

Data-Driven Birth Outcomes Objectives for a Community Health Improvement Plan

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Background

- Non-profit hospital systems are required to conduct a Community Health Needs Assessment (CHNA) and create a Community Health Improvement Plan (CHIP) (Stall, Anderson, Fadel, & Goodman, 2012).
- The CHNA is an assessment identifying the health needs of the people a particular hospital system serves. The hospitals are then required to prioritize identified needs and determine a plan of action to address them within their community, which is what constitutes the CHIP.
- Premier Health, one of the leading health systems in southwest Ohio, is affected by the CHNA and CHIP requirement. Premier was interested in data-driven evidence on factors associated with poor birth outcomes in four Montgomery County, Ohio zip codes identified as priority areas for public health intervention.
- Results of the analysis can be used to guide in the development of birth outcomes-oriented CHIP objectives for Premier and used to make decisions about health system fund allocation to improve birth outcomes.

Methods

- Study participants included live births and their mothers in four Montgomery County, Ohio zip codes: 45415 (N=267), 45416 (N=158), 45417 (N=1,104), and 45426 (N=571). Data were obtained from Public Health – Dayton & Montgomery County's live birth datasets from 2013, 2014, and 2015. Using de-identified data made the study exempt from review by the Wright State Institutional Review Board.
- A cross-sectional study was conducted and data were analyzed using SPSS. Frequency tables were created for categorical variables (n, %) and descriptive statistics were generated for continuous variables (mean, standard deviation [SD]). Subjects with missing data for any analysis variable were excluded from the analysis.
- Multiple linear regression was used to test for associations between the predictor variables and the outcome of interest, **birth weight**. Predictor variables included: maternal age, race, education level, marital status, breastfeeding status, Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) use, Apgar score at five minutes, average number of cigarettes smoked during pregnancy, attending physician at birth, payment method for birth, and month prenatal care began. Separate models were fit for each zip code.
- Multiple linear regression results were interpreted using the coefficient (β) as a measure of the effect size and the p-value to determine statistical significance. For categorical predictor variables, a β of greater than zero indicated the average birth weight was greater in that particular category than in the reference category (ref). For continuous predictor variables, a β of greater than zero meant there was a positive association between predictor and outcome.
- All tests were two-sided and conducted at the $\alpha = 0.05$ level of significance.

Results

Characteristics of the Study Sample, by Zip Code

- The average age range of mothers in the four zip codes was 25 to 27 years old.
- In all zip codes except 45415, over half of mothers had only attained a high school diploma/GED or less.
- The predominant race category in all four zip codes was non-White.
- Over half of all mothers in each zip code were breastfeeding at the time of discharge.
- Over half of mothers in each zip code had begun prenatal care in the third month of pregnancy or earlier.

Results (continued)

Characteristics continued...

- A large percentage of mothers participated in WIC in all four zip codes.
- The primary method of payment for birth in each zip code was Medicaid.
- Most mothers in each zip code had a Doctor of Medicine (MD) attending to the birth of their child.
- The average number of cigarettes smoked by mothers during pregnancy ranged from one to two cigarettes in each zip code.
- The average Apgar score at five minutes across zip code ranged from 8.59 to 8.75.

Table 1

Comparison of Regression Coefficients by Zip Code

Independent variable	45415 (N=267)	45416 (N=158)	45417 (N=1,104)	45426 (N=571)
Intercept	1639.08	694.38	2477.77	1780.77
Maternal age	-6.40	8.90	-0.423	-11.35
Maternal education				
< High School Degree	183.28	-37.57	0.61	-112.88
High School Diploma or GED	-17.12	159.64	-61.21	-7.30
Some College or More	(ref)	(ref)	(ref)	(ref)
Maternal race				
White	283.68	228.36	197.81	292.44
Non-White	(ref)	(ref)	(ref)	(ref)
Marital status				
Married	41.36	223.63	93.65	131.92
Not Married	(ref)	(ref)	(ref)	(ref)
Breastfeeding at time of discharge				
Yes	(ref)	(ref)	(ref)	(ref)
No	-271.04	-74.37	9.83	-51.49
Month prenatal care began				
1 st – 2 nd month	-81.19	286.18	4.79	-116.05
3 rd month	-32.26	275.48	-79.80	-187.02
4 th month	-40.78	11.67	1.82	-203.18
5 th month + / none	(ref)	(ref)	(ref)	(ref)
WIC participation				
Yes	(ref)	(ref)	(ref)	(ref)
No	-21.45	-99.09	-82.13	-60.83
Payment method for birth				
Medicaid	-43.36	-117.11	-58.84	-24.36
Other	(ref)	(ref)	(ref)	(ref)
Type of doctor attending to birth				
MD	-23.45	-411.73	-91.92	-166.59
DO	144.59	-314.98	-142.18	-181.57
Other	(ref)	(ref)	(ref)	(ref)
Mean # cigarettes smoked during pregnancy	-19.08	2.61	-14.09	-0.55
Apgar at five minutes	199.27	270.37	96.64	222.86

*Bold coefficients were statistically significant ($p < 0.05$)

Note: GED = General Education Development; WIC = Special Supplemental Nutrition Program for Women, Infants, and Children; MD = Doctor of Medicine; DO = Doctor of Osteopathic Medicine; (ref) = reference category

Results (continued)

Key Findings (see Table 1)

- In all four zip codes, children of White mothers had greater mean birth weight compared to children of non-White mothers; this difference was statistically significant in all zip codes except 45416.
- A one-unit difference in Apgar scores at five minutes was associated with an average birth weight difference of 197.29g across the four zip codes, with lower birth weight associated with lower Apgar scores and more immediate risk. This association was statistically significant in all zip codes.
- Beginning prenatal care earlier in pregnancy was significantly associated with greater birth weight in 45416. In other zip codes, the association was not statistically significant and was in the opposite direction.
- In zip codes 45415, 45416, and 45417, children of mothers who were not breastfeeding at time of discharge had lower mean birth weights compared to children of mothers who were breastfeeding. This association was statistically significant in zip code 45415.
- More cigarettes smoked during pregnancy was associated with lower mean birth weights in zip codes 45415, 45417, and 45426. This association was statistically significant in zip code 45417.
- Maternal age, education level, marital status, WIC participation, type of doctor attending to birth and payment method for birth were not significantly associated with birth weight.

Discussion & Conclusion

- Associations found between maternal age, race, marital status, breastfeeding status at time of discharge, month prenatal care began, WIC participation, Apgar scores, and the outcome of interest - birth weight, were consistent with the literature review findings.
- The lack of association revealed between maternal level of education and birth weight was not consistent with the findings in the literature review; the literature review found that mothers with lower levels of education were more likely to experience adverse birth outcomes, including low birth weight. This study revealed no association.
- Poor birth outcomes are a significant public health issue, especially within Montgomery County, Ohio. The study results revealed that certain variables (maternal race, smoking, Apgar scores, breastfeeding, and month prenatal care began) were significantly associated with differences in mean birth weight. All of these associations were statistically significant in at least one zip code.
- After the study was conducted, it was noted that breastfeeding and Apgar scores could not be causally related to nor directly influence birth weight because they occur after the birth of the child. Although related to birth outcomes measured after birth, breastfeeding and Apgar scores cannot be targeted by hospitals for improving birth weight. Including them in the linear regression model used for the analysis may have attenuated the results for the other predictors. The analysis could be rerun, excluding breastfeeding and Apgar scores, to assess this possibility. Alternatively, further study could examine birth weight and preterm birth as correlated with/predictive of breastfeeding and Apgar scores.
- Premier Health can use the significant associations revealed in this study to guide the development of birth outcomes-oriented, data-driven objectives for their CHIP, and to make funding allocation decisions to improve birth outcomes in each of these four Montgomery County zip codes.

References

Stall, E., Anderson, C., Fadel, M., & Goodman, D. H. (2012). Community Health Needs Assessment: 5 Phases to Compliance. *Becker's Hospital Review*. Retrieved from <http://www.beckershospitalreview.com/legal-regulatory-issues/community-health-needs-assessment-5-phases-to-compliance.html>