



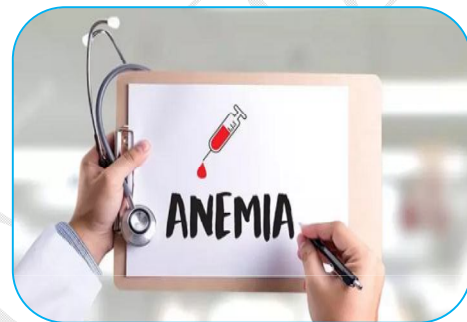
A NOTE ON THE SPATIAL PREVALENCE OF ANEMIA IN INDIA

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ABSTRACT:

This study analyzed the spatial differences in the incidence of anemia among different states in India, using the NFHS 3 data. This study modeled the incidence of severe anemia among men and women. Statistically significant differences exist across regions even after accounting for the nutritional, health, education and social characteristics. Level of education is significantly negatively associated with anemia. Dietary factors such as consumption of leafy vegetables, meats and other comorbid conditions are also statistically significant in affecting the incidence of anemia across states.



KEYWORDS: Anemia, Spatial Analysis, Determinants of Anemia.

INTRODUCTION :

Anemia is a widely prevalent economic health problem, which is often a result of iron deficiency. World Health Organization estimates that 24.8% of world's population in 2008 suffered from anemia. Poor nutrition coupled with socio economic conditions affects the incidence. Anemia can occur at any stage of human life; its effects can be deleterious during early childhood and during pregnancy. It can result in higher maternal mortality and, low birth weights in newborns, and impaired cognitive performance and low scholastic achievements in children. In

spite of Government's best efforts to curb anemia, the problem still remains baffling. Severe regional imbalances exist between the states in terms of socio economic and health conditions of people. This empirical work proposes to elucidate the key socio economic, nutritional, other comorbid health conditions and spatial factors at play. The results from this work would help in formulating policies that redress regional imbalances.

Anemia is a condition in which the number of red blood cells or their oxygen carrying capacity is reduced. It is most commonly caused by iron deficiency. Other conditions such as deficiency of

folate, Vitamin B12 or Vitamin A deficiency, certain infections or genetic conditions may also be causal factors to anemia. Anemia can result in maternal mortality, weakness, diminished physical and mental capacity, increased morbidity from infectious diseases, prenatal mortality, premature delivery, low birth weight, and (in children) impaired cognitive performance, motor development, and scholastic achievement (NFHS 3, 2008). Severe anemia may increase the chance of child mortality (Brabin et al., 2001).

Anemia is widely prevalent in Karnataka. It is estimated that around 95% of children under 6 years are anemic, with 3%

severely anemic (National Nutrition Report, 2008). More than 50% of children (under 6 years) are anemic in HK region. Among adolescent girls (10-19 years), more than 96% are anemic, with 15% severely anemic. Among women of reproductive age, 42% are anemic with 2% severely anemic (Human Development Report, 2005). Anemia is more prevalent in low income groups than high income groups (Bentley and Griffiths, 2003). The Hyderabad-Karnataka region comprises of Bidar, Yadgir, Raichur, Koppal, Gulbarga and Bellary districts in the State of Karnataka. The majority of the taluks in the region are classified as most backward (21 out of total 28) compared to other parts of the state, by the High Power Committee (HPC 2002). The region struggles with poor infrastructure in health and educational aspects. Work force participates predominantly in agriculture (40.6%). 6.9% of workers participate in industrial work. Infant Mortality rates in the region are high (Bellary 113, Koppal 103, Raichur 67 in 2001) compared to other districts in the state. Maternal Mortality Rates(MMR) are also higher. Koppal district registered an increase in MMR from 157.24 to 208.84 in 2010-2011 (The Hindu, 2012).

Table 1: Descriptive Statistics of data used in this study

Variable	Minimum	Maximum	Mean	Std Dev
Ane_severe	0.2	3.4	1.31	0.73
adequate	31	93.8	63.10	18.00
pulses_beans	50.4	98.4	84.50	12.58
fruits	12.6	80.9	45.03	16.36
leafyveg	57.5	97.5	90.85	8.17
chicken	1.1	63.6	25.19	17.52
mean_BMI	19.4	22.9	20.69	0.87
obese	0	9.1	1.99	1.81
sc	1.4	32	15.65	7.16
st	0.1	95.4	19.67	25.32
obc	0.8	74.5	28.38	19.05
sex1	0	1	0.50	0.50
noed	4.9	60.3	27.90	12.81
ge122	4.9	38	17.21	7.24

Given the impoverished state of the region and the nature of causal factors of the problem, it is hypothesized in this study that anemia prevalence is statistically significantly different in the among various states. Data from NFHS 3 (National Family Health Survey) conducted during 2005-06 would be used in the study. Objectives of this study are to identify if statistically significant differences exist in rates of prevalence between different regions of India and to identify socio economic factors that influence the disorder.

This study analyzes data from National Family Health Surveys. The study focuses on capturing regional effects on the incidence of anemia. Anemia and Iron deficiency anemia are synonymously used, however, anemia can be caused by factors other than iron deficiency such as chronic inflammations, certain infections and genetic conditions. This study focuses only on iron deficiency.

LITERATURE REVIEW

Anemia is a condition in which the number of red blood cells or their oxygen carrying capacity is reduced. Globally, most significant contributing factor to anemia is iron deficiency, so anemia and iron deficiency anemia are used synonymously (World Health Organization, 2008). WHO defines anemia as a condition occurring when blood hemoglobin levels fall below a defined threshold which varies with age and pregnancy status. For children (0.5 -4.99 years : 110g/l, 5-11.99 years:120g/l), non pregnant women -120 g/l, pregnant women -110 g/l, and for men, 130g/l.

Symptoms of anemia include fatigue, dizziness, headache. It may lead to arrhythmias and possibly lead to heart failure (NHLBI, 2014) . Anemia can result in maternal mortality, weakness, diminished physical and mental capacity, increased morbidity from infectious diseases, prenatal mortality, premature delivery, low birth weight (Muthayya, 2009), and (in children) impaired cognitive performance, motor development, and scholastic achievement (NFHS 3, 2008). Severe anemia may increase the chance of child mortality (Brabin et al., 2001). Thomas et al (2003) and Li et al found increase in worker productivity when anemic workers were treated with iron supplements. Nissenson et al (2005) found that cost of medical treatment for anemic patients were twice that of those for non anemic patients with same comorbid conditions such as chronic kidney disease, rheumatoid arthritis etc., Lozoff et al (2006) found

Bentley and Griffiths (2002) found statistically significant differences in the prevalence of anemia between groups based on socio economic status, location of residence, body mass index and consumption of alcohol among rural women in Andhra Pradesh. Kim et al (2014) found that family income and anemia prevalence are negatively correlated among adolescent girls in Korea. Ali et al (2001) found maternal education and family income as significant factors among anemic children of 1-2 years age.

METHODOLOGY AND ESTIMATION

Following the works of Bentley and Griffiths (2002), Kim et al (2014), and Ali et al (2001), socio economic factors such as education, region, caste, religion, sex, type of nutrition, and other existing health conditions were included in the study. Regional differences in anemia incidence were estimated Least squares estimators. Data was pooled across states and regions during the study period and regression model was estimated. Diagnostics for autocorrelation, heteroscedasticity and multicollinearity were done by calculating Durbin Watson Statistic, Breush Pagan Test and Variance Inflation factors. White heteroscedasticity and autocorrelation corrected standard errors were calculated. Multicollinearity was not an issue based on VIFs. Results from the estimation are presented in Table 2.

Table 2: Parameter estimates from Least Squares Estimation

Variable	Parameter Estimate	Pr > t
Intercept	1.0591	0.2119
central	-0.3090	0.2512
east	-0.6431	0.0106
north_east	0.1933	0.6153
west	0.0718	0.7441
south	0.2419	0.4209
sex1	0.5506	0.1491
noed	-0.0081	0.5407
ge122	-0.0652	0.0013
leafyveg	0.0160	0.0280
fish_chick_meat	0.0057	0.2373
alcohol	0.0083	0.3384
asthma	-0.0002	0.0285
diabetes	-0.0002	0.1181
sc	0.0067	0.6999
st	-0.0122	0.1018
obc	0.0067	0.2640

RESULTS

Results from the estimation indicate regional differences after accounting for social, nutritional and health aspects. Eastern India comprising of Bihar, Jharkhand, Orissa and West Bengal has

significantly lower rate of incidence than the Northern States. The parameter coefficient is -0.6431 indicating this relationship. Parameter estimate on gender is positive indicating a higher rate of incidence among women compared to men, however the estimate is not statistically significant after accounting for the other socio economic, and health factors. Parameters on education are negative indicating that incidence of anemia is significantly lower in people with higher education. Among people possessing education greater than twelve years the incidence is significantly lesser. Among nutritional factors, consumption of leafy vegetables and meat is positively correlated with incidence of anemia. This result might sound paradoxical at first glance, but it should be understood and interpreted carefully. Incidence of severe anemia is modeled in the study, and diet alone may not be enough to compensate for the severe iron deficiency in the group. As the data is from a survey, the affected people might have already been on the recommended diet regimen during the data collection period. Parameter estimate on consumption of alcohol is not statistically significant. Among the other health conditions group, Asthma is significantly associated with incidence of anemia. Parameter estimate on Diabetes was not statistically significant. Parameter estimates on social variables such as caste of respondents was not statistically significant. This might be due to the overshadowing effect of nutrition and health condition variables.

CONCLUSION

This study analyzed the spatial differences in the incidence of anemia among different states in India, using the NFHS 3 data. Statistically significant differences exist across regions even after accounting for the nutritional, health, education and social characteristics. Level of education is significantly negatively associated with anemia. Dietary factors such as consumption of leafy vegetables, meats and other comorbid conditions are also statistically significant in affecting the incidence of anemia across states.

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