Understanding equity of institutional delivery in public health centre in India: An assessment using Benet Incidence Analysis

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Keywords: Delivery care, Benefit incidence, Equity, National Health Mission, India

DOI: https://doi.org/10.21203/rs.3.rs-54823/v1

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Abstract

**Background:** The National Health Mission (NHM), the largest ever publicly funded health programme worldwide used over half of the national health budget in India and primarily targeted to improve maternal and child health in the country. Though increased public health investment in India has improved the health care utilization and health outcomes across geographies and socio-economic groups, little is known on equity aspect of such large scale investment. In this context, this paper examines the utilisation pattern of delivery care and equity aspect of public investment in India.

**Methods:** Data from the recent round of National Family Health Survey (NFHS 4) conducted during 2015-16 used in the analyses. A total of 148,645 last birth delivered in an institution in a reference period of five years has been used in the analyses. The out-of-pocket (OOP) payment on delivery care is the dependent variable. Benefits Incidence Analysis (BIA), descriptive statistics, concentration index (CI), and concentration curve (CC) used in the analysis.

**Results:** Utilization of natal care from public health centres in India is pro-poor and have a strong economic gradient. However, about 28% mothers in richest wealth quintile did not pay for delivery in public health centres compared to 16% among the poorest wealth quintile. The median OOP payments for institutional delivery from public health centre was ₹1200 for mothers belonging to the poorest wealth quintile compared to ₹2000 for mothers belonging to richest wealth quintile. Benefit incidence analyses suggests that about 17.4 % of subsidies were used among poorest, 19.3% among richest quintile and 21.9% in the middle quintile. The concentration index of institutional delivery from public health centres was -0.161 [95% Confidence Interval: -0.158, -0.165] compared to 0.296 [95% Confidence Interval: 0.289, 0.303] from private health centres.

**Conclusion:** Utilisation of natal care services from public health centres in India is pro-poor. However, benefit-incidence analyses suggest that the use of subsidy is relatively higher among wealthier and better off mothers in India.

Introduction

Increasing health spending and rising health inequality is concomitant across geographies and socio-economic groups [1–4]. Rising health spending is associated with increasing public investment on health and declining out-of-pocket (OOP) payments on health spending [5–6]. Despite these, the catastrophic health spending (CHS) and impoverishment, resulting from OOP payment have been increasing in many developing countries [7–9]. The CHS, impoverishment and the poverty impact of health spending vary across countries and largely depend on income level, public policies, coverage of health insurance schemes, type of provider, payment method, disease burden and demographics [10–12]. Globally about 1.3 billion people do not have access to effective and affordable health care. Of those who have access about 170 million are forced to spend more than 40% of their household income on medical treatment. Over 100 million people annually are pushed into extreme poverty due to health spending [13].

Equity and efficiency are the two pillars of public health investment worldwide. Goal 4 and 5 of Millennium Development Goals (MDGs) and goal 3 and 10 of Sustainable Development Goals (SDGs) has outline specific goals to reduce inequality in access and utilisation to quality health services [14–15]. Most of the welfare government has made large-scale investments to increase the access and utilisation of health care services. The periodic evaluation suggests mixed impact of public health investment on health outcome and health care utilisation [16–19]. Studies used varying approaches in understanding the impact of public investment (benefit-incidence analysis, individual preference, concentration curve, concentration index). Among these, benefit incidence analyses (BIA) has been increasingly used in health economics literature [20–24, 44–45. 48]. Benefit incidence analysis is a tool which shows whether the subsidies are directed to the poorer section or it helps the better-off section of the society. It also involves the estimates of monetary value of the services and its distribution along the population [25]. Effectiveness of the distribution of limited resources to meet the needs of the poor is captured along with extent of efficient resource allocation [21].

Studies from African and Asian countries suggest that the impact of public subsidy on health care is pro-poor for some countries and pro-rich for others. A systematic review suggests that in most of the lower-middle income countries (LMICs), a pro-rich distribution of public subsidy was observed for health care service except for Nigeria [20]. In Nigeria, individuals belonging to the rural areas and poorest wealth quintile had the highest share of benefits received for utilisation of public health care services [26]. In Kenya, the distribution of public subsidy at primary health centres was pro-poor while that at hospital level were pro-rich [27]. The distribution of health services was pro-poor in Hong Kong and Malaysia and it was pro rich in Nepal, Bangladesh and India [24]. In India, the share of public subsidy for in-patient and out-patient services was 40% in the richest quintile compared to 9% in the poorest quintile [28].

Over a decade ago, the state of maternal and child health was poor in the country. In 2002-03, the maternal mortality ratio was 286 per 100,000 live births and the under-five mortality was 74 per 1,000 live births [29–30]. Over half of the mothers did not delivered at a health centre. The institutional delivery among women belonging to the poorest wealth quintile was 12.8% compared to 83.6% in richest quintile in 2005 [30]. The inequality in health care utilisation was large in many other health services [4, 31–33]. As a policy response, the Government of India in 2005 revamped the health programme in the country and launched the National Health Mission (NHM), the largest ever health program worldwide. The main objective of NHM was improvement of maternal and child health care in poorer regions of the country and among the poor and vulnerable section of the population. The NHM had an estimated annual budget of over ₹26,691 cr. in 2017-18 accounting more than half of health budget of the union government [34]. The large scale public health investments have reduced the maternal and child mortality in the country. Delivery from public health centres has increased from 18% in 2005-06 to 52.1% by 2015-16 [30, 35]. Despite the increase in coverage of services, the out-of-pocket (OOP) expenditure and catastrophic
Mathematically, the formula for calculating Benet Incidence is as follows:

\[
\text{Benet Incidence} = \frac{\text{Net of Reimbursement}}{\text{Cost of Services}}
\]

In case no charge was levied, the OOP payment was considered as zero. The cost of services for maternal care in India does not provide any coverage/reimbursement and so OOP is equivalent to household expenditure. Further, to examine the robustness of the result obtained from median value, we have also estimated benet incidence using mean value. We have estimated the benet incidence of a particular NHM programme has such provision and so the modal value for OOP payments became zero. Further, to examine the robustness of the result obtained from median value, we have also estimated benefit incidence using mean value. We have estimated the benefit incidence of a particular group utilizing service from public health centres. The OOP payment in private health centres has been taken as synonymous to cost of services. In case of maternal care, most of the health insurances in India do not provide any coverage/reimbursement and so OOP is equivalent to household expenditure. In case, no charge was levied, the OOP payment was considered as zero.

In developing countries, public investment in health remained low over time and effectiveness of public spending on health care services is an elusive empirical issue. Increasing public health expenditure on health care services does not automatically benefit all groups of population if the distribution of resources is not equitable. While the average utilisation of services may increase, it may not necessarily benefit the poor and marginalised. Therefore, it is important to assess empirically whether public spending in India truly benefits the poor section of the population. The national average in utilisation of delivery care services from public health centres conceals large variations across states and economic groups. Though there has been an increase in utilisation of maternal services from public health centres, little is known to whom it is benefiting. It is unclear whether the benefits are largely pro-poor or pro-rich. In this context, this paper examines the equity in the distribution of public subsidy among the mothers using public health centres for institutional delivery using the BIA approach.

**Data And Methods**

Unit data from the recent round of National Family Health Survey (NFHS-4) conducted during 2015-16 has been used for the analysis. NFHS 4 is the fourth in the series of Demographic Health Survey (DHS) in India that aimed to provide reliable estimates of utilization of maternal and child health services, contraception, nutrition etc. along with the socio-economic and demographic condition of the households. A total of 601,509 households, 699,686 ever-married women in the age group 15–49 and 112,122 men in the age group 15–54 were successfully interviewed across all states and union territories of India. The NFHS-4 for the first time included a set of policy relevant question on OOP payment on delivery care (defined as the expenditure net of reimbursement) for the last birth delivered at a health centre and reimbursement under Janani Suraksha Yojana (JSY). Findings from the survey along with sampling design, methodology, and results are available in the national report. Unit data from the kids file has been used, which provides details of births to mothers during five years preceding the survey. A total of 259,627 births were reported of which 190,898 were last births and 148,645 were conducted in the health centres (institutional delivery). The unit data was cleaned for factual errors on OOP payment before the analysis. The details and procedure for data cleaning are available elsewhere.

**Statistical Analysis**

Descriptive statistics, Benefit Incidence Analysis (BIA), and Concentration Index (CI), and Concentration Curve (CC) are used in the analysis.

**Benefit Incidence Analysis**

To determine the distribution of benefits received by various socio-economic groups using public health services for delivery care, Benefit Incidence Analysis has been used. One of the difficulties in benefit incidence analyses is obtaining the cost of services. In the absence of cost of services, the modal value of OOP payment for delivery has been used in literature. However, we have used the median value in our study since a significant proportion of women reported zero OOP (varying from 7–10% across the wealth quintile) of delivery at the accredited private health centres (JSY under NHM programme has such provision) and so the modal value for OOP payments became zero. Further, to examine the robustness of the result obtained from median value, we have also estimated benefit incidence using mean value. We have estimated the benefit incidence of a particular group utilizing service from public health centres. The OOP payment in private health centres has been taken as synonymy to cost of services. In case of maternal care, most of the health insurances in India do not provide any coverage/reimbursement and so OOP is equivalent to household expenditure. In case, no charge was levied, the OOP payment was considered as zero.

Mathematically, the formula for calculating Benefit Incidence is as follows:
\[ \mu_j = \sum a_{ij} \frac{\beta_j}{\alpha_i} = \sum r_{ij} \beta_j \]

Where,
- \( \mu_j \): benefit of public subsidy enjoyed by group \( j \)
- \( a_{ij} \): utilization of delivery care by group \( i \)
- \( r_{ij} \): utilization of delivery care by all groups
- \( \beta_j \): government net expenditure on delivery care by group \( j \)
- \( \gamma_j \): group \( j \) share of utilization of delivery care

The following steps have been used in the study.

i. Computing wealth quintile (population ranked by wealth) as a measure of socio-economic status.

ii. Estimating the utilization rate for delivery care in public health centres for each quintile.

iii. Estimating net subsidy at public health centres for each quintile (obtained by deducting the median OOP payment on delivery care in public health centres from median OOP payment in private health centres)

iv. Estimating individual subsidy for each quintile by multiplying the net subsidy with the utilization rate.

v. Calculating Benefit Incidence for each quintile by taking percentage share of individual subsidy.

**OOP payment and Cost of service on institutional delivery**

We have computed the OOP payment by quintile for mothers delivering at public health centres. Further, NFHS 4 does not provide any information on the actual cost of delivery care at the public health centre. Hence in line with previous literature, we have used OOP payment on delivery care in private health centres as the proxy for the actual cost of delivery care in public health centres [44-45].

**Concentration Index (CI) and Concentration Curve (CC)**

To examine the economic inequality in the utilization of delivery care services from public/private health centres, CC and CI were used. CC and CI are the commonly used measures by researchers across the globe to measure health inequality [24, 49-50]. The inequality is graphically represented through CC and plots the cumulative proportion of the population (ranked by wealth) against the cumulative proportions of the population utilizing delivery care services from public/private health centres. If CC overlaps with the line of equality, then the extent of utilization of services from public/private health centres is evenly distributed across the wealth group. However, if CC lies above the line of equality, it implies a pro-poor concentration of utilization of delivery care services while if CC lies below the line of equality, it implies a pro-rich concentration in utilization of delivery care services. CI is defined as twice the area between the CC and the line of equality. The value of CI ranges from -1 to +1, with a zero value of CI suggesting equal distribution of utilization of services across the wealth group. The negative value of CI signifies a pro-poor distribution of utilization of delivery care services while a positive value of CI signifies a pro-rich distribution.

**Result**

**Figure 1** presents the distribution of institutional delivery by wealth quintile and type of health centres in India. Among all institutional deliveries in poorest wealth quintile, 86% were in public health centre compared to 14% in private health centre. The utilization of institutional delivery from public health centres declines with an increase in the economic well-being of the households. On the other hand, economic gradient in utilization of institutional delivery in private health centres is strong and positive. In richest wealth quintile, about two-third utilized private health centre for delivery care. However, majority of the women from the poorest, poorer and middle quintile utilized public health centre for delivery.

**Table 1** presents the % of women who paid or availed services without payment at private and public health centre by wealth quintile in India. Among those availed services from public health centres, the proportion of women who did not pay for delivery care increases by wealth quintile. For example, about 17% of women in poorest wealth quintile did not pay for delivery care compared to 28% in richest wealth quintile. In case of private health centres the proportion is similar across wealth quintile.
Table 1

Percentage of mothers who did not pay for institutional delivery in India, 2015-16

| Wealth Quintile | Public | Private | Overall |
|-----------------|--------|---------|---------|
|                 | Paid   | Didn't pay | N   | Paid   | Didn't pay | N   | Paid   | Didn't pay | N   |
| Poorest         | 83.4 | 16.6 | 24518 | 90.8 | 9.2 | 3223 | 84.4 | 15.6 | 27741 |
| Poorer          | 80.9 | 19.1 | 26635 | 92.6 | 7.4 | 5167 | 83.2 | 16.8 | 31802 |
| Middle          | 77.8 | 22.2 | 24053 | 92.5 | 7.5 | 7838 | 82.3 | 17.7 | 31891 |
| Richer          | 75.9 | 24.1 | 18676 | 91.5 | 8.6 | 11149 | 82.9 | 17.1 | 29825 |
| Richest         | 71.6 | 28.4 | 11733 | 91.0 | 9.0 | 15653 | 84.2 | 15.9 | 27386 |
| **Total**       | 78.9 | 21.1 | 105615 | 91.6 | 8.45 | 43030 | 83.3 | 16.7 | 148645 |

Table 2 provides the median out-of-pocket (OOP) payment incurred by women who delivered at a health centre in India. The median OOP for delivery care increases by wealth quintile in both public and private health centre. The median OOP payment of richest wealth quintile was about seven times higher than that of poorest wealth quintile. Similarly, the median OOP payment suggests that about half of the women from poorest wealth quintile spent less than ₹1,100 whereas it was over ₹8,000 for the richest wealth quintile. The pattern holds true for deliveries at public and private health facilities but the value is much larger in private health centres. On an average, women belonging to the poorest wealth quintile and delivering in private health centre spent about five times higher than that of public health centre. The median value of OOP payment in public health centres varies from ₹1,000 in poorest wealth quintile to ₹1,200 in richer wealth quintile. On the other hand, this variation is even larger in private health centres, ranging from ₹7,000 to ₹14,600. The pattern is almost similar for the four selected states with some exception. Uttar Pradesh and Karnataka show a similar pattern of increasing OOP for institutional delivery with the increase in economic status. However, in case of Maharashtra and Rajasthan, some interesting patterns have been found. Overall, poorest women of Maharashtra spent ₹7,937 regardless their place of delivery. Furthermore, women belonging to poorest section and delivered at public health centre spent almost double than that of richest section. Similarly, for Rajasthan, richer section spent the lowest of ₹1,685 than the women belonging to other quintile in case of public health centre delivery.
Table 2 presents the benefit incidence of the public subsidy on delivery care by wealth quintile in India. The utilization rate at public health centre varied from a maximum of 24.8% among poorest quintile to 12.3% among richest quintile. During 2015-16, public subsidy was the maximum for the middle wealth quintile (21.9%) followed by richer (21.8%) wealth quintile while it was least for the poorest quintile (17.4%). Considering the mean cost of service in private health centre, the benefit of public subsidy was maximum for the women from the middle quintile (21.9%) followed by richer quintile (20.8%) (Appendix 1).
Table 3 presents results of benefit incidence on institutional delivery by wealth quintile in India, 2015-16 (Median).

| Quintile | Number people utilizing public health service (1) | Utilization Rate (2) | Median OOP in public health service (3) | Median OOP of service in private health centre (4) | Net subsidy at public health centre (5 = 4 - 3) | Individual Subsidy Benefit (6 = 5*2) | Benefit Incidence (7) | N  |
|----------|----------------------------------------------------|----------------------|-----------------------------------------|-----------------------------------------------|----------------------------------------------|-------------------------------------|----------------------|----|
| Poorest  | 26241                                              | 0.248                | 1000                                    | 7000                                          | 6000                                         | 1491                                | 17.4                 | 29729 |
| Poorer   | 24845                                              | 0.235                | 1100                                    | 8200                                          | 7100                                         | 1670                                | 19.5                 | 29729 |
| Middle   | 22533                                              | 0.213                | 1200                                    | 10000                                         | 8800                                         | 1877                                | 21.9                 | 29729 |
| Richer   | 18983                                              | 0.180                | 1200                                    | 11600                                         | 10400                                        | 1869                                | 21.8                 | 29729 |
| Richest  | 13013                                              | 0.123                | 1000                                    | 14400                                         | 13400                                        | 1651                                | 19.3                 | 29729 |
| Total    | 105615                                             |                      |                                         |                                               |                                              |                                     |                      | 148645 |

Table 4 presents results of benefit incidence on institutional delivery by place of residence, low/high performing states and educational attainment of women in India. In the urban area, the utilization rate from public health centre varied from 28.2% among women belonging to the poorest quintile to 11.6% among women from richest quintile whereas in rural areas, the utilization rate varies from 14.5% among women from richest quintile to 23.2% among women belonging to the poorest quintile. Considering median OOP of delivery care, in urban area, the share of benefit received was highest for women belonging to poorer quintile (23.1%) followed by women from middle quintile (22.5%) and poorest quintile (20.5%). In case of rural areas, the share of public subsidy was highest among women belonging to richer quintile (21.7%) followed by middle (20.9%) while it was least among women from poorest quintile (17.5). Further, benefit incidence was computed for low and high performing states. Institutional delivery in Low Performing States (LPS) varied from 12.9% among women from richest wealth quintile to 23.5% among women in poorest quintile whereas it varied from 12.5% among women from richest quintile to 25.7% among woman from poorest quintile in High Performing States (HPS). Considering the median OOP of service, the share of public subsidy was maximum for the women from middle quintile in both LPS and HPS. However, the share was minimum for the poorest quintile (18.7%) in LPS and richest quintile in HPS (17.7%). When mean OOP of delivery care was taken, the public subsidy was maximum for the women from the poorer wealth quintile (24.3%) in LPS and middle quintile in HPS (22.7%) (Appendix 2). Also, the benefit incidence of the public subsidy was computed for women with education less than five years and more than five years. The utilization rate of public health centre among women with less than five years of education varied from 21.9% among women from richest quintile to 16.7% among women from richest quintile while it varied to 25.9% among women from poorest quintile 12.1% among women from richest quintile for women with more than five years of education. Considering the median OOP of delivery care service, the benefit incidence of public subsidy was highest among women’s from the richer quintile (22.1%) having less than five years of education In comparison the share was highest among women from middle wealth quintile (21.4%) having more than five years of education.
Table 4
Utilization rate, OOP (₹), and Benefit incidence by place of residence, educational attainment and states on institutional delivery in India, 2015-16. (Median value)

| Quintile       | Number people utilizing public health service (1) | Utilization Rate (2) | Median OOP in public health service (3) | Median OOP of service in private health centre (4) | Net subsidy at public health centre (5 = 4 − 3) | Individual Subsidy Benefit (6 = 5∗2) | Benefit Incidence (7) | N   |
|----------------|---------------------------------------------------|----------------------|----------------------------------------|--------------------------------------------------|---------------------------------------------|--------------------------------------|---------------------|-----|
| Urban Poorest  | 6789                                              | 0.282                | 1060                                   | 8500                                             | 7440                                        | 2098                                 | 20.5                | 8461 |
| Poorer         | 5904                                              | 0.245                | 1200                                   | 10850                                           | 9650                                        | 2367                                 | 23.1                | 8460 |
| Middle         | 4818                                              | 0.200                | 1360                                   | 12200                                           | 10840                                       | 2170                                 | 21.2                | 8460 |
| Richer         | 3767                                              | 0.156                | 1200                                   | 13050                                           | 11850                                       | 1854                                 | 18.1                | 8460 |
| Richest        | 2794                                              | 0.116                | 1000                                   | 16000                                           | 15000                                       | 1741                                 | 17.0                |       |
|                | 24072                                             |                      |                                        |                                                  |                                             |                                      |                     | 42301 |
| Rural Poorest  | 18905                                             | 0.232                | 1000                                   | 7000                                            | 6000                                        | 1391                                 | 17.5                | 21269 |
| Poorer         | 18214                                             | 0.223                | 1050                                   | 8000                                            | 6950                                        | 1552                                 | 19.6                | 21270 |
| Middle         | 17163                                             | 0.210                | 1130                                   | 9000                                            | 7870                                        | 1656                                 | 20.9                | 21268 |
| Richer         | 15421                                             | 0.189                | 1200                                   | 10300                                           | 9100                                        | 1721                                 | 21.7                | 21269 |
| Richest        | 11840                                             | 0.145                | 12100                                  | 11100                                           | 1612                                        | 1612                                 | 20.3                |       |
|                | 81543                                             |                      |                                        |                                                  |                                             |                                      |                     | 106344 |
| LPS Poorest    | 15983                                             | 0.235                | 1000                                   | 6700                                            | 5700                                        | 1342                                 | 18.7                | 17852 |
| Poorer         | 15565                                             | 0.229                | 1000                                   | 7400                                            | 6400                                        | 1467                                 | 20.4                | 17852 |
| Middle         | 14638                                             | 0.216                | 1000                                   | 7900                                            | 6900                                        | 1488                                 | 20.7                | 17853 |
| Richer         | 12929                                             | 0.190                | 1000                                   | 8700                                            | 7700                                        | 1467                                 | 20.4                | 17851 |
| Richest        | 8767                                              | 0.129                | 1000                                   | 12000                                           | 11000                                       | 1421                                 | 19.8                |       |
|                | 67882                                             |                      |                                        |                                                  |                                             |                                      |                     | 89259 |
| HPS Poorest    | 9693                                              | 0.257                | 1500                                   | 8900                                            | 7400                                        | 1901                                 | 19.4                | 11878 |
| Poorer         | 8925                                              | 0.237                | 1500                                   | 10000                                           | 8500                                        | 2011                                 | 20.5                | 11877 |
| Middle         | 7925                                              | 0.210                | 1550                                   | 12000                                           | 10450                                       | 2195                                 | 22.4                | 11877 |
| Richer         | 6478                                              | 0.172                | 1500                                   | 13000                                           | 11500                                       | 1974                                 | 20.1                | 11877 |
| Richest        | 4712                                              | 0.125                | 1100                                   | 15019                                           | 13919                                       | 1738                                 | 17.7                |       |
|                | 37733                                             |                      |                                        |                                                  |                                             |                                      |                     | 11877 |
| Education Less than 5 years Poorest | 7615                                              | 0.219                | 950                                    | 6500                                            | 5550                                        | 1214                                 | 19.1                | 8410 |
| Poorer         | 7373                                              | 0.212                | 1000                                   | 7000                                            | 6000                                        | 1271                                 | 20.0                | 8411 |
| Middle         | 7210                                              | 0.207                | 1000                                   | 7000                                            | 6000                                        | 1243                                 | 19.5                | 8408 |
| Richer         | 6794                                              | 0.195                | 1000                                   | 8200                                            | 7200                                        | 1405                                 | 22.1                | 8410 |
| Richest        | 5815                                              | 0.167                | 1000                                   | 8400                                            | 7400                                        | 1236                                 | 19.4                |       |
|                | 34807                                             |                      |                                        |                                                  |                                             |                                      |                     | 42048 |
| Education more than 5 years Poorest | 18360                                             | 0.259                | 1100                                   | 8000                                            | 6900                                        | 1789                                 | 18.9                | 21320 |
| Poorer         | 16854                                             | 0.238                | 1252                                   | 10000                                           | 8748                                        | 2082                                 | 22.0                | 21320 |
| Middle         | 14894                                             | 0.210                | 1400                                   | 11000                                           | 9600                                        | 2019                                 | 21.4                | 21321 |
| Richer         | 12117                                             | 0.171                | 1200                                   | 12050                                           | 10850                                       | 1857                                 | 19.7                | 21317 |
| Richest        | 8583                                              | 0.121                | 1000                                   | 15000                                           | 14000                                       | 1697                                 | 18.0                |       |
|                | 70808                                             |                      |                                        |                                                  |                                             |                                      |                     | 106597 |

Figure 2 presents the concentration curve (CC) for women utilizing institutional delivery at public and private health centre respectively. The CC for women utilizing public health centre was above the line of equality indicating a pro-poor concentration of use of public health centre for delivery care.
services whereas CC was below the line of equality for women utilizing private health centre suggesting a pro-rich concentration of use of private health centre for delivery care services.

Table 5 presents the public-private differential of concentration index for institutional delivery by place of residence, low/high performing states and educational attainment of women in India. The CI values was higher for women residing in urban area using public health centre (CI: -0.209) for delivery care compared to women delivering in private health centre (CI: -0.112). Similarly, the CI for mother using private health centre for delivery services was higher for mothers from rural area (CI: 0.281) compared to urban area (CI: 0.217). The CI value of women residing in HPS (-0.177) using public health service was higher compared to their counterparts residing in LPS (-0.113). On the contrary, the CI value was higher for women residing in LPS (0.318) utilizing private health centre for delivery care services compared to those residing in HPS (0.226).

| Place of Residence | Place of Delivery | Public | 95% Confidence Interval | Private | 95% Confidence Interval |
|--------------------|-------------------|--------|-------------------------|---------|-------------------------|
| Rural              | Public            | -0.112 | (-0.115, -0.109)        | 0.281   | (0.273, 0.290)          |
|                    | Urban             | -0.209 | (-0.218, -0.200)        | 0.217   | (0.207, 0.226)          |
| State type         |                   |        |                         |         |                         |
| Low Performing States | Public         | -0.113 | (-0.116, -0.110)        | 0.318   | (0.309, 0.328)          |
|                    | Private           | -0.177 | (-0.184, -0.170)        | 0.226   | (0.217, 0.235)          |
| Education          |                   |        |                         |         |                         |
| Less than 5 years  | Public            | -0.063 | (-0.067, -0.058)        | 0.240   | (0.222, 0.258)          |
|                    | Private           | -0.177 | (-0.182, -0.172)        | 0.258   | (0.251, 0.265)          |
| More than 5 years  | Public            | -0.161 | (-0.165, -0.158)        | 0.296   | (0.289, 0.303)          |
|                    | Private           | -0.116 | (-0.153, -0.110)        | 0.250   | (0.239, 0.261)          |

Figure 3 represents the concentration index for delivery care across the states of India by public and private health facility. In India, the CI value for mothers utilizing public health centre was ~ 0.161 and was negative for all states. In contrast, the CI value for mothers utilising private health centre was 0.296 and positive for all states. A Large variation in concentration index across states in both public and private health facilities was observed. Across public health facility, the CI value was highest in Gujarat (CI: -0.235) followed Kerala (CI: -0.234) and Telangana (CI: -0.232) and lowest Jammu & Kashmir (CI: -0.047) followed by Sikim (CI: -0.066) and Himachal Pradesh (0.067). Across private health centre, the CI value was highest in Tripura (CI: 0.585) followed Madhya Pradesh (0.512) and Odisha (0.487) and lowest in Telangana (CI: 0.114) followed by Gujarat (CI: 0.127) and Andhra Pradesh (CI: 0.148).

Discussion

Resource constraints in the public healthcare system poses several challenges to meet the healthcare need of the poor and marginalized population and likely to increase the socioeconomic inequality in health outcome. Resources used for public health services has opportunity cost and in this context equity in health care is assumed to be significant. The NHM in India, the largest ever public health programmes worldwide that has been operational for over 15 years. While over half of the national health resources were invested in NHM, large-scale investment aimed to achieve multiple objectives including increasing service coverage, reducing inequality in health care and health outcomes and reducing OOP payment and CHS specifically among the poor and disadvantages. Although the priorities of these schemes are usually aimed at benefiting the economically weaker section of the population, no attempt has been made to understand the benefit-incidence of these programmes in India. This is the first ever study to investigate the distribution of public subsidy among mothers using public health centres considering institutional delivery as the case from NFHS-4, a large scale population based survey. The salient findings of the paper are as follows:

First, the utilisation of delivery care services has a strong economic gradient. Mothers belonging to the poorest and poorer wealth quintile use more of public health centre for delivery care while mothers from richer and richest wealth quintile use private health centre for delivery care services. Second, among those using public health services, a higher proportion of mothers from richest and richer wealth quintile did not pay for the services compared to poorest and poorer wealth quintile. Third, the median OOP on delivery care was about seven times higher for mothers belonging to richest wealth quintile compared to mothers from poorest quintile. The pattern was similar for deliveries in public and private health centres. However, large variation was observed in case of private health centres. Fourth, the public subsidy was relatively used more from the mothers in the middle wealth quintile suggesting that the public subsidy was not pro-poor in nature. The public subsidy in urban area was used among the poor section of the society whereas in rural areas, it was largely used among the richer section of the society when both mean and median OOP was considered. Further, the public subsidy was higher among mothers from poorer section of the society in LPS whereas the subsidy was higher among mother from middle section of the society in HPS. Fifth, the CC for mother utilizing public health centres for delivery care was above the line of equality suggesting a pro-
poor concentration of utilization of public health service whereas the CC was below the line of equality suggesting a pro-rich concentration of utilization of private health services. The CI value of -0.161 for public health centre and 0.296 for private health centre further confirms the concentration of use public health centres among the poor and private health centre among the rich. Further, the state variation in concentration index was large for both public and private health service.

We provide some plausible explanation to our findings. The utilization of delivery care from public health centres is higher among the poorest and poorer section of the population as these services at public health centres are provided at free or very nominal cost and poor people has limited ability to pay for services. On the other hand, services from private health centres are expensive in nature and are mostly used by richer wealth quintile. The higher dependency and utilization from the private health sector led to rising inequality in the health care services. The OOP expenditure incurred during delivery may be due to the complications in delivery care, caesarean delivery, cost of medicine, transportation and accompanying person etc. This OOP payment has strong and positive economic gradient. The reason is, mothers from higher economic strata have higher ability to pay for services and so they seek for better quality of care [51]. However, among those using the public health centres for delivery care, the extent of benefit was relatively higher among richer and richest quintile. The potential cause of this trend is that, the poorer women are paying more for similar services at public health centres. Although, the marginalized women should have received various reimbursement and incentives from NHM and other maternal programmes, studies suggest that, these incentives are either insufficient or there are some other factors accounting for utilization inequality, such as, low education attainment, low quality public health facility in poorer areas [20, 52]. The cash assistance programmes are not enabling factors for institutional delivery as there are some other informal payments associated with it, which in turn, opts out the marginalized section [53]. On the other hand, women from richer quintile are more aware about the ongoing programmes and incentives; so they enjoyed more benefits compared to poor. Regional variation in subsidy utilization could be another possible reason of unequal distribution of public subsidies. For instance, poor mothers from LPS enjoy higher benefit of subsidy which can be explained by the introduction of various maternal and child health programmes under NHM. The JSY under NHM provides conditional cash assistance to the eligible women from weaker section of the population. Although inequality still exists, the level of inequality has reduced and institutional delivery has increased significantly across all groups in LPS [52, 54]. Besides increasing facility based delivery, JSY has significantly increased contraceptive use, breastfeeding practice and post-natal check-up which are closely associated with accessing public health facilities [55].

We outline the following limitations of the study. First, we have used NFHS data to estimate utilization pattern, OOP payments, benefit incidence based on self-reported, there could be some recall bias. Second, we have used median cost of private health centres as proxy to cost of services in public health centres. An appropriate study on costing could be more robust to provide exact scenario. Third, our results could not cover the impact of recent initiatives such as effect of Ayushmann Bharat, Pradhan Mantri Matru Vandana Yojana etc.

**Conclusion**

Public health spending should benefit the poor and marginalized section of the society to achieve equity in health outcome. Focused policies are needed in order to maintain equity across all the wealth quintile. At the national level, policies such as, Rashtriya Swasthya Bima Yojana (RSBY), Ayushman Bharat, Pradhan Mantri Matru Vandana Yojana (PMMVY) has been providing the protection against financial risks to the economically weaker section of the population. These policies are significant to change the very outline of health care access, utilization and OOP expenditure. It is very much recommended to continue such policies with greater monitoring surveillance to make it more pro-poor, so that disadvantageous can get the substantial support.

**Declarations**

**Ethics approval and consent to participate:** As the analysis is based on secondary data available in the public domain, it needs no prior approval.

**Consent for publication:** This manuscript is an original work and has been done by the authors, SKM, RM, SM and SS who all are aware of its content and approve its submission. This manuscript has not been published elsewhere in part or in entirety, and is not under consideration by another journal. All authors gave their consent for publication in International Journal for Equity in Health.

**Availability of data and material:** The dataset used and analysed for the current study is available in DHS repository, [https://dhsprogram.com/data/dataset/India_Standard-DHS_2015.cfm?flag=0](https://dhsprogram.com/data/dataset/India_Standard-DHS_2015.cfm?flag=0)

**Competing interests:** The authors declare that they do not have any competing interest.

**Funding:** Not applicable

**Authors’ contributions:** Conception and design of study: SKM; analysis and interpretation of data: SKM, SM and SS; drafting the manuscript: SKM, SS, SM, and RM; critical revision of the manuscript for important intellectual content: SKM, RM, SM, SS.

**Abbreviations**

NHM: National Health Mission
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**Figures**

![Figure 1](http://example.com/figure1.png)

**Figure 1**

Percentage distribution of institutional delivery by wealth quintile and type of health centres in India, 2015-16.
Figure 2
Concentration curve for mothers using delivery services at public and private health facility in India, 2015-16.

Figure 3
Concentration Index of institutional delivery by public and private facility in selected states of India, 2015-16.

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