

This article presents an evaluation of an innovative community-based, case-management program for high-risk pregnant women and their infants. A 7-year analysis of the Medicaid claims from 182,196 pregnant women and those for 140,088 infants was conducted. The findings showed improved birth outcomes and a steady decrease in the cost of care for both pregnant women and their infants. Recommendations are made concerning implementation of this program in other settings with other clients.

Cost Effectiveness of a High-Risk Pregnancy Program

*Judith W. Alexander, PhD, RN, CNAA
and Marlene C. Mackey, PhD, RN, FAAN*

A southeastern state implemented a multidisciplinary, high-risk pregnancy program to reduce perinatal morbidity and mortality for medically high-risk, Medicaid-eligible pregnant women and their infants. This innovative community-based program consisted of nurse case management, nutrition and social work services, care by a medical specialist, and delivery at a risk-appropriate hospital. The purpose of this paper is to present the comprehensive 7-year evaluation of the program to determine birth outcomes and cost.

BACKGROUND

Nursing Case Management

"Case management" (in some form, often by nurses) has been used to coordinate fragmented health and human services to meet client needs while controlling costs for over 100 years in the United States (Kersbergen, 1996). According to Cohen and Cesta (1997), "the definition of nursing case management varies depending upon the discipline that employs it, the personnel and staff mix used, and the setting in which the model is implemented.

Primarily borrowing principles from managed care systems, nursing case management is an approach that focuses on the coordination, integration, and direct delivery of patient services and places internal controls on the resources used for care. Such management emphasizes early assessment and interventions, comprehensive care planning, and inclusive service system referrals (p. 5)."

Nursing case management has been used in conjunction with prenatal care services in a number of settings. In a retrospective study of 231 pregnant women, Scheideberg (1997) reported that comprehensive perinatal case management may increase infant birth-weight. Laken and Ager (1996) found that case management significantly contributed to retention in substance abuse treatment during pregnancy. In contrast, others found no significant difference in birth outcomes between women who received case management services and those who did not (Piper, Mitchel, & Ray, 1996; Schulman, Sheriff, & Momany, 1997). Moore and colleagues (1998) reported a significantly lower preterm birth rate for Black women who received a comprehensive nurse telephone intervention. Boehm, Glass, and Reed (1996) reported no difference in birth outcome for women who received a daily nurse telephone contact; however, the sample size in this study was very small (21 in each group).

More detailed information about the components of the case management used in these studies would aid in interpreting the study findings. This study achieved this goal by examining a high-risk pregnancy program that used all the elements of case management.

Cost Effectiveness of Prenatal Care Programs

There is scant literature on the cost effectiveness of prenatal care programs. The studies reviewed in this article include both the outcomes and the cost effectiveness elements. Buescher, Roth, Williams, and Goforth (1991) studied Medicaid-eligible women in North Carolina that were enrolled in a maternity-coordinated service program. They found that in comparison, non-enrolled women, those who did not receive maternity-coordinated care services through this program, had 21% incidence of higher, low-birth-weight rates; 62% higher, very-low-birth-weight rates; and 23% higher infant-mortality-rates than women who were enrolled. They estimated that each \$1.00 spent on maternity care coordination saved \$2.02 in medical costs for newborns up to 60 days of age. The program helped women receive services that not only addressed medical but also nutritional, psychosocial, and resource needs.

Gravely and Littlefield (1992) studied the relationship between cost and effectiveness of three prenatal clinic staffing models for indigent clients. They reviewed the maternal and neonatal physiological outcome data

from 156 women who attended the clinics. One clinic was physician based, one used mixed staffing (RN for prenatal teaching and NP or physician on each visit), and one exclusively used clinical nurse specialists (CNSs) with physicians available for consultation. No differences in maternal-neonatal physiological outcome variables were noted. The clinic staffed by the CNSs had the greatest patient satisfaction and lowest cost per visit.

Schramm (1992) investigated the costs and benefits of adequate prenatal care in Missouri's Medicaid Program. Findings indicated that prenatal care costs were \$233 higher for pregnancies with adequate care (compared to those with inadequate care). However, costs for postpartum and newborn care for these women with adequate care were \$347 lower resulting in a savings of \$1.49 for every additional \$1 spent. Adequacy of care was measured using a modified Kessner Index, but the type of prenatal care received by the Medicaid pregnant women remained unchanged.

Although the findings from these studies are useful, an evaluation of the cost-effectiveness of a comprehensive case management program has not been done. This study was a longitudinal evaluation of a comprehensive case management program aimed at improving birth outcomes.

Description of the High-Risk Pregnancy Program

The staff of the high-risk pregnancy program, which was evaluated in this study, followed a detailed protocol developed primarily by nurses in the state health department. The program protocol directed physicians and other prenatal care providers to screen all Medicaid-eligible pregnant women and newborns for specific clinical high-risk factors. These factors for pregnant women included outcomes of previous pregnancies (i.e., low birth weight, abortions, infant death) and health status (Rh sensitization, heart disease, diabetes, hypertension, sickle cell disease, alcohol/drug problems, incompetent cervix, renal tract disease). Newborns were assessed for low birth weight, infections, congenital malformations, seizures, hypoglycemia, cardiopulmonary abnormalities, and alcohol/drug reactions.

The high-risk pregnancy program staff channeled clients to designated clinics for prenatal and newborn care and directed them to deliver their babies at regional referral hospitals. The nurse case managers ensured that each high-risk pregnant woman and infant receive a comprehensive community-based program until the infant was 1 year of age.

Case management is a coordinating service that assures delivery of health care to patients. The nurse case manager did a monthly assessment of service needs to identify barriers and develop a service plan that coordinated and monitored delivery of direct services.

Patient/case manager face-to-face encounters took place at least every 60 days. Case management activities included risk assessment, client interviews, referrals, development of service plans, documentation, and follow-up at clinic visits, by telephone, or through home visits. The nurse case manager assisted in finding food, utilities, and shelter; arranged transportation; and provided indicated clinical and support services.

Each client in the program also received social work and nutritional services. These services involved the initial assessment of the pregnant woman and newborn,

Women participating in the project generally delivered their babies in at-risk appropriate hospitals and birth outcomes improved with participation in the project.

and follow-up care as indicated. Follow-up services, in collaboration with the nurse case manager, ensured that the clients received adequate nutrition and appropriate social services.

The 1987 and 1989 evaluations of this high-risk pregnancy program (Baker & Kronenfeld, 1992; Kronenfeld, Baker, Schluchter, & Amidon, 1987; Kronenfeld & Baker, 1989) showed positive outcomes. Women participating in the project generally delivered their babies in at-risk appropriate hospitals and birth outcomes improved with participation in the project. These evaluations did not look at the cost aspect of the project.

The 1992 evaluation (Baker & Schulman, 1992; Schulman, 1995) highlighted several improvements in outcomes and costs from the program. For example, rate of birth had fallen from 3.2% in 1986 for DRG 386 (extremely immature or respiratory distress) to 2.0% in 1990. Additionally, the findings indicated that the DRG distribution for newborns shifted from less severe DRGs during the first year of the program. This shift caused the average cost per newborn claim to be \$196 less in 1990 than it would have been had the shift not occurred.

Given the findings of the studies by Buescher and associates (1991), Gravely and Littlefield (1992), and Schramm (1992), the current study was designed to determine if a program of prenatal and newborn care

improved pregnancy outcomes while containing costs. This study extended the previous evaluations of this project by evaluating the effectiveness of the program for 7 years.

METHODS

Data used in the longitudinal (1986-1993) evaluation of the project were from the state Medicaid Management Information System (MMIS). Each MMIS data file contained different types of records, with varying numbers of records assigned to the same claimant. The two types of records used in the evaluation were the HCFA 1500 (outpatient claims) and the UB-82 (inpatient claims). These records provide information both on types of services provided and on dollar amounts paid by Medicaid for those services. The second source was the State Finance Commission Form 204 assessment database, which consisted of the risk-assessment data for pregnant women and infants.

Since the project began in April 1986 and the current evaluation only had access to data for the first half of 1993, complete data for 1986 and 1993 were not available. However, once the data sets were cleaned, claims from 182,196 Medicaideligible pregnant women and 140,088 newborn infants were available to determine the outcomes and cost-effectiveness of this program.

RESULTS

Pregnancy-Ending Diagnoses

The percentage of high-risk women in each pregnancy-ending DRG category remained relatively constant for the 7 years. For example, the percentage of women with vaginal deliveries and complicating diagnoses (DRG 372) remained at approximately 10% for the 7 years and the

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percentage of women with cesarean delivery with complications remained around 10%. The number of pregnant women that the program served during these years steadily increased, and even with the increased

numbers, the health status (i.e., the pregnancy-ending diagnosis) of the women remained stable. Pregnancy complications were minimized through widespread and more comprehensive use of the program. If the program had not been effective, increased percentages of poor outcomes (and thus higher costs) would result from serving this increased number of patients.

The average cost of a pregnancy-ending hospital stay for high-risk and low-risk pregnant women increased from 1987 to 1990, but decreased in 1991 and 1992. The costs were calculated using the UB-82 claims adjusted by the Medical Price Index (MPI) (U.S. Bureau of the Census, 1993). If the adjusted cost of a pregnancy-ending hospital stay for high-risk women in 1991 and 1992 had remained the same as in 1990 (rather than decreasing), the cost of care for high-risk of all the women would have been \$267,083.37 higher in 1991 and \$601,596.21 higher in 1992. Therefore, cost savings of over \$267,083 occurred in 1991 and over \$601,596 in 1992. These total cost reductions are in spite of the increased numbers of women who were served in the program during this period.

For example, in 1991 the average cost of a DRG 370 (cesarean section with complications) delivery was \$2,442.28 in MPI adjusted dollars. There were 387 DRG 370 deliveries, resulting in a total cost of \$945,549.36 (387 x \$2443.28). However, if the costs for DRG 370 had remained at the 1990 level of \$2,736.73, the total costs for that DRG would have been \$1,059,114.51 (387 x \$2736.73)—a savings of \$113,565.15.

Neonatal Diagnoses

The neonatal DRGs remained relatively stable during the 7 years (1987-1993) of the program with the exception of DRG 386-extreme immaturity/respiratory distress and DRG 387-premature with major problems. A steady decrease occurred in the percentage of infants with extreme immaturity/respiratory distress (DRG 386), the most serious diagnosis. In addition, the percentage of premature infants with major problems (DRG 387) showed a significant decrease since the start of the program. Although the program was serving increasingly more women, they were having healthier babies.

The improved outcomes (i.e., healthier babies) translated into cost savings. The cost of care of infants with DRG 386 and 387 was calculated for 1989-1992, assuming that the percentage of infants in each category had stayed at the 1987 level. This cost was compared with the actual cost for the fewer number of infants in those DRG categories in 1989-1992.

For example, in 1987 the proportion of infants in DRG 386 was 19.2% and DRG 387, 19.3%. If the proportions had remained constant, there would have been 1,173 (38.5% x 3,047 = 1,173) infants with DRG 386 and 387 in 1992 instead of the actual number of

692. The adjusted hospital cost would have been \$9,294,830.54 (1173 infants x mean cost of \$7,923.34 in 1992) versus actual adjusted cost of infant care in those DRGs of \$5,480,328.65 (692 x \$7,923.34). This calculation represents an adjusted cost saving of \$3,814,501.88 or a saving of \$7,244,961.49 in 1992 dollars. Table 1 shows adjusted cost savings and savings in current year dollars, respectively, for the years, 1988-1992. These figures demonstrate a steady, consistent increase in cost savings for newborn care for each year of the project.

In summary, this evaluation demonstrated significant and increasing cost savings for both pregnant women and their infants over the evaluation period. Additionally, the outcomes for both the women and their infants improved.

CONCLUSIONS AND RECOMMENDATIONS

The cost effectiveness of the high-risk prenatal care program, in the absence of a comparison group, was determined by examining the costs of pregnancy-ending DRGs and neonatal DRGs for the 7 years of the program (1987-1993). This study demonstrates that birth outcomes improved and that the cost of care for both high-risk pregnant women and high-risk infants steadily decreased over time. For example, there was a steady decrease in the percentage of infants with extreme immaturity/respiratory distress (DRG 386) and with major problems (DRG 387), resulting in a cost savings over 9 million dollars over a 5-year period. In addition, in 1992 the program reduced the cost of care for both infants and mothers by approximately 4½ million dollars. The findings are even more dramatic when considering that each year more high-risk clients participated in the program.

The role of the nurse case manager was crucial to the success of this high-risk pregnancy program. Not only did the case manager ensure that clients received appropriate medical, nutritional, and social work services; but the nurse also provided education, counseling, and emotional support. This sensitive, comprehensive care may have helped reduce the

women's stress or may have helped the women to more effectively deal with the stress they were experiencing. Researchers have found an association between stress and poor birth outcomes (Copper et al., 1996; Lobel, Dunkel-Schetter, & Scrimshaw, 1992) and have documented improved birth outcomes when women receive social support or other individualized nursing care (Moore et al., 1998; Norbeck, DeJoseph, & Smith, 1996). The support that the nurse case manager provided might have been a significant factor in the improved birth outcomes found in this study.

Additional evidence of the value of this high-risk pregnancy program, and nursing case management in particular, was obtained through open-ended qualitative interviews (Mackey, 1999; Mackey & Tiller, 1999) and with the use of a questionnaire (Mackey & Sobral, 1997). Both staff and clients described in detail how the program and the nurse case manager provided quality prenatal care satisfactory to both clients and staff and which improved birth outcomes.

The data presented in this evaluation demonstrated that over a 7-year period a comprehensive case management program that emphasized early assessment and intervention, extensive care planning, and inclusive system referrals improved birth outcomes. This program was effective in addressing morbidity and mortality associated with high-risk pregnancies, while containing costs over a sustained period. Such a comprehensive, multidisciplinary program is an example that could be effective in other states and with other types of pregnant women.

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TABLE 1. Adjusted Cost Savings and Savings in Current-Year Dollars by Year for Infant Care

Year	Savings in \$ Adjusted by MPI ^a	Savings in Current \$
1992	3,814,501.88	7,244,961.49
1991	2,441,393.08	4,305,888.30
1990	1,625,795.76	2,651,665.17
1989	719,007.98	1,077,609.86
1988	527,609.16	730,127.18

^aMPI is the Medical Price Index for 1993.

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- Judith Alexander, PhD, RN, and Marlene Mackey, PhD, RN, FAAN, are Associate Professors in the College of Nursing at the University of South Carolina, Columbia, SC.

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Offprints. Address requests for offprints to:
Judith W. Alexander, PhD, RN
College of Nursing
University of South Carolina
Columbia, SC 29208.