



Socioeconomic Status and Infant Development

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I. Literature Review

Over the past few decades, there has been an influx of research done on the effects of socioeconomic status (SES) in health research.¹ However, the actual method of measurement of SES has been neglected and pushed to the side. The number of research articles pertaining to SES and health research has in some years been up to 25 times higher than research for a viable way to measure SES. The actual measurement of SES has been unstable due to the lack of universal and concrete definitions for its variables. However, time and time again, study after study, SES is partially determined by a measurement of one's education, occupation, income, and social capital.²

The majority of studies measure socioeconomic status by using the parent's level of education, or more specifically, the household earner's level of education, as a factor of socio-economic status.³ To go further, Entwisle and Astone mention that the recording of the mother's education is seldom missing in a survey since the mother's education is highly correlated with the father's.⁴ Goodman adds on to this, stating that the parent's education, their partner's education, and their sex should be recorded in order to calculate the variables for the mother's education and the father's education.⁵ The highest education between the two should also be recorded. John Casey found that, although marital status is not considered a direct measure of SES, it likely correlates with financial security and partner education levels tend to correlate with each other as well.⁶

Along with education paired with gender, the specific level of education should be measured by the number of years of education each parent has completed.⁷ When it came to education in Casey's study, participants reported the highest level of education they received. Those that were reported were as low as no schooling and as high as a doctoral degree. Casey then paired these education levels with the participants' monthly income and assigned them a score that would contribute to their SES measurement.⁸ Goodman's study shows a scale of measurements ranging from less than a high school degree all the way up to professional training beyond college. To be more specific, "Education was classified according to the following scheme: less than a high school degree: Class 1, high school degree/vocational training/equivalency diploma: class 2, vocational training after high school/some college: Class 3, college Graduate: Class 4, professional training beyond college: Class 5."⁹

Along with education, occupation is often used as one of the determinants of SES because it typically reflects one's education level, one's possession of job-specific skills, it provides a substantial representation of the individual's income, and is a strong indicator of their social standing.¹⁰ Looking further into occupation as a player in SES, "occupational prestige represents the perception of a job's social status."¹¹ Occupational prestige specifically shows the social standing of the job and the job holder. According to Donald Treiman, occupational prestige is a measure of power.¹²

Studies have also only used one factor to measure SES, this factor is occupation.¹³ "Occupation has proven to be a more useful measure than other single measures..."¹⁴ Occupation is often used

because it conveys information about one's level of income, power, and educational experience, in regard to the educational requirements associated with various positions in the occupational arena.¹⁵

Two researchers, Nam and Powers, developed an occupational scale that collected data from the U.S. Census. They used the median education level and median income from all jobs reported on the census. Using this data Nam and Powers developed a scale from 0-100 that would rank jobs based on their typical education and income level for a given year. This scale was a way to reach a general consensus of the social standing of a particular occupation. This approach to measuring occupational status is still in use today.¹⁶ Another scale, called the Registrar General's Scale, categorizes and ranks occupational categories from low to high SES. These categories are ranked as, "Unemployed, Unskilled Manual Labor, Skilled Manual Labor, and Professional Labor."¹⁷ "Unemployed" being of the lowest status and "Professional Labor" being the highest.

Using occupational prestige can be an inaccurate or inadequate measurement of one's occupation and the other factors that result from occupation such as education and income.¹⁸ There are so many different occupations and varieties of a given occupation, that by placing a score on a specific job does not always relate accurately to specific environments and atmospheres that are required of the job. Due to the scope of occupation being so broad, research sides with one's occupation is determined by their education level, and income is a result of the occupation.¹⁹

A household's income (or the annual revenue coming into a household) is used in most measurements of SES. According to Duncan in "Socioeconomic Status and Cognitive Functioning: Moving from Correlation to Causation," this is because it is easy to put a number to and measure. "Because it may be difficult to measure directly a family's access to economic and social resources or their position in a social hierarchy, social scientists often use a single indicator, typically occupation or maternal education, or combine indicators (e.g., parental education, occupation, and income) into scales that indicate families' social positions."²⁰ Duncan and Magnuson's study went with a more mainstream and ease of access approach to measuring SES by taking variables that can be easily identified and explained numerically.

Duncan and Magnuson also state that not only does the amount of income a household has plays a part in SES, but a manipulation of the income number plays a role. "Both experimental and quasi-experimental studies involving manipulation of family income have demonstrated consistent associations with a number of cognitive measures."²¹

In "Socioeconomic (SES) Differences in Language Are Evident in Female Infants at 7 Months of Age," a ratio approach was used to measure income instead of a numerical approach. "Mothers and infants were categorized into one of five income to needs (ITN) categories according to income and number of persons in the household. For example, the poverty threshold for a family of two is \$15,510 per year. Families making less than this amount are classified as below the poverty line (ITN = 1). A family of two making \$62,040 per year are classified in the higher end of the range at 400% above the poverty line (ITN = 5)."²² To determine a household's ITN number, annual income was divided by the poverty line and the resulting number was the household's ITN. The ITN number was used to see how much income covered a household's essential needs. This provided more insight into how far the income in a household stretched.

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Bradley & Corwyn bring to light how social capital plays a role in identifying someone's SES. One of the components includes the social network that an individual surrounds themselves with. This can be made up of co-workers from that individual's occupation as well as others outside of their family members. By looking at one's social network, it brings to light their SES as well as the opportunities that they gain from associating and knowing specific people. The idea of family make-up also plays a role in social capital. This can be thought of as who is living in the home.²³ It is important to note if both parents are living in the house, or if it is a single parent home. This idea of family SES and their networks can also have an effect on education. It correlates with the education that is available to the family members (e.g. what kind of at home resources will be available and the kind of school environment that will be attended). This may have an impact on the level of success that is able to be reached. If a child needs help in school but they do not have the network of knowing a proper tutor, it affects the child's ability to learn and grow in their education. When researched and compared in the past, it was evident to see the differences between high and low SES schools. The most important finding was in instructional arrangement, materials, and teacher experiences. Sirin also researched the idea of relationships between parents and school personnel.²⁴ The level of SES has an influence on how involved the parents are and what the quality of the relationship looks like.

SES in one's social capital can also be identified by the type of housing situation that is present.²⁵ A neighborhood can tell a lot about the family based on what kind of people are living in the same area. Those who have a lower SES are going to live in a smaller house in a neighborhood with similar size houses. Through the government database, it is also easy to access the percentage of people who fall under the poverty line in those neighborhoods. Contributors Coffee, *et al* argue that residential property is the most valuable asset that people own.²⁶ Because it is such a valuable asset, it can be used to measure the level of one's SES. Although it still important, the location of the house is not enough information when it comes to indicating the value. The price of the house is determined by the characteristics of the residential property. This means to ignore the location and focus on the property's characteristics. By interpreting these two measurements, location and value, it gives the most accurate value when determining the level of SES.

II. Method

2.A. Data

Avera Research Institute Center for Pediatric & Community Research (CPCR) located in Sioux Falls, SD provided all of the data and information for this study. A subset of the PASS data study The data for this study was collected by the Safe Passage Study (PASS).²⁷ A subset of the PASS data was used from two study sites in the Northern Plains. This study looked to develop a definition of SES of expecting mothers and then test the definition of SES on their infant's postnatal head circumference growth and if the baby was born preterm or not. Infants were determined to be preterm if their gestational age was less than 37 weeks. Specific variables were requested following the literature review. However, the data used to calculate SES were income, the number of people supported by income, the mother's completed education level, whether they are on government support or not, the type of housing and the number of times moved in the last 12 months.

2.B. Statistical Tests

The data for income, number of people supported by income, completed education level, whether they are on government support or not, type of housing, and the number of times moved in the last 12 months was ranked numerically in SES. This meant for each of the categories above, a range of scores was given as a representation of the individuals responses. For example, the income variable scores ranged from 1-7. If an individual responded to the income variable as greater than \$5,001 per month, they were then given a 7 as this was the highest level of income recorded within the study (see Table 1 for the scoring of all variables).

$$(1) \quad SES_SCORE = INCOME + NUM_SUPPORTED + EDUCATION + \\ GOVSUPPORT + HOUSING + TIMES_MOVED$$

The SES score was computed by summing all components (Equation 1) where scores ranged from 8-27. A sensitivity analysis was used to determine the cut off points of each section of SES by looking for reasonable distributions of the input variables within each resulting category. Scores ranging from 8-19 were deemed low SES, 20-23 were deemed middle SES, 24-27 were deemed high SES. A linear regression model was run comparing SES and head circumference growth (HEADGROWTH) (Equation 2). A categorical box and whisker plot was also used to show the test results (Figure 1).

$$(2) \quad HEADGROWTH_i = SES_SCORE_i + \varepsilon_i$$

A logistic regression model was used to look at the effect of SES on preterm birth (PRETERM) (Equation 3). A bar chart of the results is shown below (Figure 2).

$$(3) \quad \log \left[\frac{P(PRETERM_i)}{P(1-PRETERM_i)} \right] = SES_SCORE_i + \varepsilon_i$$

III. Results

The mean SES score from the study was 21.16, the mode was 24. The population in each classification of SES was very similar, with 1005 individuals in low SES, 1063 in middle SES, and 1059 in high SES. Of the participants classified as low SES, only 22% had an income greater than or equal to the average income of all participants, 6% of the mothers had a college degree or higher, and 90% of mothers were receiving some form of government support. Out of all the participants classified as middle SES, 86% of individuals had an income that was greater than or equal to the average, here, 36% of mothers received a college degree or higher, and only 23% of mothers were receiving support from the government. Of those participants in the high SES category, 99% of individuals had an income greater than or equal to the average, and 74% received greater than or equal to \$60,000, which was the highest level of income recorded within this study. Furthermore, 89% of mothers had a college degree or higher, and less than 1% of mothers received government support. The full breakdown of participants can be seen in Table 2.

Table 1: Descriptive Analysis of SES Variables and Scores Given in SES Scale

SES Variable	N (Percent)	Score Given
Monthly Pretax Income (INCOME)		
<= \$500	6%	1
\$501-\$1000	5%	2
\$1001-\$2000	6%	3
\$2001-\$3000	13%	4
\$3001-\$4000	18%	5
\$4001-5000	19%	6
>= \$5001	33%	7
People Supported by Income (NUM_SUPPORTED)		
>= 9	14%	1
>= 7	77%	2
>= 5	1%	3
>= 3	1%	4
>= 1	7%	5
Mother's Completed Education (EDUCATION)		
Any Primary School	1%	1
Some High School	9%	2
Completed High School	16%	3
Some College	29%	4
Completed College	28%	5
Post Graduate	17%	6
Mother Received Gov. Support (GOVSUPPORT)		
Yes	31%	0
No	69%	1
Housing Type (HOUSING)		
Other	2%	1
Informal	1%	2
Council	7%	3
Mobile/Trailer	6%	4
Farm	4%	5
House/Apartment	80%	6
Times Moved in past 12 Mo. (TIMES_MOVED)		
>=5	4%	1
>=3	10%	2
>=1	22%	3
>=0	64%	4

Table 2: Breakdown of SES Variables by SES Category

SES Variable	Low SES (1)	Middle SES (2)	High SES (3)
Quantity (Individuals in Class)	1005	1063	1059
Pretax Income, (\$36,000 Mean), (>=\$60,000 Max)	22% > \$36,000, 3% >=\$60,000	86% > \$36,000, 19% >=\$60,000	99% > \$36,000, 74% >=\$60,000
People Supported on Monthly Income (Including Mother)	20% >= 9	16% > =9	6% > =9
Mother's Education (% Who Completed College Degree or Higher)	6%	36%	89%
Mother Received Government Services (EBT, TANF, and/or WIC)	90%	23%	< 1%
Housing Type	56% House/Apartment, 21% Council, 13% Trailer	90% House/Apartment, 6% Farm, 3% Trailer	97% House/Apartment, 2% Farm
Number of Times Moved in Last 12 Months	59% >=	38% > =3	13% > =3

After running the tests on head circumference growth, the mean head growth after year 1 was 117.2mm. The simple linear regression between SES and head circumference growth returned a p-value of .110. This p-value does not show significance. Its estimated value of .7702mm shows that an increase in the level of SES will result in a .7702mm increase in head circumference growth. The results of this test can be seen in the plot in Figure 1.

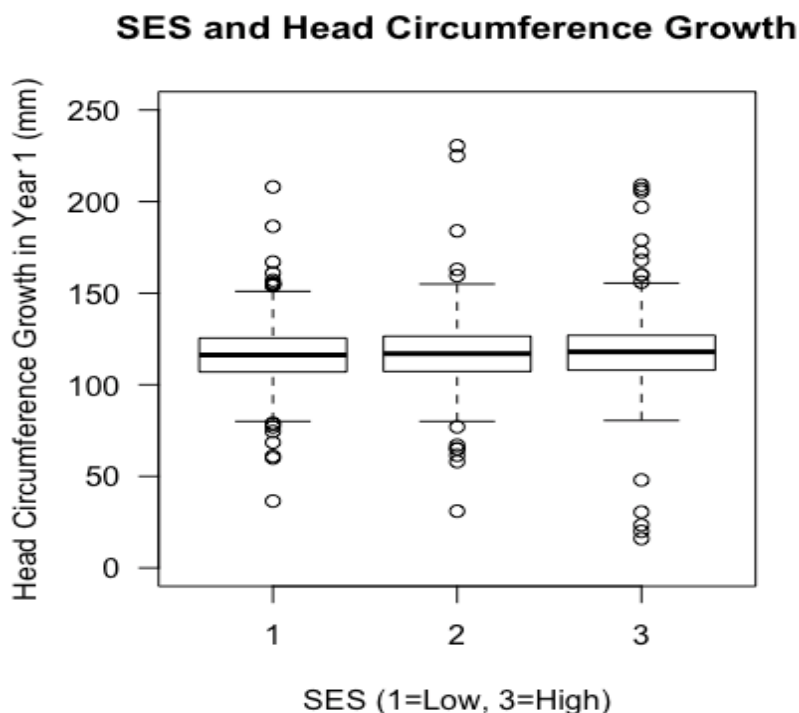


Figure 1: SES and Head Circumference Growth

This Box and Whisker plot shows the majority of responses within the 100-150mm range of growth, as represented by the bold black lines. The outliers are represented by the circles above or below the mean.

Of the 3127 individuals that received an SES score, 95.5% (2989 individuals) responded to the question of duration of pregnancy. Furthermore, only 9% (278) of pregnancies were considered preterm. 46% of preterm births occurred with individuals of a low SES, 29% of middle SES, and 25% of high SES. The estimated value taken from the logistic regression was -.4667. As SES level increases the probability of having a preterm birth decreases. The p-value was less than 0.001. This shows that the relationship between preterm births and SES level is significant. The results of this test can be seen in Figure 2.

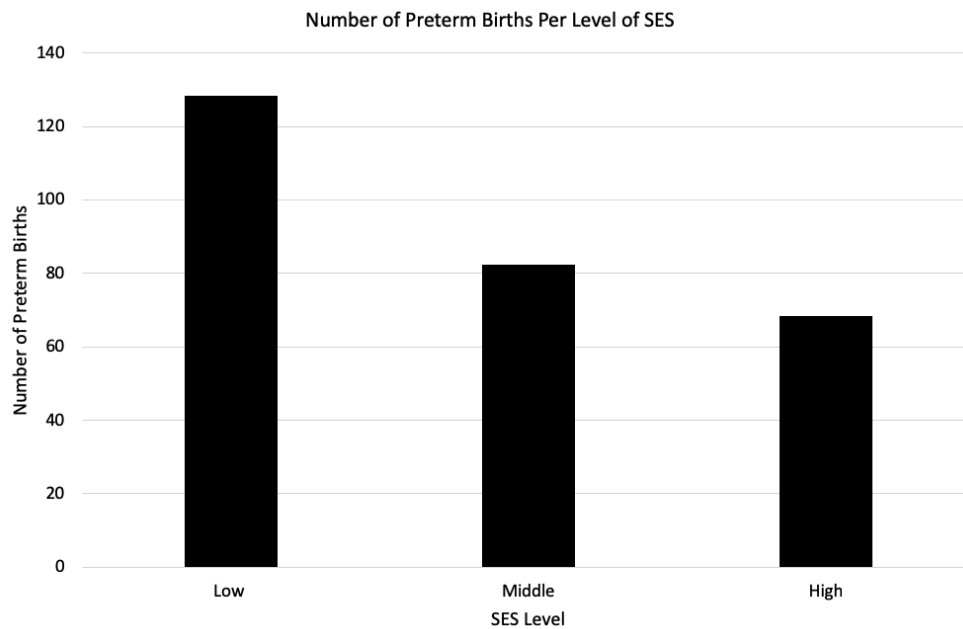


Figure 2: Number of Preterm Births per Level of SES

This bar chart shows as SES level increases amount of preterm births continue to decrease.

IV. Discussion

Having a thorough and accurate definition of SES allows researchers to gain an understanding of how SES affects different areas of individuals' lives. In this case, infant development is the key topic and having a good measurement of SES provides an opportunity to compare the effects of different levels of SES in infant development.

The method used for defining SES was effective because it allowed for categorical data to be measured and accounted for in statistical tests. This method also went deeper by taking into account more than just the amount of money that is being made or how educated the mother was. It took into account how far the household income went when data for the number of people supported by that income was utilized. The housing situation of the mother, as well as how many times the mother had moved in the previous 12 months, gave insight into more of the social situation that the child was developing in. Taking into account multiple variables added an extra layer of depth when categorizing participants into SES groups as the environment a child is in plays a role in their development.

Compared to previous methods of accounting for SES, where typically no more than 3 variables are used, this method allows for a larger number of variables to be taken into account. By doing so, a more complete understanding of an individual's SES level becomes available. The use of

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the number scale allows for responses to be accounted for on an individual level. This led to the potential for a variety of statistical tests to be utilized.

V. Limitations

Throughout this study, limitations were encountered when measuring individuals' levels of SES. The categories and data ranges that the CPCR PASS study collected were not constructed to the degree that was believed to create an accurate picture of SES. A fuller knowledge of the participant's lifestyle would allow for a clearer reading on their SES.

VI. Future

The discoveries of this study have brought to light some important details that could further be used in future studies. Steps that could be taken differently would be to include more specific data. In the future, recommendations to researchers will be made in order to collect data that better represents the components of the SES definition. This would give a more in-depth look into the four components of SES. The use of a numerical index was beneficial to this study when measuring the participant's SES and is recommended for future studies. With this strong definition of SES, other areas of an individual's or family's lives can be observed and tested. In the future, research on the impacts of SES level to college performance and job placement will be conducted.

VII. Conclusion

Establishing a credible measure for SES will continue to be a disputed topic in both economic and health research. Because there are so many potential variables and ways to interpret and manipulate data that could be used in the equation for SES, it continues to be a malleable and living equation. However, the four staple components in this study: education, occupation, income, and social capital have shown to be dependable when measuring SES.

VIII. Acknowledgements

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X. Notes

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