CHCS

Center for
Health Care Strategies, Inc.

ROI Evidence Base:
Studies on High-Risk Pregnancy

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This set of studies is part of the *ROI Evidence Base*, which was developed by the Center for Health Care Strategies and Mathematica Policy Research, Inc. to help policymakers identify intervention strategies with the potential to both improve quality and reduce health care costs. For the full *ROI Evidence Base*, visit **www.chcs.org**.

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High-Risk Pregnancy Studies Reporting Decreases in Cost/Utilization - Summary Table

Clinical Focus	Author/Year	Target Population	Intervention Strategies	Evaluation Timeframe	Cost/Utilization Outcomes	Quality of Evidence
High-Risk Pregnancy	Brooten 2001	Pregnant women	Advanced practice nurses to perform prenatal home visits including education and counseling, clinical assessments, and medication monitoring. Intervention included one postpartum home visit and daily phone access.	8 weeks postpartum	9% decrease in maternal prenatal acute care visits; 39% decrease in mean prenatal hospitalization charges; 79% decrease in mean length of stay for postpartum rehospitalizations	A
High-Risk Pregnancy	Koniak-Griffin 2002	Newborns (of pregnant teens)	Prenatal and postpartum home visits by case manager public health nurses. During pregnancy, education on preparation for childbirth and self-care during pregnancy. Prenatal classes for mothers on parenting and health. Postpartum home visits on health, sexuality and family planning, motherhood, life skills, and social and emotional support.	1 year postpartum	52% reduction in total hospital days in first year of life.	A
High-Risk Pregnancy	Olds 2004	Pregnant women	Intensive home visits by nurses to promote prenatal health, maternal/parental parenting skills and child health, and maternal/parental adult development.	6 years postpartum	16% reduction in number of subsequent pregnancies and births over 3 years; 9% reduction in months on Medicaid for mothers	A
High-Risk Pregnancy	York 1997	Newborns	Advanced practice nurses to perform intensive education during hospitalization. Additional home visits and phone calls either until delivery, or for those enrolled at delivery, 8 weeks postpartum.	8 weeks postpartum	64% reduction in infants' hospital charges.	A
High-Risk Pregnancy	Svikis 1997	Newborns (of pregnant women with active drug use)	One week of residential drug treatment followed by intensive outpatient day treatment services through labor and delivery.	Immediate postpartum period	62% reduction in NICU admissions	C
High Risk Pregnancy	Ruiz 2001	Newborns (twins)	Use of advanced practice nurse to provide prenatal care, which included weekly clinic visits, home visits, and 24 hour availability for phone support.	Immediate postpartum period	65% decrease in mean hospital charges	C
High Risk Pregnancy	Luke 2003	Newborns (twins)	Specialized clinic providing additional maternal education and nutritional assessment and monitoring.	3 years postpartum	31% reduction in NICU admissions	C
High Risk Pregnancy	Reece 2002	Newborns	RN and SW home visit, health education, nutritional assessments, and parenting classes. Free transportation and on-site child care, coordination of care. Well baby care, and immunizations for 1 year after birth.	Immediate postpartum period	58% reduction in NICU admissions	C
High Risk Pregnancy	Stankaitis 2005	Newborns	Identification of high-risk pregnant women through reimbursement incentives to obstetric practices; perinatal nurse care coordinators; psychosocial and medical support including home visits, transportation assistance, skilled home care, and social service referrals.	Immediate postpartum period	47% reduction in NICU admissions;	C

Wherever possible, impacts on service utilization (such as hospitalizations or acute care visits) are expressed as percentage reductions in the number of services per person per unit time. If the article does not present numbers of services per person per unit time but does provide the total number of services, service use/person/time is estimated by dividing the number of services by the sample size, without accounting for variable lengths of follow up. In cases where only numbers or proportions of people with any (one or more) service use are reported, service use impacts are expressed as percentage reductions in the proportion with any service use. For studies that reported on delivery and the immediate postpartum period, and that only reported a proportion of neonates with a NICU admission during this initial hospitalization , we have approximated the relative reduction in numbers of NICU admissions by the relative reduction in proportion with NICU admissions, under the assumption that most critically ill neonates will only have one NICU admission immediately following their birth.

[b]*See study detail on how the study's results on the program's effects on the proportion of infants requiring hospitalization were converted into a percentage relative reduction.*

Detail for Selected Study - Brooten, 2001

Characteristic	
Author and Year of Publication	Brooten, 2001
Clinical Focus	High-risk pregnancy
Target Population	Women with high-risk pregnancies (gestational or pregestational diabetes mellitus, chronic hypertension, preterm labor, or high risk of preterm labor).
Intervention Strategies	Use of advanced practice nurses specialized in caring for high-risk pregnant women and infants to perform prenatal home visits to provide education and counseling, perform clinical assessments, monitor medication and consult patient's physician about adjusting medication. Nurses also made one postpartum home visit to assess complications and medications, confirm appointments for medical follow-up, and provide referrals to community resources. Patients had daily phone access to nurses.
Additional Targeting Criteria	None stated
Opt-in/opt-out, if available	Opt-in
Enrollment rate, if available	Not stated
Geographic Location	Philadelphia, PA
Type of Community	Urban
Health Care Setting	Large urban tertiary care hospital (Hospital of the University of Pennsylvania)
Health Insurance	Mostly public insurance (95.5% of Treatment group and 91.8% of Control group)
Quality of Evidence	A
Study Design	Randomized Controlled Trial
Sample Size	173 (T=85, C=88)
Evaluation Timeframe	8 weeks postpartum
Cost/Utilization Outcomes	12% decrease in total number of maternal prenatal acute care visits (T=230, C=261, $p<0.05$); 79% decrease in mean length of stay for postpartum rehospitalizations (T=1.2, C=5.7, $p<0.05$); 39% decrease in mean prenatal hospitalization charges (T=$6213, C=$10196, $p<0.05$)
Full Citation	Brooten, Dorothy. JoAnne Youngblut, Linda Brown, Steven Finkler, Donna Neff, and Elizabeth Madigan. "A Randomized Trial of Nurse Specialist Home Care for Women with High-Risk Pregnancies: Outcomes and Costs." *American Journal of Managed Care*, 7(8): 793-803, 2001 August.

Detail for Selected Study - Koniak-Griffin, 2002

Characteristic	
Author and Year of Publication	Koniak-Griffin 2002
Clinical Focus	High-risk pregnancy
Target Population	Pregnant adolescents aged 14-19 referred to a county health department for public health nursing
Intervention Strategies	Case manager public health nurses conducted home visits--1 or 2 prenatal visits in 2nd or 3rd trimester, then approximately 15 postpartum visits. Participants attended four classes in 3rd trimester on preparation for motherhood, parenting, and health. In prenatal home visits, nurses educated on preparation for childbirth and self-care during pregnancy, in postpartum visits nurses focused on health, sexuality and family planning, motherhood, life skills, and social and emotional support. Home visits lasted 1.5-2 hours.
Additional Targeting Criteria	No prior live births, gestation $\leq$ 26 weeks, planning on keeping infant, no history of drug dependence, and no medical or obstetric complications.
Opt-in/opt-out, if available	Opt-in
Enrollment rate, if available	Not available
Geographic Location	Southern California county with population 1.6 million
Type of Community	Not stated
Health Care Setting	County health department and home
Health Insurance	84% of mothers on Medi-Cal
Quality of Evidence	A
Study Design	Randomized controlled trial
Sample Size	102 (T=55, C=47)
Evaluation Timeframe	1 year postpartum
Cost/Utilization Outcomes	52% reduction in total hospital days for infants in first year of life (T=74 total days, C=154 total days, $p<0.001$); 42% reduction in hospitalizations (T=14, C=24, $p<0.05$); 12% increase in proportion of children adequately immunized (T=96%, C=86%, $p<0.05$)
Full Citation	Koniak-Griffin, Deborah, Nancy L. Anderson, Mary-Lynn Brecht, Inese Verzemnieks, Janna Lesser, and Sue Kim. "Public Health Nursing Care for Adolescent Mothers: Impact on Infant Health and Selected Maternal Outcomes at 1 Year Postbirth." *Journal of Adolescent Health*, vol. 30, January 2002, pp. 44-54.

Detail for Selected Study - Olds, 2004

Characteristic	
Author and Year of Publication	Olds 2004
Clinical Focus	High-risk pregnancy
Target Population	Low-income, unmarried pregnant women
Intervention Strategies	Treatment: Free, round-trip cab transportation to all scheduled prenatal care visits, intensive nurse home-visiting services during pregnancy, 1 in-hospital postpartum visit, and home visits from hospital discharge through child's 2nd birthday. Nurses followed detailed guidelines to promote (1) health prenatal behaviors in mother, (2) mother's/parents' parenting skills and child's health and development, and (3) parent(s) planning of future pregnancies, completion of education, and seeking of employment. Control: Free cab transportation as above, developmental screening and referral services for child at 6, 12, and 24 months of age.
Additional Targeting Criteria	<29 weeks gestation, no previous live births, at least two of following: unmarried, <12 years of education, or unemployed.
Opt-in/opt-out, if available	Opt-in
Enrollment rate, if available	Not stated
Geographic Location	Memphis, TN
Type of Community	Urban
Health Care Setting	Home
Health Insurance	Not stated
Quality of Evidence	A
Study Design	Randomized Controlled Trial
Sample Size	641 (T=197, C=444)
Evaluation Timeframe	6 years
Cost/Utilization Outcomes	16% reduction in subsequent pregnancies and births for mothers (T=1.16 pregnancies, 1.08 children; C=1.38, 1.28, p=0.01) 9% reduction in months on Medicaid for mothers (T=11.98, C=13.08, p=0.08)
Full Citation	Olds, David L., Harriet Kitzman, Robert Cole, JoAnn Robinson, Kimberly Sidora, Dennis W. Luckey, Charles R. Henderson, Carole Hanks, Jessica Bondy, and John Holmberg. "Effects of Nurse Home-Visiting on Maternal Life Course and Child Development: Age 6 Follow-up Results of a Randomized Trial." *Pediatrics*, vol. 114, no. 6, December 2004, pp. 1550-1559. Most recent of a series of papers from this group of researchers on two important, related studies. Previous papers (among others) on the Memphis project were on pregnancy outcomes and child outcomes through age 2 (Kitzman et al. *JAMA* 1997; 278(8): 644-652), and maternal outcomes for 3 years after birth (Kitzman et al. *JAMA* 2000; 283(15): 1983-1989). Report of a similar intervention in rural New York state in Olds et al. *JAMA* 1997; 278(8): 637-643.

Detail for Selected Study – York, 1997

Characteristic	
Author and Year of Publication	York 1997
Clinical Focus	High-risk pregnancy
Target Population	Women with either diabetes or hypertension during pregnancy.
Intervention Strategies	For women hospitalized before delivery: Masters-level perinatal nurse specialists to perform education and discharge planning during admission. Earlier discharge than the standard care group and at somewhat higher blood sugars if women had mastered specific knowledge and skills. After discharge, nurse specialists provided education, support, and referrals until delivery (daily home visits for three days starting on the day of discharge, at least two more home visits after that, and telephone or clinic contacts three times per week). For women hospitalized for labor and delivery: After delivery, nurse specialist performed assessments, education, and discharge planning; women were discharged once they mastered specific knowledge and skills. After discharge, nurse specialists provided education, support, and referrals for 8 weeks (minimum of 2 home visits and 10 telephone calls--twice a week for first 2 weeks, then weekly for next 6 weeks). Nurse specialists available for calls 12 hours per day M-F and 4 hours per day weekends.
Additional Targeting Criteria	Enrollment during first hospitalization--whether hospitalized before delivery (mainly mothers with diabetes hospitalized for glucose control) or hospitalized at the time of labor and delivery.
Opt-in/opt-out, if available	Opt-in
Enrollment rate, if available	Not stated
Geographic Location	Not stated
Type of Community	Urban
Health Care Setting	Academic medical center
Health Insurance	60 and 70% public, 40 and 30% private (treatment and control groups, respectively)
Quality of Evidence	A
Study Design	Randomized controlled trial
Sample Size	96 (T=44, C=52)
Evaluation Timeframe	8 weeks after discharge from hospitalization for delivery
Cost/Utilization Outcomes	26% reduction in hospital charges for mother antepartum through delivery (T=$7,087, C=$8,952, p=0.02); 64% reduction in hospital charges for neonates (T=$4,957, C=$13,793, p=0.02).
Full Citation	York, Ruth, Linda P. Brown, Philip Samuels, Steven A. Finkler, Barbara Jacobsen, Cynthia A. Persely, Anne Swank, and Deborah Robbins. "A Randomized Trial of Early Discharge and Nurse Specialist Transitional Follow-Up Care of High-Risk Childbearing Women." *Nursing Research*, vol. 46, no. 5, September/October 1997, pp. 254-261.

Detail for Selected Study - Svikis 1997

Characteristic	
Author and Year of Publication	Svikis 1997
Clinical Focus	High-risk pregnancy
Target Population	Women with active drug use and drug dependence
Intervention Strategies	1 week of residential drug treatment followed by intensive outpatient day treatment services through labor and delivery.
Additional Targeting Criteria	Women voluntarily admitted to a treatment program
Opt-in/opt-out, if available	Opt-in
Enrollment rate, if available	Not stated
Geographic Location	Baltimore, MD
Type of Community	Urban
Health Care Setting	Center for Addiction and Pregnancy at Johns Hopkins Bayview Medical Center
Health Insurance	100% Medicaid
Quality of Evidence	C
Study Design	Cross-sectional comparison group design; comparison group women included women refusing treatment or failing to seek treatment
Sample Size	146 (T=100, comparison=46)
Evaluation Timeframe	Immediate postpartum period
Cost/Utilization Outcomes	62% reduction in NICU admissions (T=10% with NICU admission, C=26% with NICU admission, p=0.01); 92% reduction in NICU days across all newborns (T=0.8 days/neonate, C=10.2 days/neonate, p=0.01)
Full Citation	Svikis, Dace S., Archie S. Golden, George R. Huggins, Roy W. Pickens, Mary E. McCalu, Martha L. Velez, C. Todd Rosendale, Robert K. Brooner, Preston M. Gazaway, Maxine L. Stitzer, and Carol E. Ball. "Cost-effectiveness of Treatment for Drug-abusing Pregnant Women." *Drug and Alcohol Dependence*, vol. 45, 1997, pp. 105-113.

[a] *As stated in the Summary Table, we have approximated the relative reduction in the number of NICU admissions by the relative reduction in the proportion of neonates requiring NICU admission, under the assumption that most critically ill neonates will only have one NICU admission.*

Detail for Selected Study - Ruiz, 2001

Characteristic	
Author and Year of Publication	Ruiz, 2001
Clinical Focus	High-risk pregnancy
Target Population	Mothers and infants (twins)
Intervention Strategies	Use of advanced practice nurse to provide prenatal care, which included weekly clinic visits, home visits, and 24 hour availability for phone support. Nurse assessed premature labor risk, psychosocial environment (support of partner, home situation, etc), and nutrition. The nurse worked in consultation with a perinatologist.
Additional Targeting Criteria	None stated
Opt-in/opt-out, if available	Opt-in for intervention group
Enrollment rate, if available	Not stated
Geographic Location	Travis County, Texas
Type of Community	Urban and rural
Health Care Setting	Specialized twin clinic
Health Insurance	Majority on public insurance
Quality of Evidence	C
Study Design	Retrospective historical cohort. Data for the comparison group was extracted from a review medical records of mothers that received standard care the year before.
Sample Size	71 (T=30, C= 41)
Evaluation Timeframe	Immediate postpartum period
Cost/Utilization Outcomes	42% decrease in mean length of stay for newborns in days (T=10.5, C=18, $p<0.02$); 54% decrease in mean neonatal intensive-care unit days (T=7.8, C=17, $p<0.007$); 65% decrease in mean hospital charges for newborns (T=$16,116, C=$46,796, $p<0.004$)
Full Citation	Ruiz, Jeanne. Brown, Charles. Peters, Mark. Johnston, Amy. "Specialized Care for Twin Gestations: Improving Newborn Outcomes and Reducing Costs." *Journal of Obstetric, Gynecologic, and Neonatal Nursing, 30(1): 52-60, 2001 January/February.*

Detail for Selected Study – Luke, 2003

Characteristic	
Author and Year of Publication	Luke 2003
Clinical Focus	High-risk pregnancy
Target Population	Pregnant women with twin gestations
Intervention Strategies	In addition to routine prenatal care with woman's own OB, twice-monthly prenatal visits to registered dietitian and nurse practitioner, additional maternal education, modification of maternal activity, individualized dietary prescription, multimineral supplementation, and serial monitoring of nutritional status
Additional Targeting Criteria	Excluded--emergency transfers, shared placenta, fetal death of one twin, major fetal congenital anomalies
Opt-in/opt-out, if available	Opt-in for intervention group
Enrollment rate, if available	Not stated
Geographic Location	Ann Arbor, Michigan
Type of Community	Suburban/urban
Health Care Setting	Specialized "multiples" clinic at academic medical center (Univ. of Michigan Health Systems)
Health Insurance	Approximately 17% Medicaid (8% of treatment group and 20% of comparison group), 83% private
Quality of Evidence	C
Study Design	Comparison group with regression adjustment
Sample Size	529 (T=190, C= 339)
Evaluation Timeframe	3 years
Cost/Utilization Outcomes	31% reduction in proportion of infants with NICU admission (T=43%, C=62%, p<0.0001)[a] 47% reduction in cost of twin births (T=$16,115, C=$30,398, p=0.002) Adjusted odds ratio for re-hospitalizations of infants in 3 years after birth of 0.31 (p=0.05)[b]
Full Citation	Luke, Barbara, Morton B. Borwn, Ruta Misiuna, Elaine Anderson, Clark Nugent, Cosmas van de Ven, Barbara Burpee, and Shirley Gogliotti. "Specialized Prenatal Care and Maternal and Infant Outcomes in Twin Pregnancy." *American Journal of Obstetrics and Gynecology*, vol. 189, no. 4, October 2003, pp. 934-938.

[a]*As stated in the Summary Table, we have approximated the relative reduction in the number of NICU admissions by the relative reduction in the proportion of neonates requiring NICU admission, under the assumption that most critically ill neonates will only have one NICU admission.*

[b]*Using the formulas that define odds ratios (OR) and the percentage reduction in proportion with an event, an OR of 0.31 corresponds to a relative reduction in proportions of about 68%, depending on the underlying control group proportion and the relative risk ratio.*

Detail for Selected Study – Reece, 2002

Characteristic	
Author and Year of Publication	Reece 2002
Clinical Focus	High-risk pregnancy
Target Population	Low-income, unmarried, pregnant women
Intervention Strategies	RN and SW made initial home visit to explain program, conduct physical examination, and assess family needs. Prenatal visits with certified nurse-midwives for prenatal care and health education (with supervision and consultation by attending and resident obstetricians), nutritional assessments, parenting classes. Program provided transportation and on-site child care, made referrals, coordinated and followed-up on care, and followed-up on missed appointments. Well baby care, developmental assessments, and immunizations (including for siblings) by pediatric nurse practitioner for 1 year after birth
Additional Targeting Criteria	None stated
Opt-in/opt-out, if available	Opt-in
Enrollment rate, if available	Not stated
Geographic Location	Philadelphia, PA
Type of Community	Low-income urban
Health Care Setting	Home and special clinic at academic medical center (Temple University Hospital)
Health Insurance	Not stated
Quality of Evidence	C
Study Design	Comparison group study
Sample Size	818 (T=381, C=437)
Evaluation Timeframe	Immediate postpartum period
Cost/Utilization Outcomes	58% reduction in proportion with NICU admissions[a] (T=2.8%, C=6.6%; $p<0.05$)
Full Citation	Reece, E.A., G. Lequiamon, J. Silva, V. Whiteman, and D. Smith. "Intensive Interventional Maternity Care Reduces Infant Morbidity and Hospital Costs." *Journal of Maternal-Fetal and Neonatal Medicine*, vol. 11, no. 3, 2002, pp. 204-210.

[a]As stated in the Summary Table, we have approximated the relative reduction in the number of NICU admissions by the relative reduction in the proportion of neonates requiring NICU admission, under the assumption that most critically ill neonates will only have one NICU admission during their initial hospitalization following birth.

Detail for Selected Study – Stankaitis, 2005

Characteristic	
Author and Year of Publication	Stankaitis 2005
Clinical Focus	High-risk pregnancy
Target Population	At-risk pregnant women
Intervention Strategies	Health plan instituted reimbursements to obstetric practices to submit health risk assessments on each pregnant health plan member in a timely fashion; perinatal nurse care coordinator to coordinate care between clinicians, community outreach programs, health plan's social work program, and skilled nursing and home care services. Psychosocial support for those needing it including home visits, transportation assistance, referral to social work services; behavioral health support for those with mental health and substance abuse problems.
Additional Targeting Criteria	None stated
Opt-in/opt-out, if available	Opt-out
Enrollment rate, if available	Not stated
Geographic Location	Rochester, NY
Type of Community	Not stated
Health Care Setting	outpatient
Health Insurance	Medicaid managed care plan
Quality of Evidence	C
Study Design	Pre-post at program level (successive years of birth outcomes before and after the program); comparison with experience of all Upstate NY Medicaid enrollees over the same time period.
Sample Size	Not stated
Evaluation Timeframe	Immediate postpartum period
Cost/Utilization Outcomes	47% reduction in number per 1,000 live births with NICU admissions[a] (pre=108, post =57; $p<0.01$)
Full Citation	Stankaitis, Joseph A., Howard R. Brill, and Darlene M. Walker. "Reduction in Neonatal Intensive Care Unit Admission Rates in a Medicaid Managed Care Program." *American Journal of Managed Care*, vol. 11, March 2005, pp. 166-172.

[a]*As stated in the Summary Table, we have approximated the relative reduction in the number of NICU admissions by the relative reduction in the proportion of neonates requiring NICU admission, under the assumption that most critically ill neonates will only have one NICU admission during their initial hospitalization following birth.*