Early Start

A Cost–Beneficial Perinatal Substance Abuse Program

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OBJECTIVE: To conduct a cost–benefit analysis of Early Start, an integrated prenatal intervention program for stopping substance use in pregnancy.

METHODS: A retrospective cohort study was conducted of 49,261 women who had completed prenatal substance abuse screening questionnaires at obstetric clinics and who had undergone urine toxicology screening tests. Four study groups were compared: women screened and assessed positive and followed by Early Start (screened-assessed-followed, n=2,032), women screened and assessed positive without follow-up (screened-assessed, n=1,181), women screened positive only (screened-positive-only, n=149), women in the control group who screened negative (control, n=45,899). Costs associated with maternal health care (prenatal through 1 year postpartum), neonatal birth hospitalization care, and pediatric health care (through 1 year) were adjusted to 2009 dollars. Mean costs were calculated and adjusted for age, race, education, income, marital status, and amount of prenatal care.

RESULTS: Screened-positive-only group adjusted mean maternal total costs ($10,869) were significantly higher than screened-assessed-followed, screened-assessed, and control groups ($9,430; $9,230; $8,282; all $P<.001$). Screened-positive-only group adjusted mean infant total costs ($16,943) were significantly higher than screened-assessed-followed, screened-assessed, and control groups ($11,214; $11,304; $10,416; all $P<.001$). Screened-positive-only group adjusted mean overall total costs ($27,812) were significantly higher than screened-assessed-followed, screened-assessed, and control groups ($20,644; $20,534; $18,698; all $P<.001$). Early Start implementation costs were $670,600 annually. Cost–benefit analysis showed that the net cost benefit averaged $5,946,741 per year.

CONCLUSION: Early Start is a cost-beneficial intervention for substance use in pregnancy that improves maternal–infant outcomes and leads to lower overall costs by an amount significantly greater than the costs of the program.

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LEVEL OF EVIDENCE: II

Alcohol, tobacco, and other drug use remains a paramount problem in pregnancy leading to preventable morbidity and mortality in more than 400,000 pregnancies annually.[1–3] Exposure to alcohol, tobacco, and other drugs in pregnancy leads to increased rates of placental abruption, intrauterine fetal demise, low-birth-weight neonates, neonatal abstinence syndrome, and preterm labor and birth.[1,2,4] In turn, preterm birth, associated with short-term and long-term morbidity, adds significant costs.[5] Despite multiple educational advertising campaigns, substance use during pregnancy continues to be significant. Data from the Substance Abuse and Mental Health Services Administration in 2008 revealed no significant decrease in pregnancy usage (5.1% up from 4% in 2005–2006).[6]

In 1990, Kaiser Permanente Northern California developed Early Start, an integrated prenatal intervention program for stopping alcohol, tobacco, and other drug use.[7] The program created the Early Start specialist position, a licensed clinical social worker or marriage and family therapist with expertise in substance use and pregnancy who is located within the obstetrics and gynecology department. Appointments for substance use are linked to routine prenatal care

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visits. The colocation removes barriers that women face in obtaining substance use counseling, such as child care, fear of discrimination, and stigmatization.[1,2] Previous research demonstrated that women who screened positive and participated fully in Early Start with at least one follow-up visit had perinatal outcomes similar to women in the control group, whereas those women who were only screened-assessed also had significantly improved outcomes as compared with the screened-positive-only group.[2] The 1-hour psychosocial assessment alone has a significant effect on behavior with a decrease in alcohol, tobacco, and other drug usage; improving outcomes; and decreasing subsequent utilization.

This article further analyzes the Early Start study groups by conducting a cost analysis of health care use and outcomes of mothers and infants using adjusted 2009 dollars. We hypothesized that the savings achieved through reduced medical care consumption by Early Start participants, both the assessment-only group and those who returned for at least one follow-up appointment, would be greater than the costs of the program, making it cost-beneficial.

MATERIALS AND METHODS

This was a retrospective cohort study using a cohort previously described.[2] The setting was Kaiser Permanente Northern California, a multispeciality group model managed care organization with integrated information and care delivery systems. The study sites were Kaiser Permanente Northern California outpatient obstetric clinics where Early Start was in operation during the study period (January 1, 1999–June 30, 2003), ambulatory care centers, and hospitals.

Potential Early Start patients are identified based on response to a self-administered prenatal substance abuse screening questionnaire completed at the first prenatal appointment, clinician referral, self-referral, or positive results on the universal urine toxicology screening test. Women who screen positive are referred to an Early Start specialist, who conducts an in-depth psychosocial assessment.[2] Of the women in the cohort who were referred to Early Start, 95.6% had assessments. If the patient is considered to be at risk for substance use during pregnancy, she is strongly encouraged to attend Early Start follow-up appointments that are linked to her routine prenatal visits. As needed, women also may be referred to chemical dependency and other community support programs.

Our original cohort consisted of 49,985 women and their singleton infants. Of those women, 724 were excluded from the analyses because of missing delivery records or incorrect delivery Diagnosis Related Group's (DRG), leaving 49,261 women in the analytic cohort, all of whom had completed the screening questionnaire, had urine toxicology screening tests, had either live births or intrauterine fetal demises, and had electronic DRG data. Of the 49,985 infants, 305 intrauterine fetal demises and 672 with missing birth records or incorrect DRGs were excluded, leaving 49,008 infants for analysis. For analyses by gestational age at delivery, four infants with missing gestational age were excluded, leaving 49,004 infants.

Four study groups of pregnant women were defined based on their screening, assessment, and follow-up status. Group 1 was "screened-assessed-followed" (n=2,032) and included women who were screened positive (by questionnaire with or without positive urine toxicology), assessed, and diagnosed as chemically-dependent, substance abusing, or at-risk for alcohol or substance use by an Early Start specialist and had at least one follow-up Early Start appointment. The mean number of follow-up visits was 2.5, with a median of 2.0. We did not stratify based on number of follow-up visits because 88% had four or less visits, and only 2% had more than seven visits.

Group 2 was "screened-assessed" (n=1,181) and included women who were screened positive (by questionnaire with or without positive urine toxicology), assessed, and diagnosed as chemically-dependent, substance abusing, or at-risk for alcohol or substance use by an Early Start specialist but had no Early Start follow-up appointments.

Group 3 was "screened-positive-only" (n=149) and included women identified as substance abusers based on a positive urine toxicology (with or without positive screening questionnaires) but were never assessed or followed-up by Early Start. The group received the community standard of care, which included screening, advice from their obstetricians to stop using, follow-up urine toxicology, and continued referrals to Early Start or outside support programs.

Group 4 was "controls" (n=45,899) and included women with no evidence of substance abuse during pregnancy and were defined as having a negative screening questionnaire and a negative screening urine toxicology test. There was otherwise no difference in the prenatal care program for the four groups.

Costs associated with maternal health care (prenatal through 1 year postpartum), neonatal birth hospitalization care, and pediatric health care (1 year after birth) were estimated based on inpatient and outpatient-utilization data and were adjusted to 2009 dollars using the medical component of the consumer price index. Outpatient use data in the year after delivery required health plan membership; women and infants without at least

10 months of membership in that year were omitted from the outpatient analyses. The loss rate was least for the control group (21.3%) and similar for the screened-positive-only (29.5%), screened-assessed (30.1%), and screened-assessed-followed (28.1%) groups. The source of unit costs was the Cost Management Information System of Kaiser Permanente. Cost Management Information System identifies the services by patient during an encounter with the health system and assigns unit costs to those services based on the expenses incurred by the providing departments in the given calendar year. Hospitalizations were assigned a cost based on DRG and length of stay. Office visit costs were based on department and type of provider and included visit, laboratory, and radiology. Outpatient pharmacy costs were obtained directly from the Kaiser Permanente Northern California outpatient pharmacy database.

Mean utilization and costs, adjusted for age, race, education, income, marital status, and amount of prenatal care, were compared among the four study groups in pairs, adjusting for multiple comparisons using the Tukey-Kramer method in PROC general linear models in SAS. Adjusted means were calculated using the least squares means options in SAS, which adjusts the means by fixing continuous explanatory variables at their means and equally distributing categorical explanatory variables across their categories. Medians and interquartile ranges were also calculated. To determine the costs of substance abuse in pregnancy, the screened-positive-only group was compared with the control group. To determine the potential cost differences produced by Early Start, the screened-positive-only group was compared with the screened-assessed-followed and screened-assessed groups. Previous research indicated that the screened-assessed group had improved outcomes, intermediate between the screened-assessed-followed and screened-positive-only groups.[2]

Once the cost analysis was completed, we formalized the cost–benefit analysis by comparing program costs to the potential costs of the outcomes and increased utilization for the screened-assessed-followed and screened-assessed groups that would have accrued if the mother had not participated in Early Start. Cost–benefit analyses have a higher standard than other cost-effectiveness analyses because they must actually lead to cost savings to be cost-beneficial. The study was approved by the Kaiser Permanente Northern California Institutional Review Board for the Protection of Human Subjects.

RESULTS

Table 1 provides demographic comparisons of the four study groups on maternal and neonatal factors. The screened-assessed-followed, screened-assessed, and screened-positive-only group participants were significantly younger (younger than 19 years) than those in the control group. The control group women were significantly older (older than 35 years) than the screened-assessed-followed and screened-assessed groups. The screened-assessed-followed, screened-assessed, and screened-positive-only group participants were all significantly more likely to be African American than were those in the control group. Participants in all three groups were also significantly less likely to be Asian, to be married, to have higher education, and to have a higher annual income than those in the control group. The screened-assessed-followed, screened-assessed, and screened-positive-only group participants were more likely to enter prenatal care later than those in the control group, with the screened-positive-only group having the highest rate of late entry. The screened-assessed-followed group had a significantly higher median amount of prenatal care than the screened-assessed, screened-positive-only, and control groups, who all had the recommended amount of prenatal visits.

Table 2 provides adjusted mean and median maternal health care services costs by study group and data on maternal utilization of services, including the adjusted mean and median number of specific encounters per woman. Adjusted mean antepartum and mental health services costs in the screened-assessed-followed and screened-assessed groups were significantly higher than those of the control group ($P<.05$; $P<.001$). Adjusted mean delivery costs in the screened-assessed-followed, screened-assessed, and screened-positive-only groups were significantly higher than those of the control group ($P<.05$). Adjusted mean emergency department costs were 2.5 times higher for the screened-positive-only group ($600) than those of the control group ($243; $P<.001$) and 1.8 times higher than those of the screened-assessed-followed group ($327; $P<.001$).

Table 3 provides adjusted mean and median infant health care services costs by study group and data on infant use of services, including the adjusted mean and median number of specific encounters per infant. Adjusted mean birth hospitalization costs in the screened-positive-only group ($13,017) were significantly higher than those of the screened-assessed-followed ($6,690; $P<.05$), screened-assessed ($7,232; $P<.05$), and control ($5,991; $P<.001$) groups. Costs

Table 1. Demographic Characteristics by Study Group

Characteristic	Study Group: Screened-Assessed-Followed (n=2,032)	Screened-Assessed (n=1,181)	Screened-Positive-Only (n=149)	Control Group (n=45,899)	Significant Differences* (All $P<.05$)
Maternal					
Age (y)	24.9±6.3	25.4±6.3	26.8±6.8	28.7±5.8	SAF, SA, S compared with C SAF, SA compared with S
Younger than 19	16.4	13.2	10.7	4.2	SAF, SA, S compared with C
Older than 35	7.1	7.6	10.7	12.6	SAF, SA compared with C
Race					
White	31.7	37.2	23.5	25.1	SAF, SA compared with C SAF, S compared with SA
African American	26.2	19.9	29.5	7.6	SAF, SA, S compared with C SAF, S compared with SA
Hispanic	12.3	14.4	19.5	27.2	SAF, SA compared with C
Asian	4.9	5.3	6.7	23.2	SAF, SA, S compared with C
Other	21.0	19.4	18.1	14.0	SAF, SA compared with C
Missing	3.8	3.9	2.7	2.9	
Marital status (% married)	43.1	49.7	47.7	78.2	SAF, SA, S compared with C SAF compared with SA
Education (% high school or less)	47.9	42.1	52.4	31.5	SAF, SA, S compared with C SAF compared with SA
Annual income (% greater than $25,000)	41.9	33.7	45.6	19.0	SAF, SA, S compared with C SAF, S compared with SA
Late (more than 13 wk) to prenatal care	22.2	25.7	31.3	18.4	SAF, SA, S compared with C SAF compared with S
Amount of prenatal care*	0.282 (0.225–0.333)	0.256 (0.205–0.317)	0.250 (0.158–0.308)	0.256 (0.211–0.308)	SA, S, C compared with SAF
Neonatal					
Gestational age at delivery (wk)					
Before 33	1.5	2.5	5.4	1.2	SA, S compared with C SAF compared with S
33–36	6.3	6.9	10.1	5.3	
After 36	92.3	90.6	84.6	93.5	SA, S compared with C SAF compared with S
Birth weight (g)	3,358±597	3,360±618	3,187±726	3,421±567	SAF, SA, S compared with C SAF, SA compared with S

SAF, screened-assessed-followed; SA, screened-assessed; S, screened-positive-only; C, controls.
Data are mean±standard deviation, %, or median (interquartile range).
* Number of prenatal visits during pregnancy divided by the number of weeks of gestation at delivery. Recommended prenatal visits is .25 (10 visits for a 40-week gestation).

associated with 33–36 weeks of gestational age were significantly higher in the screened-positive-only group ($42,305) than in the screened-assessed-followed ($14,317), screened-assessed (11,467), and the control ($10,201) groups (all $P<.001$).

Figure 1 summarizes adjusted mean total maternal, infant, and combined health care services costs by study group. In all three categories of cost, the screened-positive-only group had the highest adjusted mean costs; for total costs, the screened-positive-only group adjusted mean ($27,812) was approximately $7,000 higher than that of the screened-assessed-followed and screened-assessed groups, and $9,000 higher than the control group adjusted mean (all $P<.001$).

The Early Start program requires a full-time (40 hours per week) Early Start specialist for approximately 1,800 annual deliveries. To provide Early Start to the cohort, approximately 27.4 full-time-equivalent Early Start specialists were required (56,927 hours). In 2009, the Early Start specialist average salary without taxes and benefits was $41.23 per hour. The total Early Start specialists salary costs for providing care to the cohort over the 3.5 years totaled $2,347,100 or $670,600 annually.

Our cost–benefit analysis compared the total cost differences between screened-assessed-followed and screened-assessed groups to the screened-positive-only group, including the costs of the Early Start program. By providing Early Start to this cohort at a cost of $2,347,100, we were able to provide an overall cost savings of $23,160,694. The net cost benefit was $20,813,594 over 3.5 years, or $5,946,741 annualized.

DISCUSSION

This study demonstrates that Early Start is a cost-beneficial intervention for substance use in pregnancy, leading to lower overall costs by an amount significantly greater than the costs of the program. Early Start has both transferability and scalability.

Table 2. Median and Adjusted* Mean Costs and Utilization of Maternal Health Services by Study Group

	Screened-Assessed-Followed	Screened-Assessed
Cost		
Maternal inpatient costs ($)		
Antepartum	426, 0 (0–0)	473, 0 (0–0)
Delivery	5,958, 4,590 (4,590–6,499)	6,040, 4,590 (4,590–6,499)
After delivery through 1 y	481, 0 (0–0)	316, 0 (0–0)
Subtotal	6,865, 4,749 (4,590–7,880)	6,829, 4,749 (4,590–7,880)
Maternal outpatient clinic costs ($)		
Mental health	136, 0 (0–0)	146, 0 (0–0)
Gynecology	912, 693 (397–1,192)	843, 591 (295–1,090)
Primary care	580, 368 (0–838)	601, 368 (0–837)
Other‡	359, 0 (0–315)	315, 0 (0–315)
Emergency department	327, 0 (0–0)	276, 0 (0–0)
Pharmacy	251, 128 (54–251)	220, 137 (60–268)
Subtotal	2,565, 1,840 (1,035–3,343)	2,401, 1,685 (906–3,224)
Total	9,430, 7,731 (5,806–10,736)	9,230, 7,737 (5,661–10,398)
Utilization		
Women with inpatient encounter type		
Antepartum	7	8
After delivery through 1 y	8	7
Women with outpatient encounter type		
Mental health	11	11
Gynecology	91	89
Primary care	65	68
Other‡	41	41
Emergency department	23	20
Pharmacy	93	94
No. of inpatient encounters per woman		
Antepartum	0.10, 0 (0–0)	0.11, 0 (0–0)
After delivery through 1 y	0.10, 0 (0–0)	0.08, 0 (0–0)
No. of outpatient encounters per woman		
Mental health	0.5, 0 (0–0)	0.5, 0 (0–0)
Gynecology	2.8, 2 (1–4)	2.5, 2 (1–3)
Primary care	1.8, 1 (0–3)	1.9, 1 (0–3)
Other‡	1.4, 0 (0–1)	1.3, 0 (0–1)
Emergency department	0.3, 0 (0–0)	0.3, 0 (0–0)
Pharmacy	7.5, 6 (3–10)	7.0, 6 (3–9)

SAF, screened-assessed-followed; SA, screened-assessed; C, controls; S, screened-positive-only.
Data are adjusted mean, median ($) (interquartile range), or % unless otherwise specified.
* Adjusted for age, race, education, income, marital status, and amount of prenatal care using the general linear models (GLM) procedure in SAS.
† *P* based on *t* tests comparing least squares means produced by Proc GLM in SAS, adjusted for multiple comparisons.
‡ Services "other" than internal medicine, gynecology, or mental health.

The program started originally in only four clinics in Kaiser Permanente Northern California in 1990 and using the full-time-equivalent ratio of one Early Start specialist for 1,800 births, clinics have been able to hire accordingly so that full coverage is provided for 35,000 births annually. Early Start specialists may

Screened-Positive-Only	Control Group	Significant Differences[†]
570, 0 (0–0)	307, 0 (0–0)	SAF, SA compared with C ($P<.05$)
6,564, 4,590 (3,521–7,412)	5,743, 4,590 (3,521–6,259)	SAF, SA, S compared with C ($P<.05$)
466, 0 (0–0)	466, 0 (0–0)	
7,600, 4,749 (3,612–7,978)	6,516, 4,590 (3,612–7,382)	SAF, S compared with C ($P<.05$) SAF, SA compared with S ($P<.05$)
146, 0 (0–0)	70, 0 (0–0)	SAF, SA compared with C ($P<.001$)
1,031, 772 (295–1,192)	875, 652 (383–1,090)	
646, 368 (0–1,105)	578, 368 (0–737)	
60, 0 (0–315)	278, 0 (0–315)	SAF, SA compared with S ($P<.05$) SAF, S compared with C ($P<.001$)
600, 0 (0–944)	243, 0 (0–0)	SAF, S compared with C ($P<.001$) SAF, SA compared with S ($P<.001$)
244, 121 (48–234)	174, 98 (42–200)	SA compared with C ($P<.05$) SAF compared with C ($P<.001$)
3,269, 2,218 (1,164–3,905)	2,118, 1,573 (855–2,694)	SA compared with C ($P<.05$) SAF compared with S ($P<.05$) SAF, S compared with C ($P<.001$) SA compared with S ($P<.001$)
10,869, 8,341 (5,553–12,517)	8,282, 6,908 (5,337–9,578)	SAF compared with SA ($P<.05$) SAF, SA compared with S ($P<.001$) SAF, SA, S compared with C ($P<.001$)
11	7	
12	8	
7	6	SAF, SA compared with C ($P<.05$)
87	93	SAF, SA, S compared with C ($P<.05$)
62	66	
39	39	
33	18	SAF, S compared with C ($P<.05$) SAF, SA compared with S ($P<.05$)
92	92	SA compared with C ($P<.05$)
0.16, 0 (0–0)	0.08, 0 (0–0)	SA, S compared with C ($P<.05$)
0.17, 0 (0–0)	0.09, 0 (0–0)	SA, C compared with S ($P<.05$)
0.5, 0 (0–0)	0.3, 0 (0–0)	SAF, SA compared with C ($P<.05$)
2.9, 2 (1–3)	2.6, 2 (1–3)	SAF compared with C ($P<.05$)
2.0, 1 (0–3)	1.8, 1 (0–2)	
2.5, 0 (0–1)	1.0, 0 (0–1)	SAF, SA compared with S ($P<.05$) SAF, S compared with C ($P<.001$)
0.6, 0 (0–0)	0.3, 0 (0–0)	SAF, SA, compared with S ($P<.001$) SAF compared with C ($P<.001$)
7.8, 6 (3–9)	5.7, 5 (2–8)	SAF, SA, S compared with C ($P<.001$)

cross-cover more than one smaller clinic site with less than 1,800 births annually, whereas other larger sites require more than one full-time equivalent.

The analysis of total costs for mothers and infants demonstrates that, if the women in the screened-assessed-followed and screened-assessed groups had

Table 3. Median and Adjusted* Mean Cost and Utilization of Infant Health Services by Study Group

	Screened-Assessed-Followed	Screened-Assessed
Cost		
Infant inpatient costs ($)		
Birth	6,690, 3,277 (1,769–5,031)	7,232, 3,277 (1,769–5,031)
Birth by gestational age categories		
Before 33 wk	116,410, 86,639 (31,734–220,119)	98,397, 86,915 (35,489–152,334)
33–36 wk	14,317, 5,693 (3,699–17,379)	11,467, 6,819 (3,699–17,379)
After 36 wk	4,046, 3,277 (1,769–3,832)	4,130, 3,277 (1,769–3,693)
Birth through 1 y	1,353, 0 (0–0)	887, 0 (0–0)
Subtotal	8,043, 3,277 (1,769–5,031)	8,119, 3,277 (1,769–5,031)
Infant outpatient clinic costs, Birth through 1 y ($)		
Primary care	2,581, 2,431 (1,908–3,160)	2,660, 2,496 (1,908–3,260)
Other‡	167, 0 (0–0)	161, 0 (0–0)
Emergency department	342, 0 (0–804)	284, 0 (0–0)
Outpatient pharmacy	80, 44 (14–98)	80, 44 (14–98)
Subtotal	3,171, 2,904 (2,094–3,964)	3,185, 2,886 (2,090–3,875)
Total	11,214, 6,383 (4,849–8,801)	11,304, 6,225 (4,891–8,448)
Utilization		
Infants with inpatient encounter type, birth through 1 y	9	8
Infants with outpatient encounter type, birth through 1 y		
Primary care	99.7	99.3
Other‡	23	24
Emergency department	27	23
Outpatient pharmacy	81	81
No. of inpatient encounters per infant		
Birth through 1 y	0.1, 0 (0–0)	0.1, 0 (0–0)
No. of outpatient encounters per infant		
Primary care	10.6, 10 (8–13)	10.9, 10 (8–13)
Other‡	0.6, 0 (0–0)	0.6, 0 (0–0)
Emergency department	0.4, 0 (0–1)	0.3, 0 (0–0)
Outpatient pharmacy	3.8, 3 (1–5)	3.8, 3 (1–5)

SAF, screened-assessed-followed; SA, screened-assessed; S, screened-positive-only; C, controls.
Data are adjusted mean, median ($) (interquartile range), or % unless otherwise specified.
* Adjusted for age, race, education, income, marital status, and amount of prenatal care using the general linear models (GLM) procedure in SAS.
† *P* based on *t* tests comparing least squares means produced by Proc GLM in SAS adjusted for multiple comparisons.
‡ Services "other" than primary care.

not had access to Early Start but were given the community standard of care with the same outcomes and utilization as the screened-positive-only group, the added costs of the increased utilization would have totaled nearly $23 million for the cohort over 3.5 years–a cost of nearly $6 million for 14,000 births. If similar programs were implemented throughout the United States, at a $500 per capita savings from these calculations, the projected annual savings for 4 million births annually would be approximately $2 billion while simultaneously leading to better maternal and neonatal outcomes.

The most notable differences in costs are those associated with preterm birth. As expected, because the neonatal negative effects of alcohol, tobacco, and other drugs have been well-established, the screened-positive-only group had significantly higher costs than the control group as well as the screened-assessed-followed and screened-assessed groups. This cost differential more than covers the cost of the Early Start program. The per-infant costs for births from 33 to 36 weeks of gestation are 2.9 times higher in the screened-positive-only group ($42,305) than in the screened-assessed-followed group ($14,317). The birth rate at this gestational age is 1.6 times higher in the screened-positive-only than in the screened-assessed-followed groups (Table 1). If the screened-assessed-followed group experienced the same preterm birth rate, subsequent use, and costs as the screened-positive-only group, the overall costs for these infants would increase by $6,839,949 for the cohort over 3.5 years. Given the significantly improved outcomes and cost savings of the assessment visit, similar economic analysis of the screened-as-

Screened-Positive-Only	Control Group	Significant Differences†
13,017, 3,277 (1,769–5,031)	5,991, 3,277 (1,769–3,693)	SAF, SA compared with S ($P<.05$) C compared with S ($P<.001$)
153,476, 163,114 (160,217–199,416)	110,869, 81,478 (37,458–150,163)	
42,305, 18,443 (3,699–55,660)	10,201, 5,657 (3,693–13,061)	SAF, SA, C compared with S ($P<.001$)
3,575, 3,277 (1,769–3,693)	3,758, 3,277 (1,769–3,693)	
681, 0 (0–0)	1,142, 0 (0–0)	
13,697, 3,277 (1,769–5,693)	7,133, 3,277 (1,769–5,031)	SAF, SA, C compared with S ($P<.05$)
2,613, 2,564 (1,891–3,286)	2,711, 2,431 (1,945–3,186)	SAF compared with C ($P<.05$)
171, 0 (0–0)	156, 0 (0–0)	
381, 0 (0–944)	331, 0 (0–0)	
81, 44 (16–101)	85, 41 (14–90)	
3,246, 2,781 (1,963–4,067)	3,283, 2,765 (2,027–3,801)	
16,943, 6,435 (4,550–10,413)	10,416, 6,016 (4,639–8,190)	SAF, SA, C compared with S ($P<.001$)
10	9	
99.7	99.6	
18	22	
26	25	
88	82	
0.1, 0 (0–0)	0.1, 0 (0–0)	
10.7, 10 (8–13)	11.1, 10 (8–13)	SAF compared with C ($P<.05$)
0.7, 0 (0–0)	0.6, 0 (0–0)	
0.4, 0 (0–1)	0.4, 0 (0–0)	
4.3, 3 (1–5)	3.8, 2 (1–5)	

sessed cohort demonstrates an additional cost savings of $4,105,468. Another finding is that there were no significant cost differences in the infants of the screened-assessed-followed and control groups, suggesting that these services reduce costs in this high-risk population to the same as those of nonsubstance users.

The screened-assessed-followed, screened-assessed, and screened-positive-only groups had increased utilization and costs of mental health services postpartum compared with the control group, which is a positive finding. A mother's utilization of mental health services allows her to express her experience and normalize feelings of frustration and helplessness, decreasing her risk of postpartum depression.

Although we present a comprehensive analysis of the resource utilization of a program proven to reduce both complications and costs of substance use in pregnancy, our study has limitations. One limitation is the study's nonrandomized design, which makes it unclear if the motivation to stop using alcohol, tobacco, and other drugs was similar in the groups. Because all cohorts had a similar amount of prenatal care, and because the screened-assessed-followed cohort previously showed the greatest alcohol, tobacco, and other drug usage on the universal screening tool, their usage or access to care does not account for the differences.[2] However, there is a limitation in that the screened-assessed-followed group may represent a more motivated patient population that was not controlled for. At this time, however, Early Start is the standard of care at Kaiser Permanente Northern California; given the original research findings of

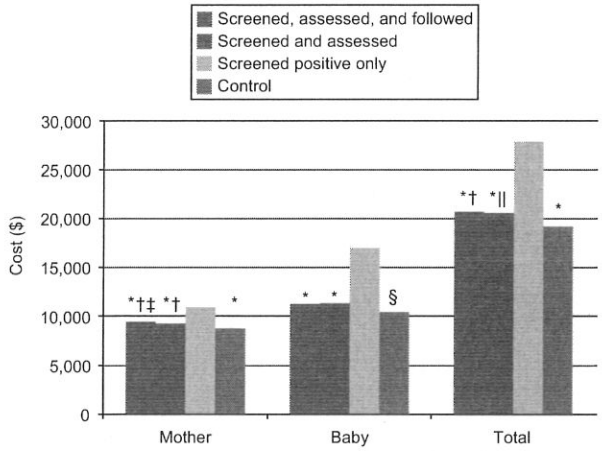

Fig. 1. Total mean maternal and infant costs. *$P<.001$ compared with the screened-positive-only group. †$P<.001$ compared with the control group. ‡$P=.03$ compared with the screened-positive-only group. §$P=.01$ compared with the screened-positive-only group. ||$P=.01$ compared with the control group.

Goler. Cost–Benefit Analysis of Early Start Program. Obstet Gynecol 2012.

significantly improved outcomes,[1] it would be unethical to withhold Early Start from pregnant women in Kaiser Permanente Northern California.

A second potential limitation is that the cohort only included births through June 30, 2003. However, as the 2008 SAMHSA data[3] suggest, there has been a small increase in substance use during pregnancy over the past 5 years, and thus we are certain that the Early Start program is still needed.

Last, there was loss of Kaiser Permanente Northern California membership in the follow-up year. If the screened-positive-only, screened-assessed, and screened-assessed-followed groups had the same retention as the control group, there would have been increased costs incurred by the emergency department utilization increase by the screened-positive-only group, and by mental health by all three groups. However, the relative costs of the outpatient services would still be markedly offset by the savings.

Health care costs continue to increase and are currently 17% of the gross domestic product.[8] The majority of Early Start cost savings are decreased hospital costs. Because Kaiser Permanente Northern California is an integrated system, costs are internalized and the benefits are realized in both the inpatient and outpatient settings. However, given that hospitals are reimbursed for providing inpatient care, there is no incentive to reduce admissions. A paradigm shift in costs is needed that encourages hospitals and health plans to provide cost-beneficial programs like Early Start that improve outcomes while decreasing societal costs.

Early Start is a reproducible program. In larger hospital clinic settings, the staffing model is more straightforward with one full-time Early Start specialist for every 1,800 births. In smaller community settings, the amount of time needed could be prorated to the number of annual births produced by a variety of clinics. Different models of care would need to be supported. For example, one licensed clinical social worker can work with multiple clinics providing services on different days of the week for Early Start patients. However, because this would lead to greater costs of care up front, it is important to determine funding mechanisms for these extra resources because they will save overall health care costs downstream.

The national implications of providing Early Start are far-reaching. The total costs for mother–infant pairs with substance abuse are $9,888 more than for the women in the control group. Nationally, with more than 200,000 pregnancies exposed to alcohol, tobacco, and other drugs, without programs like Early Start, the increased national cost for these mother–infant pairs is $1,822,800,000. We cannot afford to not fund integrated programs like Early Start.

REFERENCES

1. Armstrong MA, Gonzales Osejo V, Lieberman L, Carpenter DM, Pantoja PM, Escobar GJ. Perinatal substance abuse intervention in obstetric clinics decreases adverse neonatal outcomes. J Perinatol 2003;23:3–9.
2. Goler NC, Armstrong MA, Taillac CJ, Osejo VM. Substance abuse treatment linked with prenatal visits improves perinatal outcomes: a new standard. J Perinatol 2008;28:597–603.
3. The NSDUH report: substance use among women during pregnancy and following childbirth. Rockville (MD): Substance Abuse and Mental Health Services Administration, Office of Applied Studies; 2009.
4. American Academy of Pediatrics Committee on Drugs. Neonatal drug withdrawal. Pediatrics 1998;101:1079.
5. Schmitt SK, Sneed L, Phibbs CS. Costs of newborn care in California: a population-based study. Pediatrics 2006;117:154–60.
6. Centers for Disease Control and Prevention (CDC). Alcohol use among pregnant and nonpregnant women of childbearing age–United States, 1991–2005. MMWR Morb Mort Wkly Rep 2009;58:529–32.
7. Armstrong MA, Lieberman L, Carpenter DM, Gonzales VM, Usatin MS, Newman L, et al. Early Start: an obstetric clinic-based, perinatal substance abuse intervention program. Qual Manag Health Care 2001;9:6–15.
8. Truffer CJ, Keehan S, Smith S, Cylus J, Sisko A, Poisal JA, et al. Health spending projections through 2019: the recession's impact continues. Health Aff (Millwood) 2010;29:522–9.