

**Issues and Early Evidence for the Economic Evaluation
of the Effects of Periodontal Therapy on Pregnancy Outcomes**

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Summary (max 50 words):

Analyses of the effects of periodontal therapy on pregnancy outcomes show potential improvements in gestational age for births prior to 37 weeks for live births. This briefing provides an economic assessment of the evidence and discusses additional issues. Trade-offs between stillbirths and live births with short gestational age remain problematic.

Maternal periodontal disease has emerged as a potential modifiable risk factor for adverse pregnancy outcomes.^{1,2,3} While the recent results from the Obstetric and Periodontal Therapy [OPT] Study addressing the relationship between non-surgical periodontal therapy during pregnancy and preterm birth found no difference in the likelihood of preterm delivery by 37 weeks, the trial found (1) evidence of reductions in stillbirths or spontaneous abortions and (2) indications of increases in gestational age for births prior to 37 weeks.⁴ While fetal deaths and premature births have profound human implications, an economic evaluation of periodontal treatment for pregnant women should consider the likelihood of birth and the costs associated with birth (live or stillbirth) at each week of gestation. To this end, we provide an assessment of these issues using data from the OPT study and other sources.

The OPT study is the largest clinical trial to date addressing issues around periodontal therapy and preterm births. Of the 413 and 410 patients in the treatment and control groups, 5 treatment and 14 control patients had spontaneous abortions or stillbirths ($p=0.04$). The issue of avoided stillbirths or spontaneous abortions is problematic, since averted deaths could be converted to either premature infants or full gestations. A large proportion of the stillbirths/spontaneous abortions occurred prior to 24 weeks (four out of five treatment and 10 out of 14 control patients). Converting an early stillbirth to a live but extremely premature birth is not desirable by many standards and involves complex ethical considerations. Conversely, the other five stillbirths (four control and one treatment) occurred beyond 29 weeks gestation, when many considerations would place a high value on preventing stillbirth.

For live births, however, increased gestation of even a few weeks resulted in improved birth outcomes. This delay in delivery can reduce costs from extreme prematurity, as babies with longer gestations have lower financial burden for their birth event/admission,⁵ lower costs for the mother's admission,⁶ and lower health care costs during the first five years of life.⁷

Economic Assessment:

The top of Figure 1 uses OPT data to show gestation for all live births from 12 weeks onward. The figure suggests longer gestation for treatment than control births from 20 to 34 weeks, with little difference from 34 weeks onward. Nine treatment and 12 control patients delivered live births prior up to 22 weeks (2.9% for the control group versus 2.2% for the treatment group.) Given a paucity of data on costs for births prior to 24 weeks and the low survival rate, we focus on data for live births with gestations of greater than 22 weeks.

The first two lines in the panel below the graph show sample sizes by gestation at two week intervals up to 37 weeks for the 384 control and 399 treatment patients whose pregnancies lasted to 22 weeks. We multiply the estimated percent of live births for each two-week interval by three cost components: (1) neonatal hospital birth admission costs;⁵ (2) maternal hospital charges;⁶ and (3) cumulative hospitalization costs for the first five year of a child's life after the delivery admission based on a study in the United Kingdom (UK).⁷ We use the same cost estimates for the treatment and control groups despite the fact that treatment births in the OPT study had a higher rate of neonatal intensive care unit (NICU) admissions and days, possibly because the

treatment group may include some averted stillbirths who were more likely to require NICU care.

The differences in these birth-related costs are offset by the periodontal treatment costs. (We ignore initial screening cost to detect disease since pregnant women are seen by clinicians who could be trained to identify and refer for further periodontal treatment.) Periodontal treatment cost estimates, determined using the 50th percentile of the American Dental Association's National Dental Advisory Service 2002 Comprehensive Fee Report,⁸ include a comprehensive examination, initial prophylaxis and fluoride, four quadrants of scaling and root planning, and two maintenance appointments. This intensive treatment level makes the estimated savings conservative. All costs were adjusted to US2004\$ using the Medical Care component of the Consumer Price Index. The UK cost estimates⁷ (inpatient per diem costs based on the treating physician's specialty) were converted to US dollars; adjustment for differences in treatment intensity between the UK and US was not possible.

Based on these assumptions, periodontal therapy during pregnancy results in a reduction in birth and first five year hospital costs of \$1624 per woman treated. This reduction is offset by treatment costs estimated at \$924 per individual. Thus, the net savings resulting from extending gestational age at delivery through periodontal treatment is \$700 per woman (Figure 1, bottom panel). Treating the likelihood of delivery at each two week interval as independent events yields a confidence interval that has a very high upper limit (\$10,000) and includes zero, meaning that periodontal treatment may be cost-effective rather than cost-saving. The small number of births at

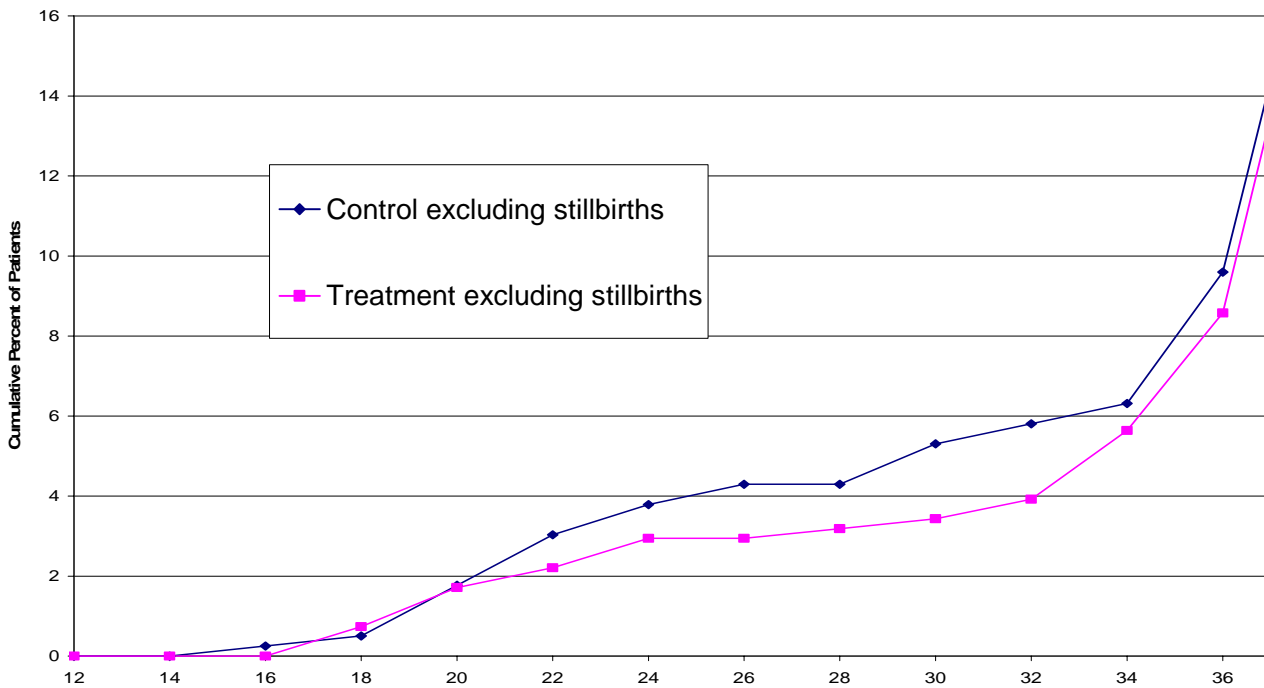
each point on the curves and the lack of actual cost data for control versus treatment patients preclude more specific determination.

In total, the recent evidence on the effect of periodontal treatment raises more questions than it answers. Although the OPT study was originally powered to determine whether the gestational-age distribution shifted (by 5, 3, and 2 weeks for gestations of 20, 25 and 30 to 35 weeks, respectively), the published study focuses on the likelihood of delivering before 37 weeks for the two groups. The calculations in Figure 1 are only for live births, and the sample size is not sufficient to sort out the important issues of differences in the rates of stillbirths and improvements in gestational ages for live births at all points on the distribution. The rough estimate of possible savings from periodontal therapy is modest and can not be estimated precisely. While the estimated savings may be low because of the assumption of intense periodontal treatment, the savings may be overestimated if the treatment group experienced greater NICU use or screening costs are included. Finally, the OPT study provided essential dental care (e.g., treatment of abscessed teeth and caries) to both treatment and control groups up to 20 weeks of gestation as well as periodontal treatment to three control patients with generalized periodontal disease progression before delivery. These treatments could further diminish any detectable effect of periodontal care.

Further evidence on the role of periodontal therapy and pregnancy outcomes remains an important agenda item.^{9,10} Periodontal treatment may not be a silver bullet that eliminates preterm births, and the proportion of preterm births that occur at the earliest and most expensive gestations is small. Yet other benefits from this intervention may accrue, such as improvements in quality of life for both the mother and

child from increases in gestational age. Furthermore, researchers have demonstrated that promoting oral health in women during pregnancy may suppress oral pathogens and diminish bacterial transmission, subsequently reducing early childhood caries, the most common chronic disease of childhood.¹¹ Larger sample study sizes with more refined outcome measures are required to guide clinical decision making. Such studies would help verify the financial impact and quality of life issues associated with promoting oral health of women during preconception, pregnancy and intrapartum.

Figure 1: Distribution of gestational age at delivery (OPT study²) and associated costs



	Weeks Gestation								Savings
	24	26	28	30	32	34	36	37	
OPT Data									
Control excluding stillbirths	381	379	379	375	373	371	358	339	
Treatment excluding stillbirth	396	396	395	394	392	385	373	353	
Estimated Percent of Women Delivering Each Period									
Controls excluding stillbirth	0.76%	0.51%	0.00%	1.01%	0.51%	0.51%	3.28%	4.80%	
Treatment excluding stillbirth	0.74%	0.00%	0.25%	0.25%	0.49%	1.72%	2.94%	4.90%	
Costs Estimates by Type (2004\$)									
Neonatal costs for birth admission	\$232,302	\$216,722	\$152,515	\$96,946	\$48,135	\$10,996	\$3,595	\$2,116	
<i>Net savings per woman</i>									\$1,398
Maternal costs at delivery	\$10,192	\$10,599	\$12,910	\$9,784	\$7,066	\$5,164	\$4,213	\$3,669	
<i>Net savings per woman</i>									\$ 48
Costs up to age 5 (post birth)	\$24,818	\$24,818	\$17,830	\$17,830	\$5,259	\$5,259	\$5,259	\$1,232	
<i>Net savings per woman</i>									\$ 177
Total Maternal and Infant Costs (live births) per Woman Treated									\$1,624
Periodontal Treatment Costs									\$ 924
NET SAVINGS per woman treated by extending gestational age									\$700

Note: The three net saving estimates are calculated by subtracting expected treatment costs from expected control costs.

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