

Should Universal Screening For Prematurity Be Implemented? — A Cost Effectiveness Study (The Long Island Perspective)

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Introduction

It is well-established that premature birth has severe consequences on both an emotional and financial level. The annual economic impact of premature birth in the United States is estimated at \$26.2 billion. In extreme cases, the cost of a single preterm birth can exceed \$1 million. On Long Island alone, close to 3,500 infants were born prematurely in 2014 and the overall economic burden of prematurity exceeded \$180 million. Preterm birth is a multifactorial problem and no single strategy can eliminate it entirely. Risk factors contributing to preterm birth include: previous pregnancies with an adverse outcome, maternal age, maternal race, genitourinary infection, smoking, multiple gestation births, extremes of body weight, and social disadvantage. Universal cervical length monitoring (CLM) and treatment if indicated (cervical cerclage and/or progesterone therapy) have been shown to decrease the overall rate of prematurity, by approximately 34.8%. If such a screening and treatment protocol were broadly implemented over a particular geographic territory, it could potentially decrease the prevalence of preterm deliveries in that area and the host of costs and complications that accompany such deliveries.

It is important to note that this paper deals exclusively with extreme preterm deliveries defined as birth at or below 32 weeks of pregnancy. We limited our analysis to the Long Island area, therefore the underlying data both for costs of prematurity and the efficacy of the screening and treatment regimen is based upon fairly small datasets without detailed demographic information. This is relevant when including the data for the lifetime costs of cerebral palsy (a potential result of preterm labor), which are based on a national average because local cost data are unavailable.

Finally, our analysis includes only the financial costs of such births to the exclusion of emotional, psychological, and social costs of preterm deliveries.

Materials and Methods

Long Island Vital Statistics Bureau was used to obtain the information on the annual prematurity rate. The total cost of extreme prematurity was calculated using samples of hospital and health care providers bills (part A and B). The total costs of screening and treatment measures for prematurity (cervical

length screening, cost of performing cervical cerclages and administering progesterone therapy, etc.) were calculated using the standard fees paid by insurance companies. The difference between those two sums is used to determine financial benefits of the universal screening, if any.

Results

There was a total of 29,907 births on Long Island (Nassau and Suffolk counties) in 2014, out of which 481 were defined as extreme preterm deliveries; 34.8%, or approximately 167 cases of which were considered preventable.

The average cost of transvaginal sonogram (TVS) on Long Island is \$82.64. This yields a total expense of \$12,357,572 for universal cervical screening. In addition to the cost of universal TVS screening, there will be cases where such screening is followed by treatment, which includes the cost of progesterone therapies and cerclage procedures. Assuming a cost of \$4,800 per cerclage procedure (providers, anesthesia, and hospital fees) and a price of \$1,000 per progesterone treatment, we find the total cost of the interventions to be \$1,139,529 (see table 1).

Cost of prevention and treatment of premature birth in Long Island

Table 1

Therapy	Price per unit	Number of Treatments	Total Cost
Progesterone	\$1,000.00	196	\$196,470.59
Cerclage	\$4,800.00	196	\$943,058.82
TVS Cost	\$82.64	149535 (5 TVS x 29907 pregnancies)	\$12,357,572.40
Total Cost			\$13,497,101.81

We now turn to quantifying the cost savings associated with an early intervention based on a universal regimen of TVS screening. The increased delivery and neonatal costs associated with extreme preterm birth is approximately \$69,893.17. See Table 2. If 167 preterm births are avoided as a result of the universal TVS screening, the total savings is \$11,672,159.

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Table 2

Case #	Delivery Week	Cost
1	27	\$78,000.00
2	26	\$112,000.00
3	31	\$89,000.00
4	26	\$134,000.00
5	32	\$16,000.00
6	27	\$46,000.00
7	29	\$52,000.00
8	31	\$62,780.00
9	29	\$89,680.00
10	29	\$42,678.00
11	25	\$92,000.00
12	28	\$66,580.00
Average Cost		\$73,393.17

There were 319 preterm births between 28 and 31 weeks of pregnancy and 162 prior to 28 weeks of gestation. In the 28-31 week category, there is a 5.4% chance of the neonate developing cerebral palsy, and in the pre-28 week category there was an 8% chance of cerebral palsy. Thus we can determine that there should be approximately 30 cases of Cerebral Palsy on Long Island annually, based on 2014 birth levels. Research has indicated that at least 75% of Cerebral Palsy cases are perinatal in origin, thus 23 cases of Cerebral Palsy on Long Island can be attributed to extreme preterm birth. Assuming a successful rate of intervention of 34.8%, 8 cases of cerebral palsy can be expected to be avoided through the implementation of a universal TVS screening and treatment program. With a lifetime cost of approximately \$921,000 per patient, avoiding eight cases annually could result in a net savings of approximately \$7,368,000 over the lifetime of the patients. The total system-wide savings resulting the broad implementation of the proposed regimen could be as high as \$17,637,358.83.

Discussion

The core finding of this analysis is the cost effectiveness of a broad implementation of the proposed screening and treatment regimen of preterm labor in Long Island. According to our calculations, the net overall system-wide savings of implementing the proposed TVS screening and treatment program could be expected to amount to \$5,543,057. This number does not include any savings associated with the avoidance of non-extreme preterm deliveries (those occurring between 32 and 38 weeks of pregnancy) or the substantial costs related to long term morbidity, which can include everything from respiratory and learning disabilities to severe physical and cognitive impairment.

While the analysis at hand is limited to the case of the Long Island area, the substantial margin of cost effectiveness strongly suggests that such measures would be cost effective throughout much of the United States. This is all before considering the likely substantial benefits that could accrue relating to all preterm deliveries, which are more prevalent and would likely be prevented by the regimen at a similar rate. While each preterm delivery between 32 and 37 weeks is less costly and the effects of such a delivery less damaging, their prevalence—approximately six times more frequent—would likely have a substantial financial benefit at minimal additional expense. More

importantly, this analysis does not consider the wide variety of non-financial harms that result from both long and short-term neonatal morbidity. The financial costs of such morbidity are, likely, quite substantial, but the emotional impact for the life of the child and its family absolutely defies quantification.

Strengths and Limitations

The first strength of the present study is the substantial magnitude of the cost savings to be accrued. Even if various factors conspire to elevate the costs and lower the savings, the fact that the net system-wide savings exceeds one third of the overall costs of implementing the regimen create a fairly substantial margin of safety that would likely remain even if the underlying numbers shifted substantially.

The first weakness of the present study is the fairly small data set, both regarding the costs of prematurity and the efficacy of the screening and treatment regimen, upon which the study was based. Furthermore, this data lacks demographic information. The rate of cerebral palsy, even among extreme preterm deliveries, is low enough and the average associated costs high enough, that a slight divergence from the expected number of cerebral palsy cases would have an inordinate impact on the overall cost effectiveness of the regimen. However the margin of cost effectiveness adequately large that even a fairly substantial fluctuation in the number of cases would not threaten the cost effectiveness of the regimen. We must also consider the potential difficulty of convincing women to accede to the procedure and the not insignificant discomfort and inconvenience such a regimen might pose for the patient.

In conclusion, universal implementation of transvaginal ultrasound screening to detect cervical shortening and vaginal cerclage and/or progesterone therapy if needed to avoid extreme preterm delivery is a cost effective strategy on Long Island. The system-wide costs of such screening and treatment are substantially exceeded by the savings accrued by extreme preterm deliveries avoided, even without considering the, likely, substantial savings that would result from the avoided non-extreme preterm deliveries and long term morbidity.

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- This is reflective of insurance reimbursements to one of the author's practice

- 9 The cost of a 'normal' pregnancy was estimated to be \$3,500, which was subtracted from \$73,393.17 to yield \$69,893.17.
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