# Social Determinants of Anaemia Among Children Aged 6 to 59 Months Across Districts of Gujarat: Evidences from NFHS-5 Data

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## Abstract:

Four out of every fifth child in Gujarat is suffering from anaemia. Anaemia amongst children between the age of 6 months to 59 months are major health concern in Gujarat. Increasing in prevalence's of Anaemia amongst children age 6 months to 59 months miserable failing the State as a vibrant and fastest growing economy in India. The proportion of anaemia in children has increased from 69 % to 80% during the interval of NFHS -4 to NFHS -5 in Gujarat. The purpose of the study is to access the Anaemia prevalence in children and to identify the key determinations of anaemia in children age 6 months to 59 months across districts of Gujarat. Data for study are extracted from the Gujarat National family of Health survey (NFHS -5) report and Gujrat state fact sheet. After performing all the assumption includes, homoscedasticity, multicollinearity, Normality test, at the final stage multiple regression analysis is performed to explore the determinants of Anaemia among children between the age of 6-59 moths across the districts of Gujarat. The result from the analysis shows that statistically significant factor Improved sanitation and women aged 20-24 years married before18 years are emerged as significant predicators of target variable anaemia among children 6 months to 59 months of age. on the basis of above outcomes, it could be inferred that facilities of sanitation and women age between 20-24 married before the age of 18 are directly affects anaemia prevalence's amongst children between the age of 6 months to 59 months as it is a threat of infection amongst children and the frequency of early marriages results to poor maternal health, nutrition deficiency and lower maternal education. Hence, strengthening the sanitation infrastructure and women aged 20-24 married before they reached to the age of 18 across the all the 33 districts of Gujarat, promotes lower infection in children's and strengthen maternal health and education outcomes helps to reduces anaemia amongst children.

## 1. Introduction:

Anaemia among children aged 6 months to 59 months are significant public health concern in Gujarat, with long-term results to poor cognitive and motor skill growth. Increasing in prevalence's of Anaemia amongst children age 6 months to 59 months miserable failing the State as a vibrant and fastest growing economy in India. Anaemia is condition in human body where there's not sufficient supply of haemoglobin in blood to carry oxygen to organs and tissue (who 2025). According WHO The concentration of Haemoglobin level is less than < 11.5gm/dl in children is called as Anaemic and classified as mild anaemic, and the circulation of Hb <8 -10.9gm/dl in children body depicts as moderate anaemia prevalence, and the flow of Hb level in children body less than <8gm/dl is considered as severely anaemic. The impact

of anaemia at an early age among children between the age of five result into neurological complications, risk of morality, morbidity, heart failure, malnutrition and infection among children (Dhruva.Gauravi etc. al.,2025). Appropriately 50 million deaths take place worldwide due Anaemia in 2019. Major caused behind the loss of life is predominantly due to iron loss in children , thalassemia, and causes of malaria among children (WHO 2025). It has been reported by WHO that 40 percentage of children who are less than the age of five years are suffering from anaemia worldwide Infants and under five children specifically less than 2 years old are mostly exposed to anaemia.

According to Cedars-Sinai etc. all., consequences of anaemia amongst children are visible as lack of cognitive development, poor motor skills, joint pain, swelling, leukaemia and bone marrow failure. It can affect the behaviour outcome, school performance and overall growth of a child (World Health Organization, 2025). Social demographic and economic phenomena for instance low weight at birth time , children living in poverty , excessive intake of cow milk after birth , lower weight according age and height, insufficient consumption of micronutrients, risk of infection , further increase the risk among children to be anaemic. (Cedars Sinai (n.d.).

According to Gujarat State Report, published by NFHS round fifth survey 4 out of 5 child in Gujarat is diagnosed with anaemia. Anaemia prevalence in children increased from 69 percentage to 80 percentage between NFHS -4 to NFHS -5, shows an alarming situation of nutritional deficiency and inadequate intake of micronutrients among children in Gujarat.

Anaemia is recognised as major public health concern worldwide. Child age between 6 months to 2 years are mostly affected to anaemia (Dhruva.Gauravi etc. al.,2025). In Gujarat 28 % of children are mild anaemic, 49% of children are moderate anaemic and 3.1% of children are exposed to severe anaemia (NFHS-5). However, district level data from NFHS-5 district fact sheet reports heterogeneous distribution in the prevalence of Anaemia amongst children and highlights significant variation in Nutritional deficiency amongst children in Gujarat. Similarly, Data from NFHS -5 states prevalences of moderate anaemia between NFHS 4 to NFHS -5 amongst children age 6 months to 59 months are increased in most of districts of Gujarat, however mild anaemia prevalence has been declined from 31.5% to 27.5 % between NFHS- 4 to NFHS -5.

## 2. Literature review

A study conducted by (Sharma Himani etc. all 2020). stated that nearly 73 million children between the age 0-5 years are prevalent to Anaemia in India. And brings out that Gujarat state is the hotspot of Anaemia occurrence amongst children in India. The study was predominantly conducted to investigate the social and economic factor relation with anaemia in children in

India extracted from NFHS -4 round survey data .The method uses in the study are concentration index followed by bivariate and multiple logistics regression analysis conclude that the social and economic additionally maternal factor Play significant role in prevalent of Anaemia amongst children in India . Approximately 40 % of children who belong to the age of 12-23 months are most of them are presenting anaemia. Children belong to ST community often found to be anaemic in comparison to general category, similarly, children born in lower wealth quintal in has higher ratio of anaemic child then higher income class people. moreover, children residence in rural areas in comparison to urban areas are most likely to be anaemic. Additionally, male children are most likely to be anaemic compared with female children. Furthermore approximately 35% of children are anaemic whose mother did not have at least 4 ANC visit. The highest proportion of anaemia is observed in children whose birth is not delivered in hospital. Moreover, malnutrition among children specifically height is not according to their weight, and weight is not according to the age is also a reason behind the occurrence of anaemia in children. The study also identifies that the infection for instance fever and diarrhoea play key role in the occurrence anaemia in children between the age of five.

Muliya Harsh etc. al.,2022). Studied clinical and social economic determinants of anaemia among children hospitalized in Ahmedabad Gujarat. Concluded that the anaemia in children within the age 6 to 59 months are more enduring the illness and the ratio is significantly higher additionally it has increases during the period of 2015-16 to 2019-2021 from 62.6 % to 79.7% in the state . Furthermore, children who are from 6 months to 5 years are most diagnosed anaemia in Gujarat. Similarly, prevalence of anaemia most likely to common in lower income groups of people. However, mother who are educated still their children are affected by anaemia across the state. approximately 65.7% of children are exposed to severe anaemia in Gujarat. Moreover 52% of children develop anaemia because they are underweight.

A study performed by (Atanu, Sengupta etc. al., 2024) stated that prevalence's of anaemia in children varies differently amongst different regions, gender, caste religion and class. They studied key contributor to anaemia in children are sex ratio, improved sanitation facilities, adequate diet at birth, women body mass index, prevalence of malnutrition (Wasting), and diarrhoea in children. Furthermore, Gujarat is the state with highest prevalence of Anaemia in children. Appropriately 80% of children age from 6 months to 59 months are prevalent to Anaemia in Gujarat. Moreover, it has been evident that more the 17 districts in Gujarat have highest prevalence of Anaemia then national average as well as state average.

## 3. Objective:

- To identify the key determinants of Anaemia amongst children 6 months to 59 months across the district of Gujarat.

## 4. Hypothesis

$H_0$: There is no relationship between Anaemia in children and selected socio - demographic and economic variables.

$H_1$: There is relationship between Anaemia among children and selected socio demographic and economic variables.

## 5. Methodology

Present study aim is to identify the determinants of Anaemia among children who are 6 to 59 months old across the district of Gujarat. Data for the study are collected from NFHS -5 National and Gujarat state report as well as Gujarat state fact sheet. Data analysis is performed by using SPSS. Descriptive statistics was performed to understand the statistics of Anaemia amongst the children and distribution of data across the districts of Gujarat, and before conducting the multiple regression analysis standardizing of data was analysed by using shipro normality test, to find the factor associated to prevalence of anaemia amongst children between the age of five in Gujarat multiple regression analysis was performed.

### 5.1 Dependent variables

Anaemia in children age 6 months to 59 months

(Measured through supply of haemoglobin level in blood <11.0g/dl)

### 5.2 Independent variables

The list of independent variables is identified on the basis of literature review. The independent variable includes birth order three or more, women age 20-24 married before 18, less than two-point five kg to Newborns weighed at birth, severe anaemia in pregnancy, maternal education with 10+ yeary of schooling, breastfed within one hour of birth for under 3 years , children receiving adequate diet. prevalence of diarrhoea amongst children under the age of five, children under five who are underweight, mother who had at least 4 ANC visits, institutional deliveries, household with improved drinking sources of water, household with improved sanitation facilities,

## 6. Results

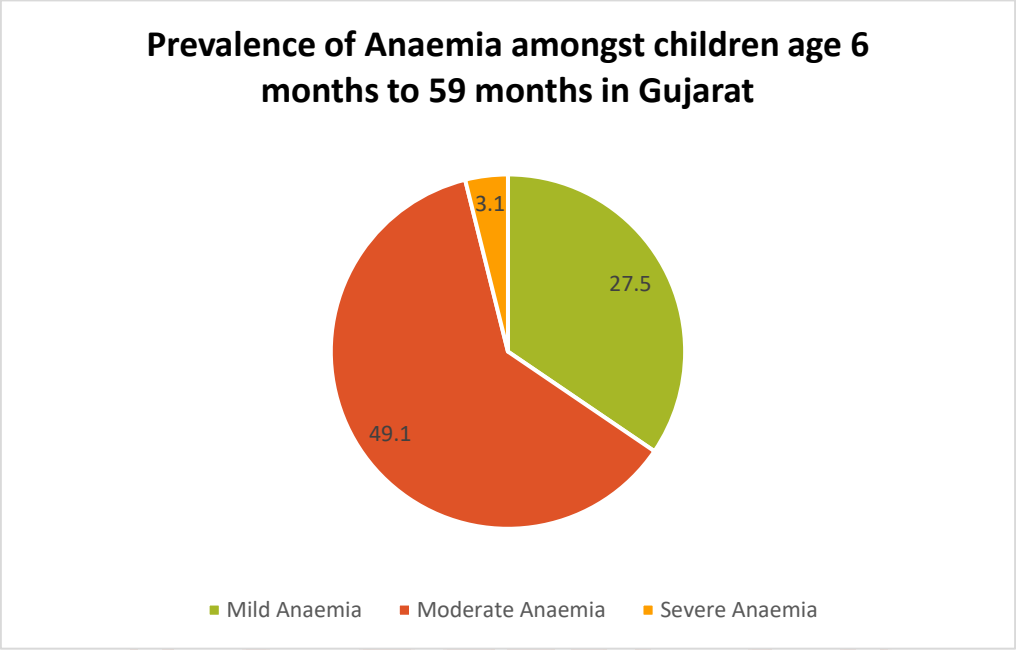
### 6.1 Normality test

**Table:1.1 Results from Normality test**

| **Normality Test** | **Statistic** | **p-value** | |
|---|---|---|---|
| Shapiro–Wilk Test | W = 0.9828 | 0.67 | Data follow a normal distribution (p > 0.05) |

| | | | |
|---|---|---|---|
| Kolmogorov–Smirnov Test | D = 0.085 | 0.78 | |

Shapiro-wilk test and Kolmogorov-Smirnov test is performed to analysis the data normality. Shapiro-wilk test is most appropriate test used for sample size less than 50 (Mataliya, j., Urvashi etc., 2025). Hypothesis of the Shapiro-wilk test Is interpret as when P value is higher than the value of 0.05 then Null Hypothesis is accepted and in contrast when the value of P is less the. 0.05 then Null Hypothesis get Rejected and Alternative Hypothesis is accepted (Mataliya. j. Urvisha etc. al., 2025). The result from the test represent that the P value is greater than 0.05 confirms that the data of anaemia amongst children follows normal distribution.

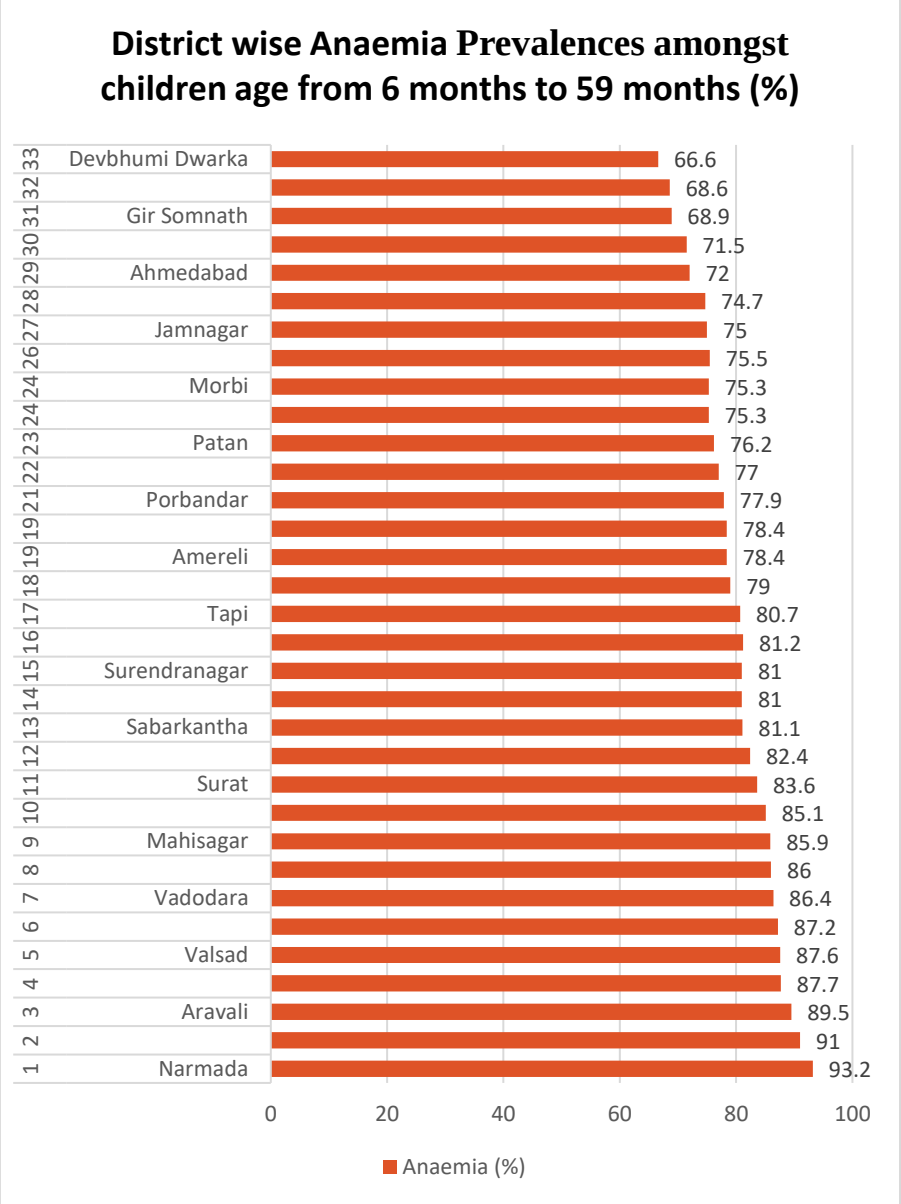



**Graph :1 Pie chart of anaemia prevalence's among children in Gujarat**

Source; NFHS-5

As illustrated in pie chart

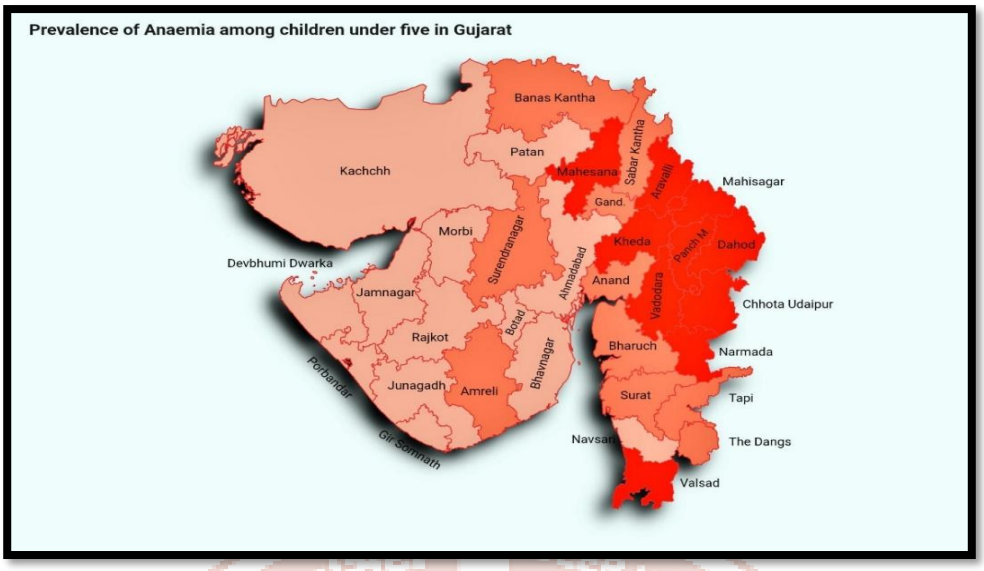
As per NFHS -5, Gujarat state report four out of five children age 6 months to 59 months are anaemic in Gujarat. The bar chart illustrates that 27.5% of children are mild Anaemic, additionally 49.1% children between 0 to 5years are suffering from moderate anaemia moreover, 3.1% are prevalent to severe Anaemia in Gujarat. yielding total prevalence of Anaemia amongst children age 6 months to 59 months in Gujarat is 80%.




Source; NFHS-5

**Graph :2 District-wise percentage of prevalence of anaemia among children age 6months to 59 moths across Gujarat**

The present Graph shows the rank wise variation in prevalence's of Anaemia amongst children age 6 months to 59 months across the districts of Gujarat. Narmada district (93.2%) reports significantly higher Anaemia prevalence across all the districts. Followed by Panchmahal (91%), Aravalli (89.5%) and Chhota Udaipur (87.7%). These districts report significantly higher prevalence of Anaemia amongst children age 6 months to 59 months then the State as well as National average. Whereas Devbhoomi Dwaraka (66.6%), reports Comparatively better status of children across the districts.




**Graph:3 Spatial distribution of prevalence of anaemia across district of Gujarat.**

The map demonstrates district wise prevalence of Anaemia amongst children age 6 months to 59 months across the districts of Gujarat. All 33 districts are divided into 3 class on the basis of ranking. The dark red coloured districts are highlighted as Highest occurrence of Anaemia among children in the state. Those districts are severely affected from anaemia and facing major Nutritional deficiency in children. Furthermore the districts falls in orange colour show moderate ratio of anaemic children in the districts. Moreover light peach colour depicts mild percentage of Anaemia Prevalence's across the districts of Gujarat.

## Table: 1:2 Descriptive statistics of prevalence's of anaemia amongst children age 6 months to 59 months across the districts of Gujarat

| Descriptive statistics of anaemia Prevalence's amongst children in Gujarat | |
|---|---|
| | |
| Mean | 79.83333 |
| Standard Error | 1.190641 |
| Median | 80.7 |
| Mode | 72 |
| Standard Deviation | 6.839712 |
| Sample Variance | 46.78167 |
| Kurtosis | -0.7497 |
| Skewness | -0.01814 |
| Range | 26.6 |
| Minimum | 66.6 |
| Maximum | 93.2 |
| Sum | 2634.5 |
| Count | 33 |
| Largest (1) | 93.2 |

| | |
|---|---|
| Smallest (1) | 66.6 |
| Confidence Level (95.0%) | 2.425257 |

From the above table1:2 represents descriptive statistics of prevalences of anaemia amongst children aged 6 months to 59 months. the average anaemia prevalence's in Gujarat is 79%.the minimum prevalence is 66.3 and maximum percentage of prevalence of anaemia among children is 93.2. the statistics of range is 26.6 percentage indicates significant variability in prevalences anaemia amongst children between the age of five across the districts. The median value (80) indicates that of half of districts carries 80% anaemia children and vice versa. The mode value represents that 72% is the frequent percentage of anaemia prevalence across districts.

The value of skewness explains that the value of median is bigger than mode hence, data are normally distributed, additionally the value of kurtosis (-0.7) negatively skewed indicates that data are evenly distributed. Where as the value of SD (6.8) tells dispersion of value around average indicates less variation in prevalences of anaemia amongst children under the age of five across districts.

Dependent Variable is – Anaemia in children age from 6 months to 59 months.

the multiple regression analysis is run to identify the key factors affecting to anaemia in children age of five. the following liner multiple regression equation explains the function relation between dependent and independent variable.

$ANA = \beta 0 + \beta 1\ ISF + \beta 2\ CAD + \beta 3\ PWSA + \beta 4\ WMBA18 + \varepsilon \ldots\ldots\ldots (1)$

ISF : Improve sanitation facilities

CAD : children having adequate diet

PWSA : pregnant Women between 20-24 Married before the age of 18

**Table 1.3 Results from Multiple regression analysis**

**Model**

**Summary**

| Model | Value of R | Value of R Square | Ad - R Square | SD | Value of DW |
|---|---|---|---|---|---|
| 1 | .616[a] | .379 | .290 | 5.76235 | 1.976 |

**Table: 1.4 Results from ANOVA Table**

**Anova**

| | SS | df | MS | F statistics | P value. |
|---|---|---|---|---|---|
| Regression | 567.284 | 4 | 141.821 | 4.271 | .008[b] |

| | | | | | |
|---|---|---|---|---|---|
| Residual | 929.730 | 28 | 33.205 | | |
| Total | 1497.013 | 32 | | | |

**Table 1.5: Results from Coefficients table**

Coefficients

| Model | USC | | SC | t | Sig. | 95.0% CI for B | | Collinearity value | |
|---|---|---|---|---|---|---|---|---|---|
| | B | SE | Beta | | | LB | UB | Tolerance | VIF |
| (Constant) | 93.065 | 7.543 | | 12.337 | .000 | 77.614 | 108.517 | | |
| Percentage of Pregnant Women having severe anaemia | -.321 | .211 | -.268 | -1.522 | .139 | -.753 | .111 | .713 | 1.403 |
| children age12-23months receiving adequate diet | .079 | .239 | .055 | .332 | .743 | -.410 | .568 | .809 | 1.236 |
| women age 20-24married before the age of 18 | .260 | .124 | .388 | 2.091 | .046 | .005 | .514 | .646 | 1.549 |
| Improved sanitation | -.248 | .088 | -.484 | -2.822 | .009 | -.428 | -.068 | .755 | 1.325 |

a. Dependent Variable: "children having any anaemia

The results from the multiple regression analysis model explains 37% of variation in independent variable by the predators in the model. ($R^2$=0.379, Adjusted R square = .290), the value of Durbin Watson statistics in the model is1.96 explains the is no presence of autocorrelation among the independent variable in the model. and further results from

Anova table illustrate that the model is statistically significant with p value .008 ($p < 0.05$), explains that women age 20 to 24 married before the age of 18 and improved access to sanitation facilities are significantly affects the prevalences of anaemia in children age 6 months to 59 months. In coefficient table the value unstandardised coefficient tells the effect of predicators on dependent variable in units. It tells the magnitude of increases and decreases in the unit of dependent variable.

The coefficient table shows that 1% increases in the women age 20- 24 married before the age of 18 leads to 26% increases in prevalences of anaemia in children age 6 months to 59 months. And conversely 1% increases in improved access to sanitation facilities are associated

to 24 % decreases in the prevalences of anaemia in children. additionally, there is neither an issue of multicollinearities observed as the value of variance related factor (VIF) is below 5 and tolerance values are greater than 0.20. this indicates there is noise of multicollinearity in the model.

Additionally, the results from normal p-plot shows all the point in the plot are close to diagonal line indicates equivariance. Similarly, scatter plot doesn't represent any pattern indicates equal variance represent in graph 5.

## 7. Key Findings from the study

- The study found that 27.5% of children age between 0 to 5 years are mild Anaemic, and approximately 49.1% of children are having moderate anaemia additionally 3.1% children are prevalent to severe Anaemia in the state Gujarat, which further yielding to 80% of total children age from 6 months to 59 months are suffering from anaemia.
- District-wise prevalences of anaemia among children reveals that Narmada district (93.2%) reports significantly higher prevalence of Anaemia across the all the districts. Followed by Panchmahal (91%), Aravalli (89.5%) and Chhota Udaipur (87.7%). These districts report significantly higher prevalence of Anaemia among children between the age of 6 months to 59 months then the State and National average.
- The outcomes of multiple regression analysis are statistically significant and among all predicators women age 20 to 24 years married before the age of 18 and improved access to sanitation facilities are key predictors of prevalence of Anaemia among children age 6 months to 59 months across Gujarat

## 8. Discussion

The multiple regression analysis identifies approximately 29% of variance in the explanatory variable anaemia among children age 6 months to 59 months indicating women age 20 to 24 years married before the age of 18 and improved sanitation facilities plays significant role. The model doesn't explain remaining 71% variance in the model. it doesn't explain determinants such as genetic factor, due to lack of data limitation, according to WHO prevalences of anaemia among children are also influenced by nutrition deficiency, chronic inflammation. Determinants such as, Pregnant Women having severe anaemia, women, children age 12-23 months receiving adequate diet. Are not statistically significant, however literature shows the significant impact of prevalence of anaemia among children. Moreover, indicators such diarrhoea among children under five aged , children under five aged who are underweight, mother who had four ANC visits, household with improved drinking sources of water, less than two-point five kg to Newborns weighed at birth, age with 10 or more year of

schooling, children under age of 3 breastfeed within one hour of birth is not included in the multiple regression analysis due some variable are highly correlated which mislead estimate of coefficient table.

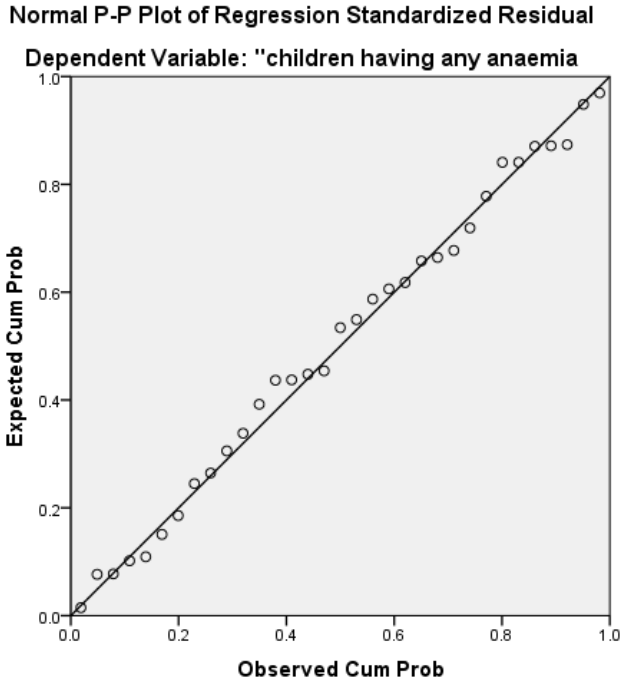
## 9. Conclusion

The study used the multiple regression analysis to identify the key determinants of Anaemia among children across districts of Gujarat. The findings from the study identifies that the women age 20 to 24 years married before the age of 18 and aces to improve sanitation service are key predictors of prevalence of Anaemia among children age between 6 months to 59 months across Gujarat.

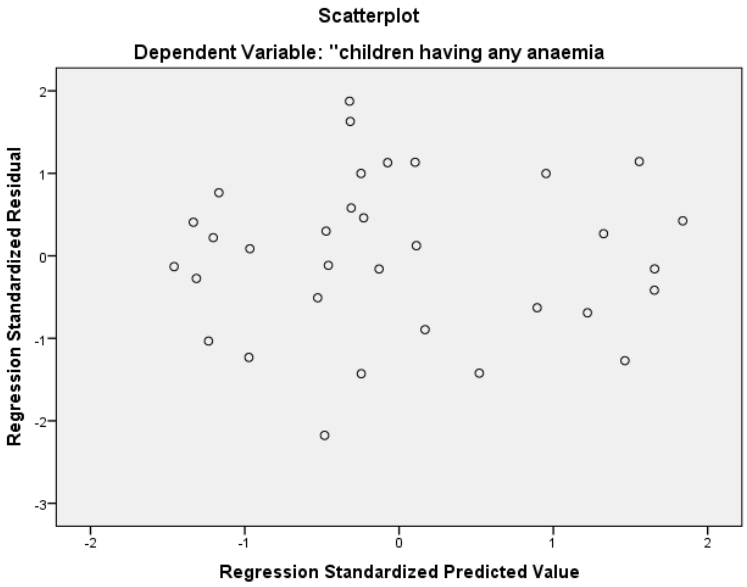
The findings reveal that early marriages of women constrain in limited access to education facilities and maternal nutrition and early pregnancies awareness, results into increasing the risk of anaemia among children. Additionally access to safe sanitation facilities plays significant role in reducing the risk of anaemia in children through decreasing the risk infection among children. promoting sanitation infrastructure and strengthen maternal health and education outcomes helps to improve more ANC visit, optimum utilisation of health services, enhance decision making among women, Dely in early pregnancy and birth order, as a consequence reduces risk of prevalences of anaemia among children.

## 10.Appendix

**Graph: Normal P-Plot**




**Graph: 2 Scatter plot of Residuals**




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