Public Health Expenditure and its Effect on Health Outcomes: A New Methodological approach in the Indian Context

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Abstract: The present study explores the effect of the revenue and capital components of public health expenditure (PHE) on major health outcomes. The present study utilizes data at state level from India on PHE and the health outcomes: Infant, Child and Neo Natal Mortality Rate, Total Fertility Rate, Children Born Underweight (%) and Tuberculosis instances. Using structural equation modeling, the causal models for PHE components affecting health outcomes are computed simultaneously. The same set of generic models is used for a) expenditure and outcome data from the same period; and b) expenditure data from a past period than the outcome data. Major results indicate a significant effect of revenue component of PHE on major health outcomes while capital component of PHE is found to have a significant effect on only select indicators. The major findings indicate a long-term effect of PHE in improving health outcomes.

Keywords: *Public Health Expenditure, Health Outcomes, Health Policy, Structural Equation Modeling, India.*

The human development paradigm performs an important service in questioning the presumed automatic linkages between expanding income and expanding human choices. Such a link depends on the quality and distribution of economic growth and not just on the quantity. A link between growth and human lives needs to be created consciously through deliberate public policy – such as public spending on social services and fiscal policy to redistribute income and assets (Romer, 1996). Thus, conscious public policy is needed to translate economic growth into human well-being and capital formation (Anyanwu & Erhijakpor, 2007). Interestingly, the literature on the effects of public expenditure on health on health outcomes is inconclusive, as researchers have found evidence of positive, negative or non-significant effects of public health expenditure (PHE) on health outcome at the country level (Kim and Lane, 2013). Various reasons have been cited as the cause of this inconclusiveness such as institutional inefficiencies (Rajkumar & Swaroop, 2007); crowding out of public spending because of private sector (Rajkumar & Swaroop, 2007; Bokhari, Gai & Gottret, 2007); and infrastructural inadequacies

(Bokhari, Gai & Gottret, 2007). In addition, the share of GDP spend on health may vary from less than 1% to 15% across nations (Kim and Lane, 2013). Thus, a single country study on the impact of the health expenditure on the health outcomes is equally important, as is a multi-country study.

Hence, the present study aims to explore the effects of the different components of health expenditure on different health outcomes in a single country context. The Indian situation provides a good background for the study, since public expenditure on health in India has been grossly inadequate since its independence in 1947. Only 17% of all health expenditure is borne by the Government, the rest being privately borne by the people, in an imperfect health care system with inadequate infrastructure (Kumar, Ram & Singh, 2013). This brings into focus the necessity of studying the state action and public expenditure on health in India with a population of over 1.2 billion. Such a study would be able to assess the role of health expenditure on different health outcomes, and provide rich insights into the functioning of public health outcomes on its intended purpose. A disaggregation of the PHE into its components – revenue and capital would enhance understanding of the differential impact of the components of PHE and multiple outcome variables would enhance understanding the relative impact of PHE on the same.

Thus, the present study explores the effect of the revenue and capital components of PHE on six health outcome indicators that include different aspects of the health status of the population, namely, mortality, fertility, morbidity and nutritional status. A standard functional form for the various linkages is estimated by using a pooled panel data set in a structural equation modeling (SEM) framework. Major findings indicate a statistically significant effect of the revenue component of PHE on most of the health outcomes in the same period as well as across different periods. However, capital expenditure is not found to have a significant effect only on Child mortality rate and total fertility rate in the same period.

The rest of the paper is as follows: the next section provides a brief literature review followed by a discussion on the various health outcome indicators used in the present study. The following section explains the methods and the database used in the study. The results are discussed in the following section. The last section provides the implications and the conclusions.

Literature Review

Many researchers underline the importance of government spending on health in determining various health outcomes. Turner (1991) found better access to health care facilities as a significant determinant of infant mortality in Nicaragua.

A cross-country study of 22 developing nations by Anand and Ravallion (1993) found public spending on health to significantly affect life expectancy at birth. Both Berger and Messer (2002) and Kumar, Ram and Singh (2013) found a positive and significant effect of public financing of health care expenditures on mortality rates. Similarly, Gani (2009) found public expenditure allocations to the health sector to improve health outcomes (infant mortality rate, under five mortality rate and crude death rate) in the Pacific Island Countries. Or (2001) indicated that the contribution of the volume of health care (more specifically of the number of active physicians) to reduce mortality in OECD countries is substantial. Likewise, Misra and Panda (2007) found health expenditure to granger cause IMR in the short run and long run whereas IMR to granger cause health expenditure only in the long run. Bradley, et al. (2011) investigated the effects of health services expenditure and found it to be associated with better outcomes for infant mortality, life expectancy, and increased potential life years lost. To summarize, a significant body of literature suggests that an increase in the public spending on health could contribute to improving the health status of the population.

Gupta, Verhoeven and Tiongson (2001) & Poullier et al., (2002) found public spending on health as an important determinant of health outcomes in low-income countries but suggested a non-linear relationship. Similar results are observed by Gupta and Mitra (2004) and Duraisamy and Mahal (2005) who found that per capita public health expenditure positively influences health status and more particularly life expectancy at birth. In a World Bank (2004) study, both per capita public spending on health and per capita GDP were found to inversely relate to IMR. Bokhari, Gai and Gottret, (2007) found government spending on health to be an important contributor to health outcomes in developing countries. Though government spending is important in general, it is very much possible that the scope of health expenditure will expand in an economy without significant improvement in health outcomes.

However, there is also empirical evidence that show little or no impact of health expenditure on mortality rates. A study by Musgrove (1996) made two attempts to assess the role of health spending on child mortality but neither supported any relation between the two variables. Filmer and Pritchett (1997) used World Bank data (1997a) and found differences in public health expenditure to explain only 0.15% of the cross-national differences in health status (in this case measured by Under 5 Mortality). Filmer and Pritchett (1997) argued that health spending has only a weak effect on infant and child health that is in contrast to the finding of Hanmer et.al, (2003) who suggested that health interventions could significantly affect infant and child health. Day and Tousignant (2005) found evidence of a weak statistically significant relationship between per capita health spending, health outcomes and per capita GDP. In addition, Grigoli and Kapsoli (2013)

found no significant effect of public health expenditure on health outcomes if the former was not efficient.

To summarize, the literature on the effect of public expenditure on health on the various health outcomes is inconclusive. All the previous studies aim at finding out the effect of total public expenditure on health but none of the studies disaggregates the public expenditure on health into its different components and finds the effect of these individual components of public expenditure on health on the health outcomes. Thus, the present study fills the gap in literature by examining the effect of the revenue and capital components of public expenditure on health on six different health outcome indicators. In effect, the present study had three major objectives. First, it aims to disaggregate the components of PHE and find the effects of each component on health outcomes. Second, it estimates the effect of the components of PHE on multiple health outcomes including mortality, fertility, morbidity and disease proneness indicators. Third, it investigates the effects of PHE on health outcomes with different time lags as suggested by Farahani, Subramanian and Canning (2009; 2010).

The study in the Indian context is relevant since the per capita health spending is observed to be strongly correlated with various health indicators (including mortality and fertility indicators) across Indian states. The evidence from national Family Health Survey (NFHS) 3 found a decline in the per capita spending on health to be related to the real decline in the extent of full immunization among the children in the age group of 12 to 23 months in four major states namely, Gujarat, Maharashtra, Orissa and Punjab. This point's to the negative effects of reduced health spending by the state governments on public health. In addition, until date none of the studies has included multiple health indicators across categories of health outcomes (such as mortality and morbidity) and have majorly ignored morbidity indicators. The inclusion of morbidity is important as an increase in public spending on health is found to decrease the average probability of death with its effects mainly on the young, elderly, and women (Farahani, Subramanian & Canning, 2010). The next section outlines the role of the major health outcome indicators to build the conceptual background.

Conceptual Background

The Health Outcome Indicators

Researchers have mentioned a wide array of health outcome indicators as the major ones affected by PHE. Anand and Ravallion (1993) identified life expectancy at birth, infant mortality rate and under 5 mortality rates as major indicators of health expenditure. Pritchett and Summers (1996); Filmer and Pritchett (1997); Anyanwu and Erhijakpor (2007) and Kumar, Ram and Singh (2013) noted infant and under five mortality rates as better measures of health status. Pritchett and Summers

(1996) further opined that these measures were less prone to measurement errors and were exogenous to income (since children are not part of the labor force. Cornia and Mwabu (1997) identified infant mortality, under 5 mortality, maternal mortality and female life expectancy as the four indicators of health status. Malik (2006) used multiple health indicators in his study such as life expectancy, infant mortality and total fertility rate in order to establish the linkage between economic growth and health status. Or (2001) have used life expectancy at birth, infant mortality, peri-natal mortality and potential years of life lost. The various health outcome indicators included by Day and Tousignant (2005) are infant mortality rate, peri-natal mortality rate, age standardized mortality rate, life expectancy at birth and life expectancy at 65. Issa and Ouattara, (2005) have identified IMR as a widely used measure of child health. Similarly, Bradley, Elkins, Herrin and Elbel (2011) included life expectancy, infant mortality, low birth weight, maternal mortality and potential life years lost. Deaton and Dreze (2009) have identified the various aspects of nutritional status to be important indicators of health.

To summarize, infant mortality rate, under five mortality rate, maternal mortality rate, life expectancy at birth, total fertility rate, peri-natal mortality and, potential years of life lost, age standardized mortality rate, life expectancy at 65, nutritional status of children and various morbidity indicators are the important outcome indicators identified in the literature by several researches.

In the present study, a total of six (06) health outcomes were included. These are Infant Mortality Rate (IMR), Child or Under Five Mortality Rate (CMR), Neo Natal Mortality Rate (NNR), Total Fertility Rate (TFR), Percentage of Children age three years born to ever-married women classified as underweight (UWT), which represents the nutritional status of children and the number of people per thousand suffering from Tuberculosis (TB). These health outcomes are selected on the ground that these outcomes are prominent measures of the health status of the population and show different aspects of health status i.e., mortality, fertility, nutritional and morbidity indicators of health status. The child related health outcomes are more robust in understanding the nature of human development in a country. Moreover, the health of children and young people are among the most important health issues (Issa and Ouattara, 2005). Thus, the focus of the present study is towards the outcomes that explain the child related factors. Lastly, the number of people per thousand suffering from Tuberculosis (TB) was selected as as a morbidity indicator. Details on each indicator are provided in the next subsections.

Infant Mortality Rate (IMR): IMR is a sensitive index of socio-economic condition of a population. Among the most commonly used indicators, infant mortality rate (IMR) refers to the number of deaths per thousand live births in the first year of a child's life. It reflects to the probability of a child dying before attaining the age one year. IMR is a reasonably good health indicator (Grubaugh & Santerre, 1996) because it is generally accepted that where infant mortality rates are high, health standard of all segments of the population ar e likely to be low (Goldman, & Grossman, 1988).

Child Mortality Rate (CMR): CMR is also referred to as under-five mortality rate. It is a leading indicator of the level of child health and overall development in countries. It is estimated by the probability of child dying before the fifth birthday per thousand live births. Infant and child mortality rates provide a good approximation of a community's current health status and bear a great implication on the welfare of the population and quality of life itself (Kumar, Ram & Singh, 2013).

Neo Natal Mortality Rate (NNR): NNR refers to the probability of dying in the first month of life. Although there have been efforts to improve child mortality especially in the post neonatal phase, yet le ss attention has been given to the determinants of neonatal mortality. Effective interventions to address risk factors such as essential new born care and there effective implementation can probably lead to a reduction in neonatal mortality rate. Surprisingly, very few researchers such as Martines, et al. (2005) have discussed about this indicator.

Total Fertility Rate (TFR): TFR is defined as the average number of children a woman would have over her reproductive lifetime if current age specific fertility rates were to remain constant. The total fertility rate is a more direct measure of the level of fertility than the crude birth rate, as it refers to births per woman. Such an indicator shows the potential for population change in the country.

Malnutrition: Malnutrition can be identified as the main factor retarding improvements in human development and Percentage of Children age three years born to ever-married women classified as underweight (UWT), which represents the nutritional status of is a key predictor of malnutrition. Malnutrition has been identified as the factor in the retardation of motor, adaptive, social and language development, as well as in the susceptibility of adults to diseases (Claeson, et al. 2000).

Number of people per thousand suffering from Tuberculosis (TB): This is considered as an important element of morbidity. Tuberculosis has been considered as a major public health problem in many parts of the world, often as a concomitant illness to HIV/AIDS (NFHS 3). Today, TB is a leading cause of death among people who are HIV-positive (Ploubidis, Palmer and Blackmore, 2012). Worldwide, an estimated one-third of the nearly 40 million people living with HIV/AIDS are co-infected with TB. In most developing countries, TB would continue to be a serious health threat even in the absence of HIV/AIDS due to the public health challenges posed by poverty, high illiteracy, and poor sanitation (Cass, Shaw & Ehman, 2013).

Methodology: In order to achieve the study objectives, the methodology adopted includes pooled panel data analysis for 16 major states India using Structural Equation Modeling (SEM). The next subsections provide details on the sample, data collection and statistical techniques used for data analysis.

Database

The empirical investigation was performed on panel data for 16 major states in India. The per capita revenue and capital expenditure on health for each state were selected as the components of PHE. The data for the PHE (revenue and capital) was obtained from the statistics on State finances published by the Reserve Bank of India (RBI). In the present study, health care expenditure refers to the expenditure incurred on medical and public health and the allocation of family welfare programs.

The data on the six health outcomes were collected from the different factsheets of the National Family and Health Services (NFHS) reports (NFHS-1, NFHS-2 and NFHS-3). The three time periods considered were 1992-93, 1998-99 and 2005-06 as during this time period the National Family and Health Survey (NFHS) report sheets are being released that makes the data on health outcomes available. The descriptive statistics for the study variables is given in Table 1.

Table 1. Descriptive Statistics: Series Mean for Study Variables across All Three NFHS

STATE	PNSDP	PCREXP	PCCEXP	IMR	CMR	TFR	NNR	UWT	TB
Andhra Pradesh	2039	61.63	0.13	63.23	17.87	2.21	43.13	35.63	23.26
Assam	1557	58.78	5.73	74.90	33.43	2.75	47.00	38.40	132.32
Bihar	1017	43.11	0.80	74.63	33.80	3.82	47.03	55.30	48.79
Gujarat	3091	73.78	0.62	61.93	22.87	2.70	39.80	41.87	35.26
Haryana	3421	63.50	8.24	57.27	19.90	3.18	32.30	33.03	27.17
Himachal Pradesh	2267	165.89	22.01	42.10	9.33	2.35	27.87	35.33	558.53
Karnataka	2278	78.08	1.54	53.37	18.30	2.34	37.10	39.40	21.41
Kerala	1932	77.29	3.06	18.47	4.00	1.96	13.60	21.67	142.36
Madhya Pradesh	1618	49.31	1.34	80.27	44.07	3.43	51.00	55.37	93.65
Maharashtra	3837	75.63	2.43	43.90	15.13	2.50	33.40	41.53	23.04
Orissa	1476	52.59	1.18	85.93	24.80	2.58	52.90	46.57	52.53
Punjab	3931	94.72	8.53	50.83	13.90	2.37	31.17	29.40	226.82
Rajasthan	1975	72.87	3.15	74.00	30.97	3.52	45.17	41.80	60.67
Tamil Nadu	2363	86.21	2.41	48.77	13.77	2.15	33.37	32.70	241.83
Uttar Pradesh	1615	51.55	3.72	86.43	36.93	4.19	53.70	47.43	29.42
West Bengal	2295	61.15	2.65	59.23	20.23	2.48	41.53	45.37	924.03

Note: PNSDP = Per capita Net State Domestic Product (Measured in INR); PCREXP = Per capita Revenue Expenditure on Health (Measured in INR); PCCREXP= Per capita Capital Expenditure on Health (Measured in INR); IMR= Infant Mortality Rate (number of deaths per thousand live births); CMR= Child Mortality Rate (probability of a child dying before the fifth birthday per thousand live births); TFR= Total Fertility Rate (number of live births per women); NNR= Neo-Natal Mortality Rate (probability of a child dying in the first month of life); UWT = Percentage of Children (below three years) Born Underweight; TB= Instances of Tuberculosis per 100,00 population.

Analysis – Structural Equation Modeling (SEM)

Structural Equation Modeling (SEM) was applied to find the effect of the revenue and capital components of public expenditure on health on the various health outcomes. This is unlike traditional econometric techniques such as granger causality or generalized least squares (GLS). Structural Equation Modelling (SEM) is used to find the effects of the revenue and capital components of public expenditure on health on the different health outcomes simultaneously. The reasons for using SEM in the present context were twofold. Firstly, most of the earlier studies investigating the effect of health outcomes have taken health expenditure as a whole and not its subcomponents. Traditional econometric techniques would not be able to handle multiple independent and dependent variables simultaneously. Secondly, researchers (Chen & Pearl, 2013) found SEM to be equally effective and having mention of usefulness in econometrics as far back as 1943 (Haavelmo, 1943).

SEM has several advantages over multiple regression that include: a) flexibility of assumptions (particularly allowing interpretation even in the face of multicollinearity); b) ability to test models overall rather than individual coefficients; c) ability to incorporate models with multiple dependent variables; d) ability to model mediating variables and model error terms; and lastly e) ability to handle difficult data (time series with auto correlated error, non-normal data, incomplete data). To add to this, multiple regressions could be highly susceptible to error of interpretation by misspecification, whereas the SEM strategy compares alternative models to assess relative model fit thus making the approach more robust (Chen & Pearl, 2013). Thus, SEM would imply a novel and more robust approach than commonly used methods.

The Conceptual Models

In the present study, two alternative models are developed and tested as follows:

No-Lagged Effect Model: This model works on the assumption that health outcomes are affected by the public expenditure on health made in the same year without any time lag. This means public expenditure on health in the year 1992-93 (NFHS 1) would affect the health outcomes in the same year 1992-93 (NFHS 1). Similarly, budgetary health care expenditure in the year 1998-99 (NFHS 2) and 2005-06 (NFHS 3) would affect the health outcomes in the year 1998-99 (NFHS 2) and 2005-06 (NFHS 3) respectively.

Lagged Effect Model: This model assumes a lagged effect of public health expenditure on the health outcomes. That means public expenditure on health in the year 1992-93 (NFHS 1) would affect the health outcomes in the year 1998-99 (NFHS 2) and health expenditure in the year 1998-99 (NFHS 2) would affect the health outcomes in the year 2005-06 (NFHS 3).

To test the 'no-lagged effect model', three independent models were developed based on the NFHS 1, 2 and 3 data respectively for the 16 states. In the first model, all the data corresponds to NFHS 1 (1992-93). The natural log of per capita revenue and capital expenditure on health of the year 1992-93 are used as independent variables and the health outcomes namely IMR, CMR, NNR, TFR, UWT and TB (all standardized values) of the same year (1992-93) are used as dependent variables. Similarly, in the second and third model, all the variables correspond to the data of NFHS 2 (1998-99) and NFHS 3 (2005-06) respectively. These three models (Model 1, 2, 3) estimate the static effect of health expenditure on health outcomes.

To test the second set i.e. 'lagged effect model', two models were estimated based on the NFHS data respectively for the same 16 states. In model 4, the independent variables i.e., the per capita revenue and per capita capital component of public expenditure on health correspond to the data of NFHS 1 (1992-93), whereas the dependent variables i.e. the health outcomes namely correspond to 1998-99 (data of NFHS 2). Similarly, in model 5, the independent variables (per capita revenue and per capita capital expenditure on health) correspond to the data of NFHS 2 (1998-99), whereas the dependent variables (health outcomes) correspond to the data of NFHS 3 (2005-06). The assumption driving this model was that the impact of public expenditure on health on the health outcomes may not be realized immediately and may be realized in the future as suggested by Farahani, Subramanian and Canning (2010). Thus, the lagged effects models would bring out the same, if any.

Mathematical representation

This is the first attempt to the author's knowledge to use SEM in analysing the impact of health expenditure components on health outcomes. SEM usually starts out with a hypothesis or a theoretical relationship that is represented in a causal model (such as Fig 1). The concepts used in the model must then be operationalized to allow testing of the relationships between the concepts in the model. Thus, the concepts are measured using variables that are represented as boxes and arrows that represent the causal relationship among the concepts/ variables. The theoretical model is tested against the obtained measurement data to determine how well the model fits the data. The mathematical form of the model/s is represented by the system of equations is given in equation 1 (where y represents the dependent variable).

$$\begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \\ y_5 \\ y_6 \end{bmatrix} = \begin{bmatrix} \gamma_1 \\ \gamma_2 \\ \gamma_3 \\ \gamma_4 \\ \gamma_5 \\ \gamma_6 \end{bmatrix} (\text{LRHEXP}) + \begin{bmatrix} \lambda_1 \\ \lambda_2 \\ \lambda_3 \\ \lambda_4 \\ \lambda_5 \\ \lambda_6 \end{bmatrix} (\text{LCHEXP}) + \begin{bmatrix} \delta_1 \\ \delta_2 \\ \delta_3 \\ \delta_4 \\ \delta_5 \\ \delta_6 \end{bmatrix} \qquad (1)$$

The graphical form of the conceptual model is illustrated in Figure 1. The model suggests per capita revenue and capital components of public expenditure on health have an impact on the health outcomes. The same generic model was used to represent both the 'no-lagged' and the 'lagged' effect models (models 1 to 5). In the first three cases, the dependent and the independent variables belonged to the same period (t). In the fourth and fifth cases the dependent variables belong to the subsequent period (say t+1) to that of the independent variables (say t). Thus,

if t represents NFHS 1, then t+1 stands for NFHS 2 and if t represents for NFHS 2, t+1 stands for NFHS 3. Expanding equation 1, the set of equations 2 to 7 is derived. Equations 2 to 7 represent the effect of the per capita Revenue and Capital expenditures on each of the health outcomes namely, IMR (2), CMR (3), NNR (4), TFR (5), UWT (6) and TB (7).

$$IMR = \gamma_1 LRHEXP + \lambda_1 LCHEXP + \delta_1 \quad \ldots\ldots 2$$

$$CMR = \gamma_2 LRHEXP + \lambda_2 LCHEXP + \delta_2 \quad \ldots\ldots 3$$

$$NNR = \gamma_3 LRHEXP + \lambda_3 LCHEXP + \delta_3 \quad \ldots\ldots 4$$

$$TFR = \gamma_4 LRHEXP + \lambda_4 LCHEXP + \delta_4 \quad \ldots\ldots 5$$

$$UWT = \gamma_5 LRHEXP + \lambda_5 LCHEXP + \delta_5 \quad \ldots\ldots 6$$

$$TB = \gamma_6 LRHEXP + \lambda_6 LCHEXP + \delta_6 \quad \ldots\ldots 7$$

In equations 1 to 7, the γ coefficients represent the effect of revenue expenditure (LRHEXP) on the health outcomes and λ coefficients represent the effect of capital expenditure (LCHEXP) on the health outcomes. The error terms in equations are represented by δ. The results of the analysis are given in the following section.

Estimation Method

The estimation method in the present study was Maximum Likelihood Method (MLE). The MLE is a covariance based estimation technique, which aims to reproduce the covariance matrix of the measured variables using the model parameters. MLE is majorly confirmative in nature that seeks to determine the extent to which the proposed (or hypothesized) model is actually consistent with the empirical data (Jöreskog 1970).

Results

The pooled data estimation was conducted using five different variations of the model given in Figure 1. As mentioned earlier, the analysis is divided into two steps based on the two alternative models used. In the first phase (i.e. no-lagged effect), three models were estimated based on the NFHS 1, 2 and 3 data respectively for the 16 states. The first phase tests the assumption that the health outcomes are affected by the expenditure on health made in the same year. i.e., expenditure corresponding to NFHS 1 affects the health outcomes of NFHS 1 and similarly the expenditure corresponding to NFHS 2 and 3 affect the health outcomes of NFHS 2 and 3 respectively. Table 2 shows the results of models 1, 2 and 3.

In phase two (lagged effect model), two models were run to estimate the lagged effect (if any) of health expenditure on health outcomes. The second phase tests the assumption that there is a lagged effect i.e. the expenditure in 1992-93 affect

the health outcomes of 1998-99 and expenditure in 1998-99 affect the health outcomes of 2005-06. Table 3 shows the results of models 4 and 5.

No-Lagged (static) Effect Model

Table 2 depicts the static effects of public health expenditure components on health outcomes. The effects are more or less consistent over the three time periods. For model 1 (NFHS 1), the revenue expenditure is found to have a negative and significant effect on IMR (-0.841), NNR (-0.836), TFR (-0.752), UWT (-0.727), CMR (-0.685) and TB (-0.542) at 5% level of significance. The capital expenditure is found to have a significant and positive effect on TFR (0.504) and CMR (0.307) in the case 1 only. The model fit statistics indicated a good model fit (Chi sq/df = 2.67, GFI = 0.95, AGFI = 0.91, NFI = 0.92, RMR = 0.05, RMSEA = 0.06).

For model 2, revenue expenditure was found to have a negative and significant effect on IMR (-0.370), NNR (-0.335), TFR (-0.445), UWT (-0.631) and TB (-0.712) at 5% level of significance. Revenue expenditure was not found to have a significant effect on CMR. Capital expenditure was found to have a significant positive effect only on the TFR (0.094) but the magnitude was very small. The model fit statistics were reasonably good for this model too (Chi sq/df = 2.79, GFI = 0.91, AGFI = 0.89, NFI = 0.90, RMR = 0.06, RMSEA = 0.06). Similarly, for model 3, revenue expenditure was found to have a negative and significant effect on IMR (-0.621), NNR (-0.640), TFR (-0.522), UWT (-0.771), CMR (-0.441) and TB (-0.535) at 5% level of significance. Capital expenditure was found to have a significant positive effect only on the TFR (0.088) and the magnitude of the effect was very small. Model fit was reasonable (Chi sq/df = 3.53, GFI = 0.90, AGFI = 0.87, NFI = 0.90, RMR= 0.06, RMSEA = 0.065).

The largest impact of revenue expenditure was observed on the variable UWT for all three models. UWT is a health outcome related to effects of malnutrition on children. One particular pattern is observed in the coefficients. For all the significant effects of revenue expenditure on health outcomes, the coefficients have the least value in the second case (in the year 1998-99). The effect of per capita capital expenditure on the health outcomes is not as profound as that of revenue expenditure.

Table 2. No Lagged Effect Models of Health Expenditure on Health Outcome

		Model 1: NFHS 1		Model 2: NFHS 2		Model 3: NFHS 3	
Independent Variable	**Dependent Variable**	**Standardized Regression Weights**	**S.E**	**Standardized Regression Weights**	**S.E**	**Standardized Regression Weights**	**S.E**
LRHEXP	IMR	-0.841***	5.79	-0.370**	5.64	-0.621***	5.14
	CMR	-0.685***	4.01	**-0.187**	3.93	-0.441**	3.31
	NNR	-0.836***	3.38	-0.335**	3.28	-0.640**	3.25
	TFR	-0.752***	0.19	-0.445**	0.22	-0.522***	0.25
	UWT	-0.727***	3.15	-0.631***	2.92	-0.771***	2.94
	TB	-0.542***	1.34	-0.712***	0.91	-0.535**	0.93
LCHEXP	IMR	**0.350**	2.54	**-0.095**	2.43	**0.132**	1.78
	CMR	0.307*	1.46	**0.011**	1.69	**0.295**	1.15
	NNR	**0.038**	1.23	**-0.199**	1.41	**-0.022**	1.13
	TFR	0.504***	0.07	0.454**	0.09	0.482***	0.09
	UWT	**0.025**	1.15	**-0.106**	1.26	**0.202**	1.02
	TB	**0.330**	0.28	**0.086**	0.24	**-0.231**	0.33

Note: Figure in **bold** represent non-significant coefficients.

Lagged Effects Model

The results of model 4 (relating components of public expenditure on health of NFHS 1 and Health Outcome of NFHS 2) and model 5 (relating the public health expenditure components of NFHS 2 and Health Outcome of NFHS 3) are diverse and interesting (Table 3). In model 4, the revenue expenditure is found to have a significant and negative impact on IMR (-0.450), NNR (-0.472), UWT (-0.541) and TB (-0.755) only. The capital expenditure was having a significant impact only on TB (-0.421). This points out to the long-term impact of capital expenditure on morbidity outcomes of health.

In model 5, the revenue expenditure was found to have a significant and negative impact on all health outcome variables namely IMR (-0.472), CMR (-0.393), NNR (-0.477), TFR (-0.528), UWT (-0.689) and TB (-0.502). The capital expenditure was found to have a significant negative effect on NNR (-0.329) and a significant positive impact on TFR (0.459) at 5% level of significance. However, the capital expenditure was found to have a negative impact on the morbidity indicator, TB (-0.35) at 10% level of significance. Even in model 4 and 5, the largest impact of revenue expenditure was observed on UWT and was consistent with the findings from models 1, 2 and 3. Model fit was reasonable for model 4 and 5.

Table 3. Lagged Effect Models of Health Expenditure on Health Outcome

		Model 4 Expenditure of NFHS 1 Health outcome of NFHS 2		Model 5 Expenditure of NFHS 2 Health outcome of NFHS 3	
Independent Variable	**Dependent Variable**	**Standardized Regression Weights**	**S.E**	**Standardized Regression Weights**	**S.E**
LRHEXP	IMR	-0.450**	6.91	-0.472**	4.29
	CMR	**-0.271**	4.56	-0.393**	2.78
	NNR	-0.472**	4.08	-0.477**	2.65
	TFR	**-0.188**	0.28	-0.528***	0.21
	UWT	-0.541**	4.17	-0.689***	2.64
	TB	-0.755***	0.92	-0.502**	0.96
LCHEXP	IMR	0.318*	2.52	**-0.149**	1.85
	CMR	**0.092**	1.67	**0.180**	1.19
	NNR	**0.285**	1.49	-0.329*	1.14
	TFR	**0.222**	0.10	0.459**	0.09
	UWT	**0.174**	1.52	**0.155**	1.14
	TB	-0.421**	0.19	-0.355*	0.25

Note: Figure in **bold** represent non-significant coefficients.

Discussion

The present study aimed at analysing the effect of the components of public expenditure on health on the different health outcomes. The revenue component was found to affect the health outcomes in a positive and significant manner, whereas the effect of capital component of public expenditure on health was not found significant for any health outcome. It should be noted here that there is significant effect of capital expenditure on some of the health outcomes after a time lag (Model 4 and 5). This raises the possibility of a long-term effect of capital expenditure on some health outcomes. The share of the revenue component in total expenditure on health is always higher in the Indian case (Hooda, 2013). Comparatively, better off states have been allocating more resources towards revenue expenditure on health. The less developed states such as Bihar and Rajasthan have been spending a higher proportion of the total public health expenditure as capital expenditure. Such results have important implications for policy. While increasing capital expenditure over time can yield better outcomes in the long run, some components

of revenue expenditure such as expenditure on doctors, immunization may have immediate desirable impact.

The major findings derived from the study have several theoretical implications. First, the findings support the notion that PHE affects health outcomes (Kim & Lane, 2013; Novingnon et al. 2012; Bradley, Elkins, Herrin & Elbel, 2011). Second, the revenue component of PHE was found to affect the health outcomes more than the capital component. This is a novel finding since major studies investigating the effects of PHE on health outcomes have taken aggregate PHE and not its components. In addition, this points out to the need for mor e emphasis on the capital expenditure on the provision of health services and the lack of the same in developing nations (Filmer, Hammer & Pritchett, 2000).

Third, the revenue expenditure of health is not found to have any effect on the CMR. This is interesting, since researchers in the same area have considered IMR (Bhalotra, 2007; Kim & Lane, 2013; Kumar, Ram & Singh, 2013; Novingnon et al. 2012) or Life Expectancy at Birth (Bradley, Elkins, Herrin & Elbel 2011; Anand & Ravallion 1993).

This calls for further research into the effects of PHE on CMR. Fourth, the capital expenditure was found to have a significant positive effect on the TFR in the no-lagged effects model. This supports the findings of Nurudeen and Usman (2010) who called for more capital investments in health sector for better health outcomes. In the long run (models 4 and 5) revenue expenditure was found to have a significant and negative effect on the IMR, NNR, UWT and TB. This supports the role of PHE in betterment of public health (Kim & Lane, 2013; Novingnon et al. 2012; Bokhari, Gai & Gottret, 2007; Rajkumar & Swaroop, 2007; Hanmer et al. 2003).

Fifth, the capital expenditure was found to have a significant negative impact only on TB consistently for both the cases in the lagged effect models. This suggests that the capital expenditure on health in the long run may lead to improvement of morbidity situation of the people. Sixth, for all the models, the largest impact of revenue expenditure was found on the health outcome UWT. This implies that significant amount of revenue expenditure would result in a healthy child population in both the short and long run. To summarize, the findings suggests that public expenditure on health affects the health outcomes positively and more so, out of t he two broad components of the budgetary expenditures on health, the revenue expenditure on health has affected the health outcomes more significantly as compared to the capital component of the budgetary expenditure on health.

Conclusion

Though the present study addresses an issue of current interest, it is not free from limitations. Major limitations are related to data and estimation techniques. Due to unavailability of continuous time series data for a longer period, the present study has to be limited to only three time periods. Lack of reliable data on other health outcomes such as life expectancy at birth, maternal mortality rate, etc. has confined the study to focus only on six health outcome indicators. Though, continuous time series data are available for economic growth and public expenditure on health (including the various components of public expenditure on health), yet continuous time series data on health outcomes are available only for IMR. Thus, the analysis was not possible for a continuous time series and was limited to three periods (since the data on the health outcomes were collected from the National Family and Health Survey (NFHS) reports).

The present study includes sixteen major Indian states and excludes other states due to lack of data sources for all the indicators. Due to unavailability of long continuous time series data for all the health indicators, the present study is limited to a small sample period. Given the limitations of the present study, there remains a substantial room for further research. One area of further research lies in the inclusion of more indicators of economic development and health outcomes. Similar studies could be conducted for the individual states. Further disaggregation of public expenditure on health and its effects on health outcomes could also be studied. Finally, the effectiveness of the Public Private Partnership could be examined as more such experience is gathered in the health sector of India and more live cases can be examined in detail.

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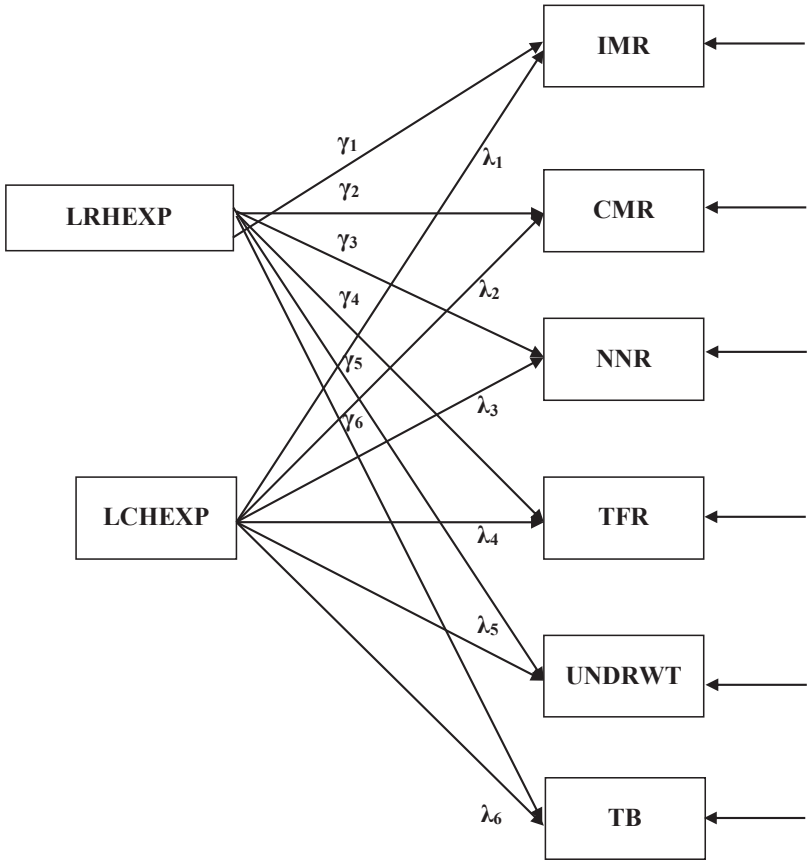

Figure 1. Conceptual Model to test the Effect of the Components of Public Health Expenditure on Health Outcomes[1].

1 γ measures for the effect of Revenue Expenditure on Health Outcomes

λ measures for the effect of Capital Expenditure on Health Outcomes