EXAMINING NEONATAL OPIOID WITHDRAWAL SYNDROME THROUGH SOCIAL DETERMINANTS OF HEALTH, RACE, AND ETHNICITY

by

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ABSTRACT

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Neonatal opioid withdrawal syndrome (NOWS) is a serious health issue in which an infant withdraws from intrauterine opioid exposure. Due to the opioid epidemic, the prevalence of NOWS increased in the United States. To determine if there are disparities in the NOWS population, social determinants of health (SDOH), race, and ethnicity were examined, as they have not been studied in NOWS previously. The Child Opportunity Index (COI), assessed SDOH factors on a community level.

Data from the 2018-2019 Texas Inpatient Discharge Data set identified 1,262 infants diagnosed with NOWS and affected by Maternal Opioid Use (MO). Infants affected by MO were included in the study as there were no clear differences in potential SDOH between these infants, since both had intrauterine opioid exposure. A majority of the infants were white (75%), non-Hispanic (60%), lived in urban areas (78%), and had Medicaid (80%). Most infants had low (28%) or very low (22%) COI levels. However,

the COI was statistically significantly lower for infants who were Hispanic, lived in rural areas, or had non-private insurance ($p<0.001$); but there were no differences based upon race. Future research should explore opportunities to address COI disparities among infants with NOWS and infants affected by MO.

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CHAPTER 1

INTRODUCTION

1.1 Research Significance

Neonatal opioid withdrawal syndrome (NOWS) affects approximately six in 1,000 newborns in the United States (U.S.) (CDC, 2021). This condition occurs when an infant withdraws from in utero opioid exposure after birth. Due to the routine practice of prescribing opioids for individuals with chronic health problems, the opioid epidemic started, and now as synthetic opioids become more common, the epidemic continues to grow in prevalence in the U.S. (Weller et al., 2020). Furthermore, NOWS has become a more significant health concern as the number of pregnant women who use opioids has also increased as a result of the epidemic (Weller et al., 2020). The effects of NOWS on infants differ in severity for each case. Acute effects of NOWS in infants cause symptoms of irritability, difficulty sleeping, tremors, hyperthermia, increased muscle tone, and skin excoriation/picking (Weller et al., 2020). Potential long-term implications for children with a history of NOWS include lower scores in motor and cognitive performance in comparison to children without a history of NOWS (Harder & Murphy, 2019). There is also an increased likelihood for these children to experience developmental delays and/or speech and language disorders (Harder & Murphy, 2019). In addition, studies indicated there are disparities in NOWS based on individual demographic characteristics (Vesoulis et al., 2020). Individual demographic characteristics describe individuals and include factors like gender or race.

To determine the degree by which NOWS is influenced by social and environmental factors, social determinants of health (SDOH) can be examined. Social determinants of health are defined as the "conditions in places where people live, learn, work and play" (CDC, 2021). These factors specifically include the community and neighborhood environment, socioeconomic status, level of education, and access to healthcare (CDC, 2021). Depending on the type of communities people live in and the resources they have available, SDOH can positively or negatively influence the type and quality of healthcare that they receive.

One way that SDOH can be explored is through the Child Opportunity Index (COI). The COI is a set of measures that uses zip codes to assess the quality of resources in communities nationwide in regard to the health of children who live in these communities (Institute for Child Youth and Family Policy, n.d.). In addition to evaluating an overall COI level, there are three subscales that examine communities based on opportunities for education, social and economic factors, and health and environment. Data is collected at the census track level and available for analysis at the level of zip codes or census tracks. Data are converted into scores so that each census track or zip code is ranked by percentile and categorized into quintiles; very low, low, moderate, high, and very high opportunity level (Institute for Child, Youth, and Family Policy, 2019). The scores and the levels determine the health opportunities children have access to in their neighborhoods and can be used to highlight potential health risks based on community factors (Institute for Child Youth and Family Policy, 2019).

Further expanding the outlook of SDOH to include assessment of disparities, including those based on sociodemographic characteristics can help determine if there are

differences in opportunity based on demographic characteristics as well. While disparities impact care and outcomes, no research to date examines disparities in SDOH for infants with NOWS. It is important to describe disparities when it comes to NOWS, SDOH, and sociodemographic characteristics because these problems must be identified before steps can be taken to address disparities and improve health outcomes.

1.2 Research Purpose

By understanding and addressing the social and environmental factors that affect health outcomes, which have been demonstrated to increase opioid misuse, steps can be taken to bring an end to the opioid epidemic and reduce NOWS. This research will describe the SDOH in infants with NOWS, using the COI, and determine the association of SDOH with demographic characteristics, including race and ethnicity, on a community level.

CHAPTER 2

LITERATURE REVIEW

A literature review was performed to find research that explored disparities in NOWS infants based on SDOH, race, and ethnicity. I found three studies that highlighted these aspects. The first study discussed NOWS in terms of the community type; the second study discussed NOWS based on sociodemographic factors; and the third study discussed race and NOWS. None of these studies, however, examined SDOH for infants with NOWS. A summary of the literature is provided below.

A recent study analyzed the effect of long-term unemployment and mental health clinician supply on rates of NOWS, and how they differ based on the community type (Patrick et al., 2019). Data was collected from all counties in 9 different states between 2009-2015. The results showed that during this period there was an average of 7.1 out of 1000 infants born with NOWS in the hospital, and the areas with mental health clinician shortages had a higher rate of NOWS compared to those without the shortage (Patrick et al., 2019). Other results showed that the 10-year unemployment rate positively correlated with higher rates of NOWS, all of which mainly occurred in rural counties (Patrick et al., 2019).

A retrospective cohort study involving 129 infants with NOWS utilized clinical and sociodemographic data to examine how these sociodemographic factors impacted hospital stays for infants with NOWS (Vesoulis et al., 2020). The results showed that African-American infants with NOWS had longer hospital stays and that African

American families had a higher degree of poverty compared to white families (Vesoulis et al., 2020). The study results also concluded that the excess length of stay for infants with NOWS, may be attributed to poverty, as the increased length of stay had a positive correlation with the degree of deprivation and poverty in the mother's community Vesoulis et al., 2020). In conclusion, African-American infants with NOWS had longer hospital stays due to

In order to determine if there are racial disparities in medical treatment for infants with NOWS, a seven-year retrospective cohort study examined NOWS severity using the modified Finnegan neonatal abstinence scoring system (FNASS) and assessed for an association with treatment for NOWS (Akers et al., 2021). The population of this study included 42 Non- Hispanic Black mothers and newborns and 42 Non-Hispanic White mothers and newborns (Akers et al., 2021). The information gathered about the infants also included gender, weight, toxicology reports, length of stay, and pharmacotherapy, (Akers et al., 2021). Even though there were no considerable differences in the severity of NOWS based on the FNASS and length of stay between the black and white infants, only 36% of black infants received pharmacologic or medication management to treat their withdrawal compared to the 57% of their white counterparts (Akers et al., 2021). Overall, this study highlights that non-Hispanic Black infants with NOWS receive less medication for their treatment in comparison to non-Hispanic White infants.

Each of these studies confirm that there is a link between sociodemographic factors and NOWS specifically in the contexts of race, unemployment, family income and access to care. However, based on the results, it is apparent that each of these studies have limitations such as the lack of racial/ethnic diversity in the population. The results

of the studies were also limited in the number of community characteristics and could be extended to include factors given the data and methods used. A greater view of community factors would provide a more complete view of the medical and social environments and potential needs of babies born with NOWS. I conducted this study in order to further determine the relationship between NOWS, SDOH, and sociodemographic characteristics at the community level. I hypothesize, based on my literature review, that there will be statistically significant differences based on SDOH, race, and ethnicity in NOWS infants.

CHAPTER 3

METHODOLOGY

3.1 Design

The sample for this study includes infants born with NOWS and Maternal Opioid Use (MO) born in Texas in 2018 and 2019. For the purposes of this study, infants born affected by MO were included in the sample because there was not a clear difference in categorization between this set of infants affected by MO and infants with NOWS, as both had intrauterine exposure to opioids which could affect future health outcomes. Secondary data analysis is the use of preexisting data to describe a population and make comparisons between groups within the population. Secondary data analysis is appropriate for this research because it allows for the examination of SDOH at the community level as well as their relationship to infants with NOWS and MO.

3.2 Data Source

Two different sets of data were used in this research: one with patient-level data that allowed for identification of infants with NOWS, and the other with community-level SDOH information that could be linked to patient-level data. To identify infants with NOWS and MO, I used the 2018-2019 Texas Hospital Inpatient Data Discharge Public Use Data Files (HIDD PUFD), which contains discharged inpatient claims data from nearly 700 hospitals in Texas, publicly available from the Texas Department of State Health Services. The Texas Inpatient Data Discharge PUFD contains patient-level data on discharged patients International Classification of Diseases, Tenth Revision,

Clinical Modification (ICD-10-CM) diagnosis and procedure codes, hospital charges and demographic data including age, race, gender, insurance status, and zip code. This patient-level data was augmented with community-level data on SDOH. The second dataset used in this research was the Child Opportunity Index (COI), which includes the types and quality of resources the infants had in their community. The COI includes four measures that assess SDOH. There is an overall COI level. In addition, there are three individual domain scores that comprise the COI: social and economic, health and environment, and education (Institute for Child Youth, and Family Policy, 2019). The community-level information used in this study was gathered from the state-normed COI levels data set and the patient-level data was specific to infants in Texas hospitals.

3.3 Sample

I identified all newborns with NOWS and/or affected by MO using the 2018-2019 Texas HIDD PUDF (see Figure 3.1). I started with all children, <18 years old, admitted to the hospital in those years. I excluded any admission that was not a newborn as NOWS is a diagnosis in the newborn period. Then, using ICD-10-CM codes I identified infants with NOWS (P96.1) and infants affected by MO (P04.14) (Oklahoma Perinatal Quality Improvement Collaborative, n.d.). This approach is widely used in studies of infants with NOWS, including a 2020 research study that looked at the accuracy of hospital coding for NOWS (Stoff et al., 2020). Subsequently, I excluded infants missing data on key variables in the primary analysis, specifically race and zip codes, from the primary data analysis. However, 26% were missing race, and since this is such a large percentage of the population, the results of the study can be affected (Langkamp et al., 2010). To ensure the accuracy of the results, I performed a sensitivity analysis that included infants whose

race was missing from the data to assess for differences in SDOH that might result from a large population where race was not available and could reflect differential SDOH.

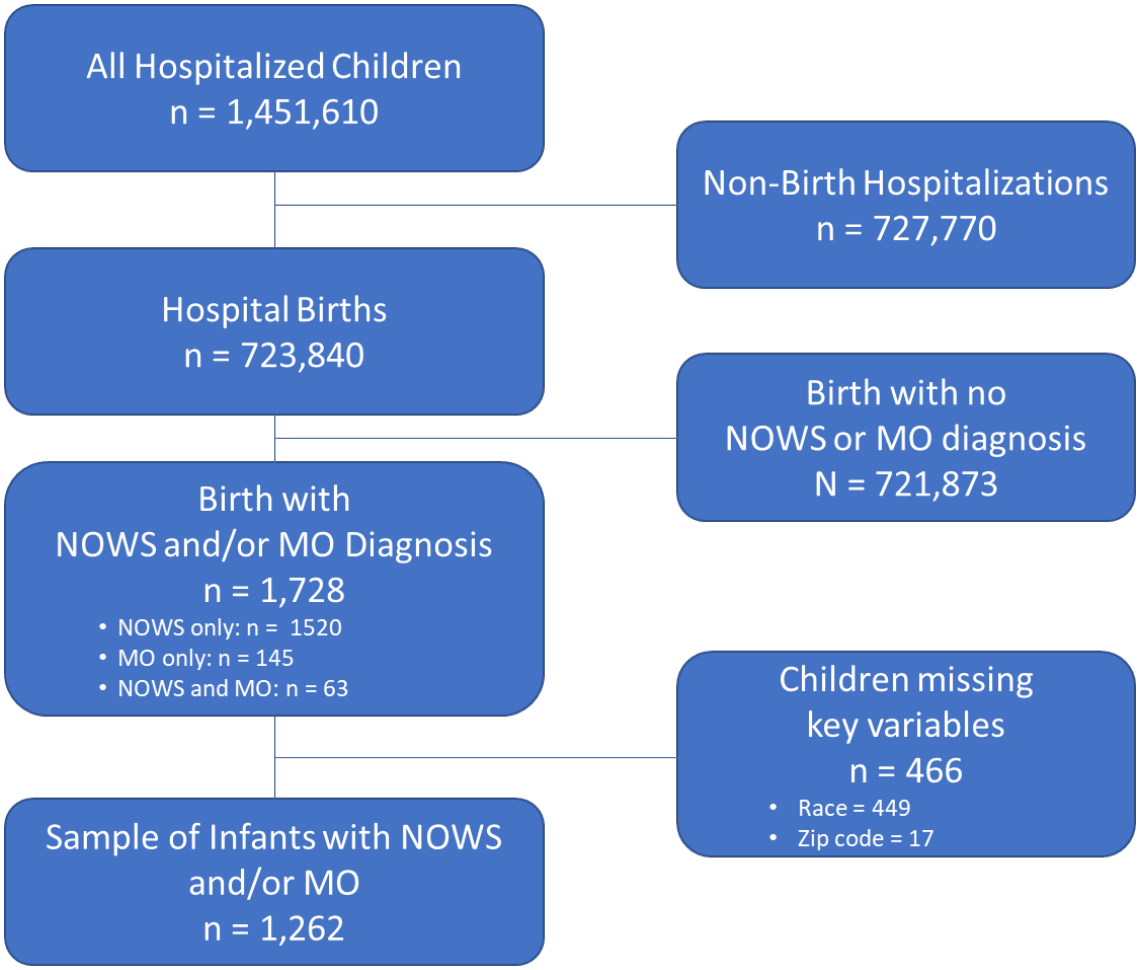

Figure 3.1. Patient Flow Diagram

3.4 Variables

The infants with NOWS and infants affected by MO from Texas hospitals in 2018-2019 were described using a variety of sociodemographic characteristics in order to determine if there were any significant differences due to these factors. Patient-level variables available in the 2018- 2019 Texas HIDD PUDF included race/ethnicity, sex, urbanicity (urban or rural residence), and types of insurance. As for the COI, there are a

total of 29 neighborhood indicators of opportunity that comprise the three domains and overall level (Institute for Child, Youth, and Family Policy, 2019) Indicators for the social and economic domain include access to employment and neighborhood resources. The health and environment indicators are aspects such as access to healthy foods and amount of pollution. For education, indicators are factors like availability of early childhood education and quality of elementary and secondary schools (Institute for Child, Youth, Family Policy, 2019). Each of these indicators are converted into z-scores and are averaged to find the overall domain score. Then, the averaged domain z-scores are combined to establish the overall index score (Institute for Child, Youth and Family Policy, 2019). As for the level of opportunity for children in the community, they are ranked from very low, low, moderate, high, and very high in each domain.

3.5 Data Analysis

Secondary data analysis was performed by using StataSE version 17 (Stata Corp, College Station, TX), a statistical analysis software. The University of Texas at Arlington IRB deemed this non-human subjects research.

3.5.1 Data Cleaning and Preparation

Before accessing the Texas HIDD PUDF and COI database, I reviewed the codebooks and identified key variables to include in the study. Upon accessing the data, the data was prepared, retaining variables that were specific to this study. Then, data were cleaned, variables were categorized and defined to support study analysis. Specifically, I categorized race into white, black, or other. Since a few different race groups (Asian or Pacific Islander and American Indian/Eskimo/Aleut) had a small population of infants with NOWS in this dataset, they were combined into the other category to create more

statistical power in recognizing differences for this study. Race was also categorized race into white, black, other, or missing for the sensitivity analysis. Additional variables with categorization specific to this study included 1) types of insurance which were categorized into private, public, uninsured, and other; 2) rurality, based upon living in a metropolitan service area, deemed urban or non-metropolitan service area deemed rural residences; 3) ethnicity, Hispanic, and non- Hispanic; and 4) sex, male, and female.

3.5.2 Identifying the Sample

After cleaning the demographic variables, the next step identified the infants with NOWS or affected by MO. Each patient could have up to 25 diagnoses included in the Texas HIDD PUDF. Using the ICD-10-CM diagnosis codes for NOWS (P96.1) and MO (P04.14), I developed coding to identify these diagnosis codes included in any of the up to 25 diagnoses. If a match was made, those infants were identified as having NOWS or being affected by MO and included in subsequent analysis. Infants that did not have an ICD-10-CM code for NOWS or MO were excluded from ongoing analysis. Then I excluded infants with NOWS or affected by MO who were missing key variables, namely race and zip code. See Figure 1 for a detailed presentation of the process for identifying the sample.

3.5.3 Merging Patient-level and SDOH

To examine community-level SDOH, patient-level data set was merged with COI data. COI data were matched with patient-level data using zip codes. If an infant lived in a zip code area with less than 30 hospital discharges in the area, data was suppressed for privacy. As a result, those zip codes did not match with COI zip code data and those infants were excluded from analysis (n=14). An additional three infants had missing zip

codes in the dataset. At this point, the patient-level data was successfully combined with the community-level SDOH of health data, and I had all the variables needed.

3.5.4 SDOH Analysis

Descriptive data statistics summarize the nominal and ordinal data distributions. I used cross-tabulations and Chi-square tests to make comparisons by race, ethnicity, sex, rurality, and type of insurance. Data was entered into tables based upon the COI levels for each of the scales and overall COI and compared by patient-level demographics. Subscale results were converted to graphic form for presentation. All tests for statistical significance were 2-tailed and evaluated at a significance level of $\alpha < 0.05$.

CHAPTER 4

RESULTS

4.1 Sample Description

A total of 1,262 infants with NOWS and affected by MO made up the primary sample for this study. Five demographic characteristics were analyzed: sex, race, ethnicity, urbanicity, and insurance status. Most infants with NOWS and infants affected by MO were male as they made up 55% of the population. The results for race showed that 75% of infants were white, 11% were black, and 14% were other. A majority (60%) of the infants were non-Hispanic. Most of the infants came from urban communities (78%) compared to rural communities (22%). Lastly, 80% of infants with NOWS and affected by MO had Medicaid/CHIP insurance while 11% had private insurance, 7% were uninsured, and 2% had other insurance.

4.2 Overall COI Results

The sociodemographic characteristics of the infants diagnosed with NOWS and affected by MO from the sample were compared by the overall state-normed COI levels (**See table 4.1**). Most (50%) of the infants had very low (n=355, 28%) or low (n=279, 22%) levels of opportunity. The COI levels for sex showed that the highest percentages of infants, both male and female, had very low COI levels and there were no statistically significant differences between infants with NOWS and infants affected by MO based on sex ($p > 0.05$). There was also no statistically significant difference in the infants COI level based on race ($p > 0.05$). As for ethnicity, urbanicity, and insurance, infants had

differences based on all three of these characteristics (p-values of <0.001). This means there are statistically significant differences between infants with NOWS and infants affected by MO based on these characteristics. Nearly two-thirds (65%) of Hispanic infants had very low or low opportunity levels compared to 41% of non-Hispanic infants. As for urbanicity, only 3% of rural infants had very high opportunity levels. The overall COI for infants based on insurance showed that those without private insurance had lower COI levels.

Table 4.1. Patient Characteristics and Overall Child Opportunity Level.

Characteristic	**Total**	**Very Low** N(%)	**Low** N(%)	**Moderate** N(%)	**High** N(%)	**Very High** N(%)	**P-value**
	N = 1,262	N = 355 (28)	N = 279 (22)	N = 272 (22)	N = 231 (18)	N = 125 (10)	
Sex							
Male	698 (55.3)	192 (27.5)	143 (20.5)	165 (23.6)	125 (17.9)	73 (10.5)	0.21
Female	564 (44.7)	163 (28.9)	136 (24.1)	107 (19.0)	106 (18.8)	52 (9.2)	
Race							
White	947 (75.0)	259 (27.4)	220 (23.2)	202 (21.3)	169 (17.9)	97 (10.2)	0.73
Black	142 (11.3)	45 (31.7)	23 (16.2)	34 (23.9)	28 (19.7)	12 (8.6)	
Other	173 (13.7)	51 (29.5)	36 (20.8)	36 (20.8)	34 (19.7)	16 (9.3)	
Ethnicity							
Hispanic	499 (39.6)	195 (39.1)	129 (25.9)	86 (17.2)	60 (12.02)	29 (5.8)	<0.01
Non-Hispanic	761 (60.4)	160 (21.0)	150 (19.7)	185 (24.3)	170 (22.3)	96 (12.6)	
Urbanicity							
Urban	980 (77.7)	294 (30.0)	197 (20.1)	191 (19.5)	180 (18.4)	118 (12.0)	<0.01
Rural	282(22.4)	61 (21.6)	82 (29.1)	81 (28.7)	51 (18.1)	7 (2.5)	
Insurance Type							
Private	141 (11.2)	15 (10.7)	35 (24.8)	29 (20.6)	35 (24.8)	27 (19.2)	<0.01
Medicaid/CHIP	1,013 (80.3)	313 (30.9)	216 (21.3)	220 (21.7)	174 (17.2)	90 (8.9)	
Uninsured	82 (6.5)	19 (23.2)	25 (30.5)	19 (23.2)	15 (18.3)	4 (4.9)	
Other	26 (2.1)	8 (30.8)	3 (11.5)	4 (15.4)	7 (26.9)	4 (15.4)	

4.3 COI and Race Results

The three COI domains were analyzed by race (**See Table 4.2**). The results for the social and economic domain and race showed that infants who were white, black, and other had similar percentages in each opportunity level ($p = 0.73$). As for health and

environment, over 50% of infants in all three race groups fell under the very low and low levels of opportunity (p = 0.30). For education, the COI levels were evenly distributed across each race category. The highest percentages of infants with NOWS and infants affected by MO in this domain were in the very low opportunity level (p = 0.76). Since the p-values from each domain were more than 0.05, that established that there were no statistically significant differences in infants with NOWS and infants affected by MO based on race.

Table 4.2. Subscales of Child Opportunity Index Based by Race

COI Subscale	COI Level	Total N (%)	White N (%)	Black N (%)	Other N (%)	p-value
		N = 1262	N = 947 (75)	N = 142 (11)	N = 173 (14)	
Social and economic	Very low	332 (26.3)	243 (25.7)	44 (31.0)	45 (26.0)	0.73
	Low	302 (23.9)	237 (25.0)	26 (18.3)	39 (22.5)	
	Moderate	264 (20.9)	192 (20.3)	33 (23.3)	39 (22.5)	
	High	234 (18.5)	174 (18.4)	26 (18.3)	34 (19.7)	
	Very High	130 (10.3)	101 (10.7)	13 (9.2)	16 (9.3)	
Health and Environment	Very low	404 (32.0)	290 (30.6)	56 (39.4)	58 (33.5)	0.30
	Low	258 (20.4)	195 (20.6)	29 (20.4)	34 (19.7)	
	Moderate	261 (20.7)	156 (16.5)	19 (13.4)	30 (17.3)	
	High	207 (16.4)	156 (16.5)	21 (14.8)	39 (17.3)	
	Very High	132 (10.5)	102 (10.8)	17 (12.0)	13 (7.5)	
Education	Very low	393 (31.1)	298 (31.5)	43 (30.3)	52 (30.1)	0.76
	Low	268 (21.2)	205 (21.7)	27 (19.0)	36 (20.8)	
	Moderate	245 (19.4)	173 (18.3)	36 (23.4)	36 (20.8)	
	High	229 (18.2)	174 (18.4)	25 (17.6)	30 (17.3)	
	Very High	127 (10.1)	97 (10.2)	11 (7.8)	19 (11.0)	

4.4 COI and Significant Subscale Results

4.4.1 Education COI

Since ethnicity, urbanicity, and type of insurance all had statistically significant differences in the population of infants with NOWS and infants affected by MO, more analysis was done to determine which COI domain(s) these differences were linked to. See educational domain COI results in Figures 4.1, 4.2, and 4.3. When the education COI was evaluated by ethnicity, 43% of Hispanic infants were found to have a very low opportunity level in comparison to 24% of their non-Hispanic counter parts ($p < 0.001$). Regarding urbanicity, a much higher percentage of rural infants had low (32%) opportunity level and had a much smaller percentage in the very high (3%) opportunity level than urban infants. The insurance subscale showed that the infants who did not have private insurance had a lower COI as at least 50% of the infants had very low and low opportunity levels than those with private insurance. The p-values for differences in the education subscale were <0.001 for ethnicity, urbanicity, and insurance status.

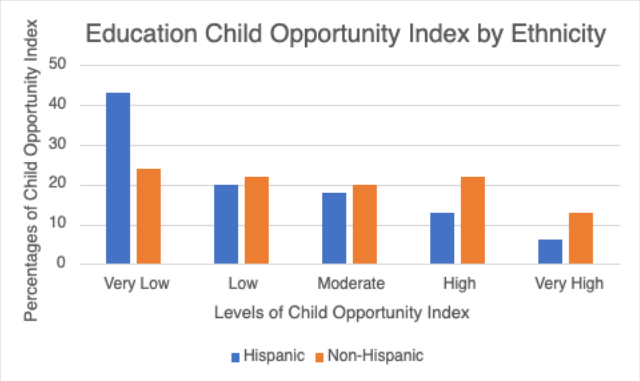

Figure 4.1: Education Child Opportunity Index by Ethnicity

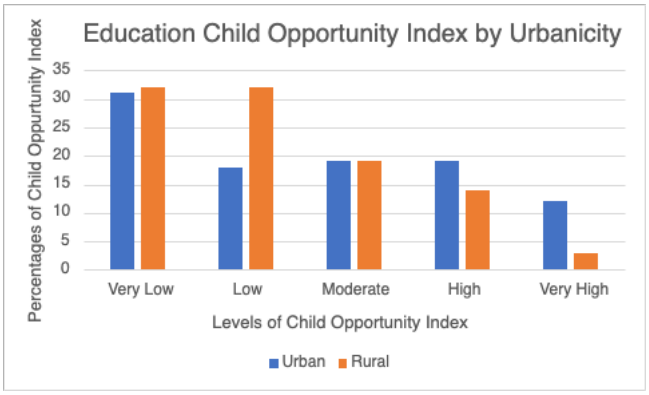

Figure 4.2: Education Child Opportunity by Urbanicity

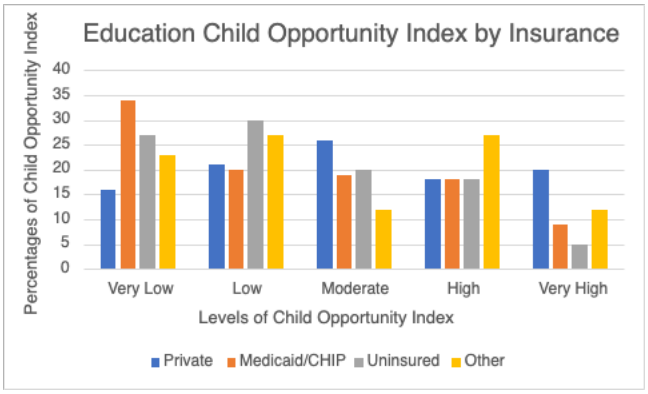

Figure 4.3: Education Child Opportunity Index by Insurance

4.4.2 Social and Economic COI

Next, I examined the social and economic COI subscale (see Figures 4.4, 4.5, and 4.6). There were significant difference between Hispanic and non-Hispanic infants in the very low opportunity level for the social and economic domain as 62% of Hispanic infants had very low or low levels of opportunity compared to just 42% of non-Hispanic infants. The percentages of urban and rural infants were similar in most opportunity levels, however only 5% of rural infants had very high opportunity levels. The insurance results for this domain showed that more than half of the infants without private insurance had very low and low opportunity levels compared to the 35% of infants with

private insurance that do. The p-values for each subscale were statistically significantly different ($p < 0.001$).

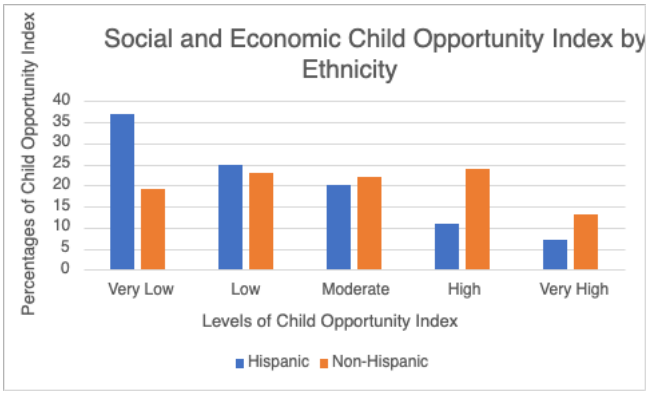

Figure 4.4: Social and Economic Child Opportunity Index by Ethnicity

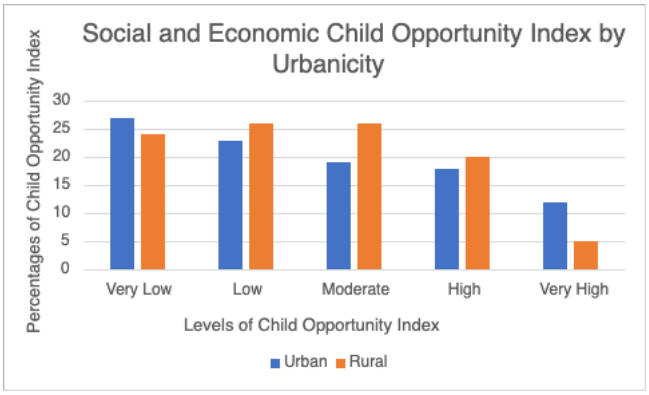

Figure 4.5: Social and Economic Child Opportunity Index by Urbanicity

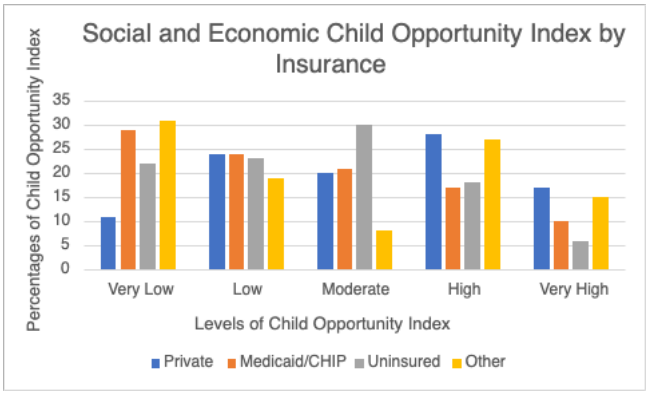

Figure 4.6: Social and Economic Child Opportunity Index by Insurance

4.4.3 Health and Environment COI

Finally, I examined the health and environment SDOH domain (see Figures 4.7, 4.8, and 4.9). Nearly 45% of infants with NOWS and infants affected by MO who were Hispanic had very low health and environment opportunity levels, which is nearly twice the percentage of non-Hispanic infants that have this opportunity level (24%). The urbanicity results showed that 35% of urban infants had very low opportunity levels in comparison to 21% of rural infants. Lastly, at least 45% of infants without private insurance had very low and low opportunity levels while 34% of infants with private insurance did. All the p-values for each health and education subscales were <0.001.

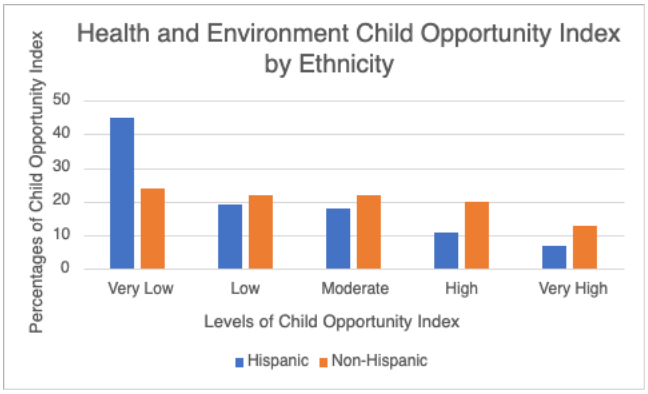

Figure 4.7: Health and Environment Child Opportunity Index by Ethnicity

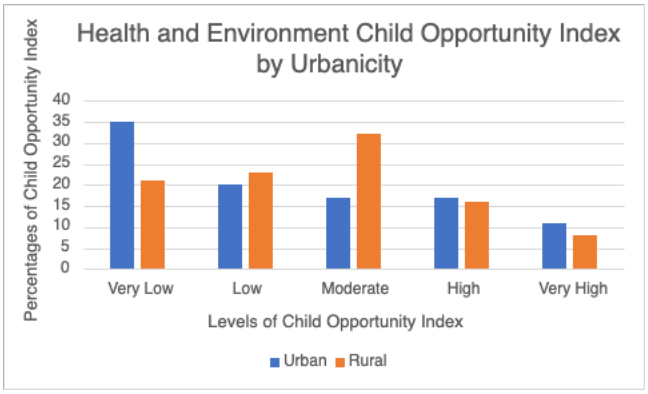

Figure 4.8: Health and Environment Child Opportunity Index by Urbanicity

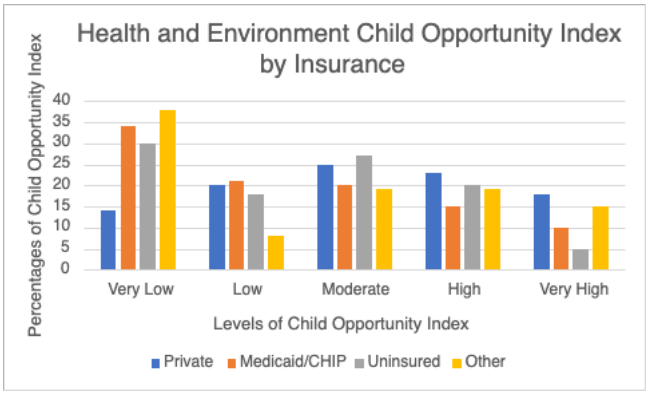

Figure 4.9: Health and Environment Child Opportunity Index by Insurance

4.5 COI and Missing Race Results

A sensitivity analysis was done for the infants with NOWS and infants affected by MO who were missing race, since 26% of infants in the Texas HIDD PUDF had race as a missing variable, to test the significance of missingness on the results. Including these infants resulted in a sample of 1,711 infants, 449 infants had race missing in the data. The infants were categorized by race as white, black, other, and missing race (See APPENDIX A). I found no statistically significant differences in overall COI level or any of the subdomain scores when comparing infants who had a race identified to those whose race was missing ($p > 0.05$). This indicates that infants with missing race did not have significant differences in their social determinant needs and the findings applicable to all infants in the data with NOWS or affected by MO.

CHAPTER 5

DISCUSSION

5.1 Introduction

The objective of this study was to examine disparities in SDOH among infants with NOWS and infants affected by MO based upon race and ethnicity. This study was a secondary analysis of data from the Texas HIDD PUDF the COI to describe the characteristics of infants with NOWS and infants affected by MO as well as the SDOH characteristics of their communities that influence their health. Through data analysis, statistically significant differences were found in infants with NOWS and infants affected by MO based on three sociodemographic characteristics: ethnicity, urbanicity and insurance status. Since these factors together have not been researched previously in NOWS, these findings generate new, meaningful knowledge about health disparities in this population of high-risk infants.

5.2 Findings

The results of the data analysis included 1,262 infants born with NOWS and affected by MO in Texas in 2018 and 2019. Most of these infants were white, non-Hispanic, and had public insurance. Additionally, most infants had low overall COI levels. When examining the differences based upon sociodemographic characteristics, there were no statistically significant differences in the infants based on

race. This finding was unexpected due to previous literature that showed racial disparities in NOWS care and maternal SDOH. However, there were statistically significant differences in COI level in infants with NOWS and infants affected by MO based on ethnicity, urbanicity, and types of insurance. This was expected due to information from previous literature on differences in SDOH based on patient characteristics, but is a new finding in relation to infants with NOWS and affected by MO. Subscale analysis was completed to determine which specific COI domains might be linked to the disparities to inform future, targeted interventions to improve SDOH for infants with NOWS and infants affected by MO.

5.2.1 Ethnicity

The results in Table 1 showed that Hispanic infants had lower levels of opportunity compared to non-Hispanic infants as greater than 50% of these infants had very low and low COI levels. In the education and health and environment subscales, at least 40% of Hispanic infants had lower levels of opportunity. In the social and economic subscale, 62% of Hispanic infants had very low and low COI levels in comparison to 42% of non-Hispanic infants. The p-values for overall COI as well as each of the subscales were <0.001. These results show that Hispanic infants with NOWS and effected by MO experience disparities in education, social and economic, and health and environment needs.

5.2.2 Urbanicity

When the infants' characteristics for urbanicity were compared by overall COI in Table 1, 3% of rural infants had very high COI while urban 12% of urban infants did. In the domain analysis, very few rural infants had high levels of educational opportunity as

only 3% of infants had very high levels and only 5% had very high in the social and economic subscale. However, the health and environment showed that 35% of urban infants had very low levels of opportunity compared to 21% of rural infants. These results are different from that of the previous two subscales overall COI which found more urban infants had lower COI. Once again, all the p-values were <0.001. The results show that while rural infants have lower levels of opportunity in their education and social and economic needs, urban infants have lower levels of opportunity for their health and environmental needs.

5.2.3 Insurance

Examination of the overall COI level by insurance status found infants without private insurance had lower levels of opportunity than those with private insurance. The education, social and economic, and health and environment subscales also had similar results. For the education and social and economic subscales, at least 50% of infants with non-private insurance had very low or low level of opportunity. For the health and environment subscale, 45% of infants without private insurance had lower levels of opportunity while 34% of infants with private insurance did. The p-value for overall COI level and each of the subscales was <0.001, which is a statistically significant difference. These results highlight that infants with non-private insurance have low SDOH opportunities in education, social and economics, and health and environment.

5.3 Limitations

One limitation of this research is that data from one state and results may not generalize to the entire US population. However, Texas is a large state with a diverse population and a mix of urban and rural populations that can reflect differences seen

across multiple other states. Another limitation is that this SDOH data set did not include a health subscale that might include information about healthcare facilities like the nearest hospitals and/or emergency centers. This information can help better describe the kinds of communities these infants live in and can give an idea of what medical resources they have access to. This study also had a large number of infants in our data set missing race as an included variable. To address this limitation, I performed a sensitivity analysis and results indicated there were not significant differences in these infants COI that might suggest they are systematically different than those who were included in the full analysis and had a documented race in the data.

5.4 Policy and Practice

Given overall low levels of COI in infants with NOWS and affected by MO in Texas, all of these infants should receive Early Childhood Intervention services from birth till 3 years old that help determine additional needs and how to find necessary resources to improve health outcomes (Texas Health and Human Services, *n.d.*). In addition, more targeted interventions for particularly vulnerable infants with NOWS and MO, based on COI include the following policy opportunities. In rural areas, more opportunities for telehealth and/or community-based healthcare should be provided in specific regions where NOWS and MO are prominent to help with their education and social and economic needs. In urban areas, policies that improve the environmental health will have beneficial impacts on infants with NOW and MO. Lastly, given the size of the population of infants with NOW and affected by MO who receive Medicaid/CHIP, Texas state legislature should consider policies to increase financial support and social resources available to patients' families at discharge to address disparities in SDOH.

As a nurse who will potentially care for infants with NOWS and infants affected by MO in the future, this research will help me identify which infants are at risk for disparities based on certain sociodemographic characteristics. This will ultimately help me to better advocate for these infants as well as their families by ensuring that they are getting their specific SDOH needs met as I discharge them from a hospital setting into the community. By doing so, I will also be promoting health equity.

CHAPTER 6

CONCLUSION

NOWS is a major health concern affecting infants throughout the country that is increasingly common as more pregnant women gain access to opioids because of the opioid epidemic. My research found overall low levels of SDOH opportunities for infants with NOWS and MO. Further, while there are no disparities in COI level for infants with NOWS and infants affected by MO based on race, there are disparities based on infants' ethnicity, urbanicity, and insurance status. Although there were limitations in this study, such as a large number of infants with NOWS and infants affected by MO missing race data, this study provides new information on other sociodemographic characteristics associated with SDOH disparities. These findings should prompt policy changes and can inform future research on SDOH interventions for infants with NOWS. Specifically, policies to increase access to early childhood intervention services should be put in place to ensure that these infants have the resources they need in their communities so they can achieve the best health outcomes for their future.

APPENDIX A

OVERALL CHILD OPPORTUNITY INDEX WITH RACE AND MISSING RACE

APPENDIX A. OVERALL CHILD OPPORTUNITY INDEX WITH RACE AND MISSING RACE

COI Subscale	COI Level	Total N (%)	White N (%)	Black N (%)	Other N (%)	Missing Race N (%)	p-value
		N = 1,711	N = 947	N = 142	N = 173	N = 449	
Overall COI	Very low	479 (28.0)	259 (27.4)	45 (31.7)	51 (29.5)	124 (27.6)	0.84
	Low	390 (22.8)	220 (23.3)	23 (16.2)	36 (20.8)	111 (24.7)	
	Moderate	361 (21.1)	202 (21.3)	34 (23.9)	36 (20.8)	89 (19.8)	
	High	307 (17.9)	169 (17.9)	28 (19.7)	34 (19.7)	76 (16.9)	
	Very High	174 (10.2)	97 (10.2)	12 (8.5)	16 (9.3)	49 (10.9)	
Social and economic	Very low	452 (26.4)	243 (25.7)	44 (31.0)	45 (26.0)	120 (26.7)	0.87
	Low	421 (24.6)	237 (25.0)	26 (18.3)	39 (22.5)	119 (26.5)	
	Moderate	349 (20.0)	192 (20.3)	33 (23.3)	39 (22.5)	85 (18.9)	
	High	314 (18.4)	174 (18.4)	26 (18.3)	34 (19.7)	80 (17.8)	
	Very High	175 (10.2)	101 (10.7)	13 (9.2)	16 (9.3)	45 (10.2)	
Health and Environment	Very low	550 (32.1)	290 (30.6)	56 (39.4)	58 (33.5)	146 (32.5)	0.34
	Low	338 (19.8)	195 (20.6)	29 (20.4)	34 (19.7)	80 (17.8)	
	Moderate	369 (21.6)	156 (16.5)	19 (13.4)	30 (17.3)	108 (24.1)	
	High	271 (15.8)	156 (16.5)	21 (14.8)	39 (17.3)	64 (14.3)	
	Very High	183 (10.7)	102 (10.8)	17 (12.0)	13 (7.5)	51 (11.4)	
Education	Very low	561 (30.2)	298 (31.5)	43 (30.3)	52 (30.1)	123 (27.4)	0.68
	Low	379 (22.2	205 (21.7)	27 (19.0)	36 (20.8)	111 (24.7)	
	Moderate	326 (19.1)	173 (18.3)	36 (23.4)	36 (20.8)	81 (18.0)	
	High	312 (18.2)	174 (18.4)	25 (17.6)	30 (17.3)	83 (18.5)	
	Very High	178 (10.4)	97 (10.2)	11 (7.8)	19 (11.0)	51 (11.4)	

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BIOGRAPHICAL INFORMATION

Tolulola Ogundiran is a senior nursing student at the University of Texas at Arlington. She will graduate in May 2023 with an Honors Bachelor of Science in Nursing. Tolulola has been a member of the Honors College and Honors College Council since Fall 2019, and is also currently a member of other on campus organizations including Alpha Lambda Delta and the Black Student Nurses Association. Tolulola plans to pursue a nursing career in pediatric nursing. She also plans to return to school in the future for a master's degree in Nursing to become a pediatric Nurse Practitioner.