To the NICU: Exploring Admission Data

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PSY 627

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**Introduction**

According to the March of Dimes, nearly thirteen million babies are born prematurely each year (2012). Prematurity is not only the leading cause of newborn death in the United States but also the cause of many “long term health problems including cerebral palsy, intellectual disabilities, chronic lung disease, blindness and hearing loss” (March of Dimes [MOD], 2012). While prevention efforts are working, premature birth cannot be eliminated, thus mandating the need for both medical and developmental care in Neonatal Intensive Care Units (NICU) across the globe.

Both the medical and developmental needs of the preterm infant are overwhelming influenced by gestational age. Gestational age, or “the time elapsed between the first day of the last normal menstrual period and the day of delivery” (American Academy of Pediatrics [AAP], 2004, p. 1362), is a significant indicator of viability as well as short and long term outcomes. Thus, identifying gestational age allows medical personal to pinpoint the leading diagnoses of the preterm infant as well as prepare for and implement optimal care.

Gestational age is often a principal indicator of chronological age at discharge and is another vital statistic in the NICU setting. . Chronological or postnatal age “is the time elapsed after birth” (AAP, 2004, p. 1362). Exploring the relationship between gestational age at birth and chronological age at discharge provides valuable insight into the average length of stay (LOS) for NICU patients, primarily preterm infants who typically experience prolonged hospitalization. Further analysis of this data may also facilitate change in care in an effort to reduce LOS and subsequent financial and emotional burden.

Other imperative considerations when evaluating the NICU population are admitting diagnosis, prematurity (less than 37 weeks gestation), gender, type of delivery, and birth weight. These factors, though less influential than gestational age, also impact length of stay and patient outcomes.

The purpose of this project, then, is to explore and evaluate admission data for the Neonatal Intensive Care Unit at Mercy-Springfield. Specifically, to analyze gestational age, length of stay, and birth weight in relation to one another and other variables (as mentioned above).

**Methods**

The primary research method employed for this project is collection and review of census data from August, September, and October 2012. Census data including gestational age, admitting diagnosis, gender, type of delivery, birth weight and length of stay was collected from the census log of the Neonatal Intensive Care Unit at Mercy-Springfield. 121 admissions were documented from August 1 – October 31; however, 14 samples were eliminated from the study for incomplete data: a discharge date was not provided for 12 samples and no gestational age was given for 2. So, the sample size (N) for this project will be 107. Only necessary data was retrieved and all samples remained anonymous.

The obtained data was first entered into a Microsoft Excel spreadsheet and then analyzed in SPSS using a variety of statistical methods. In addition to determining the mean of both GA and LOS , crosstablutaion, correlation, ANOVA and Chi-Square analyses will be performed so as to retain or reject the stated hypotheses:

1. Gestational age (GA) and birth weight will be negatively correlated

with length of stay (LOS). That is, earlier/decreased GA and lower birth weights will correlate with a longer/increased LOS.

 2. Birth weight will correlate positively with gestational age.

3. Premature infants will experience the greatest/longest length of stay.

4. A higher proportion of premature infants will be included in the CS category.

5. Males will experience a greater LOS than females.

**Results**

This project analyzed the admission data of 107 infants admitted to the Neonatal Intensive Care Unit for the months of August, September, and October 2012.

**Basic Results**

Sample size: N = 107

Gender: Male = 70 (65.4%) Female = 37 (34.6%)

Delivery Type: CS = 42 (39.3%) SVD = 65 (60.7%)

Premature: Yes = 52 (48.6%) Males: 34 (65.4%) Females: 18 (34.6%)

 No = 55 (51.4%) Males: 36 (65.5%) Females: 19 (34.5%)

Average GA: Total: 36.1 weeks Term: 38.8 weeks Preterm: 33.6 weeks

Average LOS: Total: 17.3 days Term: 9.2 days Preterm: 25.9 days

**Statistical Analyses**

Further statistical analysis revealed multiple significant correlations in regard to the hypotheses listed above. Here we will review the statistical findings for each hypothesis in the order they were provided.

1. ***Gestational age (GA) and birth weight will be negatively correlated***

***with length of stay (LOS). That is, earlier/decreased GA and lower birth weights will correlate with a longer/increased LOS.***

|  |
| --- |
| **Correlations** |
|  | LOSdays | GA | BirthWeightgm |
| LOSdays | Pearson Correlation | 1 | -.764\*\* | -.614\*\* |
| Sig. (2-tailed) |  | .000 | .000 |
| N | 107 | 107 | 107 |
| GA | Pearson Correlation | -.764\*\* | 1 | .828\*\* |
| Sig. (2-tailed) | .000 |  | .000 |
| N | 107 | 107 | 107 |
| BirthWeightgm | Pearson Correlation | -.614\*\* | .828\*\* | 1 |
| Sig. (2-tailed) | .000 | .000 |  |
| N | 107 | 107 | 107 |
|  |

This correlation matrix indicates the correlations between GA and LOS (-.764) and birth weight and LOS (-.614) are both negative and statistically significant (at 0.01), thus the hypothesis is confirmed and the null hypothesis rejected.

|  |
| --- |
| **Model Summary** |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics |
| R Square Change | F Change | df1 | df2 | Sig. F Change |
| 1 | .764a | .583 | .579 | 11.014 | .583 | 147.031 | 1 | 105 | .000 |
| a. Predictors: (Constant), GA |

 The above linear regression analysis also supports the hypothesis that GA is a significant predictor of LOS, specifically at the 0.01 level.

1. ***Birth weight will correlate positively with gestational age.***



Both the correlation table and scatterplot provided above also indicate that birth weight is in fact highly positively correlated with GA with a correlation of .828. As a result the stated hypothesis is retained and the null hypothesis rejected.

1. ***Premature infants will experience the greatest/longest length of stay.***



 While the sample size for both premature and term infants is similar, 55 and 52 respectively, the mean LOS for preterm infants is 25.9 days while the average LOS for term infants is 9.2. This ANOVA analysis indicates that the means are appreciably different and significant at the .01 level, which supports the hypothesis that premature infants will experience a greater LOS.

1. ***A higher proportion of preterm infants (in comparison to term infants)***

***will be included in the CS category.***

|  |
| --- |
| **Deliverytype \* Premature Crosstabulation** |
| Count |
|  | Premature | Total |
| No | Yes |
| Deliverytype | CS | 19 | 23 | 42 |
| SVD | 36 | 29 | 65 |
| Total | 55 | 52 | 107 |

|  |
| --- |
| **Deliverytype \* Premature Crosstabulation** |
|  | Premature | Total |
| No | Yes |
| Deliverytype | CS | Count | 19 | 23 | 42 |
| % within Deliverytype | 45.2% | 54.8% | 100.0% |
| SVD | Count | 36 | 29 | 65 |
| % within Deliverytype | 55.4% | 44.6% | 100.0% |
| Total | Count | 55 | 52 | 107 |
| % within Deliverytype | 51.4% | 48.6% | 100.0% |

|  |
| --- |
| **Chi-Square Tests** |
|  | Value | df | Asymp. Sig. (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
| Pearson Chi-Square | 1.052a | 1 | .305 |  |  |
| Continuity Correctionb | .685 | 1 | .408 |  |  |
| Likelihood Ratio | 1.053 | 1 | .305 |  |  |
| Fisher's Exact Test |  |  |  | .328 | .204 |
| N of Valid Cases | 107 |  |  |  |  |

 According to the Chi-Square Test 54.8% of preterm infants were delivered via cesarean section versus 45.2% delivered naturally (SVD). Though there is an increased percentage of CS deliveries among preterm infants it is not statically significant, so both the stated hypothesis and null hypothesis that delivery type and prematurity are independent are retained.

 Further evaluation of the Chi-Square analysis also reveals that more premature infants are delivered via SVD than CS, though this finding like the previous, is not statically significant.

1. ***Males will experience a greater LOS than females.***

Although this scatterplot below shows that LOS is greater for male infants, the t-test analysis performed on this data suggests that while the mean of males (70) greatly exceeds that of females (37), the LOS is not significantly different between the two. Rather, the average LOS is 17.6 days for males and 16.8 days for females with a 2-tailed significance of .820. Based on these findings both the stated and null hypothesis are retained.

 

**Discussion**

 Exploration, analysis, and review of admission data provides much insight into the admission and population statistics of the Neonatal Intensive Care Unit at Mercy-Springfield. To begin, it was determined that both gestational age and birth weight are statistically significant in predicting length of stay. While the data provided shows that premature infants account for only 48.6 percent of NICU admission, the data also indicates that premature infants experience a significantly longer hospitalization. One of the most pressing questions NICU parents have is “When will my baby go home?” We typically tell parents to expect discharge around/near the due date of the infant. Though we cannot predict the discharge date of each infant, term or preterm, the above findings suggest that our typical reply is at least somewhat accurate as the earlier the gestational age the longer until the infant reaches his/her due date, thus the lengthier LOS.

The findings also suggest that birth weight is a significant indicator of LOS. Again, the earlier gestation of the infant, the lower birth weight so the same holds true for birth weight as gestational age: it will take a preterm infant longer to reach a healthy weight, thus a longer LOS.

 The second finding of significance, or lack thereof, is in regard delivery route. All infants are delivered by one of two methods: spontaneous vaginal delivery (SVD) or cesarean section (CS). The original hypothesis predicted that CS deliveries were more common than SVD among preterm infants. While the findings reveal there is an increased percentage of CS deliveries among preterm infants, it is not statically significant. Rather there is only a 10% difference in the type of delivery, with approximately 55% of preterm infants delivered via CS and 45% delivered naturally. Initially these statistics seemed skewed; however, as a NICU nurse I attend many more CS deliveries than SVD deliveries as unit policy requires NICU presence at all high risk deliveries, cesarean sections included. Though these findings only narrowly support the stated hypothesis, they do provide valuable insight into the time and labor needed for attendance of CS deliveries.

 Finally, statistically analysis indicates that despite the significantly higher rate of male admissions, male and female infants share a similar LOS, 17.6 and 16.8 days, respectively. This particular finding was unsuspected as we in the NICU kindly refer to a boy babies as “wimpy, white boys” who usually seem to stick around longer then their female neighbors. This description, of course, also reflects ethnicity, which could not be studied here as it is not recorded in the NICU admission log. Though this result does not prove significant in exploring NICU admissions and does not support the stated hypothesis, it does suggest that while these boys may be wimpy, the aren’t pokey (at least in terms of discharge)!

 Overall, the analyses performed shed both useful and thought-provoking light on the census and admission data from Mercy-Springfield’s NICU. While additional studies would need to be completed to validate and apply these findings in the clinical setting, the results presented here are helpful in understanding the relationship between and among gestational age, prematurity, gender, delivery method, birth weight, and length of stay – valuable data no matter what the scale when you are caring for these fragile beings.

**Admission Data**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Gender | Premature | Delivery type | LOS (days) | GA | Birth Weight (gm) | Admit Diagnosis |
| Male | Yes | SVD | 3 | 36.4 | 2670 | Temp instability |
| Female | No | SVD | 7 | 40.4 | 3795 | Chorio |
| Male | Yes | CS | 10 | 34.6 | 2590 | Premature |
| Female | Yes | CS | 34 | 33.5 | 1780 | Premature |
| Male | Yes | CS | 11 | 33.5 | 1880 | Premature |
| Male | Yes | CS | 3 | 35.1 | 2080 | Premature |
| Male | Yes | CS | 16 | 34.2 | 2110 | Premature |
| Male | Yes | CS | 17 | 34.2 | 1900 | Premature |
| Female | No | CS | 10 | 37 | 2370 | Poor feeding |
| Female | Yes | CS | 42 | 31.5 | 1010 | Premature |
| Male | Yes | SVD | 26 | 33.6 | 2230 | Resp distress |
| Male | No | SVD | 5 | 36.4 | 3175 | Resp distress |
| Male | No | SVD | 6 | 38.2 | 3282 | Imperforate anus |
| Male | Yes | SVD | 59 | 28.6 | 1570 | Premature |
| Female | No | SVD | 3 | 39.4 | 2520 | Resp distress |
| Female | Yes | SVD | 19 | 34 | 2310 | Premature |
| Male | No | CS | 7 | 37.6 | 2950 | Resp distress |
| Female | No | CS | 8 | 39.6 | 2790 | Hypoglycemia |
| Male | No | SVD | 20 | 39 | 3250 | R/O bowel obstruction |
| Male | Yes | SVD | 38 | 32 | 1890 | Premature |
| Male | Yes | SVD | 38 | 32 | 2100 | Premature |
| Female | No | CS | 2 | 39 | 3208 | Arrhythmia |
| Female | Yes | CS | 13 | 36 | 2610 | Resp distress |
| Male | No | SVD | 7 | 39.3 | 3725 | Dusky episode |
| Male | Yes | CS | 17 | 34.4 | 1950 | Premature |
| Male | Yes | CS | 17 | 34.4 | 2420 | Premature |
| Male | Yes | CS | 13 | 35.2 | 3620 | Hypoglycemia |
| Female | Yes | SVD | 22 | 35 | 1850 | Premature |
| Male | No | CS | 7 | 38.6 | 3430 | Spina bifida |
| Male | Yes | SVD | 13 | 34.5 | 2680 | Premature |
| Male | Yes | CS | 20 | 35.1 | 2390 | Premature |
| Male | No | SVD | 7 | 40.2 | 4670 | R/O sepsis |
| Female | No | SVD | 13 | 39.2 | 4330 | Chorio |
| Male | No | CS | 4 | 40.1 | 3970 | Chorio |
| Male | No | CS | 7 | 38.5 | 4070 | Resp distress |
| Female | No | SVD | 9 | 37.4 | 2680 | Resp distress |
| Male | Yes | CS | 15 | 34 | 2460 | Premature |
| Female | Yes | CS | 71 | 27.4 | 760 | Bowel obstruction |
| Male | Yes | CS | 51 | 30.2 | 1040 | Premature |
| Male | No | SVD | 8 | 38.5 | 3700 | Resp distress |
| Female | Yes | SVD | 14 | 34.5 | 2570 | Premature |
| Male | Yes | SVD | 9 | 36.3 | 3345 | Resp distress |
| Male | No | CS | 26 | 40 | 3060 | Withdrawal |
| Male | No | SVD | 5 | 38.1 | 3410 | R/O sepsis |
| Male | No | CS | 11 | 39.4 | 2730 | Withdrawal |
| Male | No | CS | 7 | 40.3 | 3450 | Resp distress |
| Male | Yes | CS | 23 | 33 | 2130 | Premature |
| Female | Yes | CS | 37 | 32.5 | 2430 | Premature |
| Male | Yes | CS | 74 | 29 | 790 | Premature |
| Female | No | SVD | 19 | 40 | 3230 | Withdrawal |
| Male | No | SVD | 9 | 38.4 | 3470 | Resp distress |
| Female | No | SVD | 7 | 37.4 | 3080 | Hypoglycemia |
| Female | No | CS | 37 | 37.2 | 2430 | Dusky episode |
| Male | No | SVD | 29 | 37.5 | 4830 | Hypoglycemia |
| Female | No | SVD | 7 | 37.6 | 2620 | Resp distress |
| Female | Yes | SVD | 16 | 34 | 1840 | Premature |
| Male | No | CS | 10 | 38 | 3355 | Resp distress |
| Male | No | SVD | 4 | 40.3 | 3515 | Chorio |
| Male | No | SVD | 7 | 38.1 | 3430 | Resp distress |
| Male | No | SVD | 6 | 38.3 | 3790 | Trisomy 21 |
| Female | Yes | SVD | 23 | 32.6 | 1851 | Premature |
| Female | Yes | SVD | 41 | 33 | 1429 | Premature |
| Male | No | SVD | 8 | 39.4 | 2645 | Resp distress |
| Male | Yes | SVD | 31 | 33 | 2615 | Premature |
| Male | Yes | SVD | 54 | 29 | 1100 | Premature |
| Male | Yes | CS | 39 | 31.2 | 1790 | Premature |
| Male | Yes | SVD | 13 | 34.4 | 2475 | Premature |
| Female | Yes | SVD | 5 | 34.2 | 1480 | Premature |
| Male | No | SVD | 2 | 38.2 | 3110 | Pierre Robin Syndrome |
| Female | Yes | CS | 39 | 28.5 | 1170 | Premature |
| Female | Yes | SVD | 19 | 33.4 | 2450 | Premature |
| Female | Yes | SVD | 10 | 35 | 2690 | Premature |
| Male | Yes | CS | 36 | 31.3 | 1760 | Premature |
| Male | Yes | SVD | 27 | 33.2 | 1800 | Premature |
| Male | Yes | SVD | 27 | 33.2 | 2220 | Premature |
| Male | No | SVD | 17 | 39.1 | 3350 | Chorio |
| Male | Yes | SVD | 74 | 34.2 | 3070 | Gastroschesis |
| Female | No | CS | 7 | 39.2 | 4290 | Resp distress |
| Male | No | CS | 6 | 38.4 | 3020 | Resp distress |
| Female | Yes | SVD | 16 | 34.1 | 2040 | Premature |
| Female | No | SVD | 3 | 39.3 | 3680 | Resp distress |
| Male | No | CS | 6 | 40 | 3510 | Resp distress |
| Female | No | SVD | 7 | 39 | 2880 | Meconium Aspiration |
| Male | Yes | SVD | 88 | 28 | 1110 | Premature |
| Female | No | SVD | 8 | 38.5 | 2500 | Resp distress |
| Male | Yes | SVD | 9 | 36.3 | 3130 | Resp distress |
| Female | No | CS | 9 | 39.5 | 3070 | Dusky episode |
| Male | No | SVD | 10 | 35.1 | 3460 | Resp distress |
| Male | No | SVD | 14 | 39 | 3800 | Arrhythmia |
| Male | No | SVD | 8 | 37.1 | 3022 | Resp distress |
| Male | No | SVD | 3 | 37.5 | 3070 | Resp distress |
| Female | No | SVD | 13 | 38.6 | 2680 | Resp distress |
| Male | No | SVD | 5 | 37.4 | 2920 | Resp distress |
| Female | No | CS | 9 | 37 | 4280 | Resp distress |
| Male | No | SVD | 0 | 37.4 | 3420 | Bladder Outlet Obstruction |
| Male | Yes | SVD | 9 | 36.1 | 2500 | Resp distress |
| Female | Yes | SVD | 8 | 36.4 | 2935 | Resp distress |
| Male | Yes | SVD | 4 | 36.3 | 2260 | Resp distress |
| Female | No | CS | 3 | 39.6 | 3860 | Chorio |
| Male | No | SVD | 13 | 39.3 | 3610 | Resp distress |
| Male | No | SVD | 17 | 40.3 | 4210 | R/O sepsis |
| Male | No | CS | 6 | 41 | 3220 | Imperforate anus |
| Female | Yes | SVD | 12 | 36.6 | 2810 | Resp distress |
| Male | Yes | CS | 16 | 36.6 | 2610 | Resp distress |
| Male | No | SVD | 4 | 38.4 | 3330 | Resp distress |
| Male | Yes | CS | 6 | 36 | 2620 | Resp distress |
| Male | No | SVD | 15 | 38 | 3630 | Gastroschesis |

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