Asian Journal of Convergence in Technology *Volume III, Issue III*
ISSN No.:2350-1146, I.F-2.71

Trace the Best Factor by Path Analysis for the Under-Five Mortality Deaths in India

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ABSTRACT

The outcome of the paper is to trace the best factor by the path analysis and effect of Total Fertility Rate on under five mortality rates in India and also to analyze other socio economic factors affecting for the development of a region or a community or a country. The under five mortality rate, pre-school children mortality rate and Total fertility rates have been observed. The most affected factors have been identified among the few variables and analyzed from the available data. Employed Statistical and Mathematical application; Path Analysis technique, Regression analysis technique and found correlation matrices as well as descriptive values. It has been high proportion of Total fertility rate R^2, affected the under five mortality rate in India. Identified the direct and indirect effects by the Path analysis technique, fitted Regression and path models.

Keywords: Under-five Mortality rate, Total fertility rate, India and Path Analysis.

INTRODUCTION:

In general, 50% of under five mortality deaths across the global happening in five countries only. China, India, Nigeria, Democratic Republic of the Congo and Pakistan. In India (21%) and Nigeria (13%) rest of them accounted more than a third of all under five deaths. Infant mortality rate, Neo-natal mortality rate, post neo-natal mortality rate and under five mortality rate among them u5mr accounted large number of deaths. Global Neo-natal mortality deaths declined 40% from 33 deaths per 1,000 live births in 1990 to 20 in 2013. Neo-natal mortality rate, post neo-natal mortality rate, Infant mortality rate are the proportion of u5mr that occur within 28 days, after 28 days to 365 and day one to 365 days. Children mortality rate is an important factor for well being, including nutrition and health status. It is also key factor for the development of socio-economic variables. The WHO had taken steps drastically to reduce the under five mortality rate[1]. The Child mortality indicated as slowly declining in the recent years. However, we need the factors which are affected on child mortality deaths. Neo-natal mortality rate, post neo-natal mortality, Infant mortality rates and child mortality rates are used to measure the trends of under five mortality rate. The reproductive health services, neonatal care by practices of improved breast feeding, immunization; home-based treatment of diarrhoea; supplementary foods and post neo-natal care by vaccination, availing hospital facilities, transport and male-female education can reduce the under-five mortality. Total fertility rate is one of the vital event effects on under five mortality[2]. Infant Mortality and fertility rate are both important indicators for socio-economic development of an area or region or country. In the states of India, Assam is one of the poorest economically backward state and infant mortality rate, maternal mortality rate and fertility rates are also observed very high. To enhance the child survival, there is a need of reduction of fertility rate and infant mortality rate[3].

Objectives:

a) To decompose the correlation coefficient 'r' into direct, indirect effect(s) and total effect(s);
b) To test the relative importance of each causal effect when compared to the others on the same dependent variable;
c) To find the important links between the variables considered in the causal model.

Methods: Statistical methods utilized in the study are:

1. Correlation and multiple correlation coefficients, Multiple Regression Procedures, Path Analysis techniques and Useful tests of inference.

From the tables, best set of indicators related to children mortality rate of India was arrived at with the Calculation of Correlation Coefficients with Children mortality; utilization of Step-down multiple regression and Path Analysis techniques. Computer software MINITAB and SPSS programmed procedures utilized to find the correlations, multiple correlations and multiple regressions and Path coefficients.

Principles of Path Analysis:

The technique of Path analysis which was developed during 1920s by Sewall Wright as an aid to the quantitative development of genetics gained popularity in social science studies with the further expositions made by Duncan and Land. The method of Path analysis builds an ordinary multiple regression analysis. It applies only to sets of relationships among the variables which are linear, additive and causal. In multiple regressions, each predictor variable has a direct effect on the response variable. However, variables may also affect the response variable through one or more intervening variables. Path analysis is a technique for analyzing such causal relationships.

Results and Analysis:

Indicators correlated with children mortality rate and infant mortality rate we chosen. Best set of indicators

correlated with children mortality rate was chosen with the use of Step-down multiple regression analysis techniques. In the developmental and utilization of procedures in tracing the variables associated with children mortality rate, multiple correlation coefficients (R) were utilized. Correlations were tested with the use of appropriate test of t or Z test or ANOVA needful appropriate transformation procedures and multiple comparison methods with ANOVA were also utilized for tracing the differentials of variables between regions.

$$X_a \xrightarrow{R_a} X_b \xrightarrow{R}$$

The fundamental to the Path analysis is the path diagram which is the outcome of set of linearly interrelated variables and the assumed causal relationships among them. Conveniently, we may divide set of variables that are involved in any Path diagram into three groups, namely, exogenous variables, endogenous variables and the residual variables. It represents the three types of variables diagrammatically given in above figure. Exogenous variables X_b are predetermined variables and may be intercorrelated. Endogenous variables X_a on the other hand are dependent, at least in part, on the exogenous variables X_b and on the residual variables R_a.

Trends in under fiver mortality rate, Infant Mortality Rate, Total fertility rate and GDP in $

Table I.

Year	U5MR	IMR	TFR	GDP in $
2000	85.5	64.90	3.11	1800
2001	82.9	63.19	3.04	2200
2002	80.5	61.47	2.98	2540
2003	78.0	59.59	2.91	2900
2004	75.6	57.92	2.85	3100
2005	73.2	56.29	2.78	3400
2006	70.9	54.63	2.73	3800
2007	68.7	34.61	2.81	2600
2008	66.8	32.31	2.76	2900
2009	64.7	30.15	2.72	3200
2010	62.7	49.13	2.65	3500
2011	60.8	47.57	2.62	3700
2012	58.6	46.07	2.58	3900
2013	56.3	44.60	2.55	4000
2014	54.0	43.19	2.51	4200

Source: Sample Registration System

Table II.

Pearson correlation Matrix:

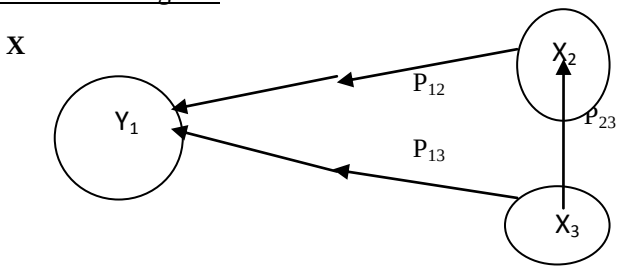
	Y(U5MR)	X_1	X_2	X_3
Y(U5MR)	1.00	0.706	0.980	-0.865
X_1 (IMR)		1.00	0.620	-0.382
X_2 (TFR)			1.00	-0.943
X_3 (GDP)				1.00

The high correlations have been found by Under-five mortality (Y) versus Total fertility X_2 is 0.980 (positive) and the correlation between under five mortality rate (Y) versus GDP in $ (X_3) is -0.865 (negative). These variables X2 and X3 are more significant at 0.05 level.

The Regression models:

Model-I : $Y=-79.984+53.821X_2+e$
Model-II : $Y=-179.991+81.264X_2+0.08X_3+e$

Path model diagram:



Y_1 = under five Morality Rate of India, 2000-2014
X_2 = Total Fertility Rate of India, 2000-2014
X_3 = GDP- Per capita (PPP) purchasing power parity basis, 2000-2014.

The statistical model adopted for this study is a simple linear model as given:

$Y_1 = P_{12}X_2+P_{13}X_3$

P_{12} = 1.480, P_{13} = 0.530 (from standardized coefficients) and $R^2_{1.23}$ = 0.992

R_u = sqrt $(1-R^2_{1.23}) = \sqrt{1-0.984064}$

$= \sqrt{0.015936} = 0.12623$

R_u = 0.12623 and $R^2 = P^2_{12}+P^2_{13}+2P_{12}P_{13}r_{23}$

Table III. Component Analysis of coefficient of determination $R^2_{1.23}$

Details	Component	Amount	R^2 (%)	Percentage R^2
Net effect				
Due to X_2	P^2_{12}	2.1904	219.67	**221.44**
Due to X_3	P^2_{13}	0.2809	28.09	28.31
Total of net effects		2.4713	247.13	249.12
Joint effect				
Due to X_2X_3	$2P_{12}P_{13}r_{23}$	-1.4793	-147.93	-149.12
Total of Joint effects		-1.4793	-147.93	-149.12
Total multiple Determination	$R^2_{1.23}$	0.992	99.20	100.00

Conclusion:

The high correlations have been found by Under-five mortality rate (Y) versus Total fertility rate X_2 is 0.980 (positive) and the correlation between under five mortality rate (Y) versus GDP in $ (X_3) is -0.865 (negative). These variables X_2 and X_3 are more significant at 0.05 levels. Component analysis of coefficient of determination; net effects of TFR versus U5MR percentage R^2 = 221.44 is positive and very high. Joint effect X_2X_3 versus U5MR, percentage R^2 = -149.12 is negative. Conclude that there are several variables effecting under five mortality in India; infant mortality rate is one of the good factor which was affected by respiratory infections and immunization. Child mortality rate leads to malnutrition, nutritional deficiencies like iron, vitamin-A and Iodine as well. Male-female illiteracy (no formal education and low socio-economic status of mothers)

one of the important factors for the low birth weight of child, vaccination facilities, hospital facilities and several demographic variables. The literacy of male-female be the key factor to reduce the high total fertility rate, infant mortality rate and under five mortality rate.

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