



The Economic Burden of Perinatal Morbidity

Indiana Perinatal Quality Improvement Collaborative

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The Economic Burden of Perinatal Morbidity

Introduction

Perinatal morbidity in Indiana causes enormous negative impacts to both health outcomes and financial expenditures. Human costs are significant, and the financial burden resulting from poor birth outcomes begins at time of delivery and often stretches into adulthood. Yet there are proven actions that can be taken to significantly improve health outcomes and reduce the economic burden for Indiana families.

While past research efforts around the United States have been largely concentrated on infant mortality, the available data clearly highlights the urgent need to address perinatal morbidity. As noted by the UCLA Center for Health Policy Research: “The published data on costs of maternal and neonatal care are sparse and not always current.”ⁱ

“...average expenditures for premature/low birthweight infants were **more than 10 times as high** as uncomplicated newborns.”

March of Dimes, 2008

Despite the limited amount of data on the cost of infant and maternal morbidity, this document provides an attempt, based on available research, to estimate the cost of perinatal morbidity in Indiana and savings that could be obtained from implementing various initiatives.

Research, specific to Indiana is needed to arrive at a more accurate cost estimate. Tracking timely performance on infant and maternity care metrics, such as severe infant maternal morbidity, informs clinical practices and drives quality improvement. Or, as stated by the Institute of Medicine in 2010:

“Every effort should be made to ensure that the outcome of each and every labor and delivery in the United States is a healthy newborn-mother tandem ... Determining the best ways to reduce maternal mortality and morbidity should have high priority in research.”

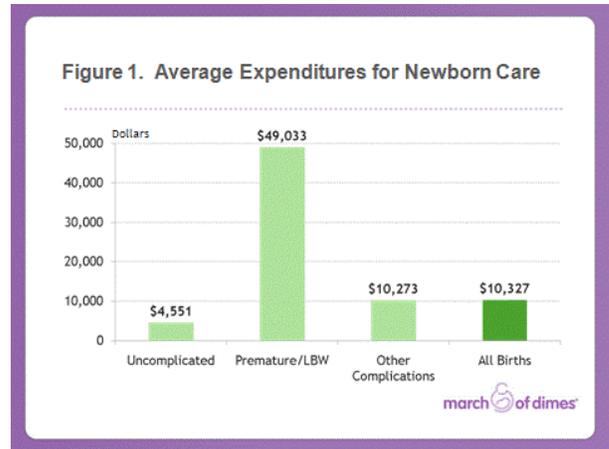
The Financial Costs of Perinatal Morbidity

Low birthweight is associated with long-term disabilities like cerebral palsy, autism, mental retardation, vision and hearing impairments and other developmental disabilities. LBW infants tend to have lower educational attainment, poorer self-reported health status, and reduced employment and earnings as adults, relative to their normal weight counterparts.

Expenditures for care of LBW infants total more than half of the costs incurred for all newborns. Data provided by March of Dimes concluded that average expenditures for

premature/low birthweight infants were more than 10 times as high as uncomplicated newborns.ⁱⁱ These expenditures include the costs related to medical care for infants from birth through the first year of life.

Utilizing the cost estimates provided by the March of Dimes, this translates into perinatal costs of over **\$441 million yearly** for the state of Indiana. Costs were estimated by first adjusting the *Average Expenditure for Newborn Care* from the March of Dimes to 2014 dollars. The average expenditure of \$55,984 was then multiplied by the number of LBW/VLBW infants. (1,175 VLBW; 6,714LBW).



The March of Dimes also analyzed linked mom and infant records, to determine the combined cost of maternal and infant care. They found that combined infant and maternity medical costs for an infant with a diagnosis of prematurity/LBW were four times as high as those for an uncomplicated newborn. For infants with a diagnosis of prematurity/LBW, the total expenditures for mothers and babies combined were \$64,713, compared to \$15,047 for uncomplicated infants.

For Indiana, adjusting to 2014 dollars (\$73,887) and using the total number of LBW and VLBW babies born in Indiana in 2014, the yearly cost is estimated at **\$582,894,543**. Alternatively, using 2014 preterm births in Indiana (8,141), the annual cost is estimated at **\$601,514,067**.

Perinatal morbidity financial costs for Indiana are estimated at \$583 to \$633 million annually

A study by the UCLA Health Center for Policy Research in 2013 calculated the costs of moderate and severe newborn morbidity (compared to no/mild morbidity) to beⁱⁱⁱ:

- \$70,468 per child with moderate morbidity, and
- \$109,490 per child with severe morbidity

Using this data, and assuming all Hoosier children born with very low birth weight would fall into the classification of 'severe morbidity' (1,175), and that most of the children born with low birth weight would fall into the classification of 'moderate morbidity' (6,714), the yearly costs for Indiana would be **over \$633 million**.^{iv}

Additional supporting data related to costs

There are a number of other studies related to the cost of maternal and neonatal morbidity which are included here as reference points to help substantiate the estimate of morbidity

cost for Indiana. For example, the U.S. Agency for Healthcare Research and Quality reports that medical costs for the average very-low-birthweight infant are \$79,000, compared with \$1,000 for a normal newborn. Care for infants in neonatal intensive care units (NICUs) accounts for 75 percent of all dollars spent for newborn care. Infants with a moderately low birth weight can cost 46 percent more than infants born at normal birth weight. ^v

Lifetime medical and societal costs of preterm birth are estimated at \$59,431 per preterm infant annually (2011 dollars). These costs consist of maternal delivery (7%), neonatal medical costs (65%), early intervention services (2%), special education services (4%), and lost household and labor market productivity (22%).^{vi} Lifetime annual costs for early intervention/special education services and lost productivity are estimated at \$16,640 annually.

Another study compared the hospital costs between heavier and lighter infants and singleton and twin births from 1995–2000 using discharge data from New York and New Jersey hospitals. ^{vii} This study revealed a peak in costs for hospital services of infants weighing nearly 800 grams at birth with a steady and significant decline in costs with increases in birth weight.

For every infant born under 2500 grams the study calculated how much money would be “saved” by raising their weight to 2500 grams. Table 1 shows the hospital costs in excess of the costs associated with 2500 grams for every infant by birth weight category. For example, increasing the weight of a typical baby born in the 800–1000 gram range to the “normal” weight range would save over \$174,857 in hospital charges. These research results reinforce the clear economic value in implementing interventions to move birth weight closer to the normal newborn weight.

Table 1. Excess Hospital Costs Associated with Low Birth Weight*

Birth Weight Segment	Excess Hospital Costs
600 – 800 g	\$180,905
800 – 1,000 g	\$174,857
1,000 – 1,500 g	\$102,703
1,500 – 2,000 g	\$34,557

*Adjusted to 2014 dollars

Maternal Morbidity

Maternal morbidity includes a broad spectrum of severity and can include complications and conditions that are associated with any pregnancy outcome. The most severe

pregnancy complications, commonly referred to as severe maternal morbidity, can result in longer hospital stays, long-term rehabilitation, and higher direct medical costs.

A study of hospital discharges found that severe maternal morbidity is 50 times more common than maternal death. Severe morbidity rates for delivery and postpartum hospitalizations were 129 and 29, respectively, for every 10,000 delivery hospitalizations.^{viii} Researchers found increasing rates of blood transfusion, acute renal failure, shock, acute myocardial infarction, respiratory distress syndrome, aneurysms, and cardiac surgery during delivery hospitalizations.

Success Stories: programs that reduce the costs of perinatal morbidity

There are programs and projects that have been proven to be successful in other states that could significantly reduce Indiana's healthcare expenditures. Savings could be dramatically increased over the years as additional perinatal quality improvement activities, specific to Indiana, are studied and implemented.

State Perinatal Collaboratives often take the lead in research and quality improvement initiatives designed to reduce infant morbidity and mortality. Reducing inappropriately scheduled deliveries is one initiative that several states have tackled and through ongoing data collection has demonstrated significant cost savings. The Ohio Perinatal Quality Collaborative estimates 6,000 births have moved from before to after 39 weeks each year, avoiding 180 NICU admissions annually.

“Determining the best ways to reduce maternal mortality and morbidity should have high priority in research.”

Institute of Medicine, 2010

Indiana Medicaid implemented non-payment of early elective deliveries in 2014. As other payers adopt similar policies and ongoing provider and member education occurs – assuming similar results in Ohio, it is estimated that the State would save **\$6.05 million annually**.^{ix}

Increasing the use of progesterone to prevent prematurity

Preterm births account for 50% of the pregnancy cost as estimated by Medicaid data, largely coming from the costs associated with neonatal admissions^x. In Indiana, according to data from 2011-2013, 8.7-9.0% of all preterm births were a second preterm birth. If progesterone could prevent 30-40% of all the recurrent preterm births, 220 preterm births in 2011, 209 preterm births in 2012 and 215 preterm births in 2013 could have been eliminated (644 preterm births over 3 years).^{xi}

Among Indiana mothers who had a history of a previous preterm birth, 29-33% gave birth to a second preterm birth (ISDH, MCH). March of Dimes has estimated each preterm birth on the average cost \$54,000 per NICU admission.

[In Indiana] this would lead to a potential savings of **\$11.9 million in 2011 and \$11.2 million in 2012**. This does not take into account the long term costs and the emotional toll that is placed on the families and society of infant deaths and of surviving premature infants with ongoing physical and developmental problems.

Since only 8-10% of the preterm births in Indiana were recurrent preterm births, this does not address the other 7600 preterm deliveries in 2011 or the other 7300 preterm deliveries in 2012. Several studies have described universal cervical length screening protocols and treatment options. These studies and protocols estimate a 30% reduction in preterm birth in these otherwise asymptomatic women which could eliminate other 450-500 premature births in Indiana yearly. This translates into huge savings both monetarily and in the prevented morbidity and mortality of these newborns.^{xii}

Reducing the costs of necrotizing enterocolitis (NEC) in premature infants

Necrotizing enterocolitis (NEC), which typically occurs in the second to third week of life in premature, formula-fed infants, is characterized by variable damage to the intestinal tract, ranging from mucosal injury to full-thickness necrosis and perforation. NEC affects close to 10% of infants who weigh less than 1500 g, with mortality rates of 50% or more depending on severity, but may also occur in term and near-term babies. Necrotizing enterocolitis is a costly disease, accounting for nearly 20% of NICU costs annually. Yet, awareness of NEC risk factors and adopting practices to reduce NEC risk, including human milk feeding, the use of feeding guidelines, and probiotics, have been shown to reduce the incidence of NEC.^{xiii}

A California based model of health care reimbursement estimated the additional cost per episode of medical NEC was \$74,000 and surgical NEC was \$198,000. An Illinois based model of health care reimbursement estimated the increased cost was \$13,000 (medical NEC) and \$22,000 (surgical NEC).

Multiplied by the number of eliminated cases of NEC through education and guideline interventions, acute health care savings for Indiana in 3 years is estimated at^{xiv}:

- **\$1,010,000** (Illinois estimate)
- **\$6,768,000** (California estimate)

Centering Pregnancy

Centering Pregnancy, a model for providing prenatal care in a group setting, has demonstrated success in helping to prevent preterm births, very low to low birth weight infants and costly neonatal intensive care stays. Research also indicates group care participants received better prenatal care, were more likely to initiate breastfeeding, and had better prenatal knowledge than those receiving usual care.

A Centering Healthcare Institute analysis of over 125 approved sites demonstrated a 33% reduction of preterm births with birth weights one pound greater than with traditional care^{xv}. A more recent study by the University of South Carolina found that Centering Pregnancy participation reduced the risk of premature birth by 36% and the incidence of delivering an infant that was LBW by 44%. Additionally, infants of Centering Pregnancy participants had a 28% reduced risk of a NICU stay^{xvi}.

Eskenazi Health has five approved sites and data from 2015 shows a 31% reduction in preterm births for Centering program participants. Data on program costs and expected cost savings from 2015 are included below, showing a **150%** return on investment for the Centering Program.

Total Cost of Program	124 participants	\$89,562
Expected Cost Savings for Reduced preterm/LBW births	4 participants	\$223,936
Expected Return on Investment		150%

There are currently at least 19 sites in Indiana that either are approved by the Centering Health Institute or are in the process of certification.

Reducing bloodstream infections in premature infants

Nosocomial infections occur in 15-30% of preterm infants and cause increased morbidity, mortality, and hospital costs. The Ohio Perinatal Quality Collaborative is working to achieve >90% compliance with the reliable use of a catheter care maintenance bundle for all NICU teams. The OPQC Neonatal units have also been focusing efforts on achieving further reductions in blood stream infection rates by increasing the immediate postpartum use of human milk feeding in 22 to 29 week gestation age infants.

Initial projects produced a 20% sustained decrease in bloodstream infections in premature infants 22-29 weeks gestation in 24 Neonatal Intensive Care Units (NICUs)^{xvii}. It's estimated that each neonatal bloodstream infection costs about \$73,700 with a length of stay exceeding on average 22 days more than that for other premature infants. However, if

surgical care is required, there is at least an additional cost of \$186,200 and infants stay roughly 60 days longer than other preterm infants.^{xviii}

Smoking Cessation Programs

Smoking is the one of the most important modifiable causes of poor pregnancy outcomes; associated with maternal, fetal, and infant morbidity and mortality. An estimated 5–8% of preterm deliveries, 13–19% of term deliveries of infants with low birth weight, 23–34% cases of sudden infant death syndrome (SIDS), and 5–7% of preterm-related infant deaths can be attributed to prenatal maternal smoking.^{xix} Babies born to smoking mothers may also have further complications including fetal growth restriction, and certain birth defects. The CDC reports that direct medical costs of a complicated birth are 66% higher for smokers.^{xx} Preventing just one smoking-related low birth weight baby can result in the avoidance of more than \$40,000 in health care expenditures.^{xxi}

Indiana has one of the highest smoking rates among pregnant women in the U.S. In 2013, in all but three Indiana counties, 15.7% of pregnant women smoked compared with 8.5% nationally. The rates in counties are from 3.0% to 32.5% with thirty-nine of Indiana's 92 counties having a smoking during pregnancy rate that is significantly higher.^{xxii}

Birth outcomes are positively impacted when pregnant mothers quit and cost reduction for medical care is achieved. According to an ASTHO report, if maternal mothers quit smoking, it can mean savings up to \$8 million annually in direct neonatal inpatient cost given the cost of an intervention (\$24-\$34) versus the costs saved (\$881) for each woman who quits smoking during pregnancy. Cutting prenatal smoking rates by just one percentage point can prevent 1,300 low birth-weight babies, and make savings of \$21 million in direct medical costs each year.^{xxiii}

Research demonstrates that cost savings can be realized through effective smoking cessation programs. Even a brief cessation counselling session of 5–15 minutes, when delivered by a trained provider with the provision of pregnancy specific, self help materials, significantly increases rates of cessation among pregnant smokers.^{xxiv} Analysis of a comprehensive smoking cessation program for all maternal mothers in Massachusetts showed that for every dollar spent on a smoking cessation programs the state saved \$2 in smoking-related health care costs. In California, the Department of Public Health's tobacco control program reduced state healthcare costs by more than \$100 million in its first seven years by reducing the number of low birth babies caused by smoking.

Indiana has several smoking cessation initiatives, including the Indiana Tobacco Quitline, which connects smoking pregnant mothers with trained tobacco cessation professionals

who set up quitting strategy plans and regular telephonic outreach. The State is also taking part in the national program, of *Baby and Me, Tobacco Free* which reports a high success rate countrywide (near two-thirds of those enrolled successfully quit). The program is currently offered in at least 25 sites across Indiana. Each participant receives at least four prenatal cessation-counseling sessions, support, and carbon monoxide (CO) monitoring, usually during a regular prenatal visit. After the birth of the baby, the mother returns monthly to continue CO monitoring and, if proven to be smoke-free, receives a \$25 monthly voucher for diapers for up to 6-12 months postpartum. Increasing the number of these programs statewide and implementing other proven initiatives can help in getting more smoking maternal women to quit and reduce the overall cost of perinatal morbidity.

Teen Pregnancy

There's been a dramatic decline in teen pregnancies since the peak year of 1991, yet the US rates of teen pregnancy are still the highest among developed countries, with three out of ten American girls still getting pregnant.^{xxv} In Indiana, teen birth rates have dropped by fifty-seven percent since 1991, and yet still about 17 teens get pregnant every day. It is also the case that 16% of all teen births were to teens who already had a child.^{xxvi}

Teen birth brings both social and economic costs. According to the CDC, in 2010, teen pregnancy and childbirth accounted for \$9.4 billion to U.S. taxpayers for increased health and foster care, and lost tax revenue because of lower educational attainment and income among teen mothers. In Indiana, the public cost of teen childbearing in 2010 is estimated at \$227 million.^{xxvii}

Currently, statistics show that only thirty-eight percent of teen mothers get a high school diploma. In addition, the daughters of teen mothers are three times more likely to become teen mothers and two-thirds of young unmarried mothers are poor, with 25% receiving public assistance within three years of a child's birth.

With the prevention of teen pregnancies, social problems show improvement, including poverty, father-absence, low birth weight, school failure, and poor preparation for the workforce. There is growing evidence that teen pregnancy programs can delay sexual activity, improve contraceptive use among sexually active teens, and/or prevent teen pregnancy and encourage abstinence.

The National Campaign to Prevent Teen and Unplanned Pregnancy indicates that effective programs can be divided into five basic categories^{xxviii}:

- Curriculum-based education, encouraging both contraceptive use and abstinence that is offered in regular school classes or after-school programs on school grounds or community centers.

- Service learning programs that aim to keep youth constructively engaged in their communities through community service activities and incorporate follow-up exercise such as group discussions or writing about their experiences.
- Youth development programs such as academic assistance, sex education, performing arts and sports opportunities, and employment assistance.
- Parent programs involving both parents and adolescents and attempt to improve parent-child communication.
- Community-wide programs that tend to be much broader in scope and that encourage involvement from the entire community. These programs might include public service announcements, educational activities for the community, or community-wide events such as health fairs.

The CDC, federal Office of Adolescent Health (OAH), and the Office of Population Affairs identified other key components for a successful strategy in preventing teen pregnancies including^{xxxix}:

- Community mobilization and sustainability in which community members and groups disseminate information, offer support, and foster cooperation across public and private sectors in the community.
- Ensuring teens have access to evidence-based teen pregnancy prevention programs which include youth-development and curriculum aimed at preventing teen pregnancies, sexually transmitted infections, or sexually risky behaviors.
- Providing youth access to contraceptive and reproductive health care services which offer teen friendly, culturally competent reproductive health care services.
- Educating civic leaders, parents, and other community members about evidence-based strategies to reduce teen pregnancy and improve adolescent reproductive health.
- Working with diverse communities and ensuring culturally and linguistically appropriate programs and reproductive health care services are available.

Also crucial is the role of adolescent males in prevention. According to the OAH, an estimated 9% percent of young men between the ages of 12 and 16 will become fathers before their 20th birthday. Because the focus has been on teen girls, there is less known about the strategies and approaches for effectively engaging males in preventing teen pregnancies. Research and programs are increasing the focus on the role of males in teenage pregnancy and childrearing.

The OAH's Teen Pregnancy Prevention Program provides competitive grants to a wide range of agencies and organizations across the county to support the implementation of evidence-based teen pregnancy prevention programs as well as the development and evaluation of new and innovative approaches. A sampling of these initiatives is included below to give a sense of the approach of some organizations and success indicators.

Additional information on evidenced based programs can be found at https://www.hhs.gov/ash/oah/oah-initiatives/teen_pregnancy/db/

- ***Families Talking Together** – evidence-based parent intervention to prevent and reduce risky sexual behavior among Latino adolescents. It includes training curriculum is to provide the necessary knowledge and skills for community health workers to effectively implement Families Talking Together—and specific instructions for community health workers to use while delivering Families Talking Together to parents. Nine months after the clinic-based intervention: 6% of youth in the intervention group had sex compared to 22% of youth in the control group.
- **Real Men** -After-school parent program with adolescent boys aged 11–14 and their fathers (or a father figure) At 12 months, participants in the group reported ever having sex without a condom compared to 60% in the control group. Fathers in the intervention group were more likely to report talking to their sons about sex-related topics compared to fathers who were not in the program.
- **Wyman’s Teen Outreach Program:** This program targets 12-18 year old youth through a nine-month youth development intervention that includes a community service learning component. Among other outcomes, interim data show changes from baseline for sex without condom (intervention: 25.6% to 18.4%; control: 34.1% to 42.9%), mean partner number (1.66 to 1.18; 1.32 to 1.36), and sex without contraception (27.0% to 22.9%; 24.4% to 24.4%).
- **The Centerstone Be in Charge 2** project implements evidence-based programs to prevent teen pregnancy in multiple settings, provides community education on preventing teen pregnancy, provides referrals and linkages to youth-friendly health care services, and conducts a social marketing campaign to reach 60% of the area’s population. The Be in Charge 2 project plans to serve over 60,000 youth across 80 counties in Indiana, Kentucky, and Tennessee by 2020. The goals of the project include increasing awareness of the consequences of teen pregnancy and unsafe sexual behavior; and the ability to delay sex and/or to use contraception if sexually active. It also aims to increase knowledge about HIV, AIDS, and other sexually transmitted infections.

Additional QI Programs Underway

Additional programs that are being implemented in a variety of states to reduce the costs of perinatal morbidity:

- Increase appropriate use of antenatal steroids
- Enteral feeding improvement
- Placental transfusions
- Neo: Neonatal Abstinence Syndrome (NAS) interventions
- C-section reduction initiatives
- Preconception Care
- Home nursing visits

Conclusion and Moving Forward

In summary, the costs of perinatal morbidity are staggering – both financial costs to the State of Indiana, and the human, social, and emotional costs to its Hoosiers. Investments in Indiana specific research and programs to reduce perinatal morbidity will pay dividends far beyond the costs.

ⁱ Pourat N, Martinez AE, McCullough, JC, Gregory KD, Korst L, Kominski GF,. Costs of Maternal Hemorrhage in California. Los Angeles (CA): UCLA Center for Health Policy Research; 2013.

ⁱⁱ March of Dimes, The Cost of Prematurity to U.S. Employers, 2008.

ⁱⁱⁱ Pourat N, Martinez AE,; 2013.

^{iv} UCLA study costs: \$74,164 in 2014 dollars * 6,714 = \$497,937,096, \$115,232 in 2014 dollars * 1,175 = \$135,397,600. Total costs: \$497,937,096 + \$135,397,600 = \$633,334,693

^v Michael Kornhauser, MD, Roy Schneiderman, MD, How Plans Can Improve Outcomes And Cut Costs for Preterm Infant Care, MANAGED CARE, January 2010.

^{vi} Behrman RE, Butler AS, eds. Preterm Birth: Causes, Consequences, and Prevention. Washington (DC): Institute of Medicine (US) Committee on Understanding Premature Birth and Assuring Healthy Outcomes; 2007. <http://www.ncbi.nlm.nih.gov/pubmed/20669423>

^{vii} Almond, Douglas, Chay, Kenneth, Lee, David S., "The Costs of Low Birthweight" The Quarterly Journal of Economics, August 2005.

^{viii} Callaghan, WM, Mackey AP, Berg CJ., Identification of severe maternal morbidity during delivery hospitalizations, United States, 1991-2003. American J Obstet Gynecol 2008: 199:133e1-133e8.

^{ix} Ohio total births: 139,034 (2010) : Indiana total births: 83,115 (2013). Indiana births as percentage of Ohio births = 0.5698 == 60% (estimated savings scaled down to 60% of what Ohio estimates). Indiana – 108 births @ average expenditure of \$55,984.

^x Medicaid Health Plans of America. "Preterm Birth Prevention: Evidence Based Use of Progesterone Treatment." Leadership Roundtable. 2014. Document.

^{xi} Recommendations to Increase the Use of Progesterone to Prevent Prematurity– IPQIC, June 2015.

^{xii} Hassan SS, Romero R, Vidyadhari D, et al. "Vaginal progesterone reduces the rate of preterm birth in women with a sonographic short cervix: a multi-center, randomized, double-blind, placebo-controlled study." Ultrasound Obstet Gynecol 38 (2011;38): 18-31. Document. & Iams, Jay D. "Identification of Candidates for Progesterone. Why, Who, How, and When?" Obstet Gynecol (2014;123): 1317-26. Document.

^{xiii} Ms Sheila M. Gephart, RN, BSN, Dr Jacqueline M. McGrath, PhD, RN, Dr Judith A. Effken, PhD, RN, and Dr Melissa D. Halpern, PhD., Necrotizing Enterocolitis Risk: State of the Science, <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3357630/>

^{xiv} IPQIC IVON Engle Herrmann WAE v2, Ganapathy V, Hay JW, Kim JH. Costs of necrotizing enterocolitis and cost-effectiveness of exclusively human milk-based products in feeding extremely premature infants. Breastfeed Med.

^{xv} Centering Healthcare Institute, Improving health by transforming care through Centering groups, <https://www.centeringhealthcare.org/uploads/files/CHI-Fact-Sheet-Set.pdf>

^{xvi} Gareau, S., Lòpez-De Fede, A., Loudermilk, B.L. et al. Group Prenatal Care Results in Medicaid Savings with Better Outcomes: A Propensity Score Analysis of CenteringPregnancy Participation in South Carolina, Matern Child Health J (2016) 20: 1384. doi:10.1007/s10995-016-1935-y

^{xvii} Ohio Perinatal Collaborative, Decreasing Bloodstream Infections Project, <https://opqc.net/projects/BSI>

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- ^{xviii} Gephart SM, McGrath JM, Effken JA, Halpern MD. Necrotizing Enterocolitis Risk: State of the Science. *Advances in Neonatal Care*. 2012;12(2):77-89. doi:10.1097/ANC.0b013e31824cee94.
- ^{xix} Smoking cessation during pregnancy. Committee Opinion No. 471. American College of Obstetricians and Gynecologists. *Obstet Gynecol* 2010;116:1241-4.
<http://www.acog.org/Resources-And-Publications/Committee-Opinions/Committee-on-Health-Care-for-Underserved-Women/Smoking-Cessation-During-Pregnancy>
- ^{xx} CDC, "Medical-Care Expenditures Attributable to Cigarette Smoking During Pregnancy -- United States, 1995," *Morbidity and Mortality Weekly Report (MMWR)*: 46(44);1048-1050, November 07, 1997, <http://www.cdc.gov/Mmwr/preview/mmwrhtml/00049800.htm>
- ^{xxi} Campaign for Tobacco Free Kids, Smoking and Pregnancy: The Harms of Continued Smoking and the Benefits of Quitting, www.tobaccofreekids.org/research/factsheets/pdf/0288.pdf
- ^{xxii} Tobacco Prevention and Cessation Commission, Indiana's Tobacco Burden, https://www.in.gov/isdh/tpc/files/Indiana_Tobacco_Burden_November_2015.pdf
- ^{xxiii} Association of State and Territorial Health Officials, "Smoking Cessation Strategies for Women, Before, During and After Pregnancy"; Recommendations for State and Territorial Health Agencies", 2013.
- ^{xxiv} Melvin CL, Dolan-Mullen P, Windsor PA, Whiteside HP Jr, Goldenberg RL, "Recommended cessation counseling for pregnancy women who smoke: a review of the evidence", *Tobacco Control* 2000;9(suppl 3): III80-III84.
- ^{xxv} Teen Pregnancy Prevention, National Conference of State Legislators, <http://www.ncsl.org/research/health/teen-pregnancy-prevention.aspx>
- ^{xxvi} The National Campaign to Prevent Teen and Unplanned Pregnancies; <https://thenationalcampaign.org/data/state/indiana>
- ^{xxvii} The National Campaign to Prevent Teen and Unplanned Pregnancies; <https://thenationalcampaign.org/data/state/indiana>
- ^{xxviii} The National Campaign to Prevent Teen and Unplanned Pregnancies; <https://thenationalcampaign.org/>
- ^{xxix} Office of Adolescent Health : Reproductive Health; <https://www.hhs.gov/ash/oah/adolescent-health-topics/reproductive->