Reduction in Neonatal Intensive Care Unit Admission Rates in a Medicaid Managed Care Program

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Background: Neonatal intensive care unit admission rates are an important birth outcome indicator for Medicaid managed care organizations.

Objectives: To reduce neonatal intensive care unit admission rates by at least 15% and to maintain that reduction through implementation of a quality improvement program.

Study Design: The organization performed a longitudinal population-based review of its birth outcomes from 1997 through 2003, focusing on neonatal intensive care unit admission rates. The return-on-investment evaluation reflected attributable incremental program costs and resultant savings.

Methods: Interventions included enhanced identification and stratification of high-risk women with the use of a health risk assessment form; outreach through nursing care coordination offering home visits, transportation, support services, social work services, and connection with other community-based organizations; and implementation of a strong informatics structure.

Results: Neonatal intensive care unit admission rates decreased from 107.6 per 1000 births in 1998 to 56.7 per 1000 births in 2003. The return on investment from the incremental program enhancements was just over $2 per $1 expended.

Conclusion: A program that identifies its high-risk pregnant enrollees in a timely fashion, provides outreach using a strong nursing care coordination and social work emphasis, and has an enhanced informatics structure can significantly affect birth outcomes for a Medicaid managed care population.

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Pregnancy is one of the primary events that lead to eligibility for Medicaid, and deliveries account for almost 50% of Medicaid inpatient discharges.[1] Women from lower socioeconomic groups experience poorer birth outcomes than those from higher socioeconomic groups.[2,3] Consequently, delivery claims and high-cost neonatal intensive care unit (NICU) expenses consume a large portion of Medicaid managed care medical expense budgets, despite advances in perinatal technology in the United States. With the shift of most Medicaid-eligible individuals to Medicaid managed care, enhancing birth outcomes becomes a major challenge for any Medicaid managed care plan.

Monroe Plan for Medical Care (MP), an independent practice association with more than 3000 providers in the Rochester region, partners with Excellus BlueCross BlueShield, Rochester, to serve as Excellus BlueCross BlueShield's delivery system for publicly financed programs targeting underserved populations. It provides care for nearly 48 000 Blue Choice Option (Medicaid managed care) enrollees in a program that covers the categories of individuals that include women and children (Temporary Assistance to Needy Families), adults who are unable to work (Safety Net), and a segment of the disabled populations (Supplemental Security Income). Monroe Plan for Medical Care is the dominant (70% of the market share) provider for Medicaid managed care in this region. It is the exclusive community provider for 14 000 enrollees in Family Health Plus, an expansion of the Medicaid managed care program in New York State for working-poor individuals. Finally, MP is the exclusive community provider of care for 11 000 children enrolled in Child Health Plus (New York State's children's insurance program).

In its relationship with Excellus BlueCross BlueShield, MP is financially responsible for the provision of all covered medical care services for enrollees in these publicly financed programs. It also is accountable for care management, disease management, and quality improvement activities that target the enrollees in these programs.

Before 1998, Medicaid managed care was an optional program for Medicaid recipients. During 1998, the most populous counties in MP's service area required mandatory enrollment of individuals covered by Medicaid in the Temporary Assistance to Needy Families and Safety Net categories into Medicaid managed care programs. Consequently, MP's overall enrollment increased from about 28 000 enrollees in 1998 to more than 73 000 in 2003, with a resultant increase in the number of births annually from about 600 in 1998 to more than 1300 in 2003.

During the late 1990s, the NICU admission rates for Medicaid, including MP, consistently were considerably

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greater than 100 per 1000 births. In 1997, there was a rudimentary prenatal and perinatal case management program that consisted of a part-time nurse case manager, ad hoc use of community support services (including home-based prenatal education), and an inconsistent approach to case finding. It made sense to implement a more comprehensive approach to prenatal care, because a reduction in NICU admission rates would favorably reduce overall costs for deliveries. This would provide an opportune area in which to achieve improvements in terms of patient care and outcomes and medical expenses.[4-6]

The medical literature reports that there are many risk factors that significantly affect birth outcomes for low-income and working-poor women, including medical comorbidities, mental health and substance abuse issues, smoking, previous preterm birth, and social-related problems such as social isolation, spousal abuse, and homelessness.[7-10] The birth outcomes database of MP (obtained through quarterly facility medical record reviews) identified social issues as correlating strongly with poor birth outcomes in comparison with other risk factors. Because comprehensive care through outreach, coordination, and education of patients seems to have demonstrated improvements in outcomes,[11-13] MP believed that early identification of risk factors, with subsequent coordinated interventions, would hold the greatest promise in mitigating the effects of risk factors in terms of birth outcomes.

Although MP's enhanced quality improvement efforts began in late 1997, the Center for Health Care Strategies invited MP in 2000 to participate in its Best Clinical and Administrative Practices "Toward Improving Birth Outcomes" program. This was a nationwide work group of 11 Medicaid managed care entities committed to developing and pilot-testing best-practice models. Best Clinical and Administrative Practices provided MP a framework in which to implement quality initiatives, using its typology of identification, stratification, outreach, and intervention. Furthermore, the collaboration with Best Clinical and Administrative Practices allowed MP to network and to identify best practices (and failed efforts) from other Medicaid managed care entities.

METHODS

During the literature review and ongoing interactions with other Medicaid managed care organizations, it was evident that there was no one magic bullet for improving birth outcomes. Consequently, MP decided that sustained improvement requires change in the care delivery system[14] to assist practitioners in doing the right thing at the right time. Monroe Plan for Medical Care thus adopted a quality improvement approach for its prenatal care improvement activities that calls for the use of learning cycles to plan and test changes in systems and processes.[15] Such cycles have been referred to as Plan-Do-Study-Act cycles, which will guide improvement teams through a systematic analysis and improvement process. As part of this process, MP solicited the professional input of its Obstetrics/Gynecology Advisory Committee in the development of its prenatal care program "Healthy Beginnings." The objectives of the program were to reduce NICU admission rates from baseline in 1998 by at least 15% during the subsequent 3 years and to maintain that reduction in the following years.

This program is part of MP's quality improvement program to enhance healthcare outcomes for all of its enrollees. The focus for any such quality improvement program is to institute organizational system changes to ensure adherence to appropriate practice guidelines through the coordination of care. This approach emphasizes organizational and care delivery improvements using existing standards of care. Consequently, there was no randomization of enrollees into intervention or control groups, and the services provided were available to all eligible enrollees, who at all times were able to refuse or terminate any services offered. Because these activities are essentially organizational system changes, institutional review board approval and participants' informed consent were not sought or required.

Identification of High-risk Individuals

Before 1997, practitioners rarely notified MP about the pregnancy of enrollees (notification would occur for almost 3% of pregnant women). In late 1997, MP developed its prenatal registration form (PRF) to serve as a means for practitioners to notify the program when an enrollee was pregnant and to provide the program with a health risk assessment for each woman. The PRF assesses risk categories of social risk factors, maternal medical history, psychoneurological history, maternal obstetrical history, and previous infant findings. During the rollout for the PRF, MP began to reimburse practices $30 for the submission of the PRF; alternatively, if the PRF was not submitted, the practitioner could potentially lose the prenatal care reimbursement. This action resulted in PRF submission rates of 85% in 1998 and subsequent annual rates in the 88% to 98% range.

Although the submission of PRFs reached 90% and higher, challenges remained regarding the timeliness of their submission. Often, practitioners would submit PRFs during the late third trimester, when the ability to mitigate any significant risks would be at a minimum. In

April 2001, Healthy Beginnings implemented a tiered payment system for the submission of the PRF in which the program would pay practitioners $50 for submission in the first trimester, $30 in the second trimester, and $20 in the third trimester. In addition, program staff visited practitioner offices to educate personnel regarding the submission of the PRF and its importance in assisting the practitioners in managing high-risk pregnant women. This intervention resulted in submission rates of the PRF within the first trimester that were consistently in the 60% and higher range.

Stratification of Risk

The PRF serves as an invaluable tool to stratify the risk for pregnant enrollees. Staff members input the PRF into the care management database, which then scores the reported findings to reflect the risk for each patient and to engage members in needed medical, behavioral health, and social and support services as identified. A committee of obstetrical practitioners and the local perinatal network developed the scoring system to stratify patients at risk throughout the community. This scoring system serves as an adjunct for care coordination decisions and is not used as admission criteria for the NICU.

During 2000, staff discovered that there was no consistent review process in place for addressing behavioral health issues identified through the PRF. In November 2000, the program instituted an integrated review process between the behavioral health and clinical medical management staff that now ensures that behavioral health staff address all mental health and substance abuse issues reported on the PRF and work to engage patients in necessary care.

Outreach

Through the quality improvement process, Healthy Beginnings has evolved its approach to outreach, from using generalized community outreach services (the local county community healthcare worker program and contracted home health agencies), to instituting a trial of using its own prenatal outreach workers, to finally engaging outreach services through the local BabyLove Program in early 2002. Whenever the Healthy Beginnings perinatal nurse coordinator identifies members at moderate-to-high risk through the PRF, the coordinator manages these individuals through communications with the practitioners, outreach programs (such as the county's Medicaid Community Health Worker program), and referral to MP's internal social work program as needed. Individuals with medical complications of pregnancy receive complex case management, home care services, or skilled nursing services as required.

The perinatal nurse coordinator refers all pregnant enrollees identified as high risk because of psychosocial problems to the BabyLove Program. This community-based program has a strong history of working effectively with high-risk pregnant women, with the added feature of social work supervision that is necessary to effectively provide outreach. The BabyLove Program offers home visits, arranges transportation, provides links to support services and social work services, and connects high-risk pregnant women with other critically needed services.

In early 2003, MP engaged the services of an additional BabyLove Program outreach worker to address the needs of depression in pregnancy. Later in 2003, MP added its own social worker to support the Healthy Beginnings clinical staff in addressing social problems.

Informatics Structure

With enhanced outreach, MP has been able to more effectively connect its pregnant women with medical, mental health, chemical dependency, community-based, governmental, and social services. Before 2001, MP stored PRF data in an internally developed Microsoft Access (Redmond, Wash) database; however, this approach to information systems did not support care management activities. In 2001, MP installed a commercially available care management software system (CaseTrakker; IMA Technologies, Sacramento, Calif) to support prenatal and perinatal care activities. The system identifies risk factors and scores the PRF, provides member demographics, identifies related practitioners, provides progress notes, creates reminders and ticklers for care management activities, stores birth outcome data, creates reports, and provides an interface for comorbidity issues. The system supports care managers and social workers by linking care management activities, risk factors, and outcomes associated with patients. As now implemented, it is not accessible to providers and does not provide a general electronic medical record; rather, it focuses on structuring the contacts that the care managers have with patients, practitioners, and community agencies, based on identified risk factors.

RESULTS

Admission Rates

The measurement for program effectiveness is the NICU admission rate for all pregnant women in MP. Because any significant programmatic changes first occurred in late 1997 and early 1998, and given that pregnancy is usually a 9-month phenomenon, the baseline year for NICU admissions is 1998. In terms of pro-

grammatic costs, 1997 serves as the baseline year, with incremental new program costs reflected in the following years.

As the **Figure** demonstrates, the NICU admission rates have progressively decreased relative to the 1998 baseline rate of 107.6 per 1000 births as MP implemented and improved the prenatal care program. Concomitantly, the NICU admission rates for Medicaid recipients in upstate New York have remained essentially the same during the same period (M. Whitbeck, Finger Lakes Health Systems Agency, Rochester, unpublished data, 2004). The NICU admissions and their associated costs in this analysis also include those infants weighing less than 1200 g. The costs for these infants were shifted out ("carved out") of Medicaid managed care to New York State Medicaid fee for service beginning in 1999; however, these children and their costs were included in the results and analysis. These program results have exceeded the original project objective of achieving a 15% reduction in the NICU admission rate.

Based on the 1998 NICU admission rate of 10.8%, a rate of 9.1% would have to be obtained to achieve the corporate objective of a 15% reduction in rates. However, to obtain a statistically credible reduction of at least 15% requires rates to fall below 6.8% to account for the potential effect of random variation. This is the rate calculated to show at least a 15% reduction statistically significant at $P < .05$ ($\alpha = .05$, 80% power) for a binomial test. Although there were reductions in NICU admission rates during 1999 and 2000, the rates in those years exceeded 9.1%. From 2001 through 2003, the rates were 8.8%, 8.9%, and 5.7%, respectively. A 1-sided exact binomial test was used to verify whether NICU admission rates were 15% below the 1998 rate. The rate during 2003 was statistically significant ($P < .01$). Arguably, this is conservative because this requires a one-third reduction in NICU admission rates. Using the weaker criterion of simply showing a statistically significant reduction compared with 1998, the rates from 2001 through 2003 were statistically significant at $P < .05$.

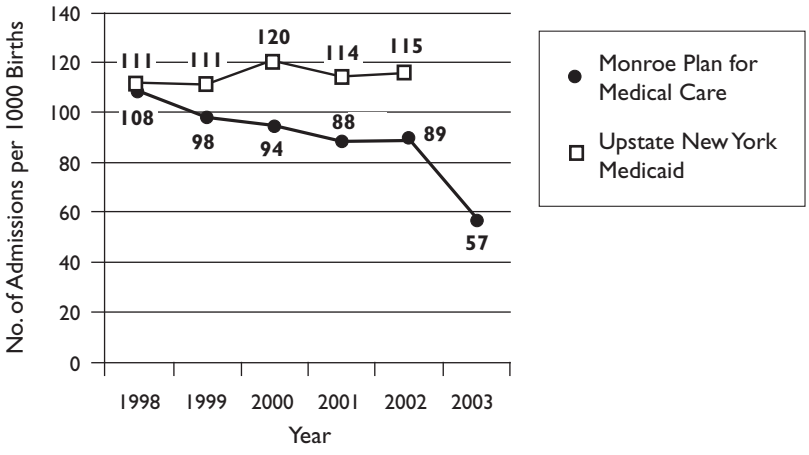
In support of the observed decrease in NICU admissions, 2 other birth outcome measures (gestational age < 32 weeks and birthweight < 1900 g) demonstrated trends in the same direction. The rate of births with a gestational age younger than 32 weeks decreased from 2.9% in 2001 to 0.9% in 2003, and the rate of births with a birthweight less than 1900 g decreased from 6.1% in 2001 to 1.6% in 2003. Birthweights less than 2500 g also decreased but less dramatically, from 10.2% to 7.6%. The mean birthweight and gestational age remained essentially flat during this period; however, a reduction in the tails of these distributions was observed. Although the mean birthweight and gestational age did not change, the reduction in extreme birthweights and gestational ages is consistent with reduced NICU admissions.

From 1998 through 2003, criteria for NICU admission remained unchanged. Therefore, within the community there was no reduction in the number of indications for NICU admissions, nor was there any redirection of children who would be candidates for NICU admission to other units. Analysis of New York's Statewide Planning and Research Cooperative System database, which captures all payer hospital data, demonstrated no concurrent changes in NICU admission rates in upstate New York for Medicaid patients (fee for service or managed care) through 2002 (M. Whitbeck, Finger Lakes Health Systems Agency, Rochester, unpublished data, 2004). Therefore, it appears that there were no external effects on NICU admission rates to explain the observed change in rates for MP.

Return on Investment

Implementation of a comprehensive care management program for prenatal care is not a trivial financial matter, particularly given that there has not been any one approach documented in the medical literature that is deemed the magic bullet. A health plan must demon-

Figure. Neonatal Intensive Care Unit Admission Rates for Monroe Plan for Medical Care and Upstate New York Medicaid



strate that whatever care or disease management program it implements will improve health outcomes and yield an economic return. Resources are scarce for most Medicaid managed care programs, and it is imperative for them to measure the effectiveness of their efforts rather than to simply continue them because they seem right. This is where measuring and analyzing the return on investment for a program are important.

For the purposes of this analysis, MP used the return-on-investment methods developed by American Healthways Inc and Johns Hopkins University.[16] This approach examines the ratio of the realized savings to the incremental program (prgm) costs, as shown in the following formula:

$$\frac{\text{(Pre–Prgm Implement Med Costs)} - \text{(Post–Prgm Implement Med Costs)}}{\text{Incremental Program Costs}}$$

In this case, medical costs (Med Costs) are the NICU costs, with the MP NICU costs in 1998 serving as the baseline for expected future years' NICU costs. The difference between actual costs and the projected costs based on the baseline year provides the value for the numerator of the ratio. Program costs for the denominator include reimbursement costs for submission of the PRF, Medicaid Obstetrical and Maternal Services program and Community Health Worker program expenses (primarily home-based prenatal education services), care management software expenses, external outreach services, internal personnel costs (full-time employees), and allocated organizational overhead.

Using the aggregate NICU cost savings (1999 through 2003) of $1 875 463 (**Table 1**) and the incremental prenatal program costs (1998 through 2003) of $924 300 (**Table 2**) in the return-on-investment ratio yields a ratio of 2.03, where for each $1 spent the enhanced prenatal care program provided a cost savings to the organization of just over $2. The ongoing rise in administrative costs per birth for the Healthy Beginnings program reflects the growth in the pregnant population, which required an increased investment in program infrastructure and the shift to a "high-touch" approach to outreach and to interventions that would require the addition of more personnel (a high-cost expense) to the program.

Despite the rising administrative costs for the program, the substantial savings realized by the program (with a demonstrated savings-to-cost ratio of 2.03) makes a strong business case for the Healthy Beginnings program. One could hypothesize that fewer NICU admissions potentially indicate overall healthier infants at birth for this high-risk population, resulting in an improved quality of life for these children and their parents and an overall societal benefit. The observed reduction in the rates of infants with gestational ages younger than 32 weeks and infants with birthweights less than 1900 g would support this. More in-depth testing of this hypothesis could be the subject of another study looking at child developmental metrics.

DISCUSSION

Program Outcomes

Monroe Plan for Medical Care contends that the implementation of its enhanced prenatal care program, Healthy Beginnings, in late 1997 and early 1998 has resulted in a marked decrease in its NICU admission rates. Other than this program, there were no known external forces that would have caused a drop in the NICU admission rates, such as a change in NICU admission criteria or coding changes or evidence that the overall population experienced a drop in rates. In 1998, the larger counties that MP serves (with most of its enrollees) converted to mandatory enrollment into Medicaid managed care for their Medicaid beneficiaries. This would mitigate any argument that the pregnant women enrolled within Medicaid managed care would be healthier than those in fee-for-service Medicaid.

There does not appear to be a consistent change in case-mix indicators that would cause the observed changes in NICU admission rates. Use of a diagnostic cost group case-mix adjuster (DxCG, Inc, Boston, Mass) showed essentially no change in the relative risk for women each year, and the mother's mean age at delivery

Table 1. Neonatal Intensive Care Unit (NICU) Costs and Savings

Year	No. of NICU Admissions	No. of Live Births	Projected NICU Costs (1998 Base $)	Actual NICU Costs ($)	NICU Cost Savings ($)	Aggregate NICU Cost Savings ($)
1998	65	604	610 700	610 700	0	0
1999	76	774	779 552	674 908	104 644	104 644
2000	93	993	998 958	736 840	262 120	366 764
2001	100	1140	1 148 600	694 433	454 167	820 931
2002	104	1164	1 167 811	1 062 280	105 531	926 462
2003	75	1325	1 327 563	378 562	949 001	1 875 463

remained the same at about 25 years. Trends for other risk factors were mixed, with incremental decreases in numbers of individuals with social risk factors, while there were increases of similar magnitude in the percentage of women with previous low birthweight pregnancies or preterm labor. Interestingly, the rate of women entering prenatal care during their third trimester decreased from 13.0% in 2001 to 7.7% in 2003. Late entrance into prenatal care is a risk factor that the program has sought to minimize through provider incentives and patient education.

Table 2. Incremental Enhanced Prenatal Program Costs

Year	Administrative Costs ($)	No. of Live Births	Administrative Costs Per Birth ($)	Incremental Program Costs Per Birth ($)	Total Costs for New Program ($)	Aggregate Costs for New Program ($)
1997	41 300	600	68.83	0	0	0
1998	69 100	604	114.40	45.57	27 500	27 500
1999	106 900	774	138.11	69.28	53 600	81 100
2000	160 000	993	161.13	92.30	91 700	172 800
2001	304 000	1140	266.67	197.84	225 500	398 300
2002	300 200	1164	257.90	189.07	220 100	618 400
2003	397 100	1325	299.70	230.87	305 900	924 300

It is difficult to ascertain if any one intervention affected these outcomes. Review of the medical literature and discussion with other Medicaid managed care programs appear to indicate that, if there is any improvement in birth outcomes for an overall population, it is usually attributable to a combination of several interventions. In this case, activities enhancing early identification, stratification, and outreach probably provided a synergistic effect on improving the outcomes. As noted in the Figure, the timing of the first substantial drop in NICU admission rates occurred during 1999, more than 1 year after the implementation of the requirement for the submission of the PRF. We believe that requiring practitioners to complete and submit the PRF, reimbursing them for submitting the PRF, and offering a program that would address identified problems encouraged them to ask about and assess important risk factors of prenatal care (eg, mental health, substance abuse, and social isolation) that might not have been readily explored and pursued in the past. The downward trend in NICU admissions (from 1998 to 2001), with the associated cost savings (especially in 2001), is reflective of the widespread provider adherence to the completion and submission of the PRF, allowing MP to intervene with patients having identified risks. The slight increase in the NICU admission rate in 2002 caused the dip in noted savings for that year. This reflects an increase of only 4 NICU admissions for the program and can be viewed as a part of normal variation in performance.

Analysis of MP birth outcomes data indicated that psychosocial or social isolation problems strongly correlate with poor birth outcomes. These include such factors as abuse by a spouse or partner, absence of a telephone, and lack of stable housing. These findings, along with care management experiences of MP and outreach staff, led to an increased emphasis of the program on outreach and social work interventions in a culturally competent manner. We contend that the engagement of the BabyLove Program (which includes a strong social work emphasis and is a high-touch program) in 2002 probably contributed significantly to the large fall in the NICU admission rate during 2003. Monroe Plan for Medical Care believes that these efforts contributed to and will maintain these decreases in NICU admissions.

Recent Interventions

Smoking is a recognized major risk factor for poor birth outcomes, and the rate of self-reported smoking among MP pregnant women has been consistently well above 20%. Previous attempts to mitigate this risk factor among pregnant women in MP had been less than successful because of a combination of practitioner unfamiliarity with evidence-based approaches for smoking cessation and a lack of appreciation of the importance of providing culturally competent counseling. In October 2003, MP, in partnership with the Monroe County Department of Public Health, launched the Greater Rochester Area Smoking Prevention program, targeting minorities for smoking cessation opportunities. For 4 community health centers, 2 community centers, and a large inner-city obstetrical practice, the project deploys culturally competent peer counselors on site who have been trained in the use of smoking cessation strategies endorsed by the Agency for Healthcare Research and Quality, Rockville, Md. The potential exists for this new initiative to remedy this problem.

Because the spacing of pregnancies tends to decrease poor birth outcomes and decrease potential stresses within a family, the postpartum visit can play a key role in enhancing a woman's coping skills and offer a venue for addressing family planning. In late 2002, MP instituted a "rewards" program, in which women who have kept their postpartum visit appointment receive a $25 gift certificate to a department store.

CONCLUSIONS

Monroe Plan for Medical Care believes that its Healthy Beginnings program has had a significant positive effect among the enrollees in its governmental programs. As a result of the reduction in NICU admissions, the program implementation and operations have produced substantive cost savings of more than $1.8 million, relative to an investment of $924 300 through 2003. The demonstration of a savings-to-cost ratio of 2.03 makes a strong financial business case for the continuation of the prenatal care program. In addition, children admitted to the NICU generally have a higher incidence of medical and developmental problems compared with other infants. One could infer that, with the reduction in NICU admissions, there are healthier infants at birth among the population served by MP, resulting in an improved quality of life for infants and their families and an overall societal benefit of having fewer children requiring early intervention services for birth-related developmental delays.

Other plans that serve Medicaid enrollees can develop and implement similarly effective prenatal care programs. The Center for Health Care Strategies offers a publicly available tool kit to assist plans in implementing the Plan-Do-Study-Act quality improvement process and in embracing the Best Clinical and Administrative Practices typology.[17] Success requires a motivated staff, appropriate tools for identification and stratification of high-risk individuals, education of practitioners regarding program benefits, infrastructure for data and outcomes measurement, and an organizational belief that incremental interventions will lead to positive outcomes for this vulnerable population.

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