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Demonstrating a Positive Return on Investment for a Prenatal Program at a Managed Care Organization

An Economic Analysis

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Healthcare providers need information to guide the management of patient health while administrators focus on resource management. The underpinning of economic analysis, in the clinical setting, is that resources are scarce. The allocation of resources requires delivered services to provide more benefits than cost and hence, the need to demonstrate a return on investment (ROI) for disease management programs. This article describes the ROI for a prenatal program developed at a Western New York Managed Care Organization (MCO). A positive ROI for the program under study will be demonstrated using a model of economic analysis. **Key words:** *case management*, *coats and cost analysis*, *disease management*, *health care economics and organizations*, *managed care programs*, *prenatal care*

HEALTHCARE providers need information to guide the management of patient care while healthcare administrators require information to focus on resource management. Both need quick access to efficient provision of services and resources, as well as cost control measures. Scarce resources are a universal factor in all economic analyses of clinical interventions, which underscores the need to identify services that provide more benefits than costs. Hence, there exists the need to demonstrate a return on investment (ROI) for disease management programs. Effectively designed and appropriately implemented disease management programs in a managed care setting can reduce healthcare costs via accurate tracking and this can be accomplished through controlling utilization of services, promoting optimal patient care behavior and improving costs, thereby improving ROI outcomes.

This article describes the ROI for a prenatal program developed at a Western New York managed care organization (MCO). A positive ROI for the program under study during the years 1999 and 2000 for which complete data costs for newborn delivery and the first year of care are available will be demonstrated using a model of economic analysis.

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LITERATURE REVIEW

Managed care and MCOs evolved as a reaction to the inflationary fee-for-service

model of healthcare delivery. Traditional fee-for-service reimbursement required insurance companies to reimburse hospital organizations and physicians for services rendered. The more services were rendered the more money the hospital organization and providers received. There were little or no incentives to control healthcare costs.

In contrast, managed care was viewed as a cost-saving alternative to the traditional fee-for-service model of healthcare delivery. MCOs were willing, for a capitated fee, to be held responsible clinically and financially for health outcomes of their enrolled members.

Using a case management focus, MCOs have implemented disease and wellness management programs that focus on outcomes management, require the use of clinical information systems, and often extend across diverse settings and locales. One result of these programs is the creation of a vast amount of otherwise unutilized clinical data and information ripe for analysis through collaborative research initiatives. Large research data sets can be generated from computerized healthcare records and clinical information databases. There is tremendous potential for nurse researchers and case managers to collect and analyze these clinical and financial data for interventions, costs, member and provider satisfaction, and ROI initiatives desirable to MCOs, which then facilitate evidence-based decision making in healthcare especially in regards to cost-benefit analysis.

Childbirth, especially low birth weight (LBW) births, is one of the conditions for which any MCO or health maintenance organization (HMO) incurs the highest cost. March of Dimes data suggest that the average economic cost of perinatal care in 1997 for LBW conditions was $50,303 per LBW birth. However, costs for complicated births can range from $20,000 to $400,000 per infant.[1,2] These statistics, combined with a US Government's *Healthy People 2010*[3] goal to increase the percentage of women who receive prenatal care in the first trimester, suggest the need to further conduct a financial analyses of prenatal care in MCOs.

An ROI for this population can demonstrably affect a health plan's bottom line by engaging in interventions to encourage optimal health behaviors by pregnant members, with the intent of preventing unnecessary LBW births. Effectively implemented, such programs can include all pregnant members, thereby mitigating the potential for complex births.

Preliminary work performed by Sackett et al[4,5] suggests that education and nursing interventions targeting prenatal enrollees significantly decreased the incidence of LBW infants. Other studies[6–12] also support the cost-effectiveness of prenatal care. Each of the authors concluded that prenatal care pays for itself by helping to minimize the prevalence and severity of LBW or very low birth weight (VLBW) births. In fact, a 1998 study[13] demonstrated that women who initiated prenatal care in their first semester were 4 times more likely to have positive infant health outcomes than were women who had no prenatal care. Further supporting this perspective, King[14] published a doctoral dissertation on the value of comprehensive prenatal care in Delaware. This study received acclaim from the then Delaware Governor Thomas R. Carper who stated, "... this study confirms what we've known all along—that sound investments in prenatal care pay dividends for children and families for many years."[15(p1)]

While many people believe that early prenatal care positively affects birth outcomes and especially infant weight, not all studies indicate prenatal care improves birth outcomes.[16–18] There are challenges concerning potential selection bias, methodological/statistical analysis issues, confounding variables, and the lack of randomized clinical control trials in selected studies. Also highlighted are research and cost challenges impacting the *value* of prenatal care aimed at improving prenatal outcomes. Two meta-analyses, one completed in 1995[19] and another in 2003,[20] suggest that preterm birth prevention educational programs may not be the answer to reducing preterm births. Instead, preventing LBW births will require a revamping of women's reproductive health

and prenatal care initiatives, with a focus on healthy lifestyles across the lifespan.

The application of economic principles to the practice of nursing is especially relevant in today's world of managed care. Economic concepts relevant to nurses include an understanding of 6 foci: (1) future directions in healthcare; (2) cost/quality valuation; (3) supply and demand; (4) market share (5) the healthcare marketplace and services; and (6) products and pricing.[21] Consumers, businesses, and the government all impact nurses and their knowledge and understanding of economics. The need for nurses to supply evidence regarding the cost-effectiveness of care is steadily increasing.

BACKGROUND

The dramatic growth in healthcare costs and the increased use of technology to store related data raise questions about any disease/health management program as to "what is the return on investment?" and "what is the cost-benefit analysis?" Businesses use ROI and cost-benefit analyses to make financial decisions. ROI is used to make capital investment decisions where projected revenues generated by the capital investment, the time required to recoup the initial investment plus ongoing program costs are compared to alternative uses of the capital asset. The cost-benefit analysis is used to determine cost savings and cost avoidance and quantifies financial benefits.

Even if a care practice is efficacious with respect to health outcomes, it must be cost-effective as well if it is to be maintained. Because budget dollars are scarce, a program promoting health practices for a given population must cost an MCO less than the savings the health practices generate. Further, the value of allocating dollars to a particular population cohort (in this case, prenatal) must be compared to the value of allocating those same dollars to another population group. "Value" must be measured in a consistent manner when such comparisons are made.

However, the application of ROI analysis to such programs is lacking, and there is no consistent approach to economic analysis when it is applied. Several authors[22,23] speak to the need for applying economic evidence to intervention-related costs and detail the importance of clinical economic analysis through the use of cost-identification analysis, cost-benefit analysis, and cost-effectiveness analysis. Jones[24] speaks to the need for maintaining clinical information systems to track the data necessary to demonstrate nursing's contribution to cost control through promoting positive member health outcomes in a managed care environment.

The cost-effectiveness and ensuing ROI of historically expensive managed care prenatal case management programs still need to be measured reliably, consistently, and over a wide range of regions and organizations. It is necessary to determine the cost-effectiveness as well as measure the economic value of prenatal case management intervention programs. The Right Start© program ROI study began in this context.

THE ORIGIN AND PURPOSE OF THE RIGHT START ROI PROJECT

The US Department of Health and Human Services, Maternal and Child Health Bureau, requires states to develop up to 10 maternal-child health priority needs. The need for a prenatal program focusing on high-risk pregnancies was evidenced by Western New York's high incidence of infant mortality (8.8%), infants born premature (11.3%), and LBW infants (7.7%) when compared to overall New York State-wide statistics.[25]

Three additional compelling reasons existed for the development of a prenatal program at an MCO: (1) childbirth is the most common condition for admission among members; (2) childbirth incurs one of the highest costs in the plan, and (3) prenatal care is a high volume specialty clinical area and a focus of the New York State Department of Health guidelines. Thus, a prenatal case management program was developed to identify high-risk mothers and ensure they receive

the care required to have healthy, full-term infants.

The ROI project was initiated during fiscal year 2001 as part of a local Western New York MCO's corporate strategic plan. Several leadership task force groups were given the assignment to look at ROI for specific disease management programs. The case manager was asked to apply principles of financial analysis, such as ROI and cost-benefit analysis, to determine whether the capital investment required for the continuation of the prenatal program was cost-effective and thus worth continuing.

The case manager worked with a variety of internal people who participated in the development of the Right Start prenatal program and others who subsequently assisted in the ROI analysis. These resources included a quality manager, a computer programmer, an epidemiologist, and a statistician/data analyst. The case manager collaborated extensively on the analysis with colleagues from the School of Nursing and Department of Economics, University at Buffalo, the State University of New York.

The analysis was based on data obtained from the prenatal clinical information system developed for the program, and stored in the MCO's claims data repository. The ROI focused on the cost-benefit affected by the reason for the prenatal program's existence, that is, to reduce the number of LBW infants born in the member population. Two years' worth of claims from pregnant members assigned to the Right Start program were compared to 2 years' worth of claims from pregnant members not assigned to the program. Analysis of these data demonstrated a significant net ROI for the Right Start prenatal program.

DEFINITIONS OF MEASURES OF THE OUTCOMES, COSTS, SAVINGS, AND ROI OF THE RIGHT START PROJECT

Definitions and justifications for the measures of the outcomes, costs, savings, and ROI of the Right Start project are described for the years 1999 and 2000. Measures of the outcomes were based on a relative decrease in the number of LBW and VLBW infants born within the maternal population assigned to the Right Start prenatal program as defined by Diagnosis Related Groups (DRG) codes. These codes are a rate-setting prospective payment system used by Medicare. Medicare pays a flat dollar amount of reimbursement for a specific case type of DRG. The DRG codes used for LBW were 602–621. The DRG codes used for VLBW were 602–608. For purposes of this financial analysis, LBW and VLBW DRGs were considered as the same population.

Based on the program costs, ROI for the Right Start project was calculated. The net cost benefit was based on data obtained from the prenatal clinical information system and the claims data repository. Claims from pregnant members of Right Start and non-Right Start program enrollees were analyzed over a 2-year span. This information provided the foundation for the ROI analysis.

LIMITATIONS OF THE MEASURES

At the onset of a study of this nature, several study limitations are evident.

Nonrandomized assignment

Assignment of pregnant members to Right Start versus non-Right Start was not randomized. Notable, however, is that group assignment was conducted as a "natural experiment." The degree of control was limited because women cannot ethically be assigned to a control group that does not receive prenatal care.

Selection biases

The MCO's immediate concern with the implementation of the program was not based on ideal experimental conditions, but on how to maximize the potential for cost savings via the targeting of pregnant members having a relatively higher risk for delivering LBW infants. Pregnant members at higher risk for delivering LBW infants were identified for participation in the program entirely at the

discretion of their provider. The providers were provided compensation by the organization ($100 per identified member). In sum, members of the Right Start program were selectively at higher risk for LBW deliveries, per the judgment of the provider.

For purposes of this financial analysis, LBW includes VLBW infants (<750 g to <2500 g) as one population; no differentiation was made between the 2 groups with respect to payments based on DRGs made by the MCO. Right Start savings were projected based on the assumption that the Right Start infants' LBW rates would be the same as those for infants not in Right Start.

All positive gains for demonstrating ROI were attributed to members' participation in Right Start. This does not preclude however, the need to unbundle the concept of prenatal care so as to determine what interventions are effective and to avoid attributing all gains to Right Start.

This ROI analysis used all hospital claims that were billed with a DRG for delivery to the MCO. There were no samples taken and no outliers were excluded.

INTERVENTIONS

A description of the Right Start program is detailed in an earlier publication.[4] All members identified as being at-risk for LBW births, whether single or multiple births, received the intervention components of the Right Start program. The intervention components of the program included provider participation, prenatal education, and case management.

Provider participation included the completion of a prenatal risk assessment form during the initial visit with subsequent referral of the pregnant member to the program. Case manager visits to the physician offices, follow-up phone calls by RN/BS nursing students and a monetary incentive for providers facilitated compliance with the referral process.

Prenatal education included a clinical assessment and specific, targeted member education. All pregnant members received a gift pack of health education materials, a prenatal video, and were encouraged to attend prenatal classes. They were also asked to answer a health risk questionnaire that identified areas requiring attention, such as preterm labor, lead screening, smoking, HIV testing, drug and alcohol abuse, prenatal education, and transportation. Targeted education material was forwarded based on responses.

Case management was provided by a baccalaureate prepared registered nurse. The case manager was responsible for the assessment, intervention, evaluation, and monitoring of all identified pregnant members. The case manager worked with the physician to develop an individualized plan of care for each at-risk member and worked with home health maternal child nurses who followed all high-risk members throughout pregnancy, visiting the member at least monthly. The initial home visit included in-depth nutritional and social risk evaluations. Member benefits also included follow-up by a registered dietician or social worker, in addition to skilled nursing services. After each home visit, a nursing note was completed, the plan of care updated, and information uploaded into a prenatal clinical information system for use by the case manager and provider.

SOURCES OF DATA AND THE SUBJECT POPULATION

Sources of data

Data were obtained from the claims data repository and a custom prenatal clinical information data entry and retrieval system, both located within the MCO. Data were extracted from these systems for the years 1999 and 2000. Categories used for claims data collection included (1) the number of deliveries, from the live birth file that used Health Care Measures/Health Employer Data Information Set (HEDIS) and Quality Assurance Reporting Requirements (QARR) specifications; (2) newborn VLBW and LBW DRG codes; and (3) the Right Start enrollment and delivery dates of the members with newborns.

Newborn data were then grouped by year for the fiscal years 1999 and 2000. Claims paid were aggregated from the newborns' dates of birth through the newborns' first birthday.

Subject population

The subject population was composed of managed care members (infants) whose mothers were in the Right Start program and mothers (infants) who were not in the Right Start program.

ANALYSIS: ESTIMATES OF GROSS SAVINGS FOR FISCAL YEARS 1999 AND 2000

Analysis of the estimates of gross savings for fiscal years 1999 and 2000 are based on costs associated with LBW infants from both Right Start and non-Right Start participants. Data were obtained from the Return on Investment Right Start Program Executive Summary.[26] Calculations for determining the savings for fiscal years 1999 and 2000 are described in detail. Table 1 describes the Right Start and non-Right Start single and multiple birth populations for 1999 and 2000.

Table 1. Right Start© and Non-Right Start Single and multiple birth populations—1999 and 2000

	Right Start	Non-Right Start
Single births		
1999		
Normal weight	857	1836
LBW*	36	124
2000		
Normal weight	1300	1578
LBW	59	91
Total	2252	3629
Multiple births		
1999		
Normal weight	16	42
LBW	10	40
2000		
Normal weight	32	16
LBW	28	26
Total	86	124
Grand total		
Normal births	2338	3753
LBW	72 (3%)	230 (6%)

*LBW indicates low birth weight.

Fiscal year 1999 savings analysis

Savings for single births

1. The average cost for the first year of life for single LBW infants was $16,208.45.
2. The average cost for the first year of life for single normal weight infants was $2247.03.
3. The rate of LBW infants among non-Right Start members (no intervention) was 0.063. (Rate is calculated from 124 single LBW births/1960 total non-Right Start births.)
4. If the Right Start infants had the same LBW rate as the non-Right Start infants, the number of LBW infants would have been 56 (calculated from 0.063×893 LBW Right Start infants). (This, more realistically, accounts for the nature of the nonrandom group assignment.)

The difference between 1 and 2 above equals estimated savings. The estimated savings on average were $13,961.42 per LBW birth avoided. If Right Start infants had the same LBW rate as non-Right Start infants, then there would have been $0.063 \times 893 = 56$ LBW Right Start infants, an increase of $56-36 = 20$ LBW infants. Therefore, the estimated savings for Right Start were $20 \times \$13{,}961.42 = \$279{,}228$.

Savings for multiple births

1. The average cost for the first year of life for multiple LBW infants was $16,800.30.
2. The average cost for the first year of life for multiple normal weight infants was $4746.28.
3. The rate of multiple LBW infants among non-Right Start members (no intervention) was 0.488. (Rate is calculated

from 40 LBW multiple births/82 total non-Right Start births.)

4. If the Right Start infants had the same LBW rate as the non-Right Start infants, the number of multiple LBW infants would have been 13 (calculated from 0.488 × 26 multiple LBW Right Start infants). (This, more realistically, accounts for the nature of the nonrandom group assignment.)

The difference between 1 and 2 above equals estimated savings. The estimated savings on average were $12,054.02 per multiple LBW birth avoided. If Right Start infants had the same LBW rate as non-Right Start infants, then there would have been 0.488 × 26 = 13 LBW Right Start infants, an increase of 13 − 10 = 3 LBW infants. Therefore, the estimated savings for Right Start were 3 × $12,054.02 = $36,162.

Fiscal year 2000 savings analysis

Savings for single births

1. The average cost for the first year of life for single LBW infants was $21,556.67.
2. The average cost for the first year of life for single normal weight infants was $2604.12.
3. The rate of LBW infants among non-Right Start members (no intervention) was 0.055. (Rate is calculated from 91 LBW single births/1669 non-Right Start total births.)
4. If the Right Start infants had the same LBW rate as the non-Right Start infants, the number of LBW infants would have been 75 (calculated from 0.055 × 1359 LBW Right Start infants). (This, more realistically, accounts for the nature of the nonrandom group assignment.)

The difference between 1 and 2 above equals estimated savings. The estimated savings on average were $18,962.55 per LBW birth avoided. If Right Start infants had the same LBW rate as non-Right Start infants, then there would have been 0.055 × 1359 = 75 LBW Right Start infants, an increase of 75 − 59 = 16 LBW infants. Therefore, the estimated savings for Right Start were 16 × $18,962.55 = $303,401.

Savings for multiple births

1. The average cost for the first year of life for multiple LBW infants was $21,939.81.
2. The average cost for the first year of life for multiple normal weight infants was $2958.73.
3. The rate of multiple LBW infants among non-Right Start members (no intervention) was 0.619. (Rate is calculated from 26 LBW multiple births/42 total births.)
4. If the Right Start infants had the same LBW rate as the non-Right Start infants, the number of multiple LBW infants would have been 37 (calculated from 0.619 × 60 multiple LBW Right Start infants). (This, more realistically, accounts for the nature of the nonrandom group assignment.)

The difference between 1 and 2 above equals estimated savings. The estimated savings on average are $18,981.08 per multiple LBW birth avoided. If Right Start infants had the same LBW rate as non-Right Start infants, then there would have been 0.619 × 60 = 37 LBW Right Start infants, an increase of 37 − 28 = 9 LBW infants. Therefore, the estimated savings for Right Start were 9 × $18,981.09 = $170,830.

In summary, for the combined years of 1999 and 2000 the total estimated savings attributed to the Right Start program were $789,621. Estimates of gross savings for the years 1999 and 2000 are described in Table 2.

INVESTMENT COSTS

Investment costs of the project included personnel allocation, mailing costs, provider reimbursement dollars, and modest miscellaneous costs (eg, nonmailing media, program marketing-related travel and expenses.) Table 3 describes the investment costs for the Right Start prenatal program for years

Table 2. Estimated gross savings—1999 and 2000

Year	Low birth weight		Estimated gross savings
	Single birth savings	Multiple birth savings	
1999	$279,228	$36,162	$315,390
2000	$303,401	$170,830	$474,231
Total	$582,629	$206,992	$789,621

1999 and 2000. Three employees dedicated time to the project, including one full-time case manager, one three-quarter-time data entry person, and three-quarter (1999) and one-quarter (2000) time programmer. Personnel costs in fiscal year 1999 were $109,225. Mailing costs were $15,300. Provider reimbursement was $127,000.The total estimated investment costs for 1999 were $251,525.

Personnel costs in fiscal year 2000 were $89,450. Personnel cost for fiscal year 2000 was lower because of differences in time allocation. More time was required from the computer programmer in 1999 for development work on the database front-end for the program and installation. Mailing costs were $28,050. Provider reimbursement was $204,300. The total estimated investment costs for fiscal year 2000 were $321,800.

Table 3. Estimates of the investment costs of the Right Start Program—1999 and 2000

	1999	2000
Personnel (4)	$109,255	$89,450*
Mailing	$15,300	$28,050
Provider reimbursement	$127,000	$204,300
Total	$251,555	$321,800

*Changes in personnel cost totals per year due to time allocation differences. More time was required from the computer programmer in 1999 for development work on the database front-end for the program.

Table 4. Annual net benefit summary—1999 and 2000

Year	Savings	Costs	Net cost benefit
1999	$315,390	$251,555	$63,835
2000	$474,231	$321,800	$152,431
Total	$789,621	$573,355	$216,266

NET COST BENEFITS

The estimates of annual net cost benefits are calculated from the program savings estimates and the program cost estimates based on costs incurred to develop and administer the program. To determine the net cost benefits of the Right Start prenatal program, the following calculation was used: annual net benefit = annual savings − program costs. Table 4 summarizes the yearly savings, costs, and net cost benefit for 1999 and 2000.

INTERNAL RATE OF RETURN ON INVESTMENT

As is customary practice in economic calculations, ROI is calculated from the function termed *Internal Rate of Return* (IRR) in Microsoft Excel©. Excel calculates the rate of return on a series of cash flows. Costs are the negative values and savings are the positive values. The formula for ROI in this case, however, is clear from the relatively small data set, and following this formula produces the same results as does the Excel program: Net Savings (return) ÷ Costs (investment) = ROI. Table 5 illustrates the fiscal year 1999 and fiscal year 2000 net savings and ROI.

CONCLUSIONS

Conclusions to be drawn from the analysis of ROI for the Right Start Program are best illustrated in the graph in Figure 1, which highlights the yearly and overall ROI for fiscal years 1999 and 2000. The Right Start Prenatal

Table 5. Net savings and return on investment—1999 through 2000

Year	Net savings	Return on investment*
1999	$63,835	25%
2000	$152,431	47%
1999 through 2000	$216,266	37%

*ROI = Net savings ÷ net costs.

Program had a positive ROI of 37% for the 2 years for which complete data are available.

Extrapolation from these results reveals a potential 24% to 46% return on future years' investments. However, a strict extrapolation from the data presented to a larger pregnant member population may not be warranted. Given the nature of the nonrandom assignment of pregnant MCO members to the Right Start program, the LBW outcomes demonstrate the substantial value of the program interventions. Based on member assignment, more LBW births would have been expected rather than fewer. Yet, the nonrandom assignment of higher risk pregnancies to Right Start also suggests that the total ROI for the program might be lower if all members were assigned to the program. If providers' judgments of higher versus lower risk pregnancies tend to be accurate, then the inclusion of a higher proportion of members with lower risk pregnancies would presumably yield less total return, due to fewer prevented LBW births.

Within the Right Start program, the only intervention for pregnancies not deemed high risk by member providers was the mailing of an educational gift pack, whereas higher risk pregnancies received personalized case management. Thus, even within the Right Start population, there existed a sliding scale for investment in a given member. Based on the above reasoning, an expansion of the population of pregnant managed care members included in the Right Start program should be accompanied by continued efforts to identify the members for whom greater investment is likely to yield return (in the form of prevented LBW births).

FUTURE REFINEMENTS

This program should continue to be monitored for savings. Definitions and outcomes need to be established to provide consistent reporting for other lines of business across multiple years. The application of other statistical measures and a report of the significance (if any) at the.05 level would potentially

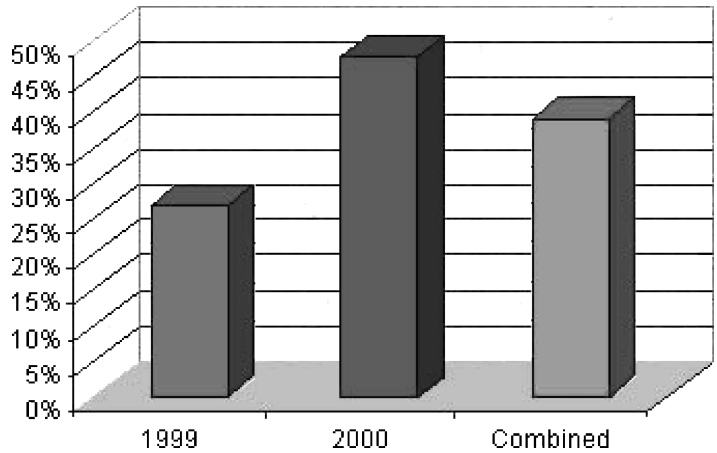

Figure 1. Return on investment for the Right Start© program.

provide much needed information on the effectiveness of the interventions provided to women who participated in Right Start. The need to identify an acceptable statistic, such as the Modified Kessner Index,[13] may be a way of measuring adequacy of prenatal care and developing an association with the actual expenditures on care with the Right Start program. Expanding the study to include Medicaid participants and market areas outside of Western New York could further validate the ROI potential of the Right Start program.

SUMMARY

Right Start is a program that can provide significant cost return to MCOs long after the yearly costs are incurred. While not as easily measured, an extensive body of knowledge about the impact of LBW births clearly supports the premise that preventing such births offers savings that extend to other affected parties. The program under examination in this article has shown a decrease in LBW rate for infants with mothers included in the program. Without the gold standard of randomized double blind studies, it is difficult to prove that this success is due to the case management interventions alone used for the Right Start program. However, as the program assignment bias was specifically for pregnancies deemed high risk by member providers, the outcome differences strongly suggest the value of pregnancy case management, and the ROI this practice can provide.

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