Assessment of Maternal and Neonatal Health in Urban Areas of Pune, India

With Comparison to Baltimore, Maryland

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Introduction: As a March of Dimes volunteer for the past 9 years, maternal and neonatal health is a long-standing passions of mine. It was my goal to use the Woodrow Wilson Undergraduate Research Fellowship to better hone in on this passion and gain meaningful hands-on clinical research experience. In 2005, there was a report released at the National Conference on Child Survival and Development in New Delhi, India. This report outlined that of the 26 million children born in India each year, about 1.2 million die during the first 4 weeks of life (1). Even more alarming is out of the 3.9 million neonatal deaths worldwide, 30% occur in India (1). Having been born in Mumbai, India myself, this was particularly concerning to me and after researching more on neonatal and infant health in India, I knew that this was the research problem I sought to investigate. In India, 47% of children under the age of 5 are malnourished and 30% of babies are born underweight (1). These poor pregnancy outcomes and low birth weight babies are mainly caused by a prevalence of infection, lack of prenatal care, and nutritional deficiencies.

In December 2007, there was an article published in the Times of India called “Pune: City of Slums”. Pune, a city of 5 million people, has a slum population,
which has grown 176% since 1991 (2). Today, it has the 2nd highest slum population in India, with over 40% of the city below the poverty line (2). With no public or private health insurance system, the majority of people in Pune are uninsured with limited to no access to affordable health care services. In comparison, Baltimore City in Maryland has a population of ~600,000 people, and it is home to 2 major university hospitals plus several community hospitals.

As a part of my Woodrow Wilson Research, I spent my 2009 Intersession volunteering and conducting research at King Edward Memorial Hospital (KEMH) in Pune, India. KEMH is unique in that it serves the lowest income bracket of patients from Pune and surrounding rural areas. It was built in 1912 during the British rule of India and initially started as a small maternity ward with only four beds. By the 1960s, almost a quarter of births in Pune took place in KEMH. Decades later, KEMH built a Level III neonatal intensive care unit (NICU) which currently has 40 beds and 1000 admissions per year. In comparison, Johns Hopkins Bayview Medical Center (JHMBC) has a Level III NICU with 25 beds and 400 annual admissions. Both hospitals have comparable facilities and medical equipment; however, the limited bed space in KEMH is simply unable to keep up with the burgeoning population of patients in Pune.

**Objective:** The goal of this pilot study was to compare differences in newborn growth parameters and maternal health conditions between mother-NICU infant dyads born at KEMH and JHBMC.
**Methods:** We performed a descriptive, secondary data analysis of existing, routinely collected clinical data from 70 mother-NICU infant pairs at each site from Dec 2008 - early Jan 2009. Medical records were reviewed for available maternal health and pregnancy issues, and newborn factors including growth parameters. Demographic factors included the mother’s level of education, occupation, marital status, and caste/race. Newborn factors included gestational age, birth weight, Apgar and maturity scores, and the growth percentile of the infants. Maternal risk factors included the number and frequency of antenatal care visits, maternal age, history of abortions, still births, low birth weight babies, and neonatal deaths, the presence of toxemia/preeclampsia during the pregnancy or delivery, substance abuse, and mode of delivery. At KEMH, a limited economic data set was also abstracted. We also compared the standard neonatal growth curves used in each population. KEMH neonates were plotted on the Singh (3) et al newborn growth chart, and JHBMC neonates on the Fenton (4) growth chart. This study was approved by the Johns Hopkins Medicine IRB.

**Results:**

Compared with the JHBMC mothers, KEMH mothers were more likely to be married (100% vs. 25%), aged 21-30 yrs (82% vs. 50%), and have preeclampsia (29% vs. 15%). There was no difference in the C-section rate (49% vs. 49%). The KEMH mothers were all Asian, 98% received prenatal care, and none had any substance abuse issues. The JHBMC mothers were a racial mix, had a 19% teen pregnancy rate, 30% were age >30yrs, and 23% had substance abuse during pregnancy.
The 70 KEMH neonates had a mean gestational age (GA) of 34 wks (range 28-39 wks) vs. 35 wks (range 24-41 wks) at JHBMC, had a lower mean birth weight (1.9 kg vs. 2.4 kg), and were more likely to be male (76% vs. 51%). The KEMH cohort was all singletons vs. 23% twins at JHBMC, but preterm birth occurred at 63% in both groups. Comparing birth size, KEMH infants were more likely to be SGA [20/67 (30%) vs. 9/69 (13%)], and less likely to be AGA [42/67 (63%) vs. 57/69 (83%)]; only 5 KEMH and 3 JHBMC infants were LGA (7% vs. 4%).
We superimposed the 10th, 50th and 90th percentile parameters of the Singh and Fenton newborn growth curves for the GA range 31-44 weeks. The Singh 90th percentile correlates with the Fenton 50th percentile, and the Singh 50th percentile correlates with the Fenton 10th percentile through 41 weeks. Plots of the KEMH cohort revealed an Excel linear best-fit trend line at the 25-50th percentile for the Singh curves, but only the 10th percentile on the Fenton chart. Likewise, the JHBMC cohort best-fit line was at the 25-50th percentile curve on the Fenton chart, but shifted to ~75th percentile on the Singh chart. (See Figures after Discussion)

**Discussion:** The 70 KEMH mother-infant dyads were sampled from a homogeneous, very poor Indian population in an urban setting. The 70 JHBMC mother-infant pairs were sampled from urban Baltimore, and some differences in the maternal and newborn data reflect a much more heterogeneous US
A greater percentage of KEMH infants were born SGA and a lesser percentage born AGA in comparison to JHBMC infants. The higher incidence of KEMH male births may have to do with the increasing number of abortions for female pregnancies. The disparities observed between these 2 mother-infant cohorts are likely multifactorial, involving at least economic, cultural, and possibly genetic differences.

Figure 3. Fenton & Singh newborn growth curves superimposed.
Figure 4. Plot of the KEMH infant cohort on the superimposed growth curves

Figure 5. Plot of the JHBMC infant cohort on the superimposed growth curves,
The last part of my research project was an economic comparison of medical costs between the two countries based on the limited economic data (n=30) of KEMH patients that was abstracted. For the KEMH patients, the costs of a full term and preterm birth were 10% and 18% respectively of their average annual salary. In comparison, full term and preterm birth costs for were 5% and 75% for the average American annual salary in 2005. It is incredible that costs of preterm births in India are so minimal in comparison to USA. In the future, I hope to expand on this economic research comparison.

Figure 6: Economic Comparison of USA (5) vs. KEMH full term and preterm birth costs

<table>
<thead>
<tr>
<th>Year 2005/2008</th>
<th>Average annual salary ($)</th>
<th>Cost of FT birth ($)</th>
<th>FT % of income</th>
<th>Cost of PT birth ($)</th>
<th>PT % of income</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>55,238</td>
<td>2,766</td>
<td>5%</td>
<td>41,456</td>
<td>75%</td>
</tr>
<tr>
<td>KEMH</td>
<td>2,736</td>
<td>285</td>
<td>10%</td>
<td>496</td>
<td>18%</td>
</tr>
</tbody>
</table>

Final Thoughts: I remember the first day I walked inside the KEMH NICU – dozens upon dozens of extended families were cramped into one small waiting room. Some sat barefoot, others slept on the ground, while others crouched on the floors. In the pediatric ward I worked at in the afternoons, I saw children with incredible diseases – Cobra bites, meningitis, pneumonia, rubella, typhoid, leukemia, among many others. What was most memorable from my trip was speaking with these families and learning about their life’s struggles. I spoke
Marathi with all the families, and despite their village dialect and my Americanized-pronunciations, we understood everything about each other. I could see their fear in the way they lowered their eyes or never smiled in the photographs I took, but also their hope in the way they gazed at the physicians or held my hand. Many of the families thanked me for being the only foreigner they would ever have the chance of meeting in their lifetime. My favorite was a young boy who asked me, “Do you see a moon from your home?” and when I replied yes, he said we would tell it messages to deliver to each other. Another woman told me I would always have a home in her village if I ever needed to escape my stressful life. There were two other mothers I met in the nursery, one twenty and the other twenty-two years old, who spoke with me for over two hours one day. Both had seen a camera for the first time, and when I took photos of their babies, they became very emotional at the mere thought that an instrument could capture reality so beautifully. All it took was a photograph of their baby to make their day. Another unforgettable experience was working in the operation theater where I shadowed KEMH’s pediatric surgeon and assisted in numerous pediatric surgeries. With the sheer number of patients that need operations, young first or second-year surgery residents handled tedious and lengthy operations. You would find it hard to believe that having the lights go off several times in the middle of a surgery was a common ordeal. One surgeon turned to me in the pitch-black and said, “Neha, simply hold your place with your fingers and hope the lights turn on soon”.
My experience at KEMH was inexpressibly eye opening and life changing. The doctors I worked with were the most honorable and selfless individuals I have ever encountered. An average day for a physician was 9am-11pm, seven days a week, and a medical fellow who worked 60-70 hours per week was paid only thirty dollars a month. Though they receive low compensation for their work, it is their desire to help others and better humanity that fuels their persistence. At KEMH, I witnessed the spirit of a physician in the truest sense, and for their hard work and devotion to human health, the respect and admiration these physicians received was unparalleled. Perhaps what struck me most was the humbleness and sense of satisfaction the patients and physicians had with their way of life, despite its limitations.

I conclude with Robert Frost’s poem called A Road Less Traveled:

“And I took the one less traveled by, and that has made all the difference.”

References:


