

An Exploratory Analysis of Public Health Care Expenditure in Odisha

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Abstract: Health is a critical dimension of human development. Provision of health care facilities for the people is a vital constituent of the development process. An attempt is made here to examine the pattern of public health expenditure in Odisha from 2000-01 to 2017-18, its impact on health outcome, further its relationship with income of the State. Study reveals that total health expenditure as percentage of GSDP is hovering around one per cent. Expenditure on Urban Health Service has been increasing, on the contrary, expenditure on Rural Health Service has declined and expenditure on 'Medical Education & Training' remains constant. 'Allopathic System of Medicine' soaks up to 75 per cent of expenditure on 'Medical & Public Health'. It is observed that both GSDP and health care expenditure have statistically significant positive impact on LEB and negative effect on IMR and CDR. However, GSDP has an edge over health care expenditure. There exists a unidirectional causality from Per Capita Health Expenditure to Per Capita Gross State Domestic Product in Odisha.

1. Introduction

Health system of our country has come under increasing strain in recent time. The COVID-19 pandemic exposed the fragility of the existing health system of India. It exposes the extent of vulnerabilities to manage the emergency in health sector. The situation is equally applicable to the State of Odisha. Among different factors that influence well-being of the people, 'availability-accessibility-affordability' of health care services is crucial component for improving population health. "National Health Policy, 2000" intend to have a 'universal health coverage' (UHC) through the provision of medical services to all sections of the society. Public provisioning of health care services is a prime necessary in a welfare oriented democratic country like India. Financing the health care service assumes prominence to achieve social welfare as well as ensuring equity.

It is said that health just cannot be defined as a state but, a process. World Health Organization mentions "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". It is one of the components of human development that determines society's wellbeing.

Sound health enhances labour productivity and contributes to material progress of the nation. Noble laureate Amartya Sen pointed out that “health contributes to a person’s basic capability to function, to choose the life he/ she has reason to value” (Sen, 1985). Ensuring a minimal level of health services to the public is an integral element of the development process.

2. Review of Literature

Political concerns, economic considerations and ethical reasons are the driving forces behind the demand for higher public spending on health (Musgrove, 1996), however, the budget constraints very often compelled the governments to cut down their health expenditure. Hence, it is imperative to examine the nexus between population health and public spending.

A good number of empirical attempts have been made by various researchers at different point of time to study the effect of public health spending on health outcome at cross-country level (Gupta *et al.*, 2002; Weitzman, 2017), among Asian countries (Narayan *et al.*, 2010), African countries (Anyanwu and Erhijakpor, 2009; Novignon, 2012; Ssozi and Amlani, 2015), OECD countries (Hitiris and Posnet, 1992; Linden and Ray, 2017), European countries (Lippi *et al.*, 2016; Van den Heuvel and Olaroju, 2017) and at national level (Deolalikar, 2005; Bhalotra, 2007; Farahani *et al.*, 2010; Barenberg *et al.*, 2017; Panda and Patra, 2021).

Existing literature on the requirement of public spending on health care seems to be divided. Some study reported that PHCE has near negligible influence on health outcomes (Filmer and Pritchett, 1999; Deolalikar, 2005; Kaur and Misra, 2003), while some others observed positive impact (Anand and Ravallion, 1993; Or, 2000, 2001; Baldacci *et al.*, 2002; Berger and Messer, 2002; Bhalotra, 2007; Farahani *et al.*, 2010; Barenberg *et al.*, 2017). The studies by Carrin and Politi (1995), Demery and Walton (1998) observed that poverty and low income rather than low health expenditure are prime reasons of poor health outcome. Other cross-country studies, viz., Kim and Moody (1992), McGuire *et al.* (1993), Musgrove (1996), Gupta *et al.* (2002) corroborated the previous researchers and concluded that level of income is a major determinant of population health. Researchers, Demery and Walton (1998), St Leger (2001), Young (2001) found socio-economic factors are highly associated with population health.

This brief review highlights the controversy on health spending and health outcome nexus. The issue is yet to be settled. The present study attempts to analyse the state level empirical evidence on this subject. Further, the conclusion so derived will help the administrators to tailor the policy framework accordingly.

3. Objectives and Hypothesis of the Study

3.1. Objectives

An attempt has been made in this article to examine three interrelated aspects of health sector in Odisha. These are:

- To analyse the level, trend and pattern of public health care expenditure (PHCE) in Odisha.
- To examine the impact of health expenditure on health outcome of the state, more particularly on life expectancy at birth (LEB), infant mortality rate (IMR) and crude death rate (CDR).

- To investigate the intricacies between PHCE and income of the State represented by Gross State Domestic Product (GSDP).

3.2. Hypothesis of the Study

H_0 : There exists bidirectional causality between public health care expenditure and income of the State.

4. Research Methodology

4.1. Data, Sample Area and Time Frame

To examine the stated objectives we have used the data collected from secondary sources, viz., Demand for Grants, Department of (Health & Family Welfare (H&FW), Demand No. 12, Ministry of Finance, Government of Odisha (different years), State Finance: A Study of Budgets, RBI (different issues) and World Health Statistics, WHO. The study area is the state of Odisha and study period ranges from 2000-01 to 2017-18.

4.2. Methods

To examine the impact of health expenditure on health outcome in the state pair-wise correlations between these variables have been used. Further, to decipher the exact quantitative impact of GSDP and health expenditure on different health outcome variables Liner Regression Models have been employed. Finally to study the linkage between per capita GSDP and per capita PHCE, time series econometrics has been utilised.

5. Data Analysis and Interpretations

5.1. Public Health Expenditure in India

Prinja *et al.* (2012) have estimated the cost of universal health care delivery in India by public and private providers taken together is around Rs. 1713 per capita per annum. By extrapolating the cost of universalisation of health care delivery for the whole of the country Indian government needs to spend 3.8 per cent of the Gross Domestic Product. Likewise, in tune with the recommendations of 'High Level Expert Group' on health, 12th Five Year Plan document mentions "over the next few years the allocation to the health sector as a ratio of GDP will be increased to 2.5 per cent".

In reality it is observed that in India: PHCE as percentage of GDP is 3.9; per capita current health expenditure is only 63 USA Dollar; and public health expenditure as a percentage of GDP is 1.4. In any respect this is abysmally low. India spends even lower than neighbouring Asian countries like Afghanistan, Bhutan, Nepal and Sri Lanka in one respect or more. Leave aside the cases of advanced countries, viz., USA, UK, Australia, Canada, Germany, France etc., even African countries like South Africa and Zimbabwe spend more than India in all these respect (Table 1). With regard to percentage of GDP devoted towards current health expenditure, USA tops the list with 16.8 per cent whereas Bhutan is at the end preceded by India with 3.9 per cent. Again USA tops the list in per capita current health expenditure and Nepal is at the bottom preceded by India, likewise France tops the list in the field of PHCE as per cent of GDP on the contrary India at the tail end.

Table 1: Health Expenditure in India vis-à-vis other Countries of the World

<i>Country</i>	<i>Current Health Expenditure as percentage of GDP*</i>	<i>Per Capita Current Health Expenditure (in US Dollar)*</i>	<i>Public Health Expenditure as per cent of GDP*</i>
Afghanistan	10.3	60	2.9
Australia	9.4	4934	6.3
Bhutan	3.5	91	2.6
Canada	10.4	4508	7.4
France	11.1	4026	9.0
Germany	11.2	4592	8.7
India	3.9	63	1.4
Nepal	6.1	44	2.3
South Africa	8.2	471	4.2
Sri Lanka	3.0	118	2.0
United Kingdom	9.9	4356	7.6
USA	16.8	9536	8.3
Zimbabwe	10.3	94	2.5
Global	6.3	822	6.0

Source: World Health Statistics 2018, WHO; HDR 2016, UNDP

Notes: * Data for the Year 2016

5.2. Public Health Care Expenditure: An Inter-State Comparison

Public health care expenditure in India consists of all the government expenditure on medical education, research, public health & family welfare, at central and state government levels towards health services both in urban and rural area. In Indian federation, the provision of health service is primarily the responsibility of the State Government. Item “Public health and sanitation, hospitals and dispensaries” is placed in entry 6 of the ‘State List’ under 7th Schedule of the Indian Constitution. However, the task of “Population control and family planning”, “Legal, medical and other professions” and “Lunacy and mental deficiency, including places for the reception or treatment of lunatics and mental deficiencies” are placed as Entry 20A, 26 and 16 respectively under the ‘Concurrent List’. Further, the Central Government may intervene by initiating programmes under central sector and centrally sponsored schemes, though the implementation of these are mainly done by the state governments.

So far as fund flow is concerned until 2002-03, all central scheme funds were routed through the state budget. The funds were first transferred as grant to the states’ consolidated account. It was therefore easy to arrive at the amount of total expenditure on health sector incurred in the states. But the system was dispensed off since then and funds have been transferred from central government directly to the implementing agencies. This practice continued till 2015-16. Therefore, it is difficult to

track PHCE at the state level. However, in the present analysis we have taken into account only the fund routed the state budget.

The proportion of States' income (Gross State Domestic Product, GSDP) earmarked for the health sector varies across states (Table 2). It ranges from a low of 0.24 per cent recorded by Uttarakhand in 2000-01 to a high of 1.74 per cent spent by Bihar for the same year. On an average Bihar spent 1.10 per cent of its GSDP per annum towards health sector, followed by Assam 1.06 per cent of GSDP per annum during the period 2000-2018. On the other hand Haryana spent only 0.46 per cent of its GSDP per annum towards health sector, preceded by Maharashtra 0.50 per cent of GSDP per annum during the same period. This implies economically advanced states spend a little and economically poor states spend more towards health sector. Well off states like Haryana, Maharashtra, Gujarat, Punjab, Karnataka, Tamil Nadu spent less of their GSDP and poor states like Uttar Pradesh, Bihar, Odisha, Madhya Pradesh, and Rajasthan spent more of their GSDP on health.

Table 2: Public Health Care Expenditure as per cent of GSDP: A Cross State Analysis

<i>State</i>	<i>2000-01</i>	<i>2017-18</i>	<i>Average 2000-18</i>
Andhra Pradesh	0.92	0.86	1.02
Assam	0.97	2.02	1.06
Bihar	1.74	1.45	1.10
Chhattisgarh	0.31	1.59	0.80
Gujarat	0.83	0.65	0.57
Haryana	0.51	0.59	0.46
Jharkhand	0.00	1.40	0.91
Karnataka	0.93	0.59	0.67
Kerala	0.95	0.96	0.83
Maharashtra	0.65	0.58	0.50
Madhya Pradesh	1.09	1.03	0.86
Odisha	1.06	1.26	0.83
Punjab	0.86	0.72	0.64
Rajasthan	1.10	1.29	0.94
Tamil Nadu	0.81	0.75	0.68
Uttar Pradesh	0.80	1.33	1.04
Uttarakhand	0.24	0.79	0.89
West Bengal	1.05	0.86	0.79

Source: Computed from 'State Finance: A Study of Budgets', RBI, different issues

5.3. Public Health Care Expenditure in Odisha

Total expenditure on health in nominal terms, its annual growth rate, the percentage of revenue expenditure in total health expenditure, state PHCE as per cent of GSDP and Health Expenditure

as per cent of Total Social Sector Expenditure are shown in Table 3. In absolute figure health care expenditure was Rs. 141 crore in 1990-91 which increased to Rs. 1957 crore in 2013-14, and to Rs. 5258 crore in 2017-18. The growth rate of health care expenditure does not depict any consistency. It varies from a low of 0.5 per cent (2003-04) to a high of 62.87 per cent (2014-15). It was even negative in two years, viz., 2001-02 and 2005-06. It is observed that revenue expenditure as a per cent of total health care expenditure is above 92 per cent. Only after 2014-15 the percentage has shown to be below 87 per cent. Total PHCE as a per cent of GSDP is hovering around one per cent, even it is less than one per cent during the decade 2003-04 to 2013-14. Around 11 per cent of SSE is devoted on health care expenditure. Initially up to 2004-05 the percentage was more than 11.5 per cent; in 2005-06 it has come down to 8.7 per cent and thereafter till 2013-14 it remained below 10 per cent level. Finally 2014-15 onwards it has reversed the earlier trend and improved marginally. The health care expenditure as a percentage of social sector expenditure was slashed during the decade 2005-2015.

Table 3: Expenditure on Health in Odisha

<i>Year</i>	<i>Total Health Care Expenditure (Rs. in Cr.)</i>	<i>Annual Growth Rate of Health & FW Expenditure</i>	<i>RE on Health as Percentage of Total Health Care Expenditure</i>	<i>Health Care Expenditure as percentage of GSDP</i>	<i>Health Expenditure as per cent of Total SSE</i>
2000-01	459	-	94.4	1.1	11.3
2001-02	450	-1.96	93.7	1.0	10.9
2002-03	497	10.44	92.4	1.0	11.8
2003-04	500	0.60	91.8	0.8	11.5
2004-05	631	26.2	99.5	0.8	13.7
2005-06	467	-25.99	96.5	0.5	8.7
2006-07	608	30.19	94.6	0.6	9.9
2007-08	747	22.86	97.3	0.6	9.1
2008-09	937	25.43	98.4	0.6	8.4
2009-10	1171	24.97	97.9	0.7	9.4
2010-11	1272	8.62	97.8	0.6	8.3
2011-12	1362	7.07	97.3	0.6	7.5
2012-13	1765	29.58	95.3	0.7	9.0
2013-14	1957	10.87	92.6	0.7	7.9
2014-15	3187	62.85	87.0	1.0	10.9
2015-16	3681	15.50	85.7	1.1	10.2
2016-17	4729	28.47	85.9	1.3	11.9
2017-18	5258	11.18	84.6	1.3	10.5

Source: Computed by the Authors

Further, per capita state health care expenditure of Odisha both at nominal and constant prices (2004-05 prices) over the study period is shown in Table 4. Data reveals that both of the above mentioned items have exhibited an increasing trend in Odisha.

Table 4: Per Capita Public Health Expenditure at Current vs. Constant Prices (in Rs)

<i>Year</i>	<i>Current Prices</i>	<i>Constant Prices (2004-05)</i>
2000-01	125.32	150.75
2001-02	121.24	140.79
2002-03	132.63	148.93
2003-04	131.83	140.38
2004-05	163.79	163.79
2005-06	119.67	114.51
2006-07	153.82	138.08
2007-08	186.37	159.83
2008-09	230.8	183.18
2009-10	284.69	217.66
2010-11	305.32	213.07
2011-12	322.56	206.64
2012-13	413.81	246.90
2013-14	454.21	255.75
2014-15	732.34	404.16
2015-16	837.19	473.79
2016-17	1064.89	611.30
2017-18	1172.15	653.37
Average 2000-18	386.26	256.83

Source: Computed by the Authors

5.4. Components of PHCE in Odisha

Table 5 reveals the components of PHCE in Odisha. Public expenditure on health can be divided in to three major heads 'Medical & Public Health, Family Welfare and Other'. Medical & Public Health alone accounts for more than 95 per cent of total expenditure on H&FW. Expenditure on Family Welfare ranges from 5 to 17 per cent, while allocation for 'Others' moves from 0.85 to 14.44 per cent. 'Medical and Public Health' is the dominant one, its share has been increasing over the time, from 75 per cent in early 2000 to 90 per cent at present. On the contrary 'Family Welfare' head receded back. Its share has slashed from 15 per cent to a low of 4.46 per cent in 2015-16.

Table 5: Head-wise Distribution of Health & Family Welfare Expenditure (in per cent)

Year	'Medical & Public Health'	'Family Welfare'	Others
2000-01	76.36	15.69	7.95
2001-02	79.16	13.18	7.57
2002-03	82.14	14.50	3.36
2003-04	73.21	12.36	14.44
2004-05	82.69	14.30	3.01
2005-06	84.05	15.95	0.00
2006-07	82.84	16.25	0.90
2007-08	83.65	15.50	0.85
2008-09	85.45	13.54	1.01
2009-10	85.03	14.16	0.81
2010-11	81.97	17.19	0.85
2011-12	83.99	14.90	1.11
2012-13	84.85	11.88	3.27
2013-14	88.19	9.15	2.66
2014-15	90.07	8.10	1.83
2015-16	92.99	4.46	2.55
2016-17	90.23	6.76	3.01
2017-18	91.13	7.05	1.82

Source: Computed by the Authors

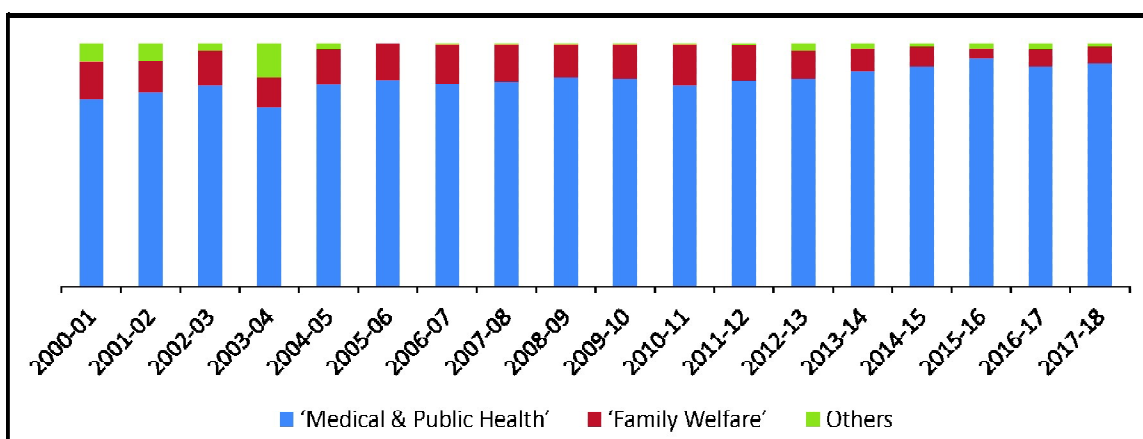


Figure 1: Components of Health Care Expenditure in Odisha

Source: Computed by the Authors from Table 5

5.5. Composition of PHCE in Odisha

The allocation for 'Medical & Public Health' is segregated into seven different sub heads, namely, Allopathy and Other Systems of Medicine, both in Rural and Urban Area; Public Health, Medical Education Training & Research and General. These sub heads have been reduced and reported in Table 6.

Table 6 shows that expenditure on Urban Health Service has been increasing from 39 per cent in 2000-01 to a high of 63 per cent in 2017-18; on the contrary expenditure towards Rural Health Service has been declined from more than 30 per cent to 16 per cent in the corresponding period. This reveals that expenditure on Urban Health Service is doubled whereas on Rural Health Service it is reduced to half. Expenditure on 'Medical Education & Training' has been more or less constant, i.e., around 10 per cent. The only exception is 2016-17, when it touched a high of 19 per cent. The situation of 'Public Health' reflects that up to 2009-10 the percentage share was more than 12, but thereafter it starts to decline to reach a low of 6.73 per cent in 2016-17. It is observed from the Table that 'Allopathic System of Medicine' soak up to 75 per cent of expenditure on 'Medical & Public Health' and 'Other System of Medicine' gets only 4 per cent share. However, the situation has been significantly changed from 2015-16 onwards. The share former is reduced to less than 50 per cent and the latter has been increased to more than 30 per cent.

Table 6: Head-wise Distribution of 'Medical & Public Health Expenditure' (in per cent)

Year	'Urban Health Service'	'Rural Health Service'	'Medical Education & Training'	'Public Health'	'Other'	Allopathic System of Medicine	Other System of Medicine
2000-01	39.96	33.65	8.43	16.93	1.03		
2001-02	40.59	33.58	9.91	15.02	0.9		
2002-03	32.05	37.80	8.24	21.00	0.91	62.99	6.86
2003-04	38.13	37.06	8.77	15.05	0.99	68.23	6.97
2004-05	51.79	28.41	7.03	12.03	0.74	74.71	5.50
2006-07	37.76	39.65	9.44	12.23	0.92	70.36	7.06
2007-08	45.32	32.48	8.28	13.11	0.81	70.50	7.30
2008-09	39.74	40.15	7.82	11.43	0.86	73.54	6.35
2009-10	39.11	37.49	9.94	12.62	0.84	70.45	6.16
2010-11	37.38	38.90	12.26	10.61	0.85	70.31	5.98
2011-12	39.41	39.36	10.39	10.08	0.76	72.90	5.88
2012-13	36.11	46.04	9.08	8.20	0.57	77.60	4.55
2013-14	42.22	35.98	12.50	8.75	0.55	73.77	4.43
2014-15	30.87	46.88	10.21	10.56	1.48	74.72	3.02
2015-16	54.39	23.91	12.21	9.15	0.34	48.30	30.00
2016-17	58.68	15.29	19.02	6.73	0.28	39.19	34.77
2017-18	63.03	16.45	11.89	8.18	0.45	43.56	35.92

Source: Computed by the Authors

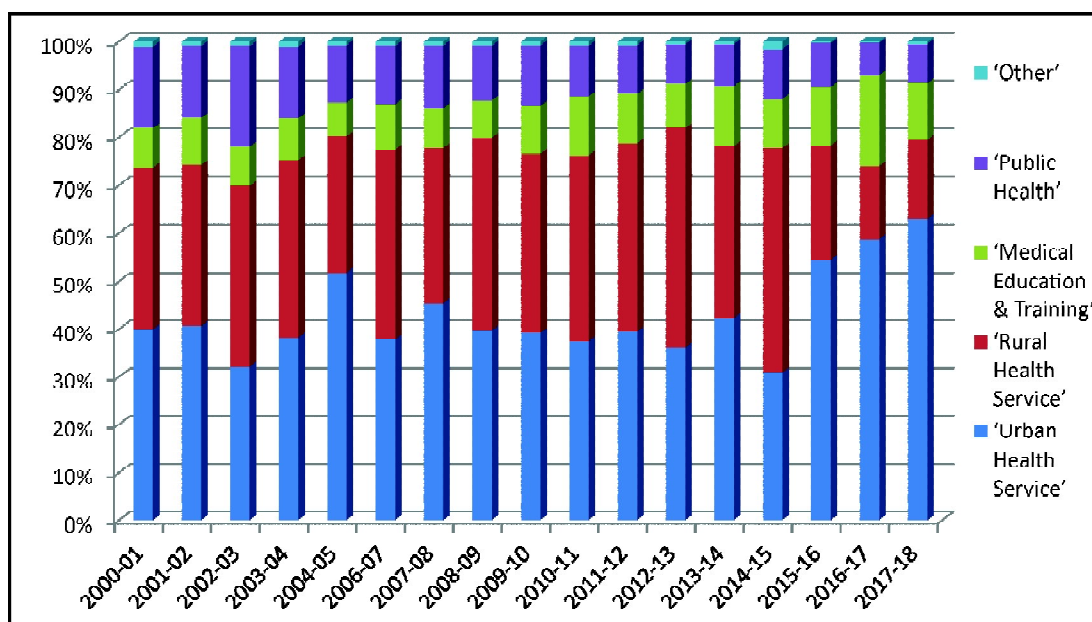


Figure 2: Composition of Health Care Expenditure in Odisha

Source: Computed by the Authors from Table 6

5.6. Elasticity of PHCE in Odisha

To examine the responsiveness of expenditure on health with respect to Social Sector Expenditure (SSE), Aggregate Expenditure (AE) and Gross State Domestic Product (GSDP) we have employed simple regression model. The outcomes are enumerated in Table 7. The result shows that the values of elasticity for SSE is less than one, i.e., less elastic but, with respect to AE and GSDP is more than one, i.e., more elastic. This implies that expenditure on health & family welfare in Odisha is less responsive to variation of the state's social sector expenditure, and more responsive to the variation of aggregate expenditure and GSDP as well.

Table 7: Regression result on the effect of SSE, AE & GSDP on HE

Dependent Variable: Natural Logarithm of Expenditure on Health			
Explanatory Variable	Constant	Coefficient	Adjusted R Square
LNSSE	-1.8190*	0.9476*	0.9636
LNAE	-4.7129*	1.1397*	0.9725
LNGSDP	-5.3399*	1.0429*	0.8836

Source: Computed by the Authors

Note: * represents significant at 1 per cent level

5.7. Health Expenditure and Health Outcome

In tune with the objective 'to examine the impact of health expenditure on health outcome of the state' we have examined the pair-wise correlation between per capita health expenditure (PCHE) and per capita gross state domestic product (PCGSDP) on the one hand and different health outcome variables, viz., LEB, IMR and CDR on the other hand. The result is shown in Table 8. The result shows that PCHE and PCGSDP are positively correlated with LEB, negatively correlated with IMR & CDR.

Table 8: Pair-wise Correlation between PCI, PCHE, LEB, IMR & CDR

	<i>LNPCGSDP</i>	<i>LNPCHE</i>	<i>LNLEB</i>	<i>LNIMR</i>	<i>LNCDR</i>
<i>LNPCGSDP</i>	1.000				
<i>LNPCHE</i>	0.859*	1.000			
<i>LNLEB</i>	0.988*	0.887*	1.000		
<i>LNIMR</i>	-0.983*	-0.889*	-0.993*	1.000	
<i>LNCDR</i>	-0.968*	-0.861*	-0.978*	-0.978*	1.000

Source: Computed by the Authors

Note: * indicates significant at 1% level

As the correlation coefficient does not go deeper into the analysis, we have applied econometric technique to quantify the causal relationship that exist between PCHE, PCGSDP and different health outcome variables. We posit the following model to be applied for econometric analysis.

$$HOV_i = \alpha + \beta PCGSDP_i + \gamma PCHE_i + \varepsilon_i$$

Where, 'HOV' represents LEB / IMR / CDR

The result of Ordinary Least Square Regression is tabulated in Table 9. The coefficient for PCGSDP and PCHE have the correct sign as expected, positive for LEB and negative for IMR and CDR. All the coefficients are statistically significant at one per cent level except the coefficient between PCHE and CDR. Further, it is observed from the value of the coefficients that GSDP has more pronounced impact on health outcome as compared with state health care expenditure. Based on the elasticity of life expectancy, a 10 per cent increase in PCGSDP would increase a rise in 1.12 per cent in LEB, whereas, only 0.25 per cent by raising the equal percentage of PCHE. Likewise, 10 per cent increase in PCGSDP and PCHE would reduce IMR by 4.76 and 1.28 respectively. The present result is quite consistent with the works undertaken by different researchers, viz., Berger and Messer, 2002; Martin *et al.*, 2008; Jaba *et al.*, 2014; Barenberg *et al.*, 2017.

5.8. Linkage between Health Expenditure & Income of the State

The foregoing analysis clearly highlights the pre-eminence of GSDP over PHCE. However, mere increase of GSDP is not enough to achieve the desired health outcome rather this income should be properly channelled for the provision of health care facilities such as infrastructure and manpower.

Table 9: Results of OLS Regression

	<i>LNLEB</i>	<i>LNIMR</i>	<i>LNCDR</i>
Constant	2.8904 (0.0000)	9.7240 (0.0000)	4.7993 (0.0000)
LNPCGSDP	0.1120 (0.0000)	-0.4764 (0.0000)	-0.2338 (0.0000)
LNPCHE	0.0255 (0.0134)	-0.1283 (0.0174)	-0.0407 (0.2668)
R ²	0.9819	0.9738	0.9401
Adj R ²	0.980	0.9715	0.9349
F-Statistic	626.42 (0.0000)	428.60 (0.0000)	180.67 (0.0000)

Source: Computed by the Authors

Note: Figure in parentheses shows the p-value

Therefore, now we shall examine the relationship between PHCE and income of the State during the period 1990-91 to 2015-16.

In this context we formulate the hypothesis “there exists bidirectional causality between public health care expenditure and income of the State” and to verify the hypothesis we employ ‘Time Series Econometrics’. Under this technique we follow three-step procedure as: (1) Augmented Dickey Fuller (ADF) (1979) and Phillips-Perron (PP) (1988) tests are used to examine the stationarity of the time series (2) the Johansen cointegration test is employed to establish long run relationship between the two series, and (3) to know the short-run dynamics we employ ‘Granger Causality Test’.

The ADF and PP Test has been used to examine the stationarity of both the series namely LNPCGSDP and LNPCHE (LN stands for Natural logarithm) and to know the order of integration by employing trend & intercept and Intercept alone models to ascertain the presence of unit root. The results of unit root test are shown in Table 10. From the table it is observed that ADF & PP tests confirmed that both the series are non-stationary at level, but becomes stationary after first difference. Hence, each original series is I (1).

The cointegrating equation gives long-run relationship between the variables, particularly for any economic model using nonstationary time series data. Here, we have used Johansen Cointegration Test but do not found any such cointegrating relation (as shown in Table 11).

The results of pairwise Granger Causality Test is shown in Table 12. It is observed that there exists a unidirectional causality between PCGSDP and PCHE and the causality runs from PCHE to PCGSDP. This implies PCHE Granger Cause PCGSDP, but PCGSDP does not Granger Cause PCHE.

In this context it should be worth mention that causality in econometrics is not the same thing as is used in day-to-day life, rather it refers more to the ability of one variable to predict (and therefore

Table 10: Unit Root Test of PCGSDP & PCHE**The Estimated τ Statistic****PANEL I**

<i>Variable</i>	<i>ADF Test</i>		<i>Intercept + Trend</i>		<i>Remark</i>
	<i>Intercept alone</i>	<i>1st difference</i>	<i>Level</i>	<i>1st difference</i>	
LNPCGSDP	0.0178	-6.5858*	-2.3021	-6.5576*	I(1)
LNPCHE	1.1461	-5.1268*	-0.7032	-5.9665*	I(1)

PANEL II

<i>Variable</i>	<i>PP Test</i>		<i>Intercept + Trend</i>		<i>Remark</i>
	<i>Intercept alone</i>	<i>1st difference</i>	<i>Level</i>	<i>1st difference</i>	
LNPCGSDP	0.0178	-6.5858*	-2.2643	-6.5576*	I(1)
LNPCHE	1.7094	-5.1259*	-0.4451	-5.9665*	I(1)

Note: MacKinnon (1996) critical value has been used for testing of unit root (H_N : The series has unit root); ‘*’ indicates significant at 1% level.

Source: Computed by the Authors

Table 11: Johansen Cointegration Test

Cointegration Rank Test (Trace Statistic)			
<i>No. of Cointegrating Equation</i>	λ (Eigen value)	<i>Trace Statistic</i>	<i>P-value</i>
None	0.2873	8.4822	0.4154
At most 1	0.0295	0.6905	0.4060
Cointegration Rank Test (Maximum Eigen value)			
<i>No. of Cointegrating Equation</i>	λ (Eigen value)	<i>Max. Eigen Statistic</i>	<i>P-value</i>
None	0.2873	7.7917	0.4003
At most 1	0.0295	0.6905	0.4060

Source: Computed by the Authors

cause) the other (Chris Brooks, 2014). “Granger causality really means only a correlation between the *current* value of one variable and the *past* values of others; it does not mean that movements of one variable cause movements of another”. Hence, PCHE in time period ‘t-1’ influences PCGSDP in time period ‘t’.

Table 12: Granger Causality Test

<i>Null Hypothesis:</i>	<i>F-Statistic</i>	<i>P-value</i>	<i>Remark</i>
LNPCGSDP does not Granger Cause LNPCHE	0.7366	0.4926	Do not Reject Null
LNPCHE does not Granger Cause LNPCGSDP	2.9932	0.0755	Reject Null

Source: Computed by the Authors

6. Results and Discussion

Foregoing analysis reveals that in India public health expenditure as a percentage of GDP is just 1.4. Our country spends very little amount on health care, lower than neighbouring Asian countries and even some of the African countries, keeping aside the cases of advanced countries. An interstate comparison shows that economically advanced states spend a little and economically poor states spend more towards health sector. On an average poor state like Bihar spent 1.07 per cent of its GSDP per annum towards health sector, however, rich state like Haryana spent only 0.45 per cent of its GSDP per annum towards health sector during the period 2000-2016. In Odisha growth rate of health care expenditure is quite inconsistent. Total PHCE as a per cent of GSDP is hovering around one per cent, even during the decade 2003-04 to 2013-14 it is less than one per cent.

Component wise 'Medical and Public Health' has an edge over 'Family Welfare', former even moves up to 90 per cent of total public health care expenditure. So far as composition of health care expenditure is concerned Urban Health Service has an increasing trend (from 39 per cent in 2000-01 to 63 per cent in 2017-18), but Rural Health Service has a declining trend (from 30 per cent to 16 per cent in the corresponding period). Expenditure on 'Medical Education & Training' has been more or less constant, i.e., around 10 per cent. Analysis shows that expenditure on health & family welfare in Odisha is less responsive to variation of the state's social sector expenditure, and more responsive to the variation of aggregate expenditure and GSDP.

Regarding health expenditure and health outcome it reveals that PCHE and PCGSDP are positively correlated with LEB, but negatively correlated with IMR & CDR. Econometric analysis depicts that the coefficient for PCGSDP and PCHE have the correct sign and statistically significant at one per cent level, positive for LEB and negative for IMR and CDR. Further, it is observed that GSDP has more pronounced impact on health outcome as compared with state health care expenditure.

To establish the relationship between per capita GSDP (PCGSDP) and per capita health expenditure (PCHE) time series econometrics has been employed. The results of pairwise Granger Causality Test shows a unidirectional causality between PCGSDP and PCHE and the causality runs from PCHE to PCGSDP. However, by using Johansen Cointegration Test we do not find any such cointegrating relation, i.e., the long-run relationship between PCGSDP and PCHE.

7. Conclusion

To sum up it is observed that in Odisha total health care expenditure as percentage of GSDP is hovering around one per cent. The annual growth rate of health care expenditure does not depict any

consistency. 'Medical & Public Health' and 'Family Welfare' account more than 95 per cent of total expenditure on H&FW and the former is the dominant one. Expenditure on Urban Health Service has been increasing, on the contrary expenditure on Rural Health Service declined and expenditure on 'Medical Education & Training' remains constant. 'Allopathic System of Medicine' soaks up to 75 per cent of expenditure on 'Medical & Public Health', however, recently it has reduced to less than 50 per cent.

The empirical result shows that both PCGSDP and PCHE have statistically significant positive impact on LEB and negative effect on IMR and CDR. However, GSDP has an edge over health care expenditure. The study of causality reveals that a unidirectional causality running from PCHE to PCGSDP in Odisha during the study period 1990-2018. This implies Per Capita Health Expenditure in one year affects Per Capita Gross State Domestic Product in the following year.

Therefore, there exists an intricate relation among GSDP, PHCE and Health Outcome. Each one reinforces the other. One cannot be improved at the cost of the other. Thus, effort should be geared up to move all these variables in unison, so as to reap optimum benefit. The managerial effort should be all inclusive irrespective of spatial, sectional and temporal dimensions of the society for a better outcome. The implications of the present endeavour clearly favours for the growth of public expenditure on health that too in rural and inaccessible area, where the need of the people is immense. Public health care expenditure should precede all other socio-economic-demographic variables to obtain the desired result. It is observed that in all most all State and Central Government followed this practice in post COVID-19 budget formulation. Hence, further research may be undertaken in this area to carry forward the analysis.

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