2 Maternal and Child Health Plan Benefit Model: Evidence-Informed Coverage

The Benefits of Prevention and Early Detection: A Cost-Offset Addendum to the Actuarial Analysis of The Maternal and Child Health Plan Benefit Model

This document is an addendum to the actuarial analysis tables located on page 18-31. It provides an annotated bibliography of studies that support the cost-offset value of prevention.

Introduction

The Maternal and Child Health Plan Benefit Model (Plan Benefit Model) emphasizes prevention. Some clinical preventive services prevent disease or injury (e.g., cervical cancer screening); others catch disease in early stages when treatment is most effective and least expensive (e.g., STI screening). Because clinical preventive services can prevent or reduce the need for treatment, they provide a **cost-offset**. Employers who invest their healthcare dollars in screening, counseling, and preventive medications may be able to avoid spending healthcare dollars on treatment services. In some cases, when the cost of screening is *less* than the cost of treatment, employers may be able to save healthcare dollars by investing in prevention.

This annotated bibliography provides an overview of key studies that support the cost-offset value of prevention. Employers are encouraged to analyze their own claims data, and review other sources, in order to identify additional cost-offset opportunities.

Key Definitions

A health intervention is termed **cost-saving** when the reduction in costs resulting from the intervention exceeds the cost required to develop and deliver the intervention.

A health intervention is considered **cost-effective** when the net cost per unit of health generated (e.g., fewer sick days, fewer cases of measles) is favorable relative to other health services. Cost-effective interventions do not reduce net healthcare costs, but they provide a good value per dollar.

I. Preventive Services

a. Well-Child Services

Impact: *Cost-effective*

Cost-effectiveness analyses of well-child care are limited; however, some studies have predicted cost-offsets or cost-savings associated with comprehensive and timely preventive care for children and adolescents.

- A study conducted by the American Academy of Pediatrics (AAP) found that it would have cost $4.3 billion to provide comprehensive clinical preventive services to all 10- to 24-year-olds in 1998. If the delivery of comprehensive clinical preventive services (as defined by the AAP) prevented 1% of the $700 billion in costs associated with preventable adolescent injuries, a hypothetical net savings of $2.7 billion would result.
  Reference: Hedberg VA, Bracken AC, Stashwick CA. Long-term consequences of adolescent health behaviors: implications for adolescent health services. *Adolesc Med.* 1999;10(1):137-151.
- Several studies have demonstrated cost-savings associated with preventive care for publicly-insured children. For example, Medicaid-enrolled children who are up-to-date on their well-child check-ups through 2 years of age are 48% less likely to experience an avoidable hospitalization.
  Reference: Hakim RB, Bye BV. Effectiveness of compliance with pediatric preventive care guidelines among Medicaid beneficiaries. *Pediatrics*. 2001:108; 90-97.
- Children with incomplete well-child care in the first 6 months of life are significantly more likely than children with complete care to visit an emergency department for an upper respiratory tract infection, gastroenteritis, or asthma. In fact, children with incomplete care are 60% more likely to visit an emergency department for any cause compared to children who are up-to-date on their well-child care. ***Reference:*** Hakim RB, Ronsaville DS. Effect of compliance with health supervision guidelines among U.S. infants on emergency department visits. *Arch Pediatr Adolesc Med.* 2002;156:1015-1020.
- When well-care visits for children aged 0 to 4 years include parental injury prevention counseling using the AAP's TIPP sheets, the cost is $2,800 per quality-adjusted life year saved (in year 2002 dollars). This counseling is cost-effective when judged using commonly accepted cost-effectiveness benchmarks.
  Reference: Miller TR, Galbraith MS. Injury prevention counseling by pediatricians: A benefit-cost comparison. *Pediatrics*. 1995;96:1-4.

b. Immunizations

7-Vaccine Routine Childhood Immunization Schedule

Impact: *Cost-saving*

Background: Numerous studies have documented that the cost of providing immunizations to children and adolescents is less expensive than treating vaccine-preventable diseases.
Summary: The cost of providing the 7-vaccine series to children was estimated at $2.3 billion (direct) and $2.8 billion (societal). In the absence of vaccination, the cost of disease among children would amount to $12.3 billion in direct costs and $46.6 billion in societal costs (societal costs

include lost productivity due to premature mortality and permanent disability, and lost opportunity costs associated with caretakers taking time off work to care for ill children). Therefore, the 7-vaccine series demonstrated a net direct cost-savings of $9.9 billion and a net societal cost-savings of $43.3 billion.
Methods: A decision tree was constructed using a hypothetical cohort of infants born in one year in the United States (n= 3.8 million). Population-based estimates of vaccination coverage, published vaccine efficacies, historical data on disease incidence prior to vaccination, and disease incidences for 1995-2001 were used to determine direct and societal costs.
Reference: Zhou F, Santoli J, Messonnier ML, et al. Economic evaluation of the 7-vaccine routine childhood immunization schedule in the United States, 2001. *Arch Pediatr Adolesc Med.* 2005;159(12):1136-1144.

Rotavirus Vaccination (*New immunization not captured in the 7-vaccine series*)
Impact: *Cost-effective*

Background: Rotavirus is a common illness among children in the United States. The illness can lead to severe dehydration, physician visits, hospitalization, emergency department visits, and death.
Summary: Though not likely to be cost-saving, the rotavirus vaccine is considered cost-effective from both direct-cost and societal-cost perspectives. A national rotavirus immunization program was estimated to prevent 13 deaths, 44,000 hospitalizations, 137,000 emergency department visits, 256,000 office visits, and 1.1 million episodes requiring a parent to stay at home with a child under 5 years of age. This study concluded that the rotavirus vaccination would generate a cost-effectiveness ratio of $336 per case prevented from the health care perspective, and $138 per case prevented from the societal perspective. Nevertheless, a second study concluded that a universal rotavirus vaccine program in the US would cost $77.30 per case averted from the health care and give a net saving of $80.75 per case averted from the societal perspectives, respectively. The cost per quality-adjusted life-year (QALY) was found to be $104,610 when we considering a child with one caregiver.
Methods: A cost-effectiveness analysis was performed using the Monte Carlo method, taking into account both societal and direct-cost perspectives. Using cumulative probability distributions, the investigators (a) estimated the total annual number of rotavirus cases for a cohort of 4 million children between 0 and 59 months of age, and (b) calculated the number of cases that would require healthcare and the associated costs. They then compared these figures to the cost of a vaccination program. However, this study used intermediate outcomes (i.e. cases and hospitalizations) rather than quality-adjusted life-years (QALYs) gained. The 2009 study incorporated herd immunity into the cost-effectiveness analysis and indicated that a rotavirus vaccination program would prevent about 90% of rotavirus incidence, mortality, hospitalization and emergency department visits annually.
References: Shim E, Galvani AP. Impact of transmission dynamics on the cost-effectiveness of rotavirus vaccination. *Vaccine*. 2009;27:4025-4030.
Widdowson MA, Meltzer MI, Zhang X, Bresee JS, Parashar UD, Glass RI. Cost-effectiveness and potential impact of rotavirus vaccination in the United States. *Pediatrics*. 2007;119(4):684-697.

Adolescent Vaccines

Impact: *Some cost-effective, some cost-saving in limited populations*

Summary: Adolescent vaccines are less cost-effective than childhood vaccines and none are cost-saving at the population level. However, adolescent vaccines do provide sizable health benefits. From the societal perpective, the hepatitis A and B; and pertussis, tetanus, and diphtheria combination (Tdap) vaccines are cost-saving for limited populations (college freshmen and 10 to 19-year-olds, respectively). From the payer perspective, adolescent vaccines cost $9,000 to $219,000 per life-year saved. Among recently recommended immunizations, the most cost-effective are the pertussis and human papillomavirus (HPV) vaccines. The least cost-effective immunization is the meningococcal vaccine.

Methods: A systematic review of the economic literature on adolescent vaccines was conducted and results were synthesized.

Reference: Ortega-Sanchez IR, Lee GM, Jacobs R, Prosser LA, Molinari NA, Zhang X, et al. Projected cost-effectiveness of new vaccines for adolescents in the United States. *Pediatrics*. 2007;121 suppl:S63-S78.

c. Preventive Dental Services

Preventive Dental Visits

Impact: *Cost-saving*

Background: Early dental visits appear to establish a pattern of preventive dental maintenance among children. Early dental visits reduce future dental risk by improving oral health. As oral health improves, oral health costs decrease.

Summary: Early dental visits are cost-effective in reducing the need for restorative care, even though early visits appear to increase the utilization of preventive care services (and preventive costs) later in childhood. In fact, there is a correlation between the age of a child's first dental visit and their total (preventive and restorative) dental costs.

Methods: A cohort of preschool-aged Medicaid-enrolled children were classified in two groups: those who had received a preventive dental visit before age one and those who had not. Health records were analyzed for increased rates of preventive visits, restorative care, and emergency visits. Utilization was used as a proxy for direct costs.

Reference: Lee JY, Bouwens T, Savage MF, Vann WF Jr. Examining the cost-effectiveness of early dental visits. *Pediatr Dent.* 2006;28:102-105.

Age at First Dental Visit	Total Dental Costs
Before age 1	$262
1- 2 years	$399
2- 3 years	$449
3- 4 years	$492
4-5 years	$546

Pediatric Dental Sealants

Impact: *Cost-effective in high-risk populations*

Background: Dental sealants are used to prevent dental caries in children. Dental caries (cavities) are caused by the acid byproducts of oral bacteria. They cause pain, and require restorative treatment to prevent further decay and infection.

Summary: From the third-party payer, direct-cost perspective, dental sealants used on children aged 5 to 7 years are cost-effective because they reduce the need for restorative care. Approximately 11% of children who had sealant treatment required subsequent restorative care, while 33% of children without sealants required restorative care. The cost of restorative care among patients with sealants was $55.50, while the cost of restorative care among patients without sealants averaged $71.90. These findings are limited to high-risk populations. When applied to a broader population, dental sealants would likely have a more moderate cost-effectiveness ratio due to the reduced incidence of dental caries. When examining both high and low risk populations, a second study concluded risk-based sealants cost an estimated $53.80 and sealing all populations was $54.60, compared to $68.10 for the non-sealed populations. The analysis indicated sealing no teeth was more costly and less effective than the other two strategies. Sealing all was found to be the most effective strategy as it cost $13.50 per tooth and an additional $.08 per tooth for each cavity-free month gained.

Methods: The first study used the direct-cost perspective and used actual Medicaid reimbursements for 9,549 children enrolled in the Alabama Medicaid program. The second study was based off of a Markov model used to construct events representing the natural history of sealant retention, cavity formation, and their associated health states. The outcome measures were the incremental cost per month gained in a cavity-free state over a ten-year period.

References: Dasanayake AP, Li Y, Kirk K, Bronstein J, Childers NK. Restorative cost-savings related to dental sealants in Alabama Medicaid children. *Pediatr Dent.* 2003 Nov-Dec;25(6):572-6.
Quinonez RB, Downs SM, Shugars D, Christensen J, Vann WF. Assessing cost-effectiveness of sealant placement in children. *Journal of Public Health Dentistry.* 2005;65(2):82-89.

Fluoride Varnish

Impact: *Cost-effective in high-risk populations*

Background: Fluoride varnish protects teeth from enamel erosion. Fluoride varnish has been shown to reduce dental caries by as much as 38% in children.

Summary: The application of fluoride varnish was found to be cost-effective in reducing early childhood caries in low-income populations. Fluoride varnish cost $7.18 for each cavity-free month gained per child and $203 per treatment averted.

Methods: The study used a decision tree analysis and a Markov model to calculate the effects of dental disease and treatment costs after fluoride varnish. The population sample was limited to Medicaid-enrolled children, and the analysis took the Medicaid payer's perspective. Since children enrolled in Medicaid are generally low-income and at higher risk for dental disease, the findings are limited to similar low-income, high-dental-risk populations. It is unclear if fluoride varnish would be cost-effective in the general population.

Reference: Quinonez RB, Stearns SC, Talekar BS, Rozier RG, Downs SM. Simulating cost-effectiveness of fluoride varnish during well-child visits for Medicaid-enrolled children. *Arch Pediatr Adolesc Med.* 2006;160(2):164-170.

d. Early Intervention Services for Mental Health / Substance Abuse

Impact: *Probably Cost-saving*

Background: Data to support the cost-effectiveness of early intervention services for non-Medicaid adolescent populations are limited. However, experience with adults suggests that early intervention services provide a cost-offset by addressing mental health conditions early, before they escalate into mental illness or substance abuse disorders that require long-term or intensive care.
References: Holder HD, Cunningham DW. Alcoholism treatment for employees and family members: its effect on health care costs. *Alcohol Health and Res World.* 1992;16:149-153.
American Psychological Association. *Defining medical cost offset: Policy implications.* Available at: http://www.apa.org/practice/offset3.html. Accessed on September 7, 2007.

e. Preventive Vision Services

Vision Screening

Impact: *Cost-effective*

Background: Eye disorders are the most common reason that children become handicapped in the United States. Some eye disorders, including cataracts, strabismus, refractive error, astigmatism, and ocular disease, cause severe and permanent vision damage or blindness. Other problems can be corrected with glasses, patching, eye drops, or optical blurring.
Summary: This article evaluated the costs and benefits of vision screening methods for preschoolers and school-aged children. All of the benefit-to-cost ratios exceeded 1.0, meaning that all of the studied screening programs had long-term benefits (e.g., reduced disability) that exceeded the cost of screening.
Methods: A decision analytic model was used to compare visual acuity screening and photoscreening in children at three different age intervals. Published estimates from the literature, managed care databases, and U.S. Government sources were used to provide epidemiological data and cost data.
Reference: Joish V, Malone D, Miller J. A cost-benefit analysis of vision screening methods for preschoolers and school-age children. *J AAPOS.* 2003;7(4):283-90.

f. Preventive Audiology Screening Services

Newborn Hearing Screening Example

Impact: *Cost-effective*

Background: Congenital hearing loss affects between 1 and 3 out of every 1,000 children. Hearing loss carries a lifetime of medical and social costs, including special education, adaptive equipment, social and community services, and lost wages due to underdevelopment of language and reading ability. Early detection and subsequent intervention can improve language acquisition and later school and work performance for children with hearing loss. Universal screening can detect 86 out of 110 cases of hearing loss per 100,000 children screened.
Summary: Newborn hearing screening strategies were examined for cost-effectiveness. Universal

newborn hearing screening was found to cost approximately $44,000 per quality-adjusted life year saved when deafness was diagnosed within 6 months of age. This figure is cost-effective in comparison to commonly accepted cost-effectiveness benchmarks. A second study found that the expected cost of universal newborn hearing screening was -$1750, indicating that the long-term value of performing the test exceeds the immediate costs when the probability of each test outcome is considered. This result is the expected cost each time the screening test is administered, so this cost should be multiplied by the total number of tests to be administered to find the total expected costs for all tests.
Methods: Using the societal perspective, investigators performed a cost-effectiveness analysis on a hypothetical birth cohort of 80,000 infants. Projected outcomes of (a) no screening, (b) selective screening, and (c) universal screening were compared. The second study utilized test performance ratios in relation to cost effectiveness to calculate the expected cost for universal newborn hearing and screening.
References: Keren R, Helfand M, Homer C, McPhillips H, Lieu TA. Projected cost-effectiveness of statewide universal newborn hearing screening. *Pediatrics*. 2002;110(5):855-864.
Gorga MP, Neely ST. Cost-effectiveness and test-performance factors in relation to universal newborn hearing screening. *Mental Retardation and Developmental Disabilities Research Reviews.* 2003;9:103-108.

g. Unintended Pregnancy Prevention Services

Impact: *Cost-saving*

Adolescents
Background: Each year in the United States, one out of every eight women aged 15 to 19 years becomes pregnant. Eighty-five percent (85%) of these pregnancies are unintended, meaning that they are either unwanted or mistimed. The social and economic consequences of teenage pregnancy are substantial. Each year unintended pregnancies among adolescents cost more than $1.3 billion in direct healthcare expenditures. Induced and spontaneous abortions that result from adolescent pregnancy cost more than $180 million. Effective contraceptives prevent unintended pregnancy; many also have the added benefit of protecting adolescents from sexually transmitted infections (STIs).
Summary: Under the most conservative assumptions, the average annual cost of not using contraception was estimated at $1,267 per adolescent at risk of unintended pregnancy. In private medical practice, savings range from a low of $1,794 for the use of spermicides at 1 year of use to a high of $12,318 for levonorgestrel implants at 5 years; in the public sector, savings range from a low of $779 for spermicides at 1 year of use to a high of $5,420 for levonoregestrel implants at 5 years.
Methods: A cost analysis was performed comparing (a) the cost of using 11 different methods of contraception (required physician visits or supplies), the cost of treating negative side effects (as well as the cost avoided due to beneficial side effects such as cancer prevention), and the cost of unintended pregnancies (births, spontaneous abortions, induced abortions, and ectopic pregnancies) that occurred during contraceptive use, to (b) the cost of not using any method of contraception. Costs were analyzed from both the private-payer perspective and the public-sector perspective. Private-sector costs were derived from the 1993 Medstat MarketScan database, which contains payment information from large-employer programs, Blue Cross/Blue Shield plans, and other third-party payer plans.
Reference: Trussell J, Koeing J, Stewart F, Darroch JE. Medical care cost-savings from adolescent contraceptive use. *Family Plan Persp.* 1997:29:248-203 & 295.

Davtyan C. Contraception for adolescents: evidence-based case review. *The Western Journal of Medicine.* 2000;172:166-171.

All Women
Summary: All contraceptive methods evaluated in this study produced a significant cost-savings in as little as one year from the societal perspective. Savings were derived from both financial savings and health gains. Compared to no contraception, oral contraceptives result in cost-savings of $8,827, the vaginal ring results in cost-savings of $8,996, and the monthly injectable results in cost-savings of $8,770.
Methods: A cost-utility analysis was completed using a Markov model and the societal perspective. Costs were calculated based on women of average health and fertility ranging from 15 to 50 years of age, who were sexually active and in a mutually monogamous relationship. Costs included professional fees, supplies, medications, fitting/insertion, and/or surgical and facility costs, depending on the method.
Reference: Sonnenberg FA, Burkman RT, Hagerty CG, Speroff L, Speroff T. Costs and net health effects of contraceptive methods. *Contraception*. 2004;69(6):447-459.

h. Preventive Preconception Care
Impact: *Cost-saving*

Background: Women with poorly controlled chronic disease prior to conception (or during the early stages of pregnancy) are at higher risk for complications during pregnancy. For example, poorly controlled diabetes is associated with a higher risk of birth defects, fetal death, and macrosomia for the infant; poorly controlled diabetes also increases a pregnant woman's risk for organ damage. Preconception care includes (a) preventive services and screening offered to women who expect to become pregnant in the near future, (b) preconception care for women who have given birth and intend to bear another child at some point in the future, and (c) counseling about the impact of preexisting health conditions on pregnancy outcomes.
Summary: From the direct-cost perspective, preconception care was found to be cost-saving.

- In a prospective analysis of a hypothetical comprehensive preconception care program, maternal and infant hospitalization costs were reduced by $1,720 per enrollee (woman). The investigators calculated that every $1 spent on preconception care would save $1.60 in maternal and fetal care costs.
- In a matched retrospective analysis of a cohort from California, investigators observed reduced maternal and infant hospitalization costs of $5.19 for every $1 spent on preconception care.
- In a third study, women enrolled in a preconception care program (the intervention group) received two outpatient visits prior to pregnancy and then regular prenatal care. Pregnant women in the intervention group experienced fewer congenital malformations (4.2% versus 13.5%) compared to women in the prenatal care-only group. The infants of women in the preconception care program were also 50% less likely to require neonatal intensive care unit (NICU) hospitalization.

Methods: A meta-analysis of three prior studies on preconception care.
Reference: Grosse SD, Sotnikkov SV, Leatherman S, Curtis M. The business case for preconception care: methods and issues. *Matern Child Health J.* 2006;10(5 Suppl):S93-9.

i. Preventive Prenatal Care

Impact: *Cost-saving in high-risk populations*

- For high-risk populations, intensive prenatal care offers significant cost-savings over conventional care. Savings mainly result from reduced hospital and NICU admission rates among neonates. Depending on the population, cost-savings range from $1,768 to $5,560 per infant/mother pair.
  References: Reece EA, Lequizamon G, Silva J, Whiteman V, Smith D. Intensive interventional maternity care reduced infant morbidity and hospital costs. *J Matern Fetal Neonatal Med.* 2002;Mar11(3):204-210; Ross MG, Sandhu M, Bernis R, Nessim S, Bradonier JR, Hobel C. The West Los Angeles preterm birth prevention project II. Cost-effectiveness analysis of high-risk pregnancy interventions. *Obstet Gynecol.* 1994;83(4): 506-511.
- One study that evaluated the effects of augmented prenatal care on women at high risk for a low birthweight (LBW) birth who were enrolled in a managed care organization, found a positive return on investment (ROI). The program included basic prenatal care, prenatal education, and case management. The program saved $13,961.42 per single LBW birth prevented and $18.981.08 per multiple (e.g., twins) LBW birth prevented. After program costs were considered, the return on investment equaled 37%; for every dollar invested in the program, $1.37 was saved.
  Reference: Sackett K, Pope RK, Erdley WS. Demonstrating a positive return on investment for a prenatal program at a managed care organization: an economic analysis. *J Perinat Neonat Nur.* 2004;18(2):117-127.
- Many of the individual interventions that comprise prenatal care are either cost-saving or cost-effective. However, there is considerable disagreement in the field with regards to the cost-effectiveness of comprehensive prenatal care among low- or medium-risk women in the general population. New research has pointed out methodological flaws in many older studies that indicated prenatal care was cost-effective population wide. For more information, please refer to:
  - Goulet C, Gevry H, Lemay M, et al. A randomized clinical trial of care for women with preterm labour: home management versus hospital management. *Canadian Medical Association Journal*. 2001;164(7):985-991.
  - McCormick MC. Prenatal care—necessary but not sufficient. *Health Services Research*. 2001;36(2):399-403.
  - Fiscella K. Does prenatal care improve birth outcomes? A critical review. *Obstet and Gynecol*. 1995;85(3):468-79.
  - Hueston WJ, Quattlebaum RG, Benich JJ. How much money can early prenatal care for teen pregnancies save?: a cost-benefit analysis. *Journal of the American Board of Family Medicine*. 2008;21(3):184-189.
  - Lu MC, Toche V, Alexander GR, Kotelchuck M, Halfon N. Preventing low birthweight: is prenatal care the answer. *J Matern Fetal Neonatal Med*. 2003;13: 362-380.
  - Alexander GR, Korenbrot G. The role of prenatal care in preventing low birth weight. *The Future of Children*. 1995;5:103-20.
  - Alexander GR, Kotelchuck M. Assessing the role and effectiveness of prenatal care: history, challenges, and directions for future research. *Public Health Rep*. 2001;116:306-316.

j. Preventive Postpartum Care

Breastfeeding Promotion /Lactation Consultation Examples
Impact: *Cost-saving*

Background: Breastfeeding improves the short- and long-term health of women and their infants, and breastfed infants have lower total healthcare costs than infants who are not breastfed. Breastfeeding decreases the incidence or severity of diarrhea, lower respiratory infections, otitis media, bacterial meningitis, botulism, UTIs, and necrotizing enterocolitis. It may also protect against sudden infant death syndrome (SIDS), insulin-dependent diabetes, and allergic diseases. Benefits to mothers include reductions of hip fractures during menopause, less postpartum bleeding, and reduced risk of ovarian and pre-menopausal breast cancers. Health plans and private payers can realize savings from supporting the promotion of exclusive breastfeeding.
Summary: Compared to breastfed infants, formula-fed infants cost the healthcare system more money in their first-year of life due to their increased rate of illness and hospitalization. For example, in the first year of life, never-breastfed infants (compared to breastfed infants) experience 2,033 excess office visits, 212 excess days of hospitalization, and 609 excess prescriptions per 1,000 infants. This additional health care cost the managed care system studied between $331 and $475 per never-breastfed infant. A second study found that hospital, doctor, or clinic visits for four or more upper respiratory tract infections were significantly greater if predominant breastfeeding was stopped before 2 months or partial breastfeeding was stopped before 6 months. Predominant breastfeeding for less than six months was associated with an increased risk for two or more hospital, doctor, or clinic visits and hospital admission for wheezing lower respiratory illness. Breastfeeding for less than 8 months was associated with a significantly increased risk for two or more hospital, doctor, or clinic visits or hospital admissions because of wheezing lower respiratory illnesses. A third study found infants who were exclusively breastfed for six months experienced less morbidity from gastrointestinal infection than those who were mixed breastfed for three or four months, and no deficits were demonstrated in growth among infants from either developing or developed countries who were exclusively breastfed for six months or longer.
Methods: Epidemiological information was collected on the most common childhood illnesses, along with cost data for the treatment of these illnesses. Data was analyzed to ascertain the excess medical costs associated with formula-feeding. The second study was conducted via a literature review. The third study was a prospective birth cohort of 2,602 liveborn children in Perth, Western Australia.
References: Ball TM, Wright AL. Health care costs of formula-feeding in the first year of life. *Pediatrics*. 1999;103(4):870-876.
Kramer MS, Kakuma R. Optimal duration of exclusive breastfeeding. *Cochrane Database System Review*. 2002;1
Oddy WH, Sly PD, Kde Klerk NH, et al. Breastfeeding and respiratory morbidity in infancy: a birth cohort study. *Archives of Disease in Childhood*. 2003;88:224-228

k. Preventive Services (General)

Impact: *Cost-saving or cost-effective*

In general, clinical preventive services are cost-effective; some are cost-saving. Examples of the cost-offset of clinical preventive services recommended in the Plan Benefit Model follow:

Children and/or Adolescents		Childbearing-age Women/ Pregnant Women
Alcohol misuse screening and counseling	Not available	Cost-saving: Each $1 invested in screening and brief counseling interventions saves approximately $4 in healthcare costs.[1, 2]
Chlamydia screening	Cost-effective/cost-saving: Screening for chlamydia allows clinicians to identify affected patients and begin treatment earlier in the course of disease, thereby improving outcomes and avoiding the health and economic consequences of latent disease such as pelvic inflammatory disorder (PID) and infertility.[3] A review of 10 cost-effectiveness studies found that screening was more cost-effective than simply testing symptomatic women, and that in some instances, screening was cost-saving even at prevalence rates as low 1.1%.[4]	
Cervical cancer screening	Cost-effective: A conventional Pap test repeated every 3 years from the onset of sexual activity up to the age of 75 costs $11,830 per quality-adjusted life year saved (in year 2000 dollars).[5] In comparison to other preventive interventions and to commonly accepted cost-effectiveness benchmarks, cervical cancer screening is highly cost-effective.[6]	
Gonorrhea screening	Cost-effective/cost-saving: Screening for gonorrhea allows for the early recognition of disease and immediate treatment, which can prevent the costly complications of late-stage disease such as PID. The average lifetime cost of PID has been estimated to range from $1,060 to $3,626 in year 2000 dollars.[7] The average lifetime cost for women who develop major complications of PID is $6,350 for chronic pelvic pain, $6,840 for an ectopic pregnancy, and $1,270 for infertility: 79% of these costs have been found to occur within 5 years of the precipitating infection.[8]	
HIV screening	Not available	Cost-saving: Compared to no screening, a universal screening program targeting pregnant women would save an estimated $3.69 million dollars and prevent 64.6 cases of pediatric HIV infection for every 100,000 pregnant women screened.[9]
Lead screening	Cost-effective/cost-saving: Compared to no screening, universal screening of all 1-year old children for elevated blood lead levels (BLLs) would produce economic benefits exceeding program costs in communities where at least 11% to 17% of children have elevated BLLs.[10]	Not applicable
Sexually Transmitted Infections (STI) (Combined Data)	Avoiding adverse outcomes of pregnancy associated with untreated STIs can offset 19% to 35% of the costs of prenatal care in certain populations of high-risk women.[11]	
Syphilis	Not available	Cost-effective: Serological screening of pregnant women can be cost-effective even when there is a very low prevalence of maternal infection because screening is inexpensive while treating congenital syphilis is costly.[12] For example, treatment for early stage syphilis ($41.26) is much less expensive than treatment for later stage disease ($2,062) (both figures in year 2001 dollars).[13]
Tobacco use screening and counseling	Cost-effective: Cost data on adolescent tobacco cessation is limited, but in adult populations the cost-effectiveness of tobacco cessation programs is quite well-established, with many approaches yielding costs under $1,000 per quality-adjusted life year saved.[14]	Cost-saving: Tobacco cessation treatment for pregnant women is considered one of the most cost-saving preventive services.[15,16] Clinical trials have shown that $6 are saved in healthcare costs for every $1 invested in smoking cessation programs for pregnant women.[17]

1. Fleming MF, Mundt MP, French MT, Manwell LB, Stauffacher EA, Barry KL. Brief physician advice for problem alcohol drinkers: long-term efficacy and benefit-cost analysis. A randomized controlled trial in community-based primary care settings. *Alcohol Clin Exp Res*. 2002;26:36-43.
2. Gentilello LM, Ebel BE, Wickizer TM, Salkever DS, Rivara FP. Alcohol interventions for trauma patients treated in emergency departments and hospitals: A cost benefit analysis. *Ann Surg*. 2005;241:541-50.
3. U.S. Preventive Services Task Force. Screening for chlamydial infection: recommendations and rationale. *Am Fam Physician*. 2002;65(4):673-76.
4. Blandford JM, Gift TL. Productivity losses attributable to untreated chlamydial infection and associated pelvic inflammatory disease in reproductive-aged women. *Sex Transm Dis*. In press.
5. Mandelblatt JS, Lawrence WF, Womack SM, Jacobson D, Bin YI, Yi-Ting H. et al. Benefits and costs of using HPV testing to screen for cervical cancer. *JAMA*. 2002;287(18):2372-2381.
6. Eichler H, Kong SX, Gerth WC, Mavros P, Jönsson B. Use of cost-effectiveness analysis in health-care resource allocation decision-making: how are cost-effectiveness thresholds expected to emerge? *Value Health*. 2004;7(5):518-528.
7. Chesson HW, Blandford JM, Gift TL, Tao G, Irwin KL. The estimated direct medical cost of sexually transmitted diseases among American youth, 2000. *Perspect Sex Reprod Health*. 2004;36(1):11-19.
8. Yeh JM, Hook EW, Goldie SJ. A refined estimate of the average lifetime cost of pelvic inflammatory disease. *Sex Transm Dis*. 2003;30(5):369-78.
9. Immergluck LC, Cull WL, Schwatrz A, Elstein AS. Cost-effectiveness of universal compared with voluntary screening for human immunodeficiency virus among pregnant women in Chicago. *Pediatrics*. 2000;105(4):E54.
10. Briss PA, Matte TD, Schwartz J, Rosenblum LS, Binder S. Costs and benefits of a universal screening program for elevated blood lead levels in 1-year-old children. In: Centers for Disease Control and Prevention. *Screening Young Children for Lead Poisoning: Guidance for State and Local Health Officials*. Atlanta, GA: National Center for Environmental Health; 1997.
11. Kuiper H, Richwald GA, Rotblatt H, Asch S. The communicable disease impact of eliminating publicly funded prenatal care for undocumented immigrants. *Matern Child Health J*. 1999:3(1):39-52.
12. Schmid G. Economic and programmatic aspects of congenital syphilis prevention. *Bull World Health Organ*. 2004;82(6):402-409.
13. Blandford JM, Gift TL. The cost-effectiveness of single-dose azithromycin for treatment of incubating syphilis. *Sex Transm Dis*. 2003;30(6):502-8.
14. Cromwell J, Bartosch WJ, Fiore MC, Hasselblad V, Baker T. Cost-effectiveness of the clinical practice recommendations in the AHCPR guideline for smoking cessation. *JAMA*. 1997:278,1759-1766.
15. U.S. Public Health Service. *Treating Tobacco use and Dependence: A Systems Approach*. Rockville, MD: Office of the U.S. Surgeon General; U.S. Public Health Service; U.S. Department of Health and Human Services; 2000.
16. Maciosek MV, Coffield AB, Edwards NM, Goodman MJ, Flottemesch TJ, Solberg LI. Priorities among effective clinical preventive services: results of a systematic review and analysis. *Am J Prev Med*. 2006;31(1):52-61.
17. Marks JS, Koplan JP, Hogue CJR, et al. A cost-benefit/cost-effectiveness analysis of smoking cessation for pregnant women. *Am J Prev Med*. 1990;6:282-291.

II. Recommended Levels of Care for Physician/Practitioner Services

Not Applicable

III. Emergency Care, Hospitalization, and Other Facility-Based Care

Not Applicable

IV. Therapeutic Services/Ancillary Services

j. Durable Medical Equipment, Supplies, Medical Food

Durable Medical Equipment
Cochlear Implants in Children
Impact: *Cost-effective*

Summary: Cochlear implants in children are cost-effective from the direct medical perceptive and cost-saving from the societal perspective. Cochlear implants for children with bilateral deafness result in lifetime cost-savings of $53,198 per child when indirect costs like changes in future education and earning potential are considered.
Methods: Pre-intervention, post-intervention, and cross-sectional surveys were administered to parents of profoundly deaf children with a cochlear implant or anticipating a cochlear implant.
Reference: Cheng AK, Rubin HR, Power NR, Mellon NK, Francis HW, Niparko JK. Cost-utility analysis of the cochlear implant in children. *JAMA*. 2000;284(7):850-856.

Medical Foods
Donor Breast Milk Example
Impact: *Cost-saving for limited populations*

Background: The health benefits of human breast milk have been well-established. Breast milk provides growth factors, hormones, digestive enzymes, and immunologic factors, which are impossible to replicate with formula. Many preterm infant/mother pairs are unable to breastfeed; without access to donor milk, these infants are unable to receive the health benefits of breast milk.
Summary: Preterm infants who do not receive human breast milk are at an increased risk for costly health problems such as necrotizing enterocoltis and sepsis. The incremental cost of *not* feeding preterm infants human milk is $9,669 per infant, even when the cost of alternate forms of nutrition are included. Using donor human breast milk could save approximately $11 in NICU costs for each $1 spent on donor milk if the mother's milk is unavailable for two months, and $37 for each $1 spent on donor milk if the mother's milk is unavailable for 1 month.
Methods: A cost-effectiveness analysis from the direct-cost perspective was performed using data from published articles.
Reference: Wight NE. Donor human milk for preterm infants. *J Perinatol*. 2003;21:249-254.

V. Laboratory Diagnostic, Assessment, and Testing Services
Not Applicable