

# Inequitable coverage of non-communicable diseases and injury interventions in India

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## ABSTRACT

**Background.** We examined the inequities in coverage of interventions for non-communicable diseases (NCDs) and injuries in India.

**Methods.** Data collected by the WHO World Health Survey in 6 Indian states in 2003 were used to estimate the coverage of interventions for NCDs and injuries. Coverage was defined as the proportion of individuals who reported receiving the intervention among those in need of it. Multiple logistic regression analysis was used to assess inequities in coverage of interventions. Composite coverage was calculated for each state and assessed against expenditure on health.

**Results.** The composite coverage of interventions for NCDs and injuries for all states combined was 43.9% (95% CI 43.0%–44.8%), and was higher in urban than in rural areas. Lower wealth quintiles had higher odds of being in need of interventions but lower odds of being covered. Overall, the highest quintile had composite coverage of 54.5%, compared with 34.1% for the lowest quintile. The states with lower coverage of interventions had a higher proportion of households reporting selling items or borrowing money to cover health expenditure; this proportion was highest (58.8%) in Rajasthan state that had the lowest composite coverage (36.6%).

**Conclusion.** The higher need for and lower coverage of interventions for NCDs and injuries in the poor, and the associated high risk of further adverse economic impact due to health spending, suggest that the public health system of India should improve access to these interventions at no cost for the economically disadvantaged.

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## INTRODUCTION

Non-communicable diseases (NCDs) and injuries now account for over half the burden of disease in India and affect all socioeconomic groups, with emerging evidence suggesting that

for some conditions the burden is higher in the lower socioeconomic groups.<sup>1–6</sup> The Government of India has initiated a response to this growing burden with the National Programme on Prevention and Control of Diabetes, Cardiovascular Disease and Stroke, the National Mental Health Programme and the National Road Safety Policy.<sup>7,8</sup> To track progress and to monitor health system performance for these conditions, coverage of interventions is an important measure that allows for a more immediate assessment of performance of the health system than the measurement of health outcomes.<sup>9,10</sup> It is an important tool for governments for tracking and accountability at sub-national and national levels but has not been routinely used in India for NCDs and injuries.

The WHO World Health Survey (WHS) was designed to provide baseline internationally comparable data on health system performance.<sup>11</sup> During 2002–03, the WHS was conducted in over 70 countries worldwide. In India it covered 6 states, selected to represent the different geographic regions and levels of development in the country.<sup>12</sup> These are the only data on NCD and injury intervention coverage available for India on this scale. We analysed these data to assess inequities in coverage of interventions for NCDs and injuries in India. The implications of the findings for the health system and health information development are discussed.

## METHODS

### Data

WHS was conducted in 2003 in 6 Indian states of Assam, Karnataka, Maharashtra, Rajasthan, Uttar Pradesh and West Bengal.<sup>12</sup> Multi-stage stratified sampling was used to select 10 750 households and simple random sampling to select one adult  $\geq 18$  years of age from each household.<sup>12</sup> Data were available for 9994 individuals (unweighted, 93% participation) from 10 279 households (unweighted, 96% participation).<sup>12</sup> The final sample size for individuals was 1046, 1431, 1972, 1816, 2054 and 1675 in Assam, Karnataka, Maharashtra, Rajasthan, Uttar Pradesh and West Bengal, respectively. The long versions of the standard WHS household and individual questionnaires were used to document if individuals reported ever being diagnosed and treated for angina, arthritis, asthma, diabetes, depression and schizophrenia; and if they reported being involved in a road traffic accident, having sustained any other injury, experiencing oral disorders, and if they were treated for these in the past 12 months. The current use of glasses or contact lenses and self-reported problems with near and far vision were recorded. Adults  $\geq 60$  years of age who had had their eyes examined in the past 5 years were asked if they were diagnosed with cataract in the past 5 years and if they had undergone surgery for it. Questions on symptoms experienced by respondents in the past 12 months related to each

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condition were asked except for diabetes, involvement in a road traffic accident or having sustained other injury. All women were asked whether they had had a Papanicolaou (PAP) smear in the past 3 years and women  $\geq 40$  years of age were asked about breast screening with a mammogram.<sup>12</sup> For each household, the sources of finance for any health expenditure in the past 12 months were recorded including selling of items and borrowing money. The purpose of the health expenditure or the person on whom the expenditure was incurred was not recorded.

#### Outcome measure

Coverage of interventions was the outcome measure, which was defined as the proportion of individuals receiving the intervention (treatment) among those in need of it.<sup>13</sup> For example, for asthma, individuals who self-reported to be ever diagnosed with asthma were considered to be in need of intervention, and among them those who reported having ever been treated for asthma were considered having received the intervention. Table I shows the definitions used for coverage of each condition in this paper.

#### Data analysis

The coverage of interventions was calculated for each condition listed in Table I. Only those individuals for whom data were available for diagnosis and treatment for a condition were included in the analysis. The coverage for angina was assessed using self-report of ever diagnosis of angina and also self-reported symptoms using the Rose angina classification.<sup>14</sup> Analysis was done at 2 levels, overall for the 6 states combined and for each state separately.

*Overall for six states combined.* The rural and urban coverage estimates for each condition were adjusted for the age and sex distribution of the states, and the overall coverage estimate also adjusted for the rural–urban distribution.<sup>15</sup> The design effect of

the cluster sampling strategy was taken into consideration to calculate the 95% confidence interval (CI) for condition-specific coverage estimates.<sup>16</sup> Multiple logistic regression analysis was used to assess the association of sex, rural–urban residence and wealth quintiles with being in need of an intervention and coverage for each condition except cervical and breast cancer. The associations were considered statistically significant if the 95% CIs did not overlap. Wealth quintiles in the WHS dataset are based on ownership of permanent assets, with quintile 1 being the poorest and 5 the richest.<sup>12</sup>

The coverage was examined at the individual level for the number of conditions covered among those in need of intervention for any one or more conditions diagnosed, except cataract and screening for cervical and breast cancer.

*State-level.* The composite coverage indicator was calculated using the following steps. The total number of persons reporting each condition in a state were added across the conditions. Similarly, the total number of persons reporting coverage for each condition by an intervention in that state was added across the conditions. The latter was divided by the former to estimate the composite coverage for a particular state. This method was chosen over the calculation of simple averages of coverage across the conditions, as this method ends up being a weighted estimate in proportion to the reported prevalence of the conditions. Composite coverage was calculated for each wealth quintile within each state to assess the degree of inequity within each state. The composite coverage indicator was assessed in relation to the per capita public and private health expenditure by the state using data from the National Health Accounts for the year 2001–02.<sup>17</sup> Composite coverage was also assessed in relation to the proportion of households selling items or borrowing to finance health expenses over the past 12 months.

TABLE I. Definitions of need and coverage of non-communicable diseases and injury interventions from the World Health Survey for adults  $\geq 18$  years of age in India

Condition	Individuals in need	Individuals covered*	Proportion of sample missing† (%)
Angina	Self-reported ever diagnosis	Self-reported ever treatment	4.4
Rose angina	Self-reported symptoms used to diagnose Rose angina	Self-reported ever treatment	3.4
Arthritis	Self-reported ever diagnosis	Self-reported ever treatment	1.8
Asthma	Self-reported ever diagnosis	Self-reported ever treatment	1.9
Diabetes	Self-reported ever diagnosis	Self-reported ever treatment	4.6
Depression	Self-reported ever diagnosis	Self-reported ever treatment	4.1
Schizophrenia	Self-reported ever diagnosis	Self-reported ever treatment	5.5
Oral disorders	Self-reported problems with mouth and/or teeth in past 12 months	Self-reported treatment for problem in past 12 months	2.7
Vision disorders	Self-reported vision difficulties or use of glasses or contact lenses	Report no near or far vision problems when using glasses or contact lenses	19.1
Cataracts	Self-reported diagnosis of cataract in one or both eyes in past 5 years‡	Self-reported surgery for cataract in one or both eyes in past 5 years	4.8
Road traffic injuries	Self-reported injury due to a road traffic accident in the past 12 months	Self-reported medical care or treatment	2.5
Other injuries§	Self-reported injury that limited everyday activities in past 12 months	Self-reported medical care or treatment	3.0
Screening for cervical cancer	Women aged 35–64 years	Self-report of ever having a pelvic examination with PAP test in the past 3 years	11.7
Screening for breast cancer	Women aged 40–69 years	Self-reported mammography in past 3 years	17.2

\* Coverage is defined as the proportion of individuals receiving the intervention/treatment among those in need of it

† Proportion of sample with missing responses excluded from analysis

‡ Adults  $\geq 60$  years of age who had their eyes examined within the past 5 years

§ Injury due to fall, burn, poisoning, submersion in water, or by firearm, sharp weapon or an act of violence from another person

|| Women who had missing data were assumed to be not covered and were included in the denominator

All analyses except the multiple logistic regression were conducted using the individual probability weights included in the WHS dataset. The unweighted results are presented for the multiple logistic regression as the weighted results were similar.

**RESULTS**

*Overall for six states combined*

Table II shows coverage for each condition for all 6 states combined, and rural and urban populations. The overall coverage was 43.9% (95% CI 43.0%–44.8%) with urban coverage levels generally higher than rural. The conditions with coverage <50% were depression (12.0%), vision disorders (20.7%) and schizophrenia (49.8%). The coverage for Rose angina was markedly lower than coverage of angina. In addition to the conditions shown in Table II, we calculated coverage of women for cervical and breast cancer screening, which was very low. PAP smear for cervical cancer screening among women aged 35–64 years was 1.6%, 1.4% and 3.3% for all states combined, rural and urban areas, respectively. Mammography for breast cancer screening among women aged 40–69 years was 1.8%, 1.2% and 6.5% for all states combined, rural and urban area, respectively.

The results of the multiple logistic regression analysis showed wealth quintiles to be the most significant predictor for being in need of intervention and for being covered. The general trend

showed that those belonging to the poorer quintiles were more likely to be in need of an intervention but less likely to be covered (Table III). This trend was not statistically significant for schizophrenia, cataract, road traffic injuries and other injuries. This trend was different for diabetes and vision disorders; those belonging to the higher quintiles were more likely to be in need and also more likely to be covered.

Males were significantly less likely than females to be in need of intervention for Rose angina (OR 0.73, 95% CI 0.65–0.82) and vision disorders (OR 0.82, 95% CI 0.75–0.90), but were significantly more likely to be covered for these conditions (OR 1.58, 95% CI 1.19–2.01 and OR 1.20, 95% CI 1.01–1.43, respectively). They were less likely than females to be in need of interventions for arthritis, depression and oral disorders, but more likely to report road traffic injuries (OR 3.36, 95% CI 2.60–4.34) and other injuries (OR 1.42, 95% CI 1.15–1.75). Males were more likely to be covered for other injuries (OR 2.24, 95% CI 1.41–3.57).

Urban place of residence as compared with rural was associated with higher need of interventions for angina (OR 1.45, 95% CI 1.22–1.72), arthritis (OR 1.17, 95% CI 1.03–1.32), diabetes (OR 1.49, 95% CI 1.12–1.97), depression (OR 1.59, 95% CI 1.38–1.85), vision disorders (OR 1.20, 95% CI 1.07–1.35) and cataract (OR 1.82, 95% CI 1.14–2.91). Among these conditions, urban respondents were significantly more likely to be covered for vision disorders (OR 1.56, 95% CI 1.28–1.91), but less likely for

TABLE II. Rural, urban and overall coverage for all states combined for non-communicable disease and injury interventions for adults ≥18 years of age

Condition	Rural*			Urban*			Total coverage (%) [95% CI; DE]†
	Sample	Individuals in need (%)	Coverage (%) [95% CI; DE]	Sample	Individuals in need (%)	Coverage (%) [95% CI; DE]	
Angina	8369	628 (7.5)	421 (67.0) [62.1–71.9; 1.8]	921	110 (11.9)	79 (71.5) [60.5–82.5; 1.7]	68.3 [63.8–72.9; 1.8]
Rose angina	8415	1160 (13.8)	184 (15.8) [12.7–18.9; 2.2]	971	119 (12.3)	27 (23.1) [12.6–33.6; 1.91]	18.0 [14.9–21.1; 2.1]
Arthritis	8567	1773 (20.7)	1000 (56.4) [53.3–59.5; 1.8]	978	230 (23.5)	138 (60.0) [50.7–69.3; 2.2]	57.5 [54.5–60.5; 1.9]
Asthma	8553	511 (6.0)	332 (56.4) [53.3–59.5; 1.8]	977	56 (5.7)	41 (73.3) [59.7–86.9; 1.4]	67.5 [62.7–72.2; 1.5]
Diabetes	8299	182 (2.2)	144 (79.1) [72.8–85.5; 1.2]	969	48 (5.0)	40 (82.7) [69.5–96.0; 1.5]	80.4 [74.4–86.4; 1.4]
Depression	8345	997 (11.9)	125 (12.5) [8.8–16.3; 3.3]	971	194 (20.0)	21 (10.7) [0.0–21.6; 6.2]	12.0 [8.3–15.7; 4.0]
Schizophrenia	8221	200 (2.4)	85 (42.7) [35.1–50.4; 1.2]	963	11 (1.1)	7 (66.3) [32.6–100.0; 1.5]	49.8 [42.2–57.4; 1.3]
Vision disorders	7174	405 (36.4)	125 (15.5) [13.3–17.6; 2.4]	708	380 (53.7)	125 (32.8) [24.2–41.3; 3.3]	20.7 [18.3–23.0; 2.7]
Cataract‡	1085	174 (16.0)	84 (48.4) [40.2–56.5; 1.2]	145	50 (34.5)	29 (58.6) [41.8–75.5; 1.5]	51.5 [43.8–59.1; 1.4]
Oral disorders	8479	2449 (28.9)	1145 (46.8) [44.0–49.5; 1.9]	977	300 (30.7)	190 (63.2) [55.8–70.6; 1.9]	51.7 [49.0–54.4; 2.0]
Road traffic injuries	8497	316 (3.7)	226 (71.5) [66.1–76.9; 1.2]	978	29 (3.0)	24 (82.0) [68.8–95.1; 0.9]	74.7 [69.8–79.6; 1.1]
Other injuries§	8487	345 (4.1)	250 (72.4) [67.1–77.8; 1.3]	974	42 (4.3)	27 (65.0) [45.2–84.7; 1.9]	70.2 [64.8–75.6; 1.4]
Composite coverage   [95% CI]	–	–	41.4 [40.4–42.3]**	–	–	49.7 [47.1–52.2]**	43.9 [43.0–44.8]**

\* Adjusted for age and sex distribution

† Adjusted for age, sex, and rural and urban distribution

‡ Adults aged 60 years and over who had their eyes examined within the last 5 years

§ Injury due to fall, burn, poisoning, submersion in water, or by firearm, sharp weapon or an act of violence from another person

|| Calculated by dividing the total number of individuals covered by the total number of individuals in need for all conditions, except Rose angina

\*\* 95% confidence interval estimate does not take into account the design effect CI confidence interval DE design effect

TABLE III. Association of wealth quintiles\* with being in need of an intervention and being covered by interventions for non-communicable diseases and injuries, adjusted for sex and rural-urban residence distribution†

Condition	Wealth quintile	Total	Number in need (% of total)	Odds of being in need (95% CI)	Number covered among those in need (% of diagnosed)	Odds of coverage (95% CI)
Angina	1	1855	189 (10.2)	1.45 (1.13–1.86)	108 (57.1)	0.28 (0.16–0.48)
	2	1873	172 (9.2)	1.27 (0.99–1.62)	113 (65.7)	0.39 (0.22–0.67)
	3	1871	160 (8.6)	1.12 (0.88–1.43)	112 (70.0)	0.49 (0.28–0.84)
	4	1863	195 (10.5)	1.31 (1.05–1.63)	146 (74.9)	0.65 (0.38–1.08)
	5	1855	166 (8.9)	1.00	136 (81.9)	1.00
Rose angina	1	1847	381 (20.6)	2.22 (1.80–2.75)	44 (11.5)	0.41 (0.25–0.68)
	2	1855	312 (16.8)	1.75 (1.42–2.17)	50 (16.0)	0.59 (0.36–0.97)
	3	1836	269 (14.7)	1.49 (1.20–1.84)	56 (20.8)	0.79 (0.49–1.27)
	4	1821	230 (12.6)	1.27 (1.03–1.57)	67 (29.1)	1.21 (0.76–1.91)
	5	1827	183 (10.0)	1.00	47 (25.7)	1.00
Arthritis	1	1916	483 (25.2)	1.62 (1.36–1.93)	243 (50.3)	0.55 (0.40–0.76)
	2	1913	442 (23.1)	1.46 (1.22–1.73)	251 (56.8)	0.73 (0.53–1.00)
	3	1919	404 (21.1)	1.26 (1.06–1.49)	242 (59.9)	0.82 (0.60–1.13)
	4	1909	405 (21.2)	1.23 (1.05–1.46)	258 (63.7)	0.96 (0.71–1.30)
	5	1910	349 (18.3)	1.00	225 (64.5)	1.00
Asthma	1	1919	140 (7.3)	1.31 (0.98–1.76)	80 (57.1)	0.35 (0.18–0.67)
	2	1919	150 (7.8)	1.41 (1.06–1.88)	91 (60.7)	0.42 (0.22–0.80)
	3	1913	110 (5.8)	1.02 (0.76–1.37)	74 (67.3)	0.52 (0.26–1.01)
	4	1906	105 (5.5)	0.99 (0.74–1.31)	80 (76.2)	0.77 (0.39–1.52)
	5	1905	105 (5.5)	1.00	85 (81.0)	1.00
Diabetes	1	1800	19 (1.1)	0.22 (0.13–0.38)	15 (78.9)	1.00 (0.27–3.75)
	2	1866	36 (1.9)	0.40 (0.26–0.60)	21 (58.3)	0.39 (0.15–1.01)
	3	1874	39 (2.1)	0.42 (0.30–0.62)	28 (71.8)	0.73 (0.28–1.01)
	4	1894	63 (3.3)	0.62 (0.45–0.85)	46 (73.0)	0.72 (0.33–1.60)
	5	1894	112 (5.9)	1.00	91 (81.3)	1.00
Depression	1	1860	240 (12.9)	1.48 (1.20–1.84)	26 (10.8)	0.41 (0.22–0.74)
	2	1871	260 (13.9)	1.57 (1.27–1.95)	36 (13.8)	0.58 (0.33–1.00)
	3	1900	236 (12.4)	1.31 (1.06–1.61)	40 (16.9)	0.77 (0.46–1.29)
	4	1891	289 (15.3)	1.52 (1.25–1.84)	36 (12.5)	0.59 (0.36–0.98)
	5	1882	222 (11.8)	1.00	39 (17.6)	1.00
Schizophrenia	1	1840	67 (3.6)	1.59 (1.01–2.50)	28 (41.8)	0.61 (0.24–1.52)
	2	1844	62 (3.4)	1.50 (0.96–2.35)	26 (41.9)	0.53 (0.22–1.31)
	3	1865	53 (2.8)	1.28 (0.82–2.02)	32 (60.4)	1.24 (0.49–3.17)
	4	1875	41 (2.2)	1.03 (0.65–1.63)	18 (43.9)	0.61 (0.23–1.58)
	5	1872	37 (2.0)	1.00	22 (59.5)	1.00
Oral disorders	1	1904	610 (32.0)	1.20 (1.03–1.40)	190 (31.1)	0.29 (0.22–0.38)
	2	1913	585 (30.6)	1.12 (0.96–1.31)	232 (39.7)	0.41 (0.31–0.54)
	3	1901	541 (28.5)	1.01 (0.87–1.17)	240 (44.4)	0.48 (0.37–0.62)
	4	1903	536 (28.2)	0.99 (0.85–1.14)	275 (51.3)	0.62 (0.48–0.80)
	5	1904	544 (28.6)	1.00	354 (65.1)	1.00
Vision disorders	1	1605	593 (36.9)	0.53 (0.45–0.62)	47 (7.9)	0.22 (0.15–0.31)
	2	1619	624 (38.5)	0.56 (0.48–0.66)	79 (12.7)	0.34 (0.26–0.46)
	3	1579	618 (39.1)	0.56 (0.49–0.66)	123 (19.9)	0.57 (0.44–0.75)
	4	1538	639 (41.5)	0.60 (0.52–0.70)	159 (24.9)	0.70 (0.55–0.88)
	5	1555	854 (54.9)	1.00	301 (35.2)	1.00
Cataract	1	44	23 (52.3)	2.13 (1.00–4.53)	11 (47.8)	0.69 (0.24–2.01)
	2	44	24 (54.5)	2.15 (1.04–4.43)	15 (62.5)	0.43 (0.16–1.17)
	3	78	48 (61.5)	2.87 (1.54–5.33)	24 (50.0)	0.71 (0.32–1.60)
	4	99	55 (55.6)	1.09 (1.09–3.08)	23 (41.8)	1.03 (0.50–2.11)
	5	164	72 (43.9)	1.00	31 (43.1)	1.00

\* Wealth quintile 1 is the poorest and 5 is the richest † Numbers are unweighted

depression (OR 0.63, 95% CI 0.42–0.94). Additionally, urban respondents had higher coverage for oral disorders (OR 1.40, 95% CI 1.15–1.71).

The coverage of conditions decreased with increasing number of self-reported conditions (Fig. 1). Of those diagnosed with more than one condition, coverage of all conditions was reported by only 16.1% with two conditions, 9.5% with three conditions and 4.2% with four or more conditions.

#### State-level

The composite coverage indicator was the lowest in Rajasthan (36.6%, 95% CI 33.8%–39.4%) followed by 37.8% (95% CI 36.3%–39.4%) in Uttar Pradesh, 40.0% (95% CI 37.9%–42.1%) in West Bengal, 46.2% (95% CI 41.2%–51.1%) in Assam, 47.6% (95% CI 45.7%–49.4%) in Maharashtra, and 54.0% (95% CI 51.4%–56.6%) in Karnataka.

Figure 2 shows the composite coverage for wealth quintiles within each state. A trend towards increasing coverage was seen

with increasing wealth across all states. The wealthiest quintile had similar coverage levels across the states except for Karnataka where it was higher (65%). Maharashtra showed the least inequality in coverage between the quintiles, with a 16.9% difference in coverage between the worst and best covered quintiles, as compared with 17.5% in Assam, 20% in Karnataka, 21.3% in West Bengal, 21.7% in Rajasthan and 22.9% in Uttar Pradesh. Figure 3 shows state-level composite coverage by per capita public expenditure on health as reported in the National Health Accounts for India for 2001–02. Karnataka with the highest per capita public expenditure on health had the highest composite coverage, but there was no significant trend observed across the states. Similarly, no significant trend was found between per capita private expenditure on health and state-level composite coverage.

A significant inverse relationship was found between composite coverage of interventions and the proportion of households in each state reporting selling of items or borrowing money to pay for health expenses (Fig. 4). Rajasthan with the lowest composite coverage (36.6%) had the highest proportion of households reporting selling of items or borrowing money for health expenditure (58.8%), and Karnataka with the highest coverage (54.0%) had the lowest proportion (25.1%).

**DISCUSSION**

Our analysis of the WHO WHS data for India highlights inequities in the coverage of interventions for NCDs and injuries and high levels of selling items or borrowing money to cover health expenses in states with the lowest coverage. Although the data are from 2003, they are from 6 states covering all the geographic regions of India and are the only available data on NCD and injury intervention coverage that represent the different parts of the country.

Inequities in intervention coverage were found between various socioeconomic groups, rural and urban areas, and between the states. The diagnosis of most conditions was reported to be higher in the lower socioeconomic groups; however, coverage was higher in the upper socioeconomic groups, suggesting that the former are underserved by the health system for NCDs and injuries. This inequity in coverage was reported across the states though the extent of this inequity was slightly different among the states. These findings are supported by emerging evidence from India showing that NCDs and injuries are increasingly affecting the lower socioeconomic groups.<sup>3–6,18</sup> Thus policies and programmes, including prevention programmes, must effectively target the lower socioeconomic groups to address the inequitable access to health services for NCDs and injuries. There were inequities in composite coverage between rural and urban areas and between states. Rajasthan had the lowest composite coverage, followed by Uttar Pradesh. These are 2 of the least developed states in India still struggling to lower infant mortality, thus it is not surprising these had the lowest coverage for NCDs and injuries. These states need particular attention to develop.

There was a strong relationship between lower levels of composite coverage in states and an increasing proportion of households selling items or borrowing money to pay for health expenses. The selling of items and borrowing by households is indicative of economic hardship and vulnerability to healthcare costs.<sup>19</sup> This is of importance as 70% of health expenditure in India is estimated to be out-of-pocket<sup>17,20</sup> and <2% of the population is covered by health insurance.<sup>12</sup> The data suggest that in states with low coverage, there are high levels of distress financing for health, and even this extra financing is insufficient to increase the

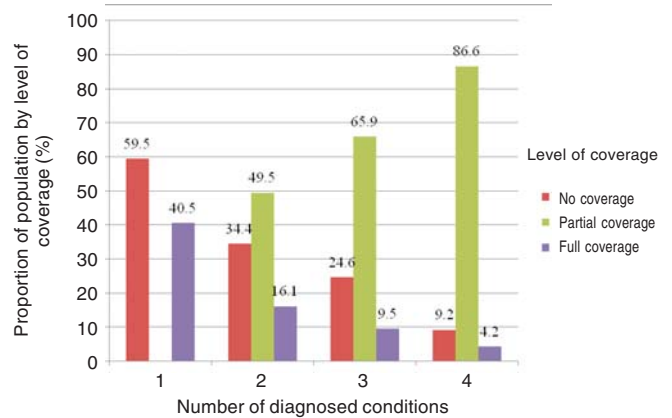


FIG 1. Level of coverage by the number of conditions diagnosed. Conditions included are: angina, arthritis, asthma, diabetes, depression, schizophrenia, oral disorders, vision disorders, road traffic injuries, and injuries other than road traffic injuries. Full coverage if all diagnosed conditions are covered, partial coverage if less than all diagnosed conditions are covered, no coverage if none of diagnosed conditions are covered. Excludes 3624 individuals with no condition diagnosed and 550 individuals with missing data on treatment for all 10 conditions.

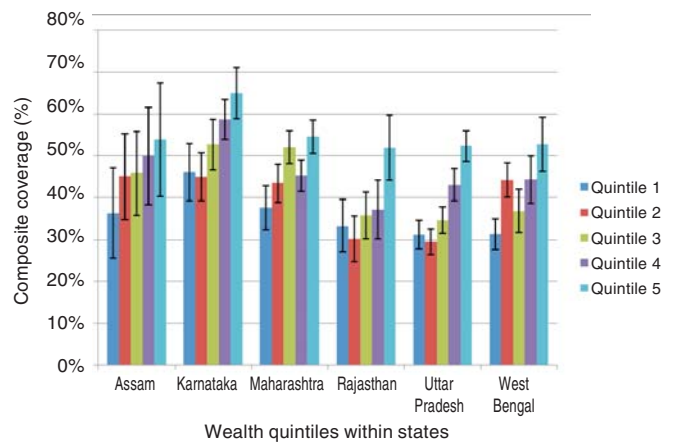


FIG 2. Composite coverage for wealth quintiles within 6 Indian states. Wealth quintile 1 is the poorest and 5 the richest

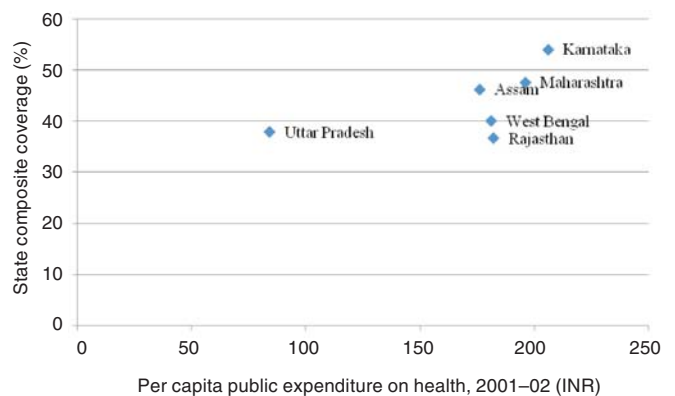


FIG 3. State composite coverage versus state per capita public expenditure on health. Per capita public expenditure on health from National Health Accounts 2001–02

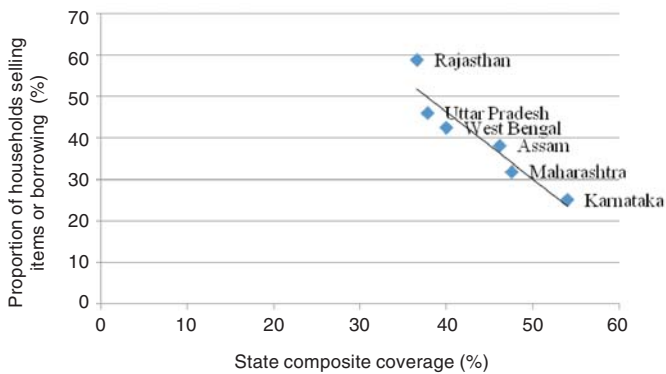


FIG 4. Proportion of households reporting selling items or borrowing to pay for health expenditure in the past year in states v. state composite coverage.  $R^2 = 0.87$ , slope =  $-1.62$  ( $p=0.007$ )

coverage for NCDs and injuries. To improve coverage for NCDs and injuries, reduction of out-of-pocket payments is needed especially for vulnerable populations through improvements in free public health services and wider coverage of appropriate insurance schemes.

The relationship between higher public expenditure on health and improvements in health outcomes is contentious,<sup>21–24</sup> however the link between higher public expenditure on health and increased coverage is thought to be stronger.<sup>10</sup> We found only a weak correlation between increasing public expenditure on health and coverage for NCDs and injuries. Different composite coverage for states with similar per capita public expenditure on health may be indicative of less attention to NCDs and injuries even in states with higher public health spending. The public health system in India has historically focused on maternal and child health and communicable diseases because these were the major contributors to the disease burden. The National Health Accounts show a modest spending for control of NCDs (0.4% and 0.9% of total health expenditure in 2001–02 and 2004–05, respectively) compared with 12% and 6% on reproductive and child health and communicable conditions.<sup>17,20</sup> These data do not take into account the spending on curative services and thus do not accurately reflect all public expenditure, but grossly highlight the poorer funding for NCDs and injuries.

The composite coverage indicator ideally should be representative of all NCDs and injuries relevant to India. Although cancer now accounts for a substantial portion of the disease burden in India,<sup>1</sup> we did not include coverage for cervical cancer screening by PAP smear and breast cancer screening with mammography in our composite coverage, as these particular interventions may not be relevant in the Indian context. The National Cancer Control Programme in India does not include screening for either cervical cancer with PAP smear or breast cancer with mammography,<sup>25</sup> and the resources required to implement these on a large scale are not available in India.<sup>25,26</sup> Alternative methods of screening for cervical cancer have been shown to be feasible to implement in India with similar benefits to PAP smear, but the long term impact is yet to be measured.<sup>27</sup>

In a comparable study that used WHS data, coverage for arthritis, angina, asthma, depression, schizophrenia and diabetes was  $\geq 70\%$  in Brazil, which is higher than what we found for India.<sup>28</sup> This is perhaps related to a stronger public health system in Brazil that provides free access to primary healthcare to a large

proportion of the population.<sup>29</sup> Coverage for angina, arthritis and asthma was assessed for Mexico with survey data collected using the WHS instrument, but the results are not comparable to our analysis as the methodology differed substantially.<sup>30</sup>

There are a number of limitations that need to be considered in interpreting our findings. The estimates of the individuals in need of intervention for most conditions are based on the self-report of ever diagnosis. There is no indication of when, by whom or how the diagnosis was made. In addition, these coverage estimates do not capture the unmet need of those individuals who have not been diagnosed with a condition. For example, it is estimated that approximately 60% of people with diabetes in India are undiagnosed.<sup>31,32</sup> Hence, the need estimated by WHS data is likely to be lower than the actual need of the population. Utilization of self-reported symptoms, such as those for Rose angina in our analysis, has been demonstrated to identify further individuals with the condition as opposed to only self-report of angina.<sup>33</sup> Like angina, some other conditions covered by WHS also had a set of symptom questions for which algorithms for predicting the probability of the respondent having the condition had been developed in the Diagnosis Item Properties Study.<sup>34</sup> These algorithms are, however, not available in the public domain, nor has the validity of these been assessed in India.<sup>34</sup> In addition, the coverage estimates were based on self-report of ever treatment irrespective of whether the individual was currently under treatment or not, or if the individual currently required treatment or not. Thus, the coverage estimates for most conditions, with the exception of vision disorders, oral disorders, cataract, road traffic injuries and other injuries, do not give the 'current coverage'. Also, no data were available to assess the quality of the treatment, and hence effective coverage could not be calculated for any condition, with the exception of vision disorders.<sup>10,35</sup> While the WHS questionnaire was tested in Andhra Pradesh to assess the population's understanding of the questions, wider validation has not been conducted in India to assess the level of accuracy in self-reported diagnosis or treatment.<sup>11</sup> This is a drawback since there is considerable variation across the states of India in culture, language and demographic parameters.

Further development of methods for measurement of effective coverage for NCDs and injuries is needed. Effective coverage is a recommended measure by WHO that takes into account the quality of the intervention.<sup>9</sup> China and Mexico have included measurements of effective coverage for NCD risk factors—hypertension, hyperglycaemia and hypercholesterolaemia, which require physical measurement and biological samples.<sup>10,36</sup> The health information system in India, which has traditionally focused on maternal and child health and communicable conditions,<sup>37</sup> needs to evolve to include regular nationwide data on NCD and injury distribution and coverage of interventions for them, for example by utilizing the periodic large-scale household surveys in India, such as the District Level Household Survey and the National Family Health Survey.<sup>38,39</sup> Additionally, while population surveys have been the main source of data for intervention coverage, the use of other sources such as health services and resource statistics also needs to be strengthened to estimate coverage of interventions. With the National Health Programmes addressing NCDs and injuries recently initiated in India, coverage estimates would be useful as part of the routine monitoring for these programmes. Careful planning is needed to ensure that these coverage indicators are relevant and adequate to monitor inequities and performance at sub-national levels.

Our analysis demonstrates that despite the higher need for NCD

and injury interventions in the poor, they are underserved by the health system in India. High levels of distress financing results from this and yet does not meet the coverage need. It is therefore necessary to provide free access to these interventions for the economically disadvantaged in India.

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#### CONTRIBUTIONS

All authors contributed to the design, analysis and interpretation, and approved the final version of the paper. MZR conducted this research as part of her PhD, for which she is enrolled at the Sydney School of Public Health, University of Sydney, Australia.

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