Appendix G
Background Information on Prenatal Care

Introduction

This appendix is intended to supplement the information *on* prenatal care in chapter 4. It has two main parts:

- detailed descriptions of studies of the effectiveness and cost-effectiveness of prenatal care, and
- background data and information on methods underlying OTA's analysis of the cost-effectiveness of prenatal care.

Studies of the Effectiveness and Cost= Effectiveness of Prenatal Care

Studies of the effects of prenatal care on birth outcomes fall into two general categories: 1) studies based on vital records (i. e., birth and death records); and 2) studies evaluating programs offering enriched or augmented prenatal care services.

The methods and findings of 26 studies that analyzed the effects of prenatal care using vital records collected by hospitals, cities, counties, States, and the Federal Government are summarized in table G-1. All of the studies shown in that table used multivariate or other techniques to control for demographic or medical risk factors that might influence birth outcomes independently of prenatal care.

In recent years, several investigators seeking to examine the effects of prenatal care on birth outcomes have applied econometric techniques—in particular, the instrumental variables method—to vital records data. Table G-2 summarizes five recent econometric analyses of the effects of prenatal care on neonatal mortality and birthweight. All five of the studies involved the application of the instrumental variables technique, a technique that is used to correct for adverse selection bias.[1] Studies using econometric techniques such as the instrumental variables method uniformly find even stronger negative effects of prenatal care on neonatal mortality and low birthweight than are found with traditional multivariate techniques. Such studies generally do not adequately control for favorable selection bias, however, and therefore can be expected to overestimate the effects of prenatal care on birth outcomes.

Table G-3 summarizes 25 evaluations of the effects on birth outcomes of programs offering augmented prenatal care. Such programs typically serve teenagers or poor women. Evaluations of programs with augmented services often use well-selected comparison groups. However, such evaluations typically compare care that is generally available to women in the community with more comprehensive programs, and it is difficult to generalize from these studies about the value of more v. less prenatal care of the kind that is generally available.

Table G-4 summarizes 12 studies of the cost-effectiveness of prenatal care. The studies differ with respect to the target population studied, the alternatives compared, and the categories of costs included. Most important in distinguishing these studies from one another, however, is the perspective of the analysis (indicated in the second column of the table). Most of the 12 cost-effectiveness studies examine the net costs of a strategy to a particular institution (e. g., a health maintenance organization) or program (e.g., Medicaid). Differences between alternatives in costs to other segments of society (e.g., patients, providers, and insurance companies) are generally not calculated.

Data and Methods Underlying OTA's Cost= Effectiveness Analysis of Expanded Medicaid Eligibility for Prenatal Care

In chapter **4,** OTA analyzed the cost-effectiveness of expanding eligibility for Medicaid to all pregnant women in poverty. OTA's analysis relied on estimates of the cost of prenatal care and health care for low birthweight babies and the expected change in the use of early prenatal care resulting from the expansion of eligibility. This section elaborates on those two topics, first, with a description of the data sources, methods, and assumptions underlying the estimate of the long-term health care costs associated with a low birthweight birth; and second, with a summary of data on the impact of insurance coverage on the use of prenatal care by poor women.

[1] Adverse selection bias is a threat to the validity of some studies of the effectiveness of prenatal care For more information on this and a related threat (favorable selection bias), see the section in ch. 4 entitled "Problems in Interpreting the Evidence " The Instrumental variables technique attempts to correct for adverse selection bias by replacing the observed value of prenatal care with a predicted value derived from a regression of prenatal care on explanatory variables that are uncorrelated with the mother's health status; the predicted prenatal care level thus derived is also assumed to be uncorrelated with the mother's health status The predicted level of prenatal care is then used in a second-stage regression analysis to predict its effect on the outcome of pregnancy.

Table G-1.—Studies Using Vital Records To Examine the Effects of Prenatal Care on Birth Outcomes

Author	Study year(s)	Research design	Prenatal care measure	Observed effects: Neonatal mortality — Whites	Neonatal mortality — Blacks	Neonatal mortality — Total	Birthweight — Whites	Birthweight — Blacks	Birthweight — Total
Kessner, et al., 1973[1]	1968	Retrospective analysis of live births in New York City controlling for race, ethnicity, social and medical risk	Adequacy of care index[27,28]	+	+	+	+	+	+
Gortmaker, 1979[1]	1968	Reanalysis of Kessner, et al. (1973) data controlling for demographics (4 measures), medical conditions, hospital service (private v. general)	Modified adequacy of care Index	0	+		+	+	
Greenberg, 1983[3]	1977	Retrospective analysis of live births in the U.S. controlling for race and education	Some v no care				†		
Showstack, et al., 1985[1]	1978	Retrospective analysis of I we births in 2 California counties controlling for demographics, hospital type, gestation	Modified adequacy of care index						
Strobino, et al., 1985[5]	1975-80	Retrospective analysis of change in neonatal mortality from 1976 to 1980 in Mississippi; race-specific decomposition of change in NMR into proportion attributed to new use of prenatal care v. proportion independent of changes in *use*	Number of visits	†	+29		0		
			Trimester in which care began	0	0				
Institute of Medicine. 1985[4]	1981	Retrospective analysis of live births in the U.S. controlling for race, educational level, marital status, age/parity risk	1. First trimester v. other				+		
			2. First-trimester care with recommended number of visits by gestational age				+		
Fisher, et al., 1985[7]	1980-83	Retrospective analysis of births in low- and high-income census tracts in Washington State, 1980-83	Percent receiving late or no prenatal care						
Quick, et al., 1981[8]	1973-75	Retrospective analysis of live births in Portland, Oregon, controlling for sociodemographic and medical-obstetric risk and membership in HMO	Modified adequacy of care index				†		
Eisner, et al., 1979[9]	1974	Retrospective analysis of live births in the U.S. controlling for demographics and pregnancy history	Some v. no care				†	†	
Terris and Glassser, 1974[10]	1961	Life table analysis of demographically matched LBW and mature weight infants born to black mothers in New York City	Month care began					Mixed[30]	
Shwartz and Vinyard, 1965[2]	1960	Modified life table analysis of live births in Washington, DC, controlling for demographics and pregnancy complications	Onset of care in specific gestational age intervals						Mixed[11]
Elster, 1984[11]	1974-79	Retrospective analysis of live births in Utah controlling for demographics, pregnancy history, and maternal age	Trimester care began				†[32]		
Dott and Fort, 1975[13]	1972	Retrospective analysis of live births in Louisiana controlling for birthwelght and poverty status	Number of visits						

Table G-1 .—Studies Using Vital Records To Examine the Effects of Prenatal Care on Birth Outcomes—Continued

Author	Study year(s)	Research design	Prenatal care measure	Observed effects: Neonatal mortality Whites	Neonatal mortality Blacks	Neonatal mortality Total	Birthweight Whites	Birthweight Blacks	Birthweight Total
Schramm and Land, 1984" . .	1981-82	Retrospective analysis of Missouri Medicaid births controlling for race, separate analysis for each year	Modified adequacy of care index	+	0	0	+	+	+
Ryan, Sweeny, and Solola, 1980 [15]	July -Dec. 1979	Retrospective analysis of live births in Memphis, Tennessee, hospital serving mainly low-income blacks; groups similiar on most demographics and medical risk	Low (O-3) v. high (4+) number of visits			+			+
Terris and Gold, 1969"	Not specified	Retrospective analysis of demographically matched pairs of LBW and mature weight black infants born in one Brooklyn, New York, hospital	Week of pregnancy at first Visit					0	
			Ratio of observed to expected/recommended number of visits by gestational age					0	
Shwartz and Poppen, 1982' [7]	1981	Retrospective analysis of births in Baltimore, Maryland, controlling for demographics, medical-obstetric factors	Modified adequacy of care Index					+	
Grossman and Jacobowitz, 1981 [18]	1964-77	Retrospective county-level analysli of live births in the U. S., controlling for demographics, family planning and abortion use, prior mortality rates	Active non-Federal MDs/1,000 population	0	Mixed [33]				
			Medicaid coverage of first-time pregnancies	0	0				
Corman and Grossman, 1985"	1964-77	Retrospective county-level analysis of live births in the U.S. controlling for demographics; availability of family planning, MIC Projects, CHCs and NICUs; WIC use	Medicaid coverage of first-time pregnancies	0	0				
Hadley, 1982 [19]	1969-73	Retrospective county group-level analysis of live births in the U.S. controlling for prior NMR, births to high-risk women, hospital births, Medicare expenditures, percent older and non-board-certified OBS, abortions and NICU	Number of OBs/1 ,000 live births	+	0				
			Medicaid coverage of unborn children	4-	0				

Table G-1.—Studies Using Vital Records To Examine the Effects of Prenatal Care on Birth Outcomes—Continued

Author	Study year(s)	Research design	Prenatal care measure	Observed effects: Neonatal mortality — Whites	Blacks	Total	Observed effects: Birthweight — Whites	Blacks	Total
Goldman and Grossman, 1982[21]	1969-78	Retrospective county-level analysis of live births in the U.S. controlling for percent nonwhite births, family income, availability of physicians	Presence and number of CHCs	Mixed	Mixed[34]	Mixed			
Corman, Joyce, and Grossman, 1987[22]	1975-80	Retrospective county-level analysis of live births in the U.S. controlling for birthweight, abortion rate, NICU availability, teen family planning use, WIC use, BCHS project use, smoking behavior, high-risk women, percent poor	Percent of live births with first-trimester care	†	†				
Joyce, 1987[23]	1976-78	Retrospective county-level analysis of live births in the U.S. controlling for birthweight, prematurity, teen family planning use, abortion use, NICU availability, smoking behavior, teen births, births to older women, high-risk women, population density	Percent of live births with first-trimester care	†	0		†	0	
Rosenzweig and Schultz, 1982[24]	1980	Retrospective analysis of live births in the U.S. controlling for demographics, parity, smoking behavior, use of prenatal screening tests, and electronic fetal monitoring	1. Delay (in months) to first visit						0
			2a Delay (in months) to first visit						—
			2b. Total number of visits						+
Harris, 1982[25]	1975-76	Retrospective analysis of fetal deaths and live births to black mothers in Massachusetts, maximum likelihood estimate of effect of prenatal care controlling for demographic and medical risk factors and gestational age	Trimester in which care began		—[35]			0	

Table G-1.—Studies Using Vital Records To Examine the Effects of Prenatal Care on Birth Outcomes—Continued

Author	Study year(s)	Research design	Prenatal care measure	Observed effects: Neonatal mortality Whites	Neonatal mortality Blacks	Neonatal mortality Total	Birthweight Whites	Birthweight Blacks	Birthweight Total
Lewit, 1983[28]	1970	Retrospective analysis of live births in New York City controlling for demographics and medical risk factors and gestational age	Delay in initiation of care Number of visits						+3, +36

Abbreviations BCHS = Bureau of Community Health Services; CHC = community health center, LBW = low birthweight; MD = medical doctor; MIC = maternity and infant care; NICU = neonatal Intensive care unit, N M R = neonatal mortality rate, OB = obstetrician; WIC = Women, Infants, and Children

Key: + = positive effect (e g., prenatal care Improves the condition)
− = negative effect (e g , prenatal care worsens the condition).
O = no effect (e g prenatal care has no impact on the condition)
Mixed = results were positive, negative, and/or nil.
Blank spaces mean the relationship was not analyzed.

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[3]R.S. Greenberg, "The Impact of Prenatal Care in Different Social Groups, " Am. **J.** *Obstet. Gynecol.* 145 "797, 1983.
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[9]V Eisner, J V Brazie, M W Pratt, et al., "The Risk of Low Birthweight, " **Am. J.** *Public Health* 69(9)887-893, 1979
[10]M. Terris and M. Glasser, "A Life Table Analyis of the Relation of Prenatal Care to Prematurity," Am **J** *Public Health* 64(9):869-675, 1974.
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[15]G Ryan, P Sweeney, and A Solola, "Prenatal Care and Pregnancy Outcome," Am. **J** *Obstet. Gynecol.* 137(8):876-881, 1980
[16]M Terris and E. Gold, "An Epidemiologic Study of Prematurity: Part II, Relation to Prenatal Care, Birth Interval, Residential History, and Outcome of Previous Pregnancies," Am **J.** *Obstet. Gynecol.* 103(3) :371-379, 1969
[17]R. Schwartz and P Poppen, **Measuring the** *Impact of CHC's* **on Pregnancy Outcomes** (Cambridge, MA: Abt Associates, Inc., Oct. 15, 1982).
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[23]T Joyce, "The Impact of Induced Abortion on White and Black Birth Outcomes in the United States," **Demography** 24(2):229-244, **1987**
[24]M.R. Rosenzweig and T.P. Schultz, ', The Behavior of Mothers as Inputs to Child Health: The Determinants of Birth Weight, Gestation, and Rate Of Fetal Growth, " *Economic* **Aspects of Health,** V R Fuchs (ed) (Chicago, IL: University of Chicago Press, 1982).
[25]J. E. Harris, "Prenatal Medical Care and Infant Mortality," **Economic Aspects of** *Health*, V.R. Fuchs (cd.) (Chicago, IL: University of Chicago Press, 1982).
[26]E. Lewit. "The Demand for Prenatal Care and the Production of Healthy Infants, " Research in Human *Capital* and Development 3:127-181, 1983.
"3-category index measuring timing of first visit, number of visits by gestational age, and type of hospital service.
[28]White = native born whites only
"Blacks = nonwhites
'"When gestational age differences were controlled, negligible differences were found in the initiation of care for mothers of all premature births and their mature comparisons However, mothers of infants premature by weight and gestation tended to initiate care earlier than their comparisons, while mothers of infants premature by weight alone tended to begin care later than their comparisons.
[31]No association was found between lack of care and low birthweight for women with complications of pregnancy. Similarly, there was no association for women without complications prior to gestational week 36. A significant association was found among women with uncomplicated pregnancies who delivered after 35 weeks gestation, controlling for demographics.
"Effect adjusted for gestational age
[33]Of four regression models tested using different control variables, two were positive and significant; two were not.
"The significance of findings varied with the CHC variable and the regression model tested Authors concluded that CHCS contributed to reductions in NMR
[35]Effect adjusted for gestational age. Prenatal care associated with improvement In Prematurity rate
j* Effect on birthweight Independent of effect through gestational a9e

SOURCE Office of Technology Assessment, 1988

Table G-2.—Econometric Studies of the Effectiveness of Prenatal Care[a]

Author	Study year(s)	Unit of analysis	Prenatal care measure	Observed effects: Neonatal mortality — Whites	Neonatal mortality — Blacks	Neonatal mortality — Total	Birthweight — Whites	Birthweight — Blacks	Birthweight — Total
Corman Joyce and Grossman 1987[b]	**1975-80**	Counties	1 Race-specific 3-yr **average percent live** births for which care began in first trimester centered on 1977	– 016 to **– .076**[g]	**026 to** 1 17q				
			2 MIC project patients and female CHC users/ 1,000 poor women		NS				
Joyce 1987[c]	**1976-78**	Counties	Percent of births receiving prenatal care in first trimester	–.047[g]	NS		061[h]	.045[h]	
Rosenzweig and Schultz 1982[d]	**Married subsample of** the **1980 National Natality Survey**	Individual	1 Delay (in months) to first visit						1 One month additional delay reduces birthweight by 40 grams
			2a Delay (in months) to first visit						2a NS
			2b. Total number of visists						2b. Average increase in birthweight of 246 to 263 grams per visit
Rosenzweig and Schultz 1986[e]	Married subsample of the 1980 National Natality Survey	Individual	Delay in months to first visit						One month additional delay reduces birthweight by 91 grams
Schultz, 1986[f]	Married subsample of the 1980 National Natality Survey	Individual	1 Delay (in months) to first visit						1 NS
			2 Total number of visits						2. 287 to 33 grams increase per visit

Abbreviations CHC = community health center, MIC maternity and infant care, NMR = neonatal mortality rate. NS = not significant.

[a] Th, studies summarized in this table analyzed vital records data us I ng the Instrumental **variables** technique

[b] H Corman, T J Joyce, and M Grossman. "Birth Outcome Productlon Functions in the the U S ," *J Human* **Resources** 22(3) 339-360, 1987

[c] J. Joyce. "The Impact of Induced Abortion of White and Black Birth Outcomes in the United States, " **Demography 24(2) 229.244, 1987**

[d] M R Rosenzweig and T p Schultz, "The Behavior of Mothers as Inputs to Child Health The Determinants of Birth Weight Gestation, and Rate of Fetal Growth *Economic* **Aspects of** *Health*. V R Fuchs (cd.) (Chicago IL: University of Chicago Press. 1982)

[e] M. R, Rosenzweig and T p Schultz, "The Stability of Household Productlon Technology: A Replication," Center Discussion Paper No 511, Economic Growth Center, Yale University, New Haven, CT, September 1986

[f] T P. Schultz Unpublished data from the 1980 National Natality Survey. prepared for the Off Ice of Technology Assessment, U S Congress, Washington, DC, July 1986

[g] Predicted percentage point change in NMR resulting from each percentage point Increase in percent of mothers receiving early prenatal care

[h] Predicted' percentage point change in low birthweight rate resulting from each percentage point increase in percent of mothers receiving early prenatal care

SOURCE Office of Technology Assessment, 1988

Table G-3.—Studies of the Effects of Programs Offering Augmented Prenatal Care[1] on Birth Outcomes

Author	Study year(s)	Research design	Prenatal care measure	Observed effects: Neonatal mortality — Blacks	Neonatal mortality — Whites	Neonatal mortality — Total	Birthweight — Blacks	Birthweight — Whites	Birthweight — Total
Peoples and Siegel, 1983[2]	1970-77, MIC project m North Carolina	**Retrospective analysis controlling for demographics, reproductive risk, adequacy of care**[28]	MIC v comparison group (all residents of three similiar nonprogram countries)				(Teens)[27]		–
Sokol, et al 1980[3]	1976-77, MIC project m Cleveland Metropolitan General Hospital, Ohio	Comparison of program participants and similiar patients ineligible due to county of residence	MIC v comparison group						†
Johnson and Hefferin. 1977'	1969-71, MIC project m Los Angeles County, California	Retrospective univariate analysis of demographically similar groups	MIC v traditional health department clinic users						0
Peoples, et al , 1984[5]	1979-81, IPO project m North Carolina	Retrospective analysis controlling for demographics and reproductive risk	IPO counties/registrants v non-I PO counties/registrants				0		
Strobino, et al , 1986[6]	1975-81, ICHP in Mississippi	Pre-post retrospective analysis controlling for demographics and reproductive risk	ICHP counties v non-ICHP counties				0[27]	0	0
State of California, 1984, and Korenbrot. 19847	1978-82, OB Access project m California	Retrospective analysis of demographically matched groups	OB Access births v matched Medic-Cal births						†
Papiernik, et al 1985'	1971-82 Haguenau, France	Time-series analysis of rates of change in program area. controlling for maternal age, blood pressure, and social class	Births in study area where special program was Implemented						†
Herron, et al 1982'	1978-79 University of California, San Francisco Medical Center	Comparison of incidence of preterm delivery in program hospital v nonprogram hospital	Preterm labor prevention program for high risk UCSF v affiliated institution without special program						+33
Burt, et al 1984[10]	1982, 38 projects sponsored by OAPP	Retrospective analysis and informal comparisons controlling for demographics	Participation in OAPP projects v other similar programs or national data						†
Moore, et al 1986"	1981-84, University of California, San Diego Medical Center	Comparison of groups with similiar demographics and medical risks	'No care v program participants						†
Smith et al 1978[12]	1970-74 Jefferson Davis Hospital, Houston, Texas	Program participants randomly selected from hospital's obstetrical clinic comparison group matched on race, age, parity month of delivery	Teenage program participants v non-participants						†

Table G-3.—Studies of the Effects of Programs Offering Augmented Prenatal Care[1] on Birth Outcomes—Continued

Author	Study year(s)	Research design	Prenatal care measure	Observed effects: Neonatal mortality: Blacks	Neonatal mortality: Whites	Neonatal mortality: Total	Birthweight: Blacks	Birthweight: Whites	Birthweight: Total
Olds et al 1986[13]	1975-80 semi-rural county in Appalachian region of New York	Randomized clinical trial	Nurse-visited v comparison					+ (Teens) 0 i Smokers) Mixed[29] l Older nonsmokers)	
Ershoft et al 1982 1983"	1980-81 southern California HMO	Pre-post design with two comparison groups, separate covariate analyses for demographics	Routine care v care and education services						0 (Total) Mixed[30] (smokers)
Leppert, Namerow. and Barker 1986[15]	1981-82 large urban teaching hospital New York City	Retrospective analysts controlling for demographics complications of pregnancy	Number of visits						†
University Associates, 1985"	1984-85 11 local health departments in Michigan	Retrospective analysis of demographically similar groups	Number of visits						†
			Trimester at which care began						0
			Outcome of prior pregnancy compared to outcome of pregnancy whale enrolled in program for same women				0	+	+
			Program participants v non-participants						†
Fence et al 1981[17]	1974-78, University of Maryland Hospital, Baltimore Maryland	Retrospective analysis of matched pairs in terms of age race parity and socioeconomic status	Young teen users of comprehensive clinic v regular clinic users						†
McAnarney et al 197818	1972.73 3 settings in Rochester New York	Retrospective analysis of groups matched for race and public assistance status	Comprehensive maternity project for teens v a CHC v a hospital obstetrics clinic						

Table G-3.—Studies of the Effects of Programs Offering Augmented Prenatal Care[1] on Birth Outcomes—Continued

Author	Study year(s)	Research design	Prenatal care measure	Observed effects					
				Neonatal mortality			Birthweight		
				Blacks	Whites	Total	Blacks	Whites	Total
Grossman and Jacobowtiz 1981[19]	1964-77 MIC projects throughout the U S	Retrospective county-level analysis controlling for demographics, family planning and abortion use prior mortality rates	Presence of MIC projects and number of births to participants as percent of births to poor women	0	0				
Corman and Grossman 198520	1964-77 MIC projects throughout the U S	Retrospective county-level analysis controlling for demographics, availability of family planning abortion and NICUs: WIC use Medicaid eligibility	Number of MIC projects and CHCs per 1,000 poor women	Mixed[31]	Mixed[31]				
Corman, Joyce, and Grossman 1987[29]	1975-80, U S	Retrospective county-level analysis controling for birthweight, abortion and NICU availability teen family planning use, WIC use, smoking behavior, high-risk women, percent poor	MIC project patients and CHC female users per 1 000 poor women	Mixed[32]	Mixed[32]				
Shapiro, et al , 1958[22]	1955 New York City	Retrospective analysis controlling for race, SES, maternal age	Prepaid group practice (HIP) v private practice patients	0[27]	+		0		
Shapiro et al 1960[23]	1955-57, New York City	Retrospective analysis controlling for race, SES, maternal age	Augmented prepaid group practice (HIP) v private practice patients	+27	+		+		
Rivara et al 1985[24]	1970-78 Kentucky	Pre-post with comparison group, two groups similar on socioeconomic risk factors, standarized NMRs by birthweight birth multiplicity and infant gender	Regionalized perinatal care program counties v comparison counties						
Heins et al 1983[25]	1976-78, South Carolina	Retrospective analysis, all participants were low Income, high risk	Regionalized perinatal care program participants v nonparticipants						0
McCormick et al 1985[26]	1970-79 eight regions	Pre-post with comparison group having similiar demographics	Eight regionalized perinatal care program regions v eight comparison regions						0

Abbreviations HIP = Health Insurance Plan of New York City, an HMO, HMO = health maintenance organization ICHP – Improved Child Health Project, IPO – Improved pregnancy outcomes. LBW = low birthweight; MIC = maternity and infant care, NICU = neonatal intensive care unit NMR – neonatal mortality rate OAPP – Off Ice of Adolescent Pregnancy program. OB = obstetrician SES = socioeconomic status, UCSF = University of California San Francisco

KEY + = positive effect (e g comprehensive program Improves the condition)
= negative effect (e. g., comprehensive program worsens the condition)
O = no effect (e.g., comprehensive program has no impact on the condition)
Mixed = results were positive, negative and/or nil
Blank spaces mean the relationship was not analyzed

'Augmented care includes programs which provide supplemental services in addition to prenatal medical care These programs provided one or more of the following types of special services outreach. transportation. nurse home visitation nutrition and social services, health education, followup of missed appointments. case management/coordination of services, and dental care El igible partici pants were usually adolescents and/or low income or medically Indigent women Target areas vaned in size also Comparison groups typically received a more limited range of services

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[3] R J Sokol R B Woolf, M .G Rosen, et al "Risk. Antepartum Care, and Outcome I m pact of a Maternity and Infant Care Project, *Obstet./Gynecol* 56(2) 150.156 1980

[4] D K Johnson and E A Hefferin, "Perinatal Outcomes Among High-Risk Patients in Two Prenatal Care Programs, *Inquiry* 14.293-302. 1977

[5] M D Peoples, R C Grimson, and G L Daughtry, "Evaluation of the Effects of the North Carolina Improved Pregnancy Outcome Project Implications for State-Level Decision Making," *Am J Public Health* 74(6) 549-554, 1984

[6] D M Strobi no, G A Chase, Y J Kim, et al , "The Impact of the Mississippi Improved Child Health Project on Prenatal Care and Low Birthweight, " *Am* **J** *Public Health* 76(3) 274-278, 1986

"State of California, Health and Welfare Agency, Department of Health Care Services. "Final Evaluation of the Obstetrical Access Pilot Project. July 1979-June 1982. " Sacramento, CA 1984, and C C Korenbrot, Risk Reduction in Pregnancies of Low-Income Women, " *Mobius* 4(3).35-43. 1984

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[9] M A Herron, M Katz, and R K Creasy, "Evaluation of a Preterm Birth Preventlon Program Preliminary Report, " *Obstet/Gynecol* 59 "452-456, 1982

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"Black = nonwhite

[28] Adequacy of care index = 3-category index measuring timing of first visit, number of visits by gestational age and type of hospital service; index originally developed for use in the Kessner, et al (1973) study

[29] No effect on average birthweight but percent LBW lower in experimental group

[30] Higher mean birthweight in augmented care group higher mean birthweight than in comparison group but no significant difference between groups in percent LBW

"When prior (baseline) death rates were controlled there was no significant association between the prenatal care measure and the dependent vanable Significant findings were obtained when baseline death rates were not cent rolled for wh ites, the relationshi p was positive while for blacks, the relationshi p was negative

[32] Results were si gn ificant on ly when birthwei ght was controlled

[1] Effect was for preterm delivery which is correlated with birthweight

SOURCE Off Ice of Technology Assessment 1988

Table G-4.—Studies of the Cost-Effectiveness of Prenatal Care

Author	Year(s) and target population	Alternates compared	Perspective of analysis	Maternal costs		Newborn costs			Change in expected birthweight	Ratio of savings to cost
				Prenatal care only	Maternity care	Initial NICU hospital	All initial hospital	Other expenses		
Korenbrot 1984[1], State of California, 1984[2], Phibbs and Korenbrot, 1986[3]	1978-82, Medi-Cal eligible pregnant women m California	OB Access Project augmented v routine care for Medi-Cal women			x16	x		Rehospitalized during first year	33.8% [15] reduction in LBW rate	1 7 to 26
Malitz 1983[4]	1981 pregnant women in Texas who would become Medicaid - eligible at delivery	Change in utilization after expansion of Medicaid coverage from pregnancy verification	Medicaid		x		x		NA	
		a Eligible for prenatal care only			x		x			a 1.01[15] (all cases 1 12[15] (adolescents)
		b Eligible for all Medicaid			x		x			b Net costs =$558/ case and $332/adolescent
Schramm and Land, 1984[5]	1981-82, Missouri Medicaid births	Adequate" v inadequate care	Medicaid		x		x		16%[15] reduction in LBW rate	1 34 to 1 12'5 "
Schramm and Land, 1984[5]	1981-82, pregnant women in Missouri who would become Medicaid eligible at delivery	Unborn Child Program[18] expansion of Medicaid coverage from pregnancy verification	Medicaid		x		x		7-30%[15] reduction in LBW rate[19]	Net costs =$157/ case
Institute of Medicine, 1985'	1980, national cohort of women aged 15-39 with less than 12 yrs of education receiving public assistance	First trimester v other	U S health care system	x				Rehospitalized during first year long-term single-year morbidity costs	13-22%[15] reduction in LBW rate[20]	2.03[15] to 338 With a 6.4% reduction in LBW rate, savings equal costs

Ricketts, 1986[7]	1984, low-income women in Colorado	Adequate[21] v. inadequate or no care	Colorado health care system	×			X		60.3% reduction in LBW rate	2.72 to 4.15
Berger, 1984[8]	Years not specified, low-income women in Lea County, New Mexico	Some v. no care	Lea County public health care system		×		×	Rehospitalization in first year; medical and institutional costs for neurological impairment to age 21	50%[15] reduction in LBW rate	5.84[15]
Blackwell, et al., 1983[9]	1982, Medicaid eligibles and poor ineligibles in the U.S.	Augmented v. routine care	Medicaid (Federal Government)		X[16]	×		Rehospitalized in first year	63-65%[15] in first year[22]	2.93[15]
Leppert and Namerow, 1985[10]	1981-82, adolescents seeking care at a hospital in New York City	1. Augmented: >3 visits v. <3 visits 2. Augmented v. nonprogram	Hospital-based program		×		×		1. 71%[15] reduction in LBW rate 2. 28.2%[15] reduction in LBW rate	2.14 to 3.05[15]
Moore, et al., 1986[11]	1981-84, medically indigent women seeking care at a hospital in San Diego County, California	Augmented (3+ visits) v. nonprogram (<3 visits)	Hospital-based program		×		X		71%[15] reduction in LBW rate	4.66[15]
Ershoff, et al., 1983[12]	1981, pregnant smokers receiving care in a California HMO	Augmented v routine	One HMO		X		X		27.8%[15] reduction in LBW (NS)	Approximately 2.00
Ershoff, et al 1982[13]	1981, all pregnant women receiving care in a California HMO	Augmented v. routine	California		×		X		NS for LBW rate[23]; fewer preterm and more small-for-date babies for augmented care group	2.5

Table G.4.—Studies of the Cost-Effectiveness of Prenatal Care—Continued

Author	Year(s) and target population	Alternates compared	Perspective of analysis	Maternal costs: Prenatal care only	Maternal costs: Maternity care	Newborn costs: Initial NICU hospital	Newborn costs: All initial hospital	Newborn costs: Other expenses	Change in expected birthweight	Ratio of savings to cost
Joyce, et al 1986[14]	1975-80, all pregnant women in the U S	first trimester v other	U S health care system	X					For whites: 27-66 fewer LBW births per 1,000 additional users of first-trimester care For blacks 20-97 fewer LBW births per 1,000 additional users of first-trimester care	Cost of prenatal care only per LBW birth averted =$3,200 to $6,500 for whites and $1,900 to $9,400 for blacks savings not calculated

Abbreviations: HMO = health maintenance organization; LBW = low birthweight; NA = not available, NS = not significant, OB = obstetrician.

[1]C.C. Korenbrot, "Risk Reduction in Pregnancies of Low-Income Women, " *Mobius* 4(3)35-43, 1984

[2]State of California, Health and Welfare Agency, Department of Health Care Services, "Final Evaluation of the Obstetrical Access Pilot Project, July 1979-June 1982, " Sacramento, CA, 1984

[3]C S Phibbs, and Korenbrot, C.C , "Cost Impact of Comprehensive Prenatal Care on Medi-Cal With the Implementation of AB3021," testimony to the Ways and Means Committee of the California State Assembly, Apr. 16, 1986

[4]D Malitz, "A Cost-Benefit Analysis of Extending Medicaid Coverage To Prowde Prenatal Care to Pregnant Women, " Study submitted to the Texas Department of Human Resources, Austin, TX, May 1983

[5]W Schramm, and G Land, "Prenatal Care and Its Relationship to Medicaid Costs, " prepared under HCFA Grant No 11-P-98305, State Center for Health Statistics, Division of Health, Missouri Department of Social Services, December 1984.

[6]Institute of Medicine, *Preventing Low Birthweight* (Washington, DC National Academy Press, 1985)

[7]S Ricketts, Family Health Services Division, Colorado Department of Health, Denver, CO, Internal memorandum, February 1986

[8]L. B. Berger, "Public/Private Cooperation in Rural Maternal Child Health Efforts The Lea County Perinatal Program, " **Texas** *Medicine* **8054.57,** September 1984.

[9]A.G. Blackwell, L Salisbury, and A.P. Arriola, Public Advocates, Inc., San Francisco, CA, "Administrative Petition To Reduce the Incidence of Low Birth Weight and Resultant Infant Mortal ity, " administrative petition to the U S. Department of Health and Human Services, 1983

[10]P C Leppert, and P B Namerow, "Costs Averted by Providing Comprehensive Prenatal Care to Teenagers, " *J. Nurse-Midwifery* 30(5):285-289, **1985.**

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[12]D.H. Ershoff, N.K Aaronson, B.G. Danaher, et al., *Cost-Benefit Analysis of a Comprehensive Prenatal Health Education* **Program** *Within* **an HMO Setting,** *Executive* **Summary,** prepared for the Office of Health Information, Health Promotion and Physical Fitness and Sports Medicine, Public Health Service, U S Department of Health and Human Services, Washington, DC, July 1982

[13]D H. Ershoff, N K Aaronson, B G. Danaher, et al., "Behavioral, Health, and Cost Outcomes of an HMO-Based Prenatal Health Education Program, " *Public Health* Reports 98(6):536-547, 1983.

[14]T Joyce, H Corman, and M Grossman, "A Cost-Effectiveness Analysis of Strategies To Reduce Infant Mortal ity. " *Medical* **Care.** in press

[15]Calculation by OTA

[16]Physician fees only

[17]Adequate care = care begun by the 4th month with at least five visits for preterm deliveries and at least eight visits for full-term births Inadequate care = all other comb! nations of timing and frequency

[18]Prenatal care was provided to previously ineligible first-time mothers under this program

[19]Range is based on analyses on 2 separate years of data

[20]The major objective of this study was to estimate savings if the Publ IC Health Service goal for the LBW rate (9%) was met

[21]Adequate = 6 + visits, Inadequate = 5 or fewer visits

[22]Range is for current Medicaid eligibles and ineligibles

[23]Overall figures for LBW not reported.

SOURCE Office of Technology Assessment, 1988

Approach Used To Estimate the Net Long-Term Health Costs of Low Birthweight[2]

Low birthweight is associated with, and in some cases clearly brings about, increased levels of illness and disability over a person's lifetime **(580,665).** It follows, then, that if the low birthweight rate—i.e., the percentage of live births that are low birthweight—could be reduced, there would be fewer infants born with chronic illness and physical or developmental disability, with consequent savings in the health care costs of treating these conditions.

Long-term health care costs associated with low birthweight births result from early intervention programs, [1] special education, adult care and services, and institutional or foster care. Other long-term health care costs, not considered in OTA's analysis, may result from unpaid parental and other voluntary care, and occasional acute care expenses beyond the first year.

OTA's analysis made the following assumptions regarding the types of care that low birthweight children will receive over their lifetimes and the costs of that care:

- all infants surviving at age 1 will survive to age 35, regardless of their level of disability;
- costs of care are calculated only to age 35;
- the severity of disability as evaluated at age 1 is constant through age 35; and
- the costs of special services provided to moderately and severely impaired populations (i. e., institutional or foster care, adult care and services, special education, and early intervention), by level of disability, are the same as the costs of providing these services to severely and moderately mentally retarded people.

Available data on the quantity and costs of care are imperfect and in some cases incomplete. To account for the uncertainty in the estimates, OTA estimated the long-term costs of low birthweight in a range, with high- and low-cost boundaries.

Estimates of Long-Term Outcomes by Birthweight Group.—To compare the net extra long-term costs of care for low birthweight babies with those of normal birthweight babies, OTA needed data on health outcomes across all birthweight categories, including normal birthweight. One study, by Shapiro, et al. (580), collected data on the outcomes of approximately 200,000 births in regions of six States in 1978-79. That study included all birthweight categories and also provided information on developmental outcomes at age 1 for the followup population (the roughly **80** percent of the infants in the study population that survived to year 1).

Another study that evaluated a followup population of neonatal survivors to determine developmental outcomes, by Marlow, et al, (403), was based on a sample of 1,000 births in Great Britain from 1976-80. The Marlow, et al., study included only births of less than **2,000 grams, so** the results are not considered in OTA's analysis. As shown in table G-5, however, neonatal mortality and morbidity for very low birthweight infants in the Shapiro and Marlow studies are quite similar.

Health outcomes at age 1 by birthweight category as reported by Shapiro, et al., are shown in table G-6 (580). Note that l-year-olds evaluated as having mild congenital anomalies are grouped in the normal outcomes category in the table. To the extent that children with mild congenital anomalies have differentially greater care needs than normal birthweight children, OTA's analysis underestimates the long-term health care costs of low birthweight.

Table G-5.— Health Outcomes Per 1,000 Very Low Birthweight Births

Outcome	Shapiro, et al.[a]	Marlow, et al.[b]
Normal outcome ... , ...	390	331
Moderate impairment	102	125
Severe impairment	69	74
Dead (neonatal mortality rate)[c]	439	470

[a] S Shapiro, M C. McCormick, B H Starfield, et al., "Changes in Infant Morbidity Associated With Decreases in Neonatal Mortal ity," **Pediatrics 72(3)"408-415,** 1983 Shapiro, et al , defined adverse outcomes among survivors in the following terms 1) severe *impairment* (i e , a congenital anomaly likely either to shorten life or affect function severely and/or a gross motor delay corresponding to a develop. mental quotient (DQ)< 70), 2) **moderate** *impairment* (i e , a congenital anomaly likely to affect functioning moderately and/or a suspect gross motor performance correspond ng to a DO of 70 to 79; and 3) *mild* **congenital** *anomaly* (i e , a congenital anomaly likely to have a minor effect on functioning). The sharpest distinction is between the first category of severe conditions, which Invariably require extensive medical resources and often require social support, and the latter two categories. In this table, OTA classified mild congenital anomalies as normal outcomes.

[b] N Marlow, S.W. D'Souza, and M L Chiswick, "Neurodevelopmental Outcome in Babies Weighing Less Than 2,001 g at Birth, " *Br* **Med** *J* **2941582.1588,** 1987 Marlow, et al., defined **adverse neurodevelopmental outcomes among survivors in three major groups" 1)** *major handicap* (cerebral palsy, developmental retardation (Griffiths quotient or IQ < 71), blindness or deafness sufficient to warrant special education, and hydrocephalus; 2) minor *developmental impairment* (squints, minor degrees of refractive error or hearing loss, abnormalities of muscle tone without disability, poor fine motor function, non febrile fits, or border. line results of psychometric testing (Griffiths quotient or IQ from 71 to 85).

[c] The neonatal mortality rate is defined as the number of infants who die in the first 28 days of life per 1,000 live births

SOURCE Off Ice of Technology Assessment, 1988

[2] Birthweight categories are defined here as follows. normal birthweight is at least 2,500 grams, and low birthweight is under 2,500 grams. Low birthweight has two parts: very low birthweight (under 1,500 grams) and moderately low birthweight (from 1,500 to 2,500 grams).

[1] Early intervention programs are broadly defined by the Education of the Handicapped Act Amendments of 1986 (Public Law 99-457) as developmental services provided to handicapped infants or toddlers. These services include family training, counseling, and home visits; special instruction; speech pathology and audiology; occupational therapy, physical therapy; psychological services; case management services, medical services only for diagnostic or evaluation purposes; early identification, screening and assessment services; and health services necessary to enable the infant or toddler to benefit from the other early intervention services

Table G-6.— Health Outcomes Per 1,000 Live Births by Birthweight Category

Outcome at the end of 1 year[a]	Low birthweight <1,500g	Low birthweight 1,500-2,500g	Low birthweight Total (< 2,500g)	Normal birthweight (> 2,500g)	All birthweights
Normal outcome	364	818	744	909	899
Moderate impairment	96	106	104	68	69
Severe impairment	65	40	44	18	20
Dead (infant mortality rate)[b]	475	36	108	5	12

[a]Shapiro, et al., defined adverse outcomes among survivors in the following terms: 1) **severe impairment** (i.e., a Congenital anomaly likely either to shorten life or affect function severely and/or a gross motor delay corresponding to a developmental quotient (DQ) < 70); 2) **moderate impairment** (i.e, a congenital anomaly likely to affect functioning moderately and/or a suspect gross motor performance corresponding to a DQ of 70 to 79, and 3) *mild congenital anomaly* (i e , a congenital anomaly likely to have a minor effect on functioning). The sharpest distinction is between the first category of severe conditions, which invariably require extensive medical resources and often require social support, and the latter two categories In this table, OTA classified mi Id congenital anomalies as normal outcomes
[b]The infant mortality rate is defined as the number of infants who die in the first year of life Per 1,000 live births

SOURCE: Reproduced by permission of **Pediatrics. S.** Shapiro, M C McCormick, B H Starfield. et al "Changes in Infant Morbidity Associated With Decreases in Neonatal Mortality, " *Pediatrics* 72(3):408-415, **1983**

Note also that the Shapiro, et al., data in table **G-6** are based on developmental outcomes in 1978-79 and therefore do not capture the impact of new technologies introduced since then, such as those in neonatal intensive care units **(665). To the extent that** the disability rate at age 1 has improved since 1980, OTA's analysis overestimates the long-term health care costs of low birthweight.

Assumptions About the Kinds of Services Received. —Because information on the kinds of services that will be provided to children who have severe or moderate developmental impairments at age 1 does not exist, OTA's analysis is based on the care provided to severely and moderately mentally retarded people in the United States. Barden, et al. **(46), analyzed** the lifelong services required for mentally retarded people in the following categories: institutionalization, foster care, adult care and services, and special education. OTA included these services and one more, early intervention programs, in its cost-effectiveness analysis.

Barden, et al. **(46),** assumed that all severely mentally retarded people would require institutionalization. In addition, they assumed that one-half of all moderately or mildly mentally retarded people would receive foster care from age 5 to 20, and that all of them would receive adult care and services from age 20 for life. In the general population, less than half of the severely mentally retarded people in the United States are actually in public and private mental retardation facilities (361). The placement of the others, whether at home or in foster or residential care, is unclear.

In its analysis, OTA used two sets of assumptions regarding the special services provided to severely and moderately impaired children (see table G-7). The high-cost estimate of the costs of long-term care is based on the assumption that all severely impaired children will receive institutional care from age 5 to 35. The low-cost estimate, on the other hand, is based on the assumption that only 25 percent of severely impaired children will receive institutional care from age 5 to 35. Another 25 percent will receive foster care from age 5 to 20, and the remaining 50 percent will

Table G-7.—Assumptions Regarding the Special Services Required by the Severely and Moderately Impaired Populations in OTA's Analysis
(in 1986 **dollars, undiscounted)**

	Percent of population receiving service	
	High-cost estimate	Low-cost estimate
Severely impaired		
Institutional care (ages 5-35)	100 %	*25%*
Foster care (ages 5-20)	0%	*25%*
Adult care and services (ages 21-35)	0%	*75%*
Special education		
(ages 4-10)	100 "/0	100%
(ages 1 1-15)	100 "/0	100%
(ages 16-20)	100"/0	100%
Early intervention (ages O-3)	100 "/0	100%
Moderately impaired		
Institutional care (ages 5-35)	0%	0%
Foster care (ages 5-20)	50%	*25%*
Adult care and services (ages 21-35)	100%	100%
Special education		
(ages 4-10)	**100%**	100%
(ages 1 1-15)	100%	100%
(ages 16-20)	100%	100"/0
Early intervention (ages O-3)	100%	100 "/0

SOURCE Off Ice of Technology Assessment, 1988

be cared for at home from age 5 to 20. A further assumption in the low-cost estimate is that beginning at age 21, all noninstitutionalized severely impaired individuals will receive adult care and services until at least age **35.**

In both the high- and low-cost estimates, it is assumed that none of the moderately impaired population will enter institutions. The high-cost estimate is based on the assumption that **50** percent of moderately impaired children will receive foster care and **50** percent will receive care at home from age 5 to 20. The low-cost estimate is based on the assumption that only **25** percent of moderately impaired children will receive foster care from age 5 to **20; 75** percent will receive care at home from age 5 to **20.** In both the high- and low-cost estimates, it is assumed that all moderately disabled individuals will receive adult care and services from age 21 to 35.

The other special services for the impaired population included in OTA's analysis were special education and early intervention programs. In Barden, et al. **(46),** the level of special education required (and associated costs) depended on a child's age and level of mental retardation, although both severely and moderately retarded children received special education from ages 4 through **20.** OTA adopted Barden, et al. 's assumption about special education for severely and moderately impaired children.

Early intervention is a new and evolving concept in the care of disabled children, so the estimated levels of care (and associated costs) vary. In one study, early intervention was provided for both severely and moderately developmentally disabled children from birth through age **3 (736).** OTA assumed that all moderately and severely disabled children would receive early intervention through age 3.

Assumptions About **the Cost of Care.—In the study by Barden, et** al. **(46), the costs of institutionalization were calculated** on the basis of data obtained at the Wisconsin Center for Developmental Disabilities. Barden, et al. 's estimate of **$36,500** per year in 1982 is similar to national information obtained by OTA for 1985 ($35,000 to $45,000) (361). Barden, et al., subtracted $4,000 per year from their figure of $36,500 to net out normal personal consumption costs, yielding an estimate of **$32,500** per year (in 1982 dollars).

OTA's analysis incorporates Barden, et al.'s assumptions about the cost of institutional care. Since costs reported in Barden, et al. 's analysis were in 1982 dollars, however, OTA adjusted them to 1986 dollars using the medical care component of the Consumer Price Index (an increase of 13.6 percent). This adjustment yielded an estimated cost of institutionalization in 1986 dollars: $36,920 per year (see table G-8).

Table G-8.—Assumptions Regarding the Annual Cost of Special Services Required by the Severely and Moderately Impaired Populations in OTA's Analysis (in 1986 dollars, undiscounted)

	Annual cost per child receiving the service
Annual cost of institutional care (ages 5-35)	$36,920[a]
Annual cost of foster care (ages 5-20)	$ 5,680[a]
Annual cost of adult care and services (ages 21-35)	$13,632
Annual cost of special education (ages 4-10)	$ 5,888
(ages 1 1-15)	$ 6,549
(ages 16-20)	$ 6,501
Annual cost of early intervention (ages O-3)	$2,045 to $4,089

[a]This estimate does not include $4,544 in personal consumption costs
[b]Special education costs represent those costs in excess of costs of normal education

SOURCE: Office of Technology Assessment, 1988

OTA's assumptions about the costs of foster care and adult care and services are similarly based on those of Barden, et al. **(46)** and updated to 1986 dollars. The annual cost of foster care in 1986 dollars is estimated to be $5,680, and the annual cost of adult residential care and services is estimated to be $13,632.

Special education costs, as mentioned above, depend on age and the level of mental retardation. The cost assumptions of Barden, et al. **(46),** are based on a nationwide study by Kakalik, et al. (313). Assuming that all mentally retarded people receive special education, and in the absence of further national information on the added costs of special education, OTA figures used the same figures for both its high- and low-cost estimates.

For the costs of early intervention from birth to age 3, OTA used as a low-cost estimate Walker and colleagues' (736) estimate of **$2,045** per year (in 1986 dollars). Since Walker and colleagues' estimate was based on one program in one area and since the concept of early intervention itself is evolving, OTA's high-cost estimate was double this figure: **$4,089** per year.

The costs shown in table G-8, which summarizes OTA's assumptions regarding the long-term costs of services provided to moderately and severely impaired children, are in 1986 undiscounted dollars. Because long-term costs of services are spread out over 34 years, however, costs incurred in the distant future must be discounted to their present (1986) value.

The choice of a discount rate is somewhat arbitrary. Although the rate should represent society's valuation of the costs of the opportunity of present v. future consumption, it is difficult to know what rate actually rep-

resents that value. Barden, et al. (46), used a 7-percent discount rate. Others have used higher rates, up to 10 percent. Ten percent appears to be quite high as a discount rate in real after-tax dollars. Indeed, 7 percent may itself be high. (A high discount rate implies a lower cost estimate than a low discount rate.) OTA applied a 7-percent discount rate to both its low-cost estimate and its high-cost estimate of the cost of special services required by moderately and severely impaired populations. OTA also applied a 4-percent discount rate to these two estimates.

Results. —Table G-9 presents the estimated lifetime cost of special services for each moderately and severely impaired child, discounted at 4 percent and 7 percent. For the moderately impaired, the discounted lifetime cost of services ranges from $90,000 to $167,000 in 1986 dollars. For the severely impaired, the cost ranges from $177,000 to $634,000. Although the range in each case is wide, the lifetime costs are high even under the most conservative assumptions.

The percentage of births that result in severe and moderate impairment varies by birthweight category. The expected lifetime cost of special services per birth in each birthweight category is shown in table G-10.

Table G-9.—Low-Cost and High-Cost Estimates: Lifetime Cost of Special Services[a] for Each Moderately and Severely Impaired Child (in 1986 dollars, discounted at 4 and 7 percent)

	Cost per child	
	Moderately impaired	Severely impaired
Low-cost estimate		
4% discount rate	$147,000	$292,000
7% discount rate	$90,000	**$177,000**
High-cost estimate		
4% discount rate	$167,000	$634,000
7% discount rate	$106,000	$413,000

[a]Cost of special services for impaired Individuals from 1 to 35 years of age.

SOURCE Office of Technology Assessment, 1988

The estimates in table G-10 can be used to calculate the net long-term savings that can be expected from reducing the rate of low birthweight. Two assumptions underlie the calculation:

- moving a birth from the low birthweight category to the normal birthweight category will reduce the probability of impairment to the level experienced by infants in the normal birthweight category; and
- reductions in the number of low birthweight babies in each low birthweight category (moderately low birthweight and very low birthweight) will occur in proportion to the relative frequency of these categories in the population of births. (In 1985, 82 percent of all low birthweight infants were moderately low birthweight; 18 percent were very low birthweight.)

According to OTA's calculation based on these assumptions, the net long-term savings that would be gained by preventing each low birthweight birth (i.e., moving it to the normal birthweight category) would be between approximately $9,000 and $23,000 (see table G-II). Or, restated, the net long-term cost of each low birthweight birth is between $9,000 and $23,000.

The Impact of Health Insurance Coverage on the Use of Prenatal Care

OTA's cost-effectiveness analysis in chapter **4** used data from the 1982 National Survey of Family Growth to estimate the proportion of pregnant women newly eligible for Medicaid who would switch from late initiation of prenatal care to care in the first trimester of pregnancy as a result of the expansion of Medicaid eligibility to all pregnant women in poverty. OTA assumed that 44 percent of women who are newly eligible for Medicaid, and who would not otherwise receive first-trimester care, would switch to first-tri-

Table G-10.—Low-Cost and High-Cost Estimates: Expected Lifetime Cost of Special Services[a] Per Birth in Specified Birthweight Categories (in 1986 dollars, discounted at 4 and 7 percent)

	Cost per birth by birthweight category		
	Normal birthweight	Moderately low birthweight	Very low birth weight
Low-cost estimate			
4% discount rate	$15,000	$27,000	$33,000
7% discount rate	$9,000	**$17,000**	**$20,000**
High-cost estimate			
4% discount rate	$23,000	$43,000	$57,000
7% discount rate	$15,000	$28,000	$37,000

[a]Cost of special services for impaired individuals from 1 to 35 years of age

SOURCE: Office of Technology Assessment, 1988.

Table G-1 1 .—Low-Cost and High-Cost Estimates: Net Long-Term Cost[a] of Low Birthweight Per Birth (in 1986 dollars, discounted at 4 and 7 percent)

Low-cost estimate	
4°/0 discount rate	$13,080
7°/0 discount rate	$ 8,540
High-cost estimate	
4°/0 discount rate	$22,520
7°/0 discount rate	$14,620

[a]Cost from age 1to 35

SOURCE Off Ice of Technology Assessment, 1988

mester care as a result of expanded eligibility for Medicaid. This assumption is based on the fact that approximately 44 percent of pregnant women who were eligible for Medicaid in 1982 received first-trimester prenatal care.

Other data are available on the use of prenatal care by insurance status, but in most available studies, the comparison group was not limited to women in poverty. Spitz, et al., using **1976-78 data** from Georgia, found that the proportion of Medicaid recipients receiving first-trimester prenatal care differed little from the proportion in three non-Medicaid comparison groups consisting of participants in two other publicly subsidized programs and women with less than a high school education (609a). The women with the highest rate of first-trimester care were the women of low educational attainment who were not served by any publicly subsidized program. The women most probably had higher incomes than those served by the public programs,

Norris and Williams, in a 1978 study in California, found that non-Medicaid women (including nonpoor women) obtained earlier prenatal care than Medicaid women in that year (462a). Cooney studied prenatal care among women in New York City with less than 12 years of education in 1981 (117a) and compared the percentage of Medicaid recipients receiving late or no prenatal care with that of privately insured women in **30** subgroups defined by race, marital status, and age. In **23 of the 30** subgroups, the percentage of Medicaid recipients receiving delayed or no care was higher than the percentage of women with private insurance.

Hadley examined differences between Medicaid and non-Medicaid women in poverty in the number of maternity care visits as reported on the National Health Interview Survey between 1978 and 1982 (243a). Hadley analyzed a sample of women with infants 3 months of **age** or younger at the time of the interview. Annual doctor visits reported by these women largely reflected prenatal visits but also included postpartum care and visits not directly related to the pregnancy. Medicaid recipients had on average one and one-half more visits than did the uninsured women (see table G-12). The insured poor women had more visits on average than either Medicaid recipients or the uninsured women. This fact probably reflects the higher family income and stability among the in-

Table G-12.—Annual Doctor Visits and Other Characteristics of a Sample of Poor Women With an Infant 3 Months of Age or Younger, by Health Insurance Status[a]

Characteristics	Women without health insurance	Women with Medicaid	Women with insurance other than Medicaid
Number of women in sample	71	98	132
Education (yrs.)	10.9	10.6	11.7
Real income per family member (1982 dollars)	$1,672	$1,438	$2,429
Black	19.7%	42.9%	18.20/o
Community type			
Central city	28.2%	48.0%	28.0%
Rural	56.3%	19.4 %	40.20/o
Region			
Northeast	9.9%	23.5%	17.5%
South	53.5%	24.5%	43.90/0
North central	15.5%	31.6%	25.00/o
West	21.1%	20.45	13.60/o
Marital status and age			
Unmarried, 17-19	9.9%	21.%	3.80/o
Unmarried, 20+	8.5%	45.9%	6.1%
Married, 17-19	12.7%	5.1%	12.1%
Fair or poor health	14.1%	17.3%	12.1%
Number of annual doctor visits per woman[b]	11.0	12.6	13.1

[a]The data in this table are based on a sample of poor women (i.e., women living in families in which the real income per family member is less than $3.500 in 1982 dollars) who responded to the 1978, 1980, or 1982 National Health Interview Survey Insurance status reflects coverage at some time during the interview year. It was not possible to identify when during the pregnancy coverage of a given type began

[b]Reported annual doctor visits primarily reflect prenatal care vis Its, but also Include visits for postpartum care and for care unrelated to a woman's pregnancy

SOURCE J Hadley, calculations based on the 1978. 1980, and 1982 National Health Interview Survey, 1987

sured poor (e. g., income per family member was 68 percent higher among the insured poor than among Medicaid recipients). Hadley's data show clearly, however, that eligibility for third-party payment, whether it be Medicaid or other insurance, has a real effect on the quantity of prenatal care that poor women receive.