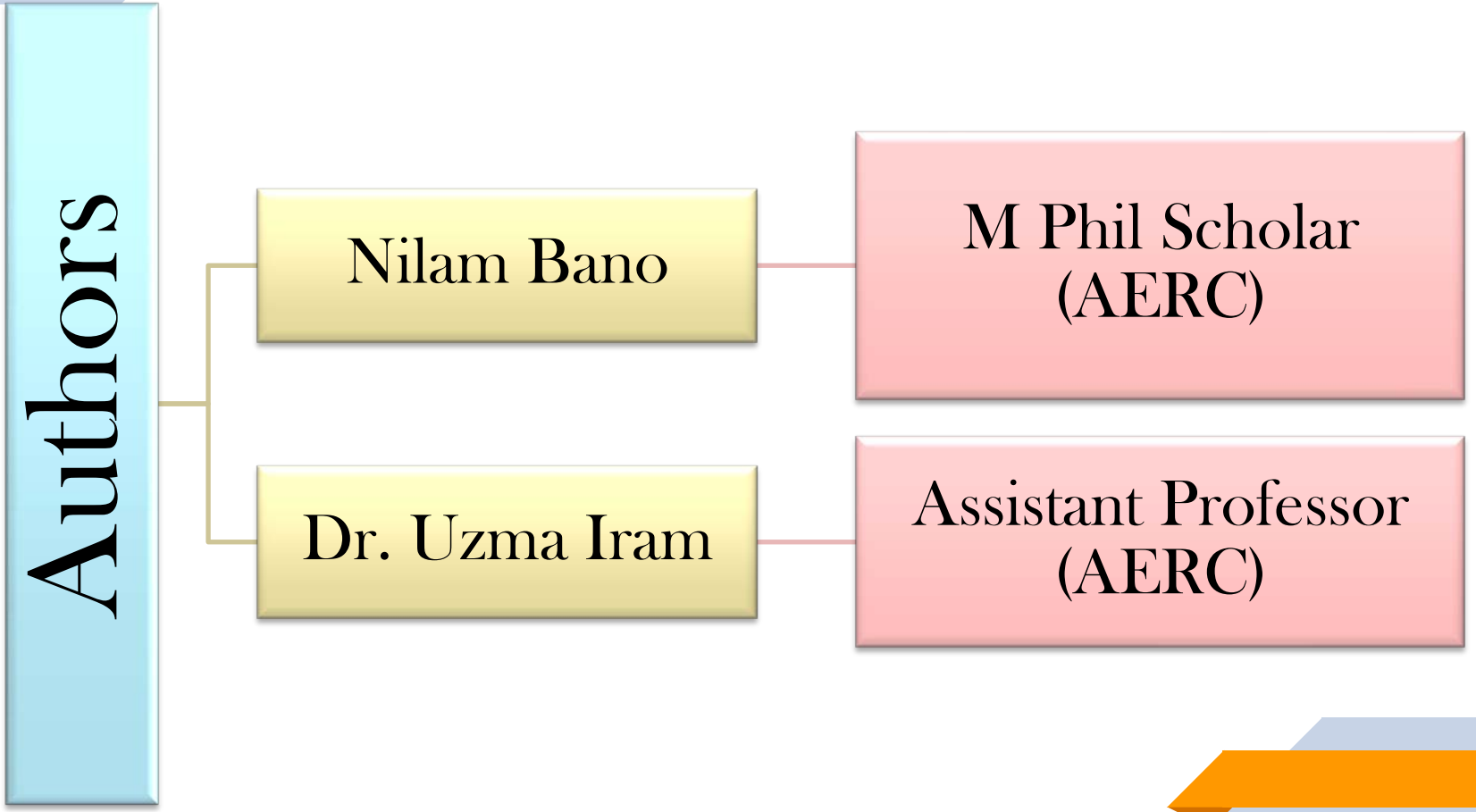
Determinants of Child Nutritional Inequalities in Pakistan: Regression Based Decomposition Analysis


Authors
Nilam Bano
M Phil Scholar
(AERC)
Dr. Uzma Iram
Assistant Professor
(AERC)


Introduction
Review of Literature
Research Methodology
Findings/Results
Conclusion
Policy Recommendations

1

Introduction

- The Central Asia Regional Economic Cooperation, or CAREC, Program is a partnership of 11 countries.

- Objective of CAREC is to enhance cooperation and support In a way of development.

Achieve Development Through Cooperation , Poverty Reduction And Accelerated Growth

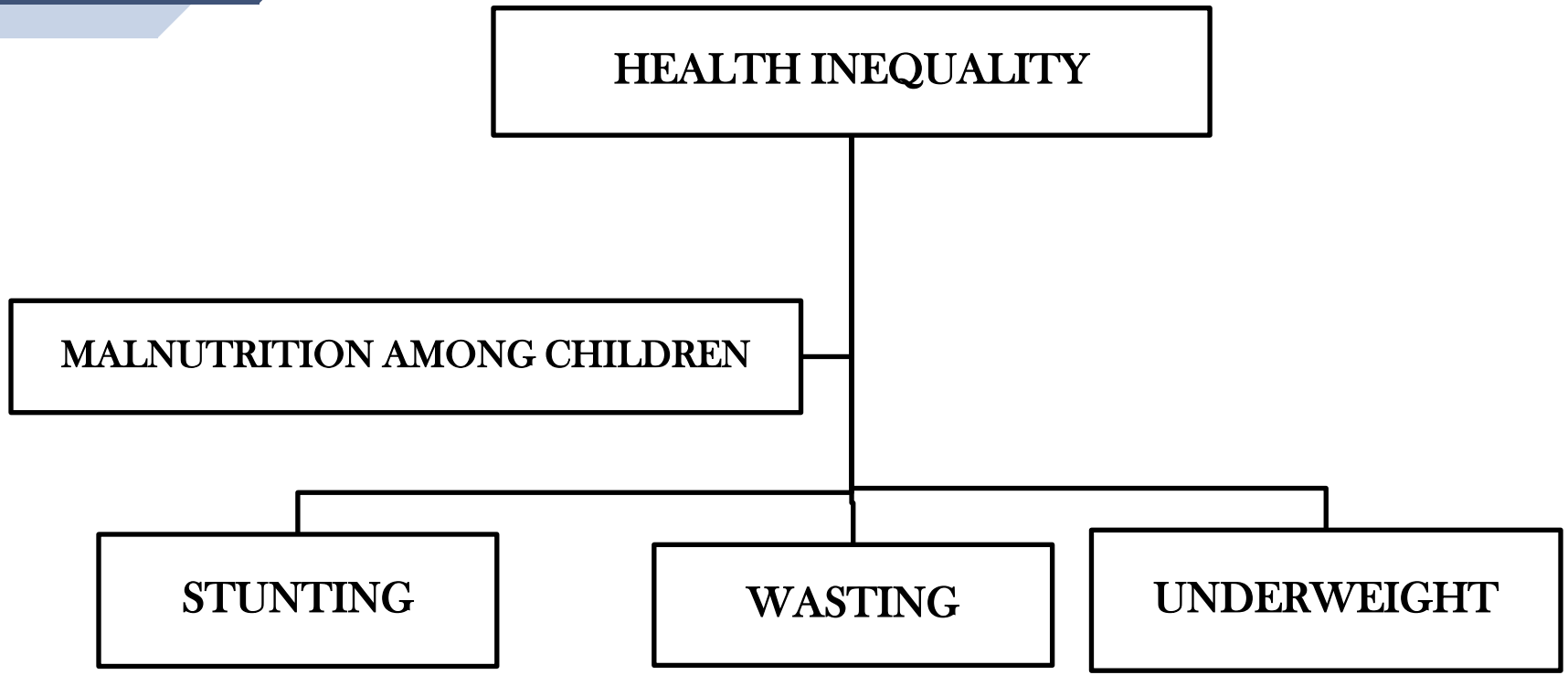
Poverty & Poor Health

- Poverty and poor health worldwide are inextricably linked. The causes of poor health for millions globally are rooted in political, social and economic injustices.
- Poverty is both a cause and a consequence of poor health. Poverty increases the chances of poor health. Poor health, in turn, traps communities in poverty.

Health Inequalities

- Health inequalities can be defined as differences in health status or in the distribution of health determinants between different population groups. (who, 2010)

- The lower an individual's socio-economic position, the higher their risk of poor health (WHO 2013).



ANTHOPOMETRIC MEASURES OF MALNUTRITION

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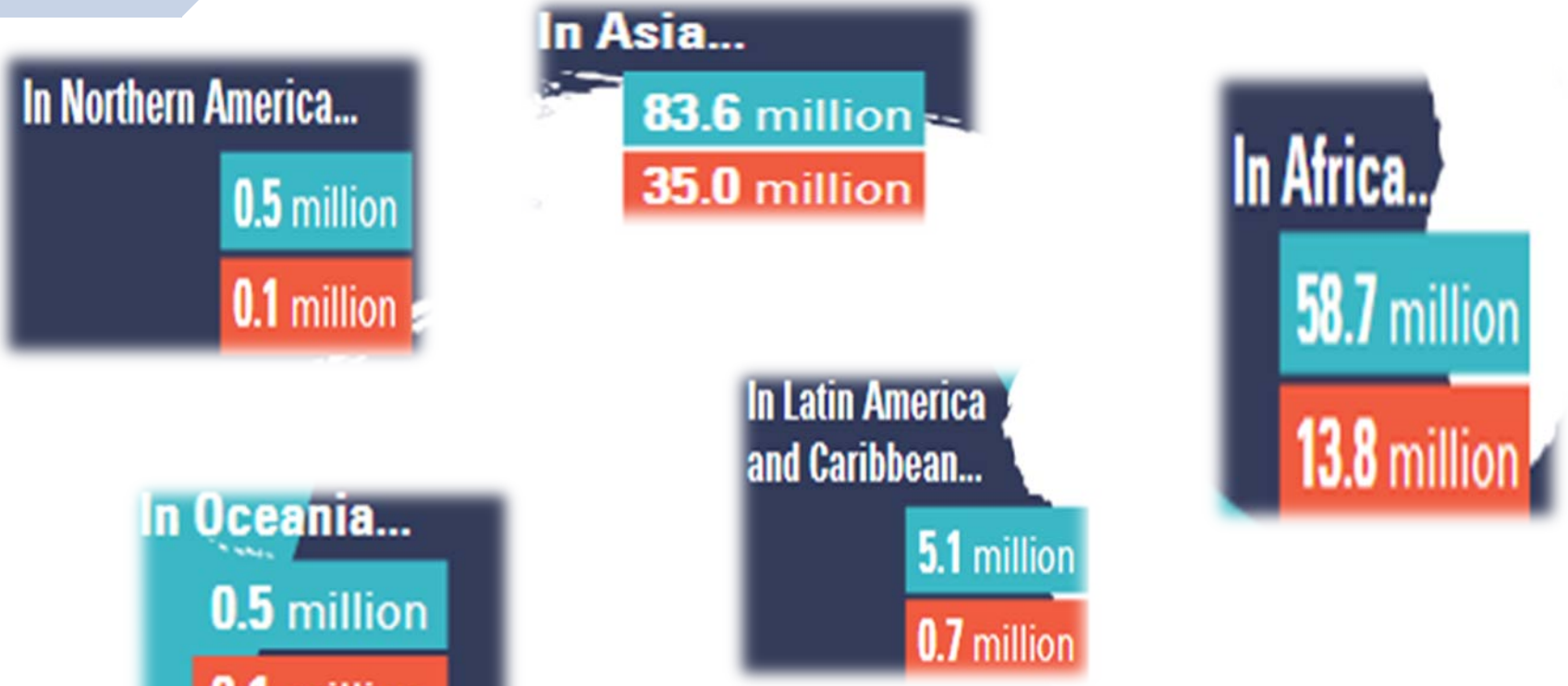
- **STUNTING /**
- The height for age (HAZ)
- A child is stunted or chronically malnourished when his/ her stature is smaller than its age.

- **WASTING /**
- Weight for height (WHZ)
- It reports the current health status of children by measuring the weight of the child with respect to his/ her height.

- **UNDERWEIGHT/**
- Weight for age (WAZ)
- This index of weight, height and age is the representative of both types (acute and chronic) of child malnutrition.

Global Estimates provided by WHO (2018)



Regional Estimates provided by WHO (2018)

Ultimate Aim of CAREC in Context of Health

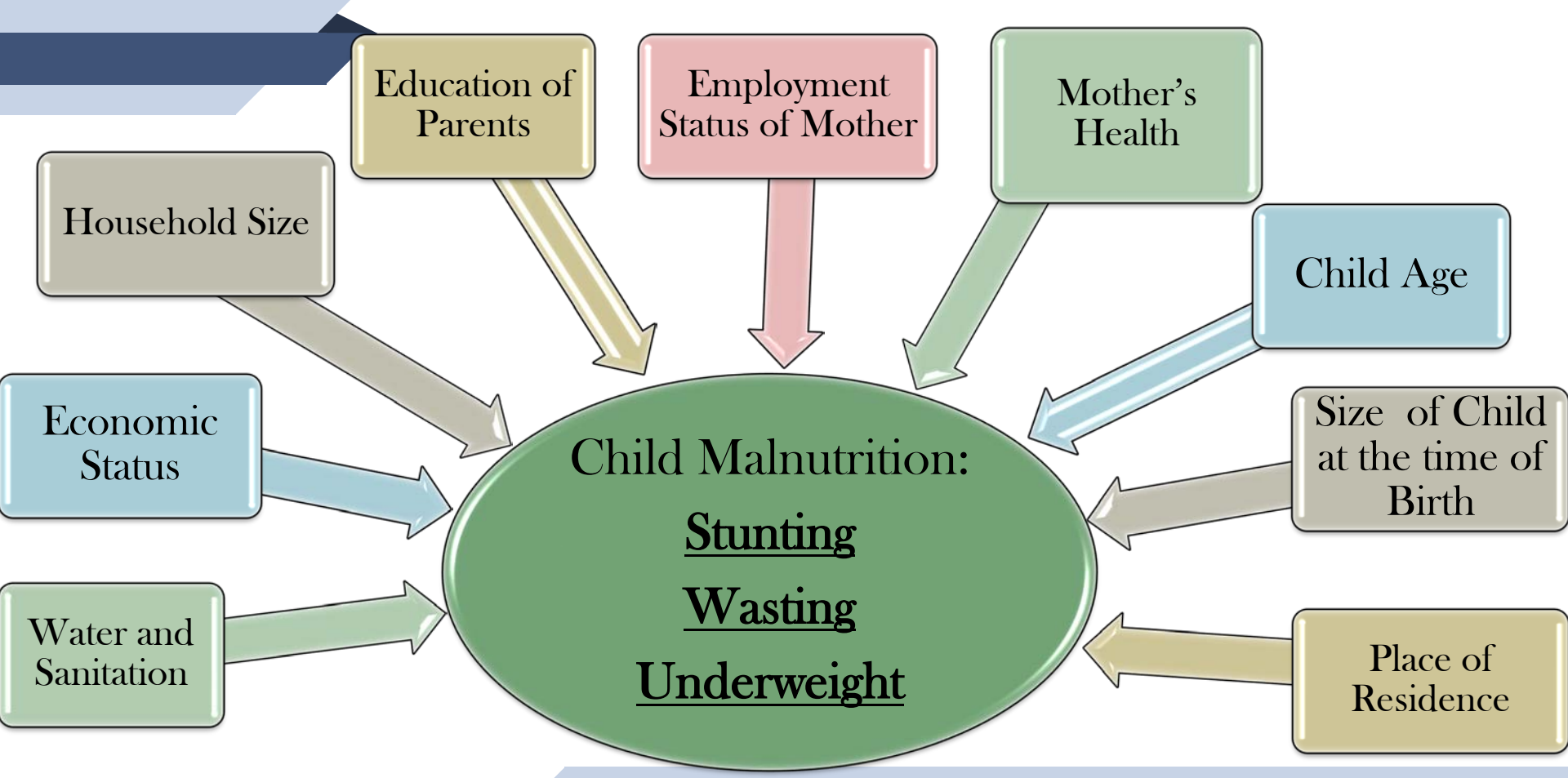
The ultimate aim is for all children to be free of malnutrition in all its forms

- Stunting 11.8%
- Wasting 3.7%

Malnutrition in CAREC Countries, UNICEF & WHO (2018)

Socio-economic Health Inequalities with respect to Children Malnutrition

- Health Inequalities among Children who are Malnourished.
- Age of Children (0-59 moths) as mentioned by WHO standards.



Responsible Factors of Malnutrition

Malnutrition in Pakistan

Variables	1990-94	1995-2005	2012-13
Underweight	40.1	38	30
Wasting	11.8	13	10.8
Stunting	36.3	37	44.8

Data Sources: 19990-94, National Health Survey; 1995-2005, UNICEF; 2012-13, PDHS

Policy Measures Taken by Authorities to Reduce Malnutrition

- Considering the alarming figures of malnutrition among children, Government of Pakistan has been intervening through multiple policies.
- In this regard the associated reasons of malnutrition in Children have been addressed such as food insecurity, malnutrition in mothers, disease and illness, inadequate health services and lack of awareness about feeding and healthcare practices.

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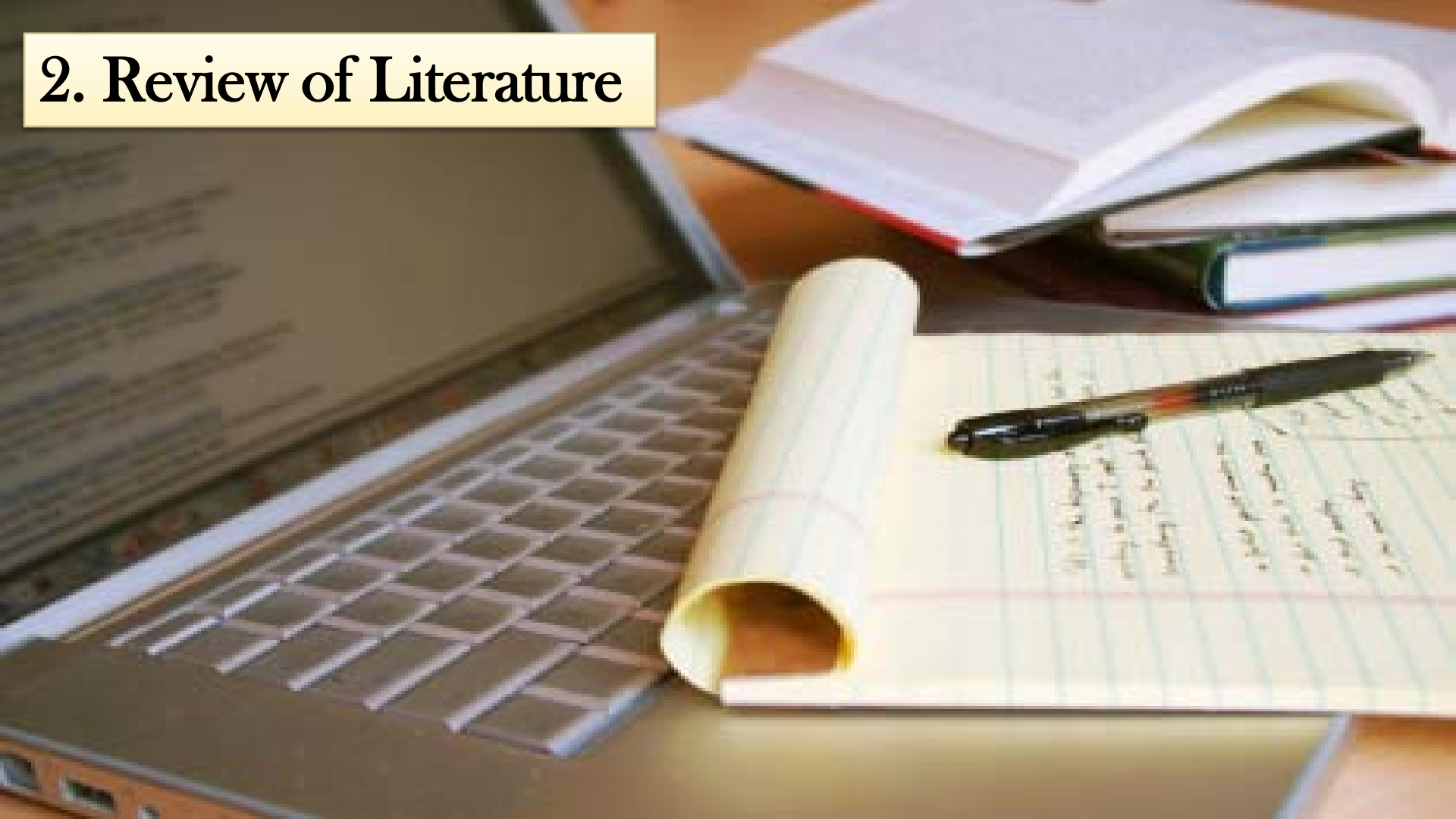
- For instance:
- the Government of Punjab's Department of Health has launched an Integrated Reproductive Maternal Neonatal Child Health and Nutrition (IRMNCH&N) Programme.
- Organized numerous Counselling sessions on Infant Young Child Feeding (IYCF)
- Provision of Food, Medicine and Vaccines and so on.

Aim of the Study

- To explore the determinants of child malnutrition and the extent to which socioeconomic inequalities in child health can be explained by socioeconomic determinants of health.

2. Review of Literature



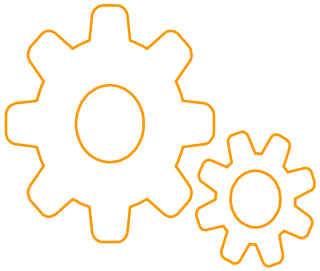
S. No.	Author & Year	Findings
1.	LuChen et. al (2014)	They found an increasing trend towards greater health inequality among Chinese children over the last two decades. Nutritional status was positively impacted by middle school enrollments, the urbanization rate, inflation-adjusted per capita gross domestic product, and per capita public health spending.
2.	Ahmad and Mesbah (2016)	Their study found that the income inequality between urban and rural households explains most of the malnutrition gap. Results were robust to the different decomposition weighting schemes measures aimed at reducing regional inequalities and improving population health outcomes.
3.	Vu Duy Kien et. al (2016)	They highlighted that Inequality in child malnutrition increased between 2000 and 2011, even though the overall rate declined. Most of the inequality in malnutrition was due to ethnicity and socioeconomic status. The total differential decomposition showed that the biggest and second biggest contributors to the changes in underweight inequalities were age and socioeconomic status, respectively.

S. No.	Author & Year	Findings
4.	Yichao Wua and Di Qib (2016)	They found the headcount ratio of children who are undernourished in stunting and underweight has declined over years from 1991 to 2009 in China, and the inequality among children who are stunted and who are underweight has been alleviated as well. The declining malnutrition rate is closely associated with the child-focused social welfare policies.
5.	Woldemariam and Timotiows (2002)	This study found evidence that socioeconomic and demographic variables have a significant influence malnutrition in children. Region of residence, household economic status, mother's employment status and decision making power over her income, mother's age and marital status are important determinants of malnutrition among children.

S. No	Author &Year	Findings
06.	Murtaza et. al (2015)	They concluded that Child nutritional status in Pakistan are linked with several factors such as severe poverty, illiteracy, lack of knowledge, and awareness of child healthcare, singularly inadequate provision of health services, and poor infrastructure.
07.	Novigan et. al (2015)	They found that there is statistically significant inequality in childhood malnutrition against the poor, irrespective of the measure of childhood nutritional status employed in the analysis. The findings also showed that individual socio-economic characteristics are important contributors to improving inequality in childhood malnutrition.

3. Research Methodology

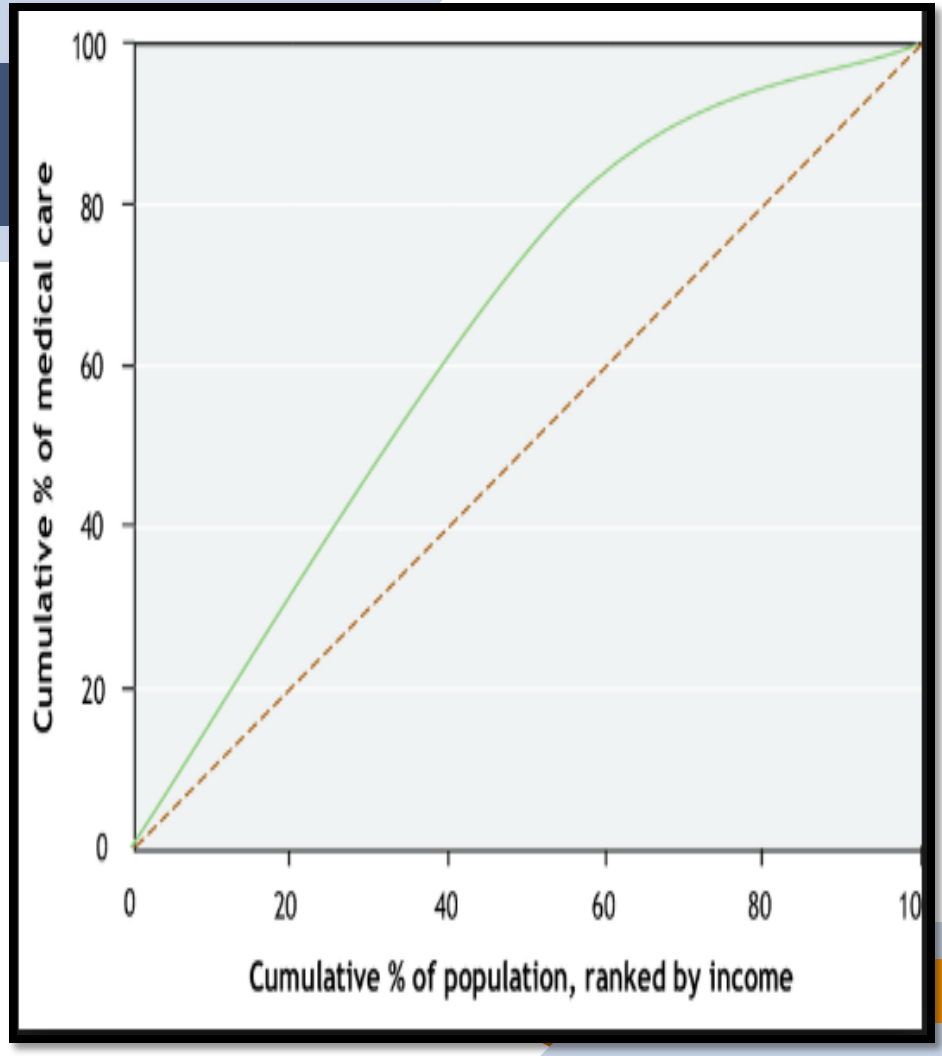
Inequality Measure and Decomposition Analysis



- Concentration Curve
- Concentration Index
- Regression Analysis
- Decomposition Analysis
  - Concentration Index of each X
  - Elasticity
  - Contribution
  - %Contribution

Concentration Curve

- The concentration index is a measure of how concentrated the study variable is in various socioeconomic segments of the population.
- It is based on the concentration curve which plots on the x-axis, the cumulative percentage of the sample ranked by the socioeconomic variable, started with the poorest and on the y-axis, the cumulative percentage of ill-health variable.



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- The concentration curves depict inequality against the poor if it lies above the line of equality (45° line).
- On the other hand, inequality against the rich exists if the curve lies below the line of equality. In a situation where there exists perfect equality in child malnutrition, irrespective of wealth status, the concentration curve is a straight line equal to the 45° line.
- The magnitude of inequality is depicted by how far the curve lies away from the line of equality. For instance, if the magnitude of inequality in favor of the rich is higher, the farther the curve will be above the line of equality.

Concentration Index

- The present study used Concentration index to quantify the existing inequality among malnourished children and to see which income group is suffering from malnutrition.
- Empirically, concentration index is explained as:

$$C = \frac{2}{\mu} cov(Yi, Ri) \qquad (3.1)$$

- **Yi** represents the dependent variable; Stunting, Wasting, Underweight.
- **Ri** shows the fractional rank of the population in terms of his/her belonging from the specific wealth quintile
- **μ** denotes the average value of the dependent variable.
- **cov** refers to the covariance of the outcome variable.

Decomposition Analysis of Concentration Index

- Decomposition analysis helps to explore the magnitude of contribution of the responsible factors to the existing inequalities.
- Regression model is formed to develop the relationship between dependent variable and explanatory variables.

$$Yi = \alpha + \Sigma k \beta k Xki + \varepsilon i \qquad (3.2)$$

- Yi shows the outcome variable
- Bk shows the coefficients
- Xk represents the set of explanatory variables
- εi denotes the error term

- The basis of relationship among outcome variable and the set of explanatory variables, the concentration index for outcome variable can be denoted as follows:

$$C = \Sigma k\left(\frac{\beta k \bar{x} k}{\mu}\right) Ck + \frac{GC\varepsilon}{\mu} = C\hat{y} + \frac{GC\varepsilon}{\mu} \qquad (3.3)$$

- U denotes the mean of dependent health variable
- Whereas xk (bar) is the average of xk
- ck denotes the value of concentration index of xk.
- Moreover, the term GC is used as to show the residual value of concentration index.
- The equation consists of two parts. The first part is based on the elasticity and the concentration indices of the explanatory variables. It explains how much change in the dependent variable is based on the one explanatory variable.
- On the other hand, the second part shows the error term or unexplained term that shows the effect of other unquantifiable factors on health status of different socioeconomic groups.

Variables to Estimate Children Health Inequality

Dependent Variables

- The anthropometric indicators of nutritional status of under-five children have been used in this study:
- Stunting or The height for age (HAZ)
- Wasting or Weight for height (WHZ)
- Underweight or weight for age (WAZ)

Independent Variables:

- Child Age
- Child Age (square)
- Child Gender (female)
- Wealth Index
- Household Size
- Improved Toilet Facilities
- Improved Water Sources
- Region (Urban)
- Mother Education
- Mother Age (log)
- Mother's BMI
- Not Working Mother
- Father Education
- Father Age

Data Source

- Pakistan Demographic and Health Survey (PDHS) for the year 2012-13
- Conducted by NIPS
- 14000 Households

- 500 PSUs including 252 rural and 248 urban areas of Pakistan
- Each PSU is based on 28 households

4. Results/ Findings

Description of Variables

Variables	Description of Variables
Stunting (0-1)	Binary variable: Stunted children = 1; Not stunted = 0
Wasting (0-1)	Binary variable: Wasted children = 1; Not wasted = 0
Underweight (0-1)	Binary variable: Wasted children = 1; Not wasted = 0
Child characteristics	
Birth order	Continuous variable:
Size of child at birth	Dummy Variable: average and large sized children= 1; Otherwise = 0
Child age	Continuous variable: 0-59 months
Child age (square)	Square of the above mentioned child age
Child gender (female)	Dummy variable: female child = 1; otherwise = 0
Household characteristics	
Wealth Index	Continuous variable
Household size	Continuous Variable
Improved toilet facilities	Dummy variable: presence of toilet facility = 1; otherwise = 0
Improved water sources	Dummy variable: Access to safe drinking water = 1; otherwise = 0
Region (Urban)	Dummy variable: If the region is Urban = 1; otherwise= 0
Parental characteristics	
Mother education	Continuous variable
Mother age (log)	Log of mother age
Mother's BMI	Continuous variable
Not working mother	Dummy variable: Not working mother= 1; otherwise = 0
Father education	Continuous variable
Father age	Continuous variable

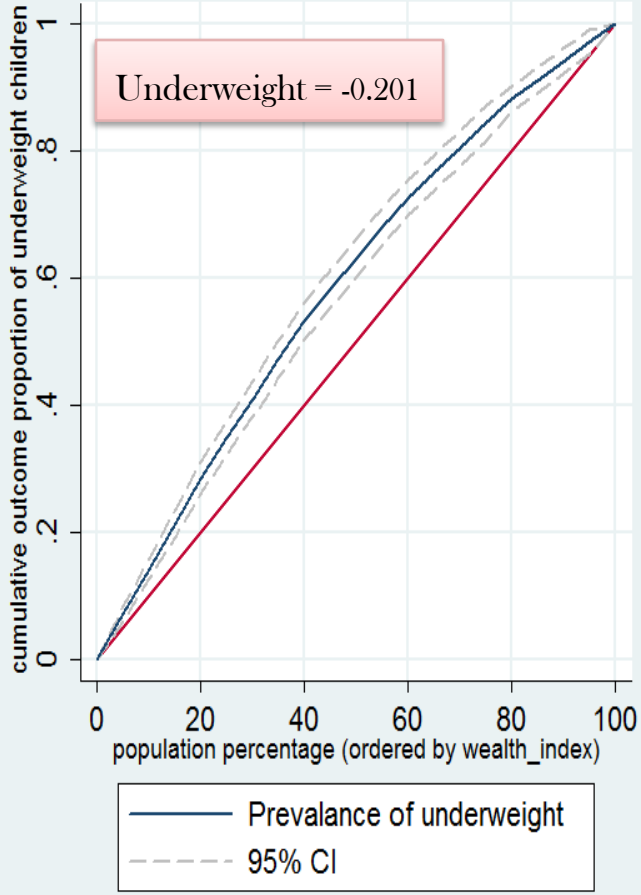
Descriptive Statistics

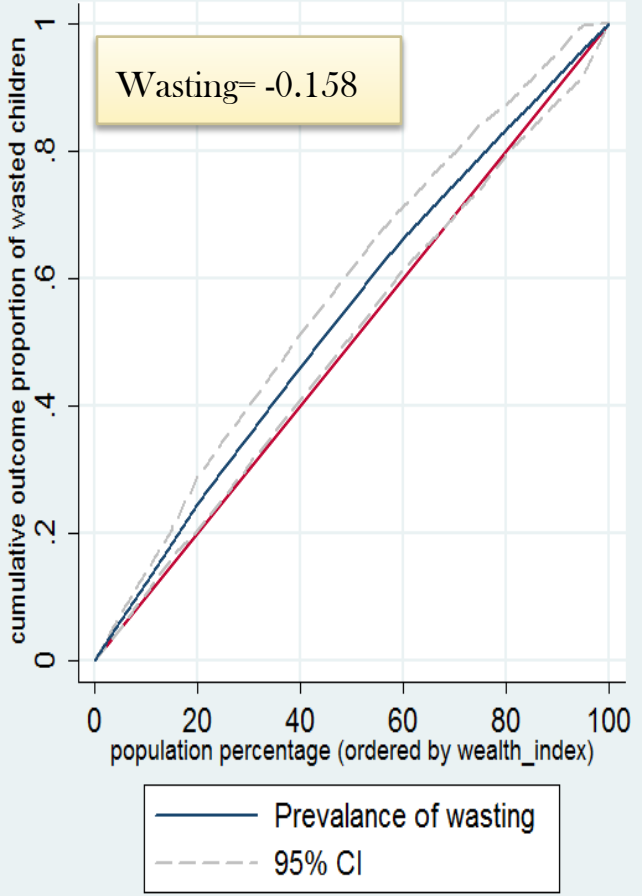
Variables	Mean	Standard Deviation	Minimum Value	Maximum Value
Stunting (0-1)	0.45	0.49	0	1
Wasting (0-1)	0.10	0.30	0	1
Underweight (0-1)	0.267	0.44	0	1
Birth order	3.502	2.38	1	
Size of child at birth	0.820	0.38	0	1
Child age	30.151	17.20	0	59
Child age (square)	1205.081	1060.69		
Child gender (female)	0.985	1.00	0	1
Wealth Index	3.00	1.42	1	5
Household size	9.29	5.07	2	48
Improved toilet facilities	0.74	0.43	0	1
Improved water sources	0.30	0.45	0	1
Region (Urban)	0.43	0.49	0	1
Mother education	1.86	2.170	0	6
Mother age	29.4	0.21	15	49
Mother's BMI	24.27	7.63	0	1
Working mother	0.78	0.41	0	1
Father education	2.78	2.13	0	6
Father age	34.87	8.28	16	65
No. of Households= 3071				

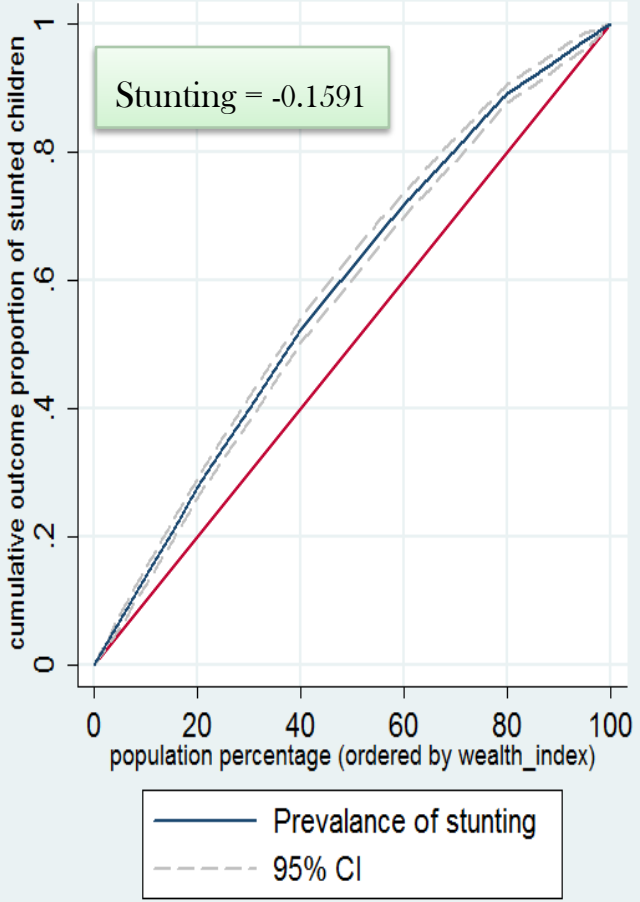
Magnitude of Concentration Indices

Dependent Variables	Values of Concentration Indices
Stunting	-0.1591
Wasting	-0.158
Underweight	-0.201

Concentration Curves for Malnourished Children







Logistic Regression Output for Child Malnutrition

Variables	Stunting		Wasting		Underweight	
	Coefficient	Z-statistics	Coefficient	Z-statistics	Coefficient	Z-statistics
Child characteristics						
Birth order	0.088 (0.249)***	3.56	0.014 (0.384)	0.39	0.042 (0.0271)*	1.56
Size of child at birth	-0.364 (0.102)***	-3.56	-0.160 (0.148)	-1.08	-0.458 (0.105)***	-4.25
Child age	0.086 (0.009)***	9.03	-0.030 (0.013)**	-2.30	0.016 (0.010)**	1.68
Child age (square)	-0.001 (0.0001)***	-7.07	0.0001 (0.0002)	0.69	-0.0001 (0.0001)	-1.18
Child gender (female)	-0.091 (0.039)**	-2.34	-0.141 (0.064)**	-2.35	-0.092 (0.042)**	-2.18
Household characteristics						
Wealth Index	-0.340 (0.042)***	-8.00	0.012 (0.065)	0.19	-0.066 (0.046)*	-1.44
Household size	0.033 (0.008)***	4.21	-0.005 (0.012)	-0.46	0.009 (0.008)*	1.06
Availability of toilet facility	0.160 (0.106)*	1.51	-0.226 (0.154)*	-1.47	-0.153 (0.109)	-1.40
Improved water sources	0.046 (0.092)	0.51	-0.232 (0.147)*	-1.57	-1.845 (0.103)*	-1.78
Region (Urban)	0.246 (0.095)**	2.58	0.170 (0.146)	1.16	0.0226 (0.104)	0.104
Parental characteristics						
Mother education	-0.057 (0.022)***	-2.60	-0.092 (0.036)**	-2.56	-0.106 (0.025)***	-4.22
Mother age	-0.477 (0.308)*	-1.55	-0.237 (0.459)	-0.52	-0.667 (0.339)**	-1.96
Mother's BMI	-0.017 (0.006)***	-2.60	-0.0309 (0.012)**	-2.39	-0.0627 (0.010)***	-6.13
Working mother	-0.755 (0.098)	-0.77	0.182 (0.155)	1.17	-0.0965 (0.103)	-0.93
Father education	-0.063 (0.198)***	-3.22	-0.007 (0.030)	-0.26	-0.046 (0.021)**	-2.15
Father age	-0.017 (0.006)***	-2.72	0.0061 (0.008)	0.68	-0.011 (0.007)*	-1.62
Constant	1.963 (0.900)**	2.18	0.254 (1.354)	0.19	3.716 (0.988)***	3.76
Pseudo R^2	0.1052		0.038		0.065	
LR-chi2	444.87		78.49		234.35	
Number of observations	3071		3071		3071	

*** =p<0.01, **=p <0.05, *=p <0.1 Values are in parenthesis () show standard errors

Decomposition Analysis for the Stunted Children

	(A)	(B)	(C)= (AxB)	(D)	(E)
Dependent variable: Stunted	concentration index	elasticity	contribution	contribution to CI	% contribution
Child characteristics					
Birth order	-0.090	0.089	-0.008	0.050	5.040
Size of child at birth	0.019	-0.196	-0.004	0.024	2.383
Child age	-0.013	1.082	-0.014	0.087	8.731
Child age (square)	-0.019	-0.570	0.011	-0.070	-6.950
Child gender (female)	-0.004	-0.070	0.000	-0.002	-0.196
Household characteristics					
Wealth Index	0.268	-0.527	-0.141	-0.888	-88.825
Household size	0.020	0.138	0.003	-0.018	-1.778
Availability of toilet facility	0.204	0.069	0.014	-0.088	-8.799
Improved water sources	0.321	-0.011	-0.003	0.022	2.186
Region (Urban)	0.491	0.054	0.027	-0.167	-16.706
Parental characteristics					
Mother education	0.368	-0.099	-0.037	0.230	23.004
Mother age (log)	0.000	-0.529	0.000	0.001	0.128
Mother's BMI	0.053	-0.143	-0.008	0.047	4.728
Working mother	0.098	0.008	0.001	-0.005	-0.514
Father education	0.149	-0.058	-0.009	0.055	5.460
Father age	-0.005	-0.357	0.002	-0.012	-1.151
Residual			0.007	1.732	173.200
Sum			-0.159	0.999	99.939

Decomposition Analysis for the Wasted Children

	(A)	(B)	(C)= (AxB)	(D)	(E)
Dependent Variable: Wasting	Concentration index	Elasticity	Contribution	Contribution to CI	% Contribution
Child characteristics					
Birth order	-0.090	-0.162	0.015	-0.093	-9.302
Size of child at birth	0.019	-0.154	-0.003	0.019	1.904
Child age	-0.013	-1.140	0.015	-0.093	-9.338
Child age (square)	-0.019	0.244	-0.005	0.030	3.026
Child gender (female)	-0.004	-0.072	0.000	-0.002	-0.206
Household characteristics					
Wealth Index	0.268	-0.494	-0.133	0.845	84.543
Household size	0.020	-0.032	-0.001	0.004	0.412
Availability of toilet facility	-0.205	0.204	-0.042	0.267	26.688
Improved water sources	0.321	0.012	0.004	-0.024	-2.432
Region (Urban)	0.491	0.107	0.053	-0.336	-33.580
Parental characteristics					
Mother education	0.368	-0.156	-0.057	0.365	36.527
Mother age	1.785	0.000	0.001	-0.004	-0.440
Mother's BMI	0.053	-0.294	-0.016	0.099	9.902
Working mother	0.098	0.152	0.015	-0.095	-9.476
Father education	0.149	-0.045	-0.007	0.043	4.292
Father age	-0.005	0.154	-0.001	0.005	0.503
Residual			0.003	-0.030	-3.000
Sum			-0.158	1.000	100.023

Decomposition Analysis for the Underweight Children

	(A)	(B)	(C)= (AxB)	(D)	(E)
Dependent Variable: Underweight	Concentration index	Elasticity	Contribution	Contribution to CI	% Contribution
Child characteristics					
Birth order	-0.090	-0.004	0.000	-0.002	-0.169
Size of child at birth	0.019	-0.276	-0.005	0.027	2.654
Child age	-0.013	0.120	-0.002	0.008	0.763
Child age (square)	-0.019	-0.087	0.002	-0.008	-0.835
Child gender (female)	-0.004	-0.096	0.000	-0.002	-0.213
Household characteristics					
Wealth Index	0.268	-0.626	-0.168	0.833	83.295
Household size	0.020	0.118	0.002	-0.012	-1.202
Availability of toilet facility	0.204	-0.020	-0.004	0.021	2.059
Improved water sources	0.321	-0.006	-0.002	0.009	0.898
Region (Urban)	0.491	0.080	0.039	-0.196	-19.567
Parental characteristics					
Mother education	0.368	-0.141	-0.052	0.258	25.830
Mother age	0.000	-0.529	0.000	0.001	0.101
Mother's BMI	0.053	-0.346	-0.018	0.091	9.071
Working mother	0.098	0.016	0.002	-0.008	-0.782
Father education	0.149	-0.013	-0.002	0.010	0.954
Father age	-0.005	-0.403	0.002	-0.010	-1.027
Residual			0.004	-0.018	-1.820
Sum			-0.201	1.000	100.010

Conclusion/Findings

- The estimated negative value of concentration indices illustrated that the children who belong from marginalized households are more affected by the poor nutritional status.
- The result of regression based decomposition analysis indicates that child age, size of child at birth, wealth index, household size, parents' education, mother's health and place of residence are the most contributing factors in the prevalence of existing malnutrition inequalities.

Policy Recommendations

- Given the findings of the present research, policy makers are suggested to design policies in a way that can be implemented smoothly and help to improvise the picture of nutritional inequality in Pakistan.
- Considering the outcomes of the study, policy makers should strategically make policies to lessen the female drop out ratio from early years of schools as the study shows that mother education plays a significant role to diminish the child nutritional inequalities.

Cont……

- Moreover, comprehensive policies and effective implementation are needed by the side of authorities to increase the income of the poor households in order to improve their feeding practices and nutritional status.
- In addition to it, increasing the number of effective health awareness programs for mothers would create notable difference in terms of children's nutritional status and helps to decline the magnitude of nutritional inequalities.

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- Policy makers should design policies in a way that local level tracking of nutritional status for monitoring can implemented. This would help the evaluation of government interventions regarding their effectiveness.

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