

# A Statistical Nightmare: The Denominator Reigns Supreme.

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I remember learning about the denominator in elementary school. It was that divisive dividend that spoiled a perfectly good whole number and fractionated what had been previously a perfectly logical field of mathematics. I recovered quickly from my disappointment and came to respect the power of these numbers. In Neonatology, the denominator reigns supreme. How does this number that sits below the numerator become so powerful?

Let's start with something easy. We have two delivery services at

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two hospitals. One delivery service has a cesarean section rate of 20% one month; the other, 40%. Immediately, it is apparent that one hospital has a rate that is twice that of the other hospital. This rate is much higher than guidance on the appropriate cesarean section utilization rate. What could account for the difference between the two hospitals? Before we go down the road of looking at prematurity rate, the proportion of high-risk referrals, and utilization of perinatology consultation, we need to know the denominator. In this case, both hospitals only delivery five patients per month. The difference between the two hospitals is only one cesarean section per month (i.e., one versus two).

Most situations are more challenging. Suppose we take two fictitious Neonatal Intensive Care Units. Both are level 3b or greater NICU's. Both have a delivery service of 500 births per month, similar demographics, and a commitment to a quality process. In this vignette, each of NICU's admits 100 babies each month. In the first unit, 90% of the babies who are started on antibiotics receive 48 hours of therapy; 10% receive a full seven days. In the second unit, 10% of the babies who are started on antibiotics receive 48 hours of therapy; 90% receive a full seven days. In the first unit, the average duration of antibiotic use following admission is only 2.5 days; in the second unit, the average duration is 6.5 days. None of the babies in either unit have a positive blood culture. Which unit practices better antibiotic stewardship? Most will immediately choose the first unit. The numbers are just too compelling, but there is more information that one needs to know before answering the question.

What is the denominator? At first blush, it appears that the number is 500, but this is not the number of patients that are admitted to each NICU. 500 is the number of babies delivered each month at each hospital. The admissions to the NICU are 100 per

month. Is this the elusive denominator? No, we are not interested in the number of babies who were admitted to the NICU. Where is the denominator hiding? The denominator is the number of babies who are started on antibiotics when they are admitted to the NICU. In the first NICU, all 100 babies who are admitted to the NICU receive antibiotics. In the second NICU, of the 100 admitted, only 10 receive antibiotics.

What does this data mean in real terms? In the first NICU, ten babies receive a seven-day course of antibiotics, and 90 receive a 48-hour course. In the second NICU, nine babies receive a seven-day course, and one baby receives a 48-hour course. Since there are no positive cultures in any of the patients, it would be hard to argue that the second group is missing sepsis. Even though they treat 90% of their babies receiving antibiotics for a complete course of seven days, they treat fewer patients with a complete course of antibiotics. Most quality metrics would rank the second unit dead last in antibiotic stewardship. However, if one looks at antibiotic usage alone, the first unit uses 507 doses of antibiotics per month versus 57 for the second unit. This difference of 450 doses per month means 15 doses per day. The amount of additional nursing and pharmacy time required to fill these doses is staggering, not to mention the cost. By failing to recognize the denominator, it is easy to come to the wrong conclusion.

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Moreover, we are not considering the babies that never make it to the NICU. If the second unit evaluated 20 or 30 patients in the well-baby area who were never admitted to the NICU, they would not "receive credit" for avoiding antibiotic use. To improve their "statistics", the second NICU would need to start treating all of their babies with antibiotics on admission to the NICU. Perhaps admitting those babies who would never have otherwise been admitted for 48 hours of antibiotics will make the second unit competitive with the first unit. Using this "logical" approach, the second unit would look better on the quality care matrix. This quality measure may lead to good statistics, but it is bad medicine.

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# Respiratory Syncytial Virus:

## How you can advocate for babies this RSV season

Track national data and trends at the CDC's website  
[www.cdc.gov/rsv](http://www.cdc.gov/rsv)



Identify babies at greatest risk



including those with CLD, BPD, CF, and heart conditions

Teach families how to protect



their babies from respiratory infections

Advocate for insurance coverage for palivizumab prophylaxis so more babies can be protected \*



Use your best clinical judgement



when prescribing RSV prophylaxis

Tell insurers what families need



and provide the supporting evidence



\*See the NPA's evidence-based guidelines at [www.nationalperinatal.org/rsv](http://www.nationalperinatal.org/rsv)