effect of the maternity management program (NOP), we must be able to adjust for these confounding patient characteristics. We did so using a propensity mix adjustment. The details are given in the methodology section.

METHODOLOGY

To draw valid conclusions regarding differences in outcomes between the NOP and non-NOP cohorts, the cohorts must exhibit the same demographic, racial, and age-mix characteristics. Race designation was unknown for some members, and records for these mothers were eliminated. A propensity mix adjustment (Seeger 2007, Heckman 2009, Obenchain 1997, Rubin 1997, D'Agostino 1998) was applied to adjust for variations in the stated demographic and regional distributions identified in Table 1.

Propensity mix adjustment

Matching members of the treat-

TABLE 1
Total population characteristics

Characteristic	NOP participants	NOP nonparticipants	p<
State*			
Arizona	1.06%	0.2%	0.0000
Georgia	42.3%	39.5%	0.0000
New Jersey	4.1%	2.6%	0.0000
Ohio	14.8%	10.4%	0.0000
South Carolina	2.1%	2.2%	0.1407
Texas	33.4%	41.4%	0.0000
Wisconsin	2.2%	3.5%	0.0000
	100.0%	100.0%	
Race			
Asian/Pacific	0.9%	0.9%	0.8700
Black	27.0%	29.1%	0.0000
Caucasian	21.6%	17.7%	0.0000
Hispanic	19.5%	22.2%	0.0000
Native American/Alaskan	0.1%	0.1%	0.4206
Unknown	30.9%	30.1%	0.0089
	100.0%	100.0%	
Age group			
Under 20 yrs	20.3%	21.6%	0.0000
20–29	62.8%	62.3%	0.1781
30–39	15.8%	15.0%	0.0014
40–50	1.1%	1.1%	0.8709
	100.0%	100.0%	
Births			
Singletons	97.0%	97.5%	0.0001
Twins	2.9%	2.5%	0.0005
Triplets	0.09%	0.04%	0.0027
	100.0%	100.0%	
Member count	36,824	39,911	

ment group (NOP) to members of the control group (non-NOP) is often used for studies so that potential bias in outcomes between the groups is minimized or neutralized. This approach is often used as a "second best" option in lieu of alternative study designs, such as randomized control trial (RCT). The method is based on finding similar attributes amongst test and control groups. Many characteristics may enter as confounders for low birth conditions that may unduly influence the results. In our approach, we were able to identify locations, race, age bands, and birth counts as possible characteristics. Use of these factors leads to as many as 240 matching groups (NON/non-NOP). Propensity scoring minimizes the number of dimensions in this comparison by collapsing the vector of population covariates to a single value so that members can be matched to each other (Rubin 1997, Rosenbaum 1983, Joffe 1999, Thorpe 1999).

The process is technically implemented by applying a logistic regression model with an outcome variable representing test versus control status and regressed on the characteristics as described in Table 2. This process of matching has the effect of balancing all variables that are components of the score, and thus removing the confounding effect from these variables between the test and control groups (Rubin 1996, Knopp 1999).

We used a sample matching algorithm based on a "greedy" algorithm (Parsons 2001). In this approach, a one-to-one matching is performed for the non-NOP group to the NOP group. The process used here is a Greedy 5 1 digit match, meaning that treatment cases were first matched to the control cases based on 5 digits of the propensity score. For those that did not match, cases were matched to controls on 4 digits of the propensity score, and successively matching on digit counts until the 5th process matches the remaining cases to the control cases on 1 digit propensity score.

We tested various algorithms for matching between cases and controls. The p-value comparing cases to controls was not significant for any of the selected criteria and other algorithms did not improve the match.

The revised distribution is shown in Table 2.

In Table 2, the reduced sample size is due to missing race and state information. The remaining data show that the differences between NOP and non-NOP populations identified in Table 1 have been eliminated by the propensity adjustment. The propensity mix adjustment corrects for the

innate differences in regional, racial, multiple birth count, and demographic characteristics.

In the second step, we applied a logistic regression model with three outcomes: birth weight <2500 g, <1500 g and <1000 g.

The independent variables in this model are:

1. NOP, which is expected to reflect program effect between NOP participants and the non-NOP group;
2. Regional variables representing different states: Ga., S.C., Texas (dropping Ariz. as an omitted variable);
3. Race representing Asian/Pacific, Black, Caucasian and Hispanic dropping Native American/Alaskan as an omitted variable; and
4. Age band (categorical variables) representing <20 years, 20–29 years, 30–39 years and 40–50 years of age.

RESULTS

Table 3 shows the results of the logistic regression.

Table 3 presents results of three logistic regression equations with outcome variables (low birth weights) <2500 g, <1500 g and <1000 g. The results exhibit independent effects of NOP program and various other risk factors.

For low birth weight deliveries under 2500 g, the NOP group is 7.9percent less likely to have an adverse outcome compared to the non-NOP group as a result of the NOP program. This estimate is statistically significant. Other significant variables in the <2500 g outcomes equation are age bands 30–39 years and 40–50 years which have 9.1% and 48.5% higher likelihood of low birth babies compared to the omitted age group (<20 years). Also significant is the state: low birth babies are 30.2% less likely in Georgia than in Arizona (reference state).

For the low-birth-weight deliveries under 1500 g, the NOP effect is significant at the 95% confidence level. Participants in the NOP program have a 20% lower likelihood of having an adverse outcome compared to the nonparticipants in the NOP program. As with deliveries under 2500 g, two age bands (age groups 30–39 and 40–50) have respectively 31.7% and 167% higher likelihood of adverse (low birth weight) events compared to the excluded age band (<20 years).

For low birth weight deliveries under 1000 g, the NOP effect is significant at 95% confidence level. Participants in the NOP program have 31.2% less likelihood to have adverse outcome than the nonparticipants in

TABLE 2
Propensity score matched-pair samples characteristics

Characteristic	NOP participants	NOP nonparticipants	p<
State			
Arizona	0.4%	0.4%	1.0000
Georgia	60.1%	60.1%	0.8175
New Jersey	0.0%	0.0%	-
Ohio	0.0%	0.0%	-
South Carolina	2.0%	2.0%	0.8694
Texas	37.4%	37.4%	0.8882
Wisconsin	0.0%	0.0%	-
	100.0%	100.0%	
Race			
Asian/Pacific	1.3%	1.2%	0.2531
Black	41.1%	41.3%	0.6899
Caucasian	27.9%	27.8%	0.8871
Hispanic	29.5%	29.5%	1.0000
Native American/Alaskan	0.1%	0.1%	0.8927
Unknown	0.0%	0.0%	-
	100.0%	100.0%	
Age group			
Under 20 yrs	21.0%	20.9%	0.7790
20–29	62.2%	62.2%	0.9099
30–39	15.8%	15.8%	0.9784
40–50	1.1%	1.1%	0.5219
	100.0%	100.0%	
Births			
Singletons	97.4%	97.5%	0.4038
Twins	2.6%	2.5%	0.3835
Triplets	0.03%	0.03%	0.7815
	100.0%	100.0%	
Member count	24,078	24,078	

TABLE 3
Results of the logistics regressions

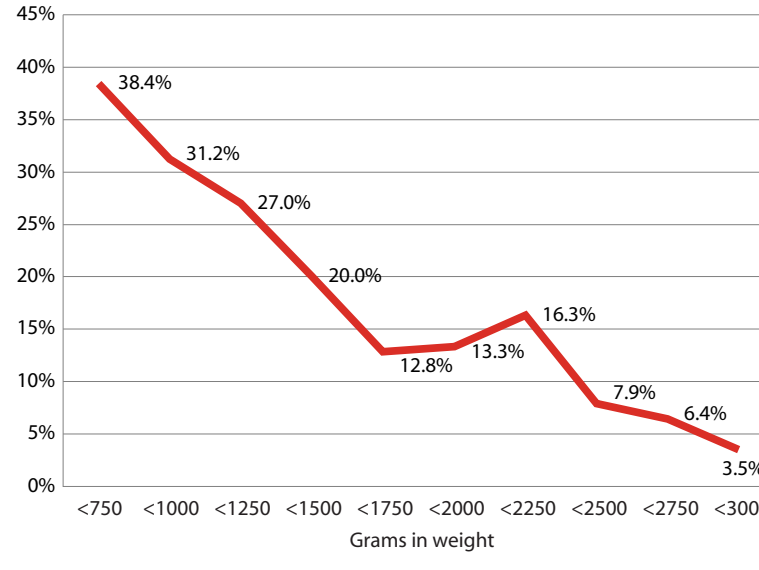
Program effect and risk factors	<2500 g (odds ratio; 95% CI)	<1500 g (odds ratio; 95% CI)	<1000 g (odds ratio; 95% CI)
NOP effect	0.921* (0.869–0.975)	0.800* (0.695–0.920)	0.688* (0.552–0.858)
Regions			
Ga.	0.698^ (0.468–1.041)	1.024 (0.325–3.229)	0.678 (0.165–2.778)
S.C.	0.952 (0.613–1.478)	1.648 (0.490–5.545)	1.298 (0.286–5.889)
Texas	0.950 (0.634–1.424)	1.126 (0.353–3.594)	0.627 (0.149–2.644)
Race			
Asian/Pacific	1.030 (0.391–2.715)	0.264 (0.027–2.603)	0.237 (0.024–2.368)
Black	1.928 (0.765–4.860)	1.458 (0.199–10.685)	0.572 (0.077–4.277)
Caucasian	1.091 (0.433–2.750)	0.633 (0.086–4.640)	0.256 (0.034–1.916)
Hispanic	1.153 (0.458–2.902)	0.735 (0.101–5.363)	0.282 (0.038–2.089)
Age bands			
20–29 Years	0.976 (0.907–1.050)	0.917 (0.766–1.097)	1.016 (0.757–1.362)
30–39 Years	1.091^ (0.992–1.197)	1.317* (1.058–1.640)	1.673* (1.189–2.354)
40–50 Years	1.485* (1.166–1.890)	2.669* (1.708–4.172)	3.751* (2.001–7.031)
Likelihood ratio	P<.0001	P<.0001	P<.0001
Observations	48,156	48,156	48,156

NOP. As with other low birth weights the last two age bands (age group 30–39 and 40–50) have a 67.3% and 275% higher likelihood of adverse (low birth weight) events compared to the excluded age band (<20 years).

Another important finding is that the results are not driven by variations in race or regions. Through matched sampling via the propensity mix methodology, we have been able to cancel such effects across the participating and non-participating cohorts. The higher age band effect is robust across all groups although our expectation was that mothers in age band 30–39 years would have better outcomes than those mothers in the band <20 years of age.

Figure 2 exhibits continuous relative proportions. Various adverse outcomes were constructed for birth weights <750 g, <1000 g, <1250 g etc. Multiple logistic equations, each representing one such outcome measure, was applied to the underlying

FIGURE 2
Relative proportions of low birth events of participants vs. nonparticipants



data. This resulted in estimates of odds ratios, (interpreted as relative proportions) to generate Figure 2. Figure 2 demonstrates that there are higher relative effects of NOP program for preventing extremely low birth weight babies, e.g., 38.4% less likelihood of <750 g babies in the participant group compared to the nonparticipant group, 31.2% less likelihood for <1000 g babies, 27.0% less likelihood of <1250 g babies, etc. The program has less effect at preventing low birth weight babies at <3000 g which is only effective at 3.5% for the participants versus nonparticipants and with a weaker ($p<.10$) statistical confidence level.

DISCUSSION AND POLICY IMPLICATIONS

The focus of our study is the effect of identification and enrollment of pregnant Medicaid members into a managed care health plan prenatal program over a 20 month period.

Our data suggest that participation in a managed Medicaid prenatal care program improves birth outcomes.

Results of our study support strongly reduction for <1500 g and <1000 g events for the program participants with 95% statistical credibility and reduction in <2500 g events for the participants with 90% statistical credibility.

The reduction likelihood ranges from a low of 7.9% for <2500 g births for NOP participants, to higher reductions at 20.0% for <1500 g births and 31.2% for <1000 g outcome for program participants.

The program actively encourages early notification of pregnancy and increased awareness of the program amongst members and network physicians.

Overall, the focus on the NOP program has resulted in an increase in enrollment to approximately 60% of the women who deliver a baby.

As the study shows, the ability to increase enrollment significantly above the current 60% level offers the opportunity to affect low birth weight deliveries significantly, particularly in the lowest birth weight categories.

An important policy implication of this study is the need for cooperation between the state and managed care companies to develop a single, short notification of pregnancy form for use throughout the state to improve compliance with this request for information.

Some states have developed such a form; however it is often cumbersome and difficult to complete. A statewide database, set up and administered correctly, could offer valuable information to health plans and other payers who want to aggressively manage care for pregnant women in order to achieve the best birth outcome possible.

Potentially pregnant members identified by the health plan through indirect means like claims or state file reports are contacted through phone calls and mailings in an attempt to gather the NOP screening assessment information.

Inaccurate demographic information, the inaccessibility of many of the Medicaid members, and Medicaid's practice of first enrolling newly-eligible women in the fee-for-service program (and later transferring them to managed care, but sometimes with a 6–9 week delay) can seriously hinder this effort.

Many states have implemented changes to improve the Medicaid enrollment process for pregnant women.

However, each state has its own unique set of challenges and there is no "right" combination of policy that solves these challenges for every state (Hill 2009).

States where Medicaid, managed care, and public health officials work collaboratively have the most success in improving outcomes.

By partnering, they can develop policies and systems that complement and have the potential for meeting goals related to quality, fiscal integrity, access, and efficiency (Hill 2009).

Lastly, low birth weight and future complications associated with it is a serious societal drain. The root cause is a complex mix of social, economic and health care factors. While prior policy has focused on removing barriers to access for prenatal care, the data shows that this is insufficient. Medicaid maternity management programs must address prenatal care from a broader perspective, supporting pregnant mothers with both prenatal care along with other non-medical services (Buescher 1991).

LIMITATIONS

Limitations of this study include inability to control for a variety of factors that contribute to birth weight such as birth defects, maternal health and weight gain, smoking rate or substance abuse, disease comorbidity and socioeconomic issues.

However, controlling for factors that are known to have a great impact on birth weight (such as race and age), we are still able to demonstrate statistically significant improvements in birth outcomes in those members enrolled in the program versus those who were not.

CONCLUSION

Previous studies have shown mixed results of such managed maternity programs on reducing adverse outcomes, particularly low birth weight babies. This study proves conclusively that low birth weight outcome is reduced for those who participated in the managed maternity program compared to those who did not participate (making appropriate statistical adjustments for underlying differences in population characteristics). Enrollment in a Medicaid maternity management program has its greatest effect on lowest birthweight deliveries, but improves outcomes for all deliveries under 3000 g.

REFERENCES

Baldwin LMB, Larson EH, Connell FA et al. The effect of expanding Medicaid prenatal services on birth outcomes. *American Journal of Public Health,*1998; 88, 11, 1623-29.

Buescher PA, Roth MS, Williams D, Goforth CM. An evaluation of the impact of maternity care coordination Medicaid birth outcomes in North Carolina. *Amer J Pub Health.* 1991;81(12):1625–29.

D'Agostino Jr. RB. Propensity score methods for bias reduction in the comparison of a treatment to non-randomized control group. *Statist Med.* 1998;17:2265–81.

Handler, A. The intervention works but not for the intended problem: the case of prenatal care and low birth weight/prematurity, Chicago, IL: Maternal and Child Health Program, School of Public Health, Univ. of Illinois at Chicago; 2008.

Heckman JJ, Todd PE. A note on adapting propensity score matching and selection models to choice based sample. NBER. 2009 working paper 15179.

Herbert P, Reed G, Entman SS, Mitchell EF Jr., et al. Serious maternal morbidity after childbirth: Prolonged hospital stays and readmissions. Obstet Gynecol. 1999;96(6):942–47.

Hill I, et al. Medicaid outreach and enrollment for pregnant women: What is the state of the art? The Urban Institute, 2009.

Joffe MM, Rosebaum PR. Invited commentary: propensity scores. *Am J Epidemiol.* 1999;150:327–333.

Kaiser Family Foundation. http://www.statehealthfacts.org

Knopp RH. Drug treatment and lipid disorders. *N Engl J Med.* 1999;341:498–511.

Lopez NJ, Smith PC, Guiterrez J. Higher risk of preterm birth and low birth weight in women with periodontal disease. *J Dental Res.* 2002;81(1):58–63.

March of Dimes Foundation—The cost of prematurity to employers http://marchofdimes.com/peristats/pdfdocs/cts/ThomsonAnalysis2008_SummaryDocument_final121208.pdf. Accessed on 3/29/11.

March of Dimes, PeriStats. http://bit.ly/fjMokS. Accessed on 3/29/11.

Obenchain RL, Melfi CA. Propensity score and Heckman adjustments for treatment selection bias in database studies. Proceedings of the Biopharmaceutical Section. 1997.

Parsons LS. Reducing bias in a propensity score matched-pair sample using greedy matching techniques". 2001. *Proceedings of the Twenty-Sixth Annual SAS Users Group International Conference, Long Beach, CA.* :214–26. http://www2.sas.com/proceedings/sugi26/p214-26.pdf. Accessed on 3/8/11.

Reinold C, Dalenius K, Smith B, Brindley P, Grummer-Strawn L. *Pregnancy Nutrition Surveillance 2007 Report.* Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention; 2009.

Rosenbaum PR, Rubin DB The central role of propensity score in observational studies for causal effects. *Biometrica.* 1983;70:41–55.

Rubin DB. Estimating causal effects from large data sets using propensity scores. *Ann Int Med.* 1997;127(8) (part 2): 757–63.

Rubin DB, Thomas N. Matching using estimatedpropensity scores: relating thoery to practice. *Biometrica.* 1996;52:249–264.

Seeger JD, Kurth T, Walker AM. Use of propensity score technique to account for exposure-related covariates. *Med Care.* 2007;45(10);S143–148.

Thorpe KE, Flome J, Joski P. "The Distribution of Health Insurance Coverage Among Pregnant Women, 1999". Emory University, Report, prepared for the March of Dimes Foundation. April 2001. http://www.marchofdimes.com/downloads/The_Distribution_of_Health_Insurance_Coverage_among_Pregnant_Women.pdf. Accessed on 3/8/11.