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Two Countries: India's rural healthcare landscape and what is means for policy

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1 Introduction

One view of primary care in rural India is that it is available only through publicly-operated Primary Health Care Centers or Sub-Centers, which are sparsely located and under-staffed. According to this view, qualified doctors in India are mostly located in urban locations and access to quality in rural India is poor. An alternate view agrees that even though access to *qualified* providers in rural India is low, a wide variety of health care providers with diverse qualifications has arisen to fill this gap. According to this view, primary health care in rural India is delivered through a vibrant, dense, and competitive marketplace. Average quality in this marketplace may be low, but considerable variation in quality implies that the rural population has multiple choices among low- and high-quality providers located in (or close to) every village.

These two views can lead to very different policy recommendations. Those who believe that the only treatment option for rural Indians is the public sector argue for a dramatic expansion of public clinics, reasoning that existing ones must be overburdened and therefore unable to provide high-quality care. The alternate view of a vibrant private sector in which patients make active choices among providers of varying quality requires a more nuanced approach to policy. For instance, it might still be the case that public sector expansion will improve population health, but by how much will depend on the relative cost and quality of new public sector clinics compared to existing private sector care, the private sector response to new public sector clinics as well as the willingness of patients to substitute private for public care.

These intellectual disagreements surrounding the rural healthcare landscape are increasingly reflected in a wide variety of policy responses across Indian states, coming dangerously close to a state of policy disarray. States like West Bengal and Chhattisgarh are trying to improve quality by including those without formal training within the ambit of the public system: either by training informal providers (West Bengal) or by creating an alternate cadre of rural health care providers with a reduced 3-year training requirement (Chhattisgarh). States like Uttar Pradesh and Madhya Pradesh are trying to improve access to high-quality care in hospitals by providing transportation links that decrease the cost of access, or by focusing on district hospitals. At the centre, the government's emphasis on "Wellness Centers" attempts to bypass the shortage of qualified public sector providers in rural India by allowing providers trained in alternative forms of medicine (primarily, Ayurveda) to also provide care in public health care centers. Many of these policies are meeting with active resistance from organizations like the Indian Medical Association, which maintain an almost Brahminical adherence to puritanical norms of training and health care provision. In their view, for instance, training informal sector providers is "like teaching thieves to steal better"; their influence led, for instance, to the closing of the Chhattisgarh initiative.

We feel that part of the intellectual disagreements and subsequent policy disarray reflects a simple but troubling fact: We just don't have the data to adjudicate between competing views of what rural healthcare really looks like. There is little information on the types of providers practicing in rural India, their qualifications or experience, or the differences in their distribution across villages and states. There are some studies that have measure what doctors know and how they practice, but these have typically been conducted in small samples in selected states. We have virtually no data on patient loads in the private sector, where 75% of Indians seek primary care and very limited data of dubious quality on patient loads in the public sector. The lack of data on these fundamental aspects of our health system implies that momentous decisions around health care provision in rural India are based on a very limited picture of what is happening on the ground.

To address this gap, we provide the first nationwide picture of the availability and quality of primary health care in rural India. We do so in three parts. First, using surveys we conducted in 1,519 rural Indian villages between 2008 and 2010, for each Indian state (except those in the Northeastern region of the country) we provide estimates on human resource availability in an average village disaggregated by qualifications and sector (public or private). We use these data to examine correlations between provider availability and state characteristics. Based on our review of the existing evidence, this is the first attempt to use dedicated surveys of health care professionals to produce a national picture of health care availability in rural India.

Second, we augment the nationwide data on provider availability with additional information on providers' knowledge of how to diagnose and treat four different health conditions that we collected using medical vignettes. Medical vignettes have been used in several previous studies in India and have been shown to be psychometrically valid, with performance strongly correlated to a provider's medical training. Although our data collection survey suffered from incomplete survey completion (discussed below), these are the only nationwide data on provider knowledge and of sufficiently high quality to allow for indicative analysis.

Third, we use our estimates of availability and knowledge to understand how proposed policies interact with the existing healthcare system in rural India. We consider three policy proposals, each of which have been proposed or discussed at the central or state levels–(a) folding Ayush providers into the public system; (b) expanding the public sector and; (c) imposing a regulatory norm whereby only providers above a certain level of knowledge are allowed to practice. We then produce estimates of how these policies will affect rural healthcare, fully acknowledging that these are 'naive' estimates where we have chosen to impose behavioral parameters such as the willingness of patients to substitute public for private care in the absence of any existing estimates. At the very least, these examples highlight how policy changes in a complex system can lead to unexpected and counter-intuitive outcomes.

Our research makes important contributions to our understanding of both the availability and quality of primary health care in India. Previous attempts to quantify the availability of human resources in India have followed one of two approaches. One approach that allows for national and sub-national estimates uses census classification of occupations at the district level with ancillary evidence from employment categories in India's National Sample Survey.[AF16, RRK+11] A second set of studies relies on dedicated surveys of health care providers with a focus on a restricted geographical area such as a district or an urban neighborhood; the most comprehensive of these studies is De Costa and Diwan (2007) in the state of Madhya Pradesh. [DCD07]

Ideally, the census and the dedicated survey approach would lead to similar estimates in the same areas. Unfortunately, it has not. While both approaches agree that qualified health care providers are rare in rural India, census studies are limited in three ways. First, census occupational categories are not designed to capture the variety of health care providers in India. For instance, the category of providers categorized as "allopathic doctors" includes both fully trained medical professionals *and* providers without any formal training. As Anand and Fan (2016) have shown, 31.4% of these providers were educated only up to to secondary school and therefore *cannot* have been formally trained. As general levels of education have increased, a significant fraction of providers with secondary education may have no formal training, making it impossible to ascertain the actual qualifications of providers that rural Indians access using census data. [FA16] Second, census data are typically available at the district, rather than the village level. Provider density at the district level can be a misleading indicator of local availability depending on the degree of spatial aggregation. If providers are concentrated in larger villages or markets along the highways (as Das et al. show in Madhya Pradesh), density per district may be high, but local availability may be low. [DHD+12]

Third, these two types of studies can lead to substantively different estimates even at a level of aggregation as large as a state. Based on census data, Anand and Fan (2016) estimate that for the state of Madhya Pradesh there were 50.6 Allopathic doctors (qualified and unqualified) and 163 health care providers (including nurses, midwives and pharmaceutical staff) per 100,000 population. [AF16] By contrast, de Costa and Diwan's (2007) statewide enumeration counted 41 qualified doctors and 156 qualified non-doctors (mostly nurses and midwives) per 100,000 population. They also counted an additional 238 trained birth attendants and untrained providers per 100,000 population, more than doubling the total number of healthcare providers in the state. [DCD07] That combined total of 435 health care providers per 100,000 population would put Madhya Pradesh – one of India's poorest states with high child mortality – just below Greece at 6th place in the World Development Indicators ranking of doctor density around the world. [nat]

Unlike human resource availability where we have at least some estimates, there are no nationwide data on quality. Starting from 2007, researchers have sought to measure quality in select samples using specialized tools. In Delhi, Das Hammer (2007) first measured the medical knowledge of healthcare providers in the public and private sector and complemented these measurements with direct clinical observations in 2008. The method of medical vignettes that they developed has since been used in samples from other Indian states, including Chattisgarh, Madhya Pradesh, Andhra Pradesh, Uttar Pradesh and Bihar. In 2016 Das et. al. used the technique of standardized patients to address several shortcomings of quality measurement from direct observations, and since then this technique has also been used–again in select samples from Madhya Pradesh, Bihar, West Bengal and Delhi. These measurements have significantly altered the narrative regarding quality of care in India, but there has been no attempt to compare quality across states (these studies were not sufficiently 'coordinated' to permit such comparisons); particularly noteworthy is the absence of quality measurement from states in South India.

Our combination of a dedicated, village-level health care provider survey *with* a focus on national representation substantially augments our understanding of the availability and distribution of health care providers at local levels across the country. The patterns we uncover confirm the findings from small-sample provider studies, but the patterns across states are surprising and different from what is usually imagined. A key result we will demonstrate is that an established North-South divide in administration, availability of medical colleges and child mortality also extends to quality and costs. The punchline of our results is that India is divided into two countries that are on different *production frontiers*–Northern states are stuck in a situation with low quality and high per-patient costs while Southern states enjoy higher quality at *lower* per-patient costs. We hypothesize why this is so and show that this divide has fundamental implications for how policies will play out in these states.

The remainder of the paper is as follows.

2 Context

India's post-independence health care system can be traced back to Joseph P. Bhore's committee report in 1946. The report envisioned a U.K.-style, tax-funded National Health System with care delivered through salaried doctors in a three-tiered public system consisting of Primary Health Clinics (PHCs) in villages, Community Health Centers (CHCs) for more complex cases, and district and city hospitals for tertiary care. [PKP+11]

The committee further envisioned that all providers would be trained in allopathic medicine over a period of 5.5 years (including 1 year of internship), after which they would be granted an MBBS degree, which is equivalent to an MD in the U.S. This vision of standardized and uniformly high quality care did not create a space for licentiate medical practitioners with a shorter training duration, who were the main providers of rural care at the time of independence. Neither did it allow for physicians trained in Indian systems of health care such as Ayurveda or Unani. The implementation of the report recommendations and oversight of the health care system was left to the states with a limited role for the federal government.

Over the next 70 years, three critical tensions in the systems led to several adjustments. First, it became clear that the country could not produce the number of MBBS doctors that would be required to provide adequate care to the entire country. In an ongoing process, the government "regularized" physicians who were trained in Indian medical systems, eventually allowing colleges to be set up for their training, and granting them recognition as AYUSH providers with a dedicated Ministry of AYUSH established in 2014.

Second, a limited federal role combined with significant geographical disparities posed a challenge to a nationalized and standardized health care service. Take medical training: the Medical Council of India (MCI) is the sole body governing medical education in all Indian states and it sets minimum standards for medical colleges in terms of the infrastructure, faculty, curricula and evaluation criteria. However, individual colleges are responsible for designing and administering MBBS exams and there is no centralized exit examination that imposes a uniform criteria on the knowledge of graduating MBBS students.

By 2016, there were 412 medical colleges with a capacity of 52,765 for undergraduate and 24,239 for post-graduate education, half of them set up after 2001 (CITE: https://www.brookings.edu/wp-content/uploads/2017/08/mci-impact-series-paper.pdf). Despite the rapid expansion, capacity remains much lower than in the U.S., which has a quarter of India's population. The spatial distribution of medical colleges remains highly skewed with 181 in 6 South Indian states and 47 in 5 East Indian states, even though both regions account for 20% of total population. [3] Finally, there have been many concerns among medical professionals and in the media about the quality of education in medical colleges, in part due to an acute shortage of teachers and clinical materials for teaching purposes. [8] Medical colleges are subject to MCI inspection, but there is a widespread perception that these inspections can be 'gamed', for instance, by recruiting faculty members and patients only during the inspection period. [9] [10] [6]

The continued shortage of MBBS doctors combined with regional disparities has led to a medical landscape with several noteworthy features. The first is that the public sector never emerged as a dominant source of care; in XXXX, the private sector accounted for XX% of all doctor visits and ZZ% of all health expenditures were borne through out-of-pocket expenditures. The second is that medical care in the private sector–and increasingly the public sector–is provided by a variety of of providers, ranging from fully trained MBBS doctors to AYUSH and informal providers, the latter without any formal training. Governments are increasingly turning to non-MBBS doctors to satisfy demand; for instance, 501 AYUSH educational institutions with an additional capacity of 26,790 students had been established by 2010 and AYUSH facilities have been collocated with District hospitals, CHCs and PHCs in most states, entertwining the quality of AYUSH education with the provision of care in the public sector.[11] The third is the persistence of regional disparities in health outcomes and in the provision of primary care. Child mortality of XX in Kerala is comparable to OECD countries, while child mortality of XX in Bihar and XX in Uttar Pradesh are similar to some of the poorest countries in Sub-Saharan Africa. To what extent these regional disparities reflect the availability and quality of medical care is currently unknown.

India's size and heterogeneity thus provides a fertile environment to examine key questions of how health systems, seen through the lens of its human resources, varies across states within a single federation. With the data that we have collected, we are able to both describe the existing health environment at a level of detail that has not been attempted previously and examine critical questions regarding health systems development.

3 Data and Methods

The Medical Advice Quality and Availability in Rural India (MAQARI) study was conducted in the 19 most populated states in India. We did not study the Northeastern states of X,Y and Z, and excluded Delhi, which is completely urban. Eventually, the sample is representative of more than 90% of India's rural population. Within each state, 10 districts were selected using probability proportional to size (PPS) based on population and within each sampled district, 8 villages were selected. The eventual sample covered 1,519 villages. [1]

To ensure broad geographical coverage, each state was divided into distinct sociocultural regions or SCRs; states have between 3-8 SCRs depending on their size . Once the state was divided into

[1]Exceptions are Uttarakhand where we sampled 9 districts (72 villages) and Uttar Pradesh, where we sampled 11 districts (88 villages). In our sampling frame from 2003, Uttarkhand had only 9 districts. The larger sample in Uttar Pradesh reflects its high population.

SCRs, the 10 districts were allocated across the SCRs proportional to population so that larger SCRs had more sampled districts. The aim of the stratification was to ensure that the study was representative across all major SCRs in the country. Once the number of districts was assigned to each SCR, districts were selected within the region using PPS. Since the study is on health care in rural India, districts with more than 60% urban population were removed from the sampling frame .

All sampling was done on the basis of the 1991 census, since that was the latest Census data available at the time of the study design in 2008. All analysis was weighted by the inverse of sampling probability, so the final estimates continue to be nationally-representative on a population weighted basis. Within each state, the sampling probability of PSUs were proportional to their population, thus, the sampling weights assigned to PSUs were needed only for aggregation across states. We adjust for the state rural population size by assigning the weight to each PSU, denoted by W_{PSU} and calculated as:

$$W_{PSU} = \frac{\text{(SCR rural population)}}{\text{(Number of PSUs in the SCR)}}$$

Details about probability weights used in the analysis of the paper can be found in Section A4.

To assess the availability of care in rural Indian villages, a village-mapping approach was used. Between October 2009 and December 2009, enumerators visited each of the 1,519 sampled villages and mapped all the primary care providers, regardless of their sector (public or private) or qualifications (MBBS, AYUSH or unqualified).[2] For every provider in this final list, we completed a questionnaire with information on medical training, experience, and details of the provider's medical practice. A total of 8,942 providers were included in the census of village providers. After excluding dental care providers and Anganwadi and Accredited Social Health Activist (ASHA) workers (whose main function is public health education and maternal health) we were left with 4,729 providers. **Appendix Table A1** shows that survey completion among these 4,729 enumerated providers was 80%, with non-completion attributable to the provider being away rather than due to refusals. As temporary absences from the clinic are a frequent occurrence in rural India, we can interpret the final sample as showing the availability on an average day or week in these villages. [CHK+06]

In addition, we also completed a questionnaire among randomly sampled households in the village, which we use to compute an index of Socioeconomic Status (SES) for each state. This SES index was computed based on household caste, school attainment of adult household members, residence characteristics such as roofing type, electricity connection, and access to piped water,

[2] To capture all the medical service providers in a village, enumerators first conducted "Participatory Resource Assessments" with households at multiple locations (at least three) within each village to obtain a list of all medical service providers within the village boundary. After enumerators conducted this assessment they visited each provider in the list and asked about other providers in their village, in case they had been missed.

and ownership of mobile phone, electric fan, pressure cooker, bicycle, television. Household-level variables were transformed to a one-dimensional index by principal component analysis. [FP98] Appendix Table A2 provides summary statistics of the household characteristics used in the calculation of the SES index.

Finally, medical knowledge was measured using clinical vignettes for 3 conditions– Tuberculosis in a young adult male, diarrhea or dysentery in a young child (half the providers received the dysentery case and the other half diarrhea) and preelcampsia in a pregnant mother. These cases had been developed and tailored to the Indian context previously, with agreed upon definitions of what constitutes a necessary checklist of history questions and examinations and correct case management for each case (CITE DAS and Hammer, and our first TB paper). Following Das and Hammer (2007), we base our measure of knowledge on each provider's adherence to the case-specific checklist of necessary history questions and examinations. Each necessary history or examination item is appropriately weighted for 'difficulty' using item-response theory and the estimated knowledge scale is then standardized to have a mean of 0 and a standard deviation of 1. Like in Das and Hammer (2007), we use a lenient definition of correct management, which includes referral to higher levels of care, but does not penalize the use of unnecessary medicines or even antibiotics. [CORRECT? ENSURE THAT WE ARE NOT USING PARAMEDICAL STAFF]

The sample for providers with medical vignettes differs from the sample on provider availability for two reasons. First, for budgetary reasons, we chose a sample rather than census of providers in each village. Second, we were unable to complete the medical vignettes with a significant fraction of sampled providers. We have traced the high incidence of non-completion to our two-stage survey strategy, where in the first stage we enumerated providers in each village using a short questionnaire and in the second stage, we sampled from this list and returned some months later to implement the clinical vignettes. We had successfully implemented this strategy in smaller studies, but it turned out to be highly problematic in a large nationwide study. Health care providers are often difficult to identify ("The provider whose clinic is by the big tree in the market"); they are frequently absent ("He/she is out for the next month and will come back after that") and the population often uses different identifiers for the same provider. Our budget was insufficient to maintain a dedicated field-team for each state and therefore when the team returned, they were able to definitively locate and complete 59.5% of the sample.

Nevertheless, for the samples that were completed, we found the data to be of uniformly high quality and in the absence of any other comparable nationwide data, results based on this exercise provide a starting point for key discussions. We must acknowledge however, that even though our results are robust to traditional parametric techniques that account for non-completion (such as inverse-probability weights), non-parametric methods such as bounding exercises are uninformative with this high rate of non-completion. We therefore advocate caution in (over) interpreting these results; for completeness we present the sample and completion proportions in Appendix Z.

4 Findings

We first present four key findings related to the availability, qualifications, workload and state-level variation in the availability of human resources for primary care in India's villages. We then present data on the distribution of knowledge across states. Finally, we use the data to provide basic simulations of widely discussed policy proposals regarding primary care in the country.

4.1 The availability of human resources for primary healthcare

Figures 1a and 1b report village-level provider counts for each state using the appropriate sampling weights, with states sorted in the order of under-five mortality rates (U5MR). (UPDATE ALL MORTALITY WITH http://rchiips.org/nfhs/NFHS-4Report.shtml). [3] The average village in our sample has 3.4 primary care providers, of whom X.X work full-time in the private sector and do not have an MBBS degree and X.X. have no formal qualifications at all (Figure 1a). Across a total of X,XXX providers surveyed, X,XXX (XX%) were informal providers (IPs), XXX were AYUSH providers (XX%) and XXX (7%) had an MBBS degree. Similarly, X,XXX were in the private sector (XX%) and the remaining X,XXX in the public sector (XX%).

Figure 1b shows what the distribution of providers by qualification implies for the average village. In our sample of villages, 7.5% report access to a public and 6.0% report access to a private MBBS provider. Since some of these villages overlap, across all 1,519 villages, only 12% have access to any MBBS provider, whether public or private. In sharp contrast, XX% of villages have access to an IP in the village and we compute that ZZ% of primary care visits occur in villages with 3 or healthcare providers. The vast majority of patients in rural India can thus access care from multiple sources in dense, competitive markets, even though this care is provided mostly through a network of providers without formal qualifications. Surprisingly, state-level variation in the number of providers appears to be uncorrelated with health indicators such as child mortality. For instance, Bihar, a state with poor human development outcomes and low SES, has 3.5 primary care providers in the average village and a U5MR of 58 per 1,000. By contrast, Tamil Nadu has 1.7 providers available in the average village with one of the lowest child mortality rates in the country at 27 per 1,000.

Figure 2 shows that providers of all types are overwhelmingly male (from 77% of public providers and 96% of private non-qualified providers) and a majority reports no other occupation

[3] We exclude paramedical staff, who account for 70% of all public providers but are mostly responsible for preventive care with a very small share of primary care visits (Appendix Figure 1 presents the statewide distribution of paramedical staff).

(63% of private non-qualified providers to 99% of public providers). Two characteristics of these providers are of particular interest. First, most providers without an MBBS degree report secondary or higher education (26% report less than secondary education), confirming that education cannot be used as a proxy for qualifications in census estimates. Second, the majority started practice between the ages of 20 and 30 with little difference by qualification. Since the average age is close to 40, half of all providers, including IPs, have been practicing for at least 10 years. Substantial tenure implies that providers view their jobs as "permanent" and are not operating as "fly-by-night" operators who enter and exit the market rapidly. IPs appear to have a permanent presence in the villages that they practice in.

Figure 3 shows that the dominance of IPs declines very slowly with state SES. IPs are a minority in only four states–Odisha, Tamil Nadu, Kerala and Assam–and even here, the share never falls below 20%. In contrast, IPs make up more than half of *all* providers in 16 of 19 states, ranging from states like Bihar and Uttar Pradesh, where health outcomes are extremely poor, to states like Punjab and Himachal Pradesh, where health outcomes are notably better. While higher state SES predicts a smaller presence for IPs, the association is weak and driven primarily by the inclusion of Kerala. Moving from the lowest to the highest value of state SES is associated with a reduction from 84% to 65% in the share of non-MBBS private providers, or 5.5p.p. per SES standard deviation. Excluding Kerala from this regression reduces the association to X.X percentage points per SES standard deviation. This still leaves a large majority share for IPs in most states and, in general, the variation across states at any given SES level is far greater than the variation across SES, with a regression r-squared of just 0.06.

Finally, most providers operate at substantial excess capacity. Based on self-reports, the average doctor sees 14 patients per day and spends 12 minutes with each, implying that a rural provider spends, on average, under 3 hours seeing patients. [4] **Figure 4** plots the total time seeing patients (vertical axis) and average consultation length (horizontal axis) for every provider in our sample. Movements along the vertical axis at the same consultation length therefore reflect higher patient loads, and movements along the horizontal axis represent higher consultation lengths. If providers were working at full capacity, we would expect to see a cluster of dots at the high end of the vertical axis (6-8 hours a day). Instead, 10% of doctors report workdays longer than 6 hours and 5% longer than 8 hours; the average provider uses 43% of their available time to see patients based on a 6-hour workday and 32% based on an 8-hour workday. Multiple regression (Table 1, Columns 1-3)

[4] In the absence of time and motion studies we rely on self-reported data. Both patient load and time spent with patients are likely exaggerated in self-reports. Therefore, the results represent an *upper bound* on true patient loads and capacity utilization in rural Indian primary clinics.In studies from Birbhum and Madhya Pradesh where we have both self-reports and clinical observations, the two are correlated but time-use and patient loads are significantly higher in self-reports compared to direct observations (see Appendix Z, TO DO). In the X% of cases where there are multiple providers in a clinic, we assume that all providers see an equal number of patients, and equally apportion the total patient load among the multiple providers. Total workload is then computed as time per patient multiplied by patients per provider day.

estimates with and without state-level controls and fixed-effects show that public providers, those with an MBBS degree, those who are younger than 60 and those who report no other occupation all report larger patient loads. However, even among public MBBS providers, self-reported hours with patients exceeds XX% only for the busiest providers above the 95th percentile.

Our results thus far highlight the high availability of primary care in rural India, most of which is provided by IPs in the private sector. A key finding is that the share of IPs remains stable across states at very different levels of SES and child mortality. If greater wealth leads to a demand for higher quality and/or child mortality is lower in states with higher quality, the share of IPs should decline with an increase in state SES. Our measurements of provider knowledge help resolve this puzzle; the fundamental insight that emerges is that in India qualifications does not equal medical knowledge. In fact, when we directly measure knowledge we indeed find that as state SES increases, so does the quality of health care providers.

4.2 The knowledge of healthcare providers in rural India

Our measure of knowledge is an appropriately weighted adherence to a checklist of necessary history questions and examinations for each case, standardized to have mean 0 and standard deviation 1. Table A.Z in the appendix relates this knowledge score to specific tasks for each of these illnesses. A provider at the mean of the distribution knew how to correctly treated dysentery, diarrhea, and TB in 75% of cases and pre-eclampsia in 60% of the cases. Moving from the 5th to the 95th percentile of the checklist increased correct diagnosis rates by approximately 30 percentage points for each of the conditions. COMMENT MORE ONCE FINALIZED

Table Z then illustrates the variation in knowledge across states and qualifications. We present multiple regression estimates from 3 specifications. Column 1 includes only provider characteristics–qualifications, sex, age, tenure and whether the provider is in the public sector. Column 2 restricts the regression to private providers only and includes the mean knowledge of *public* providers in the district as well as the mean SES of households in the district. Finally, Column 3 further restricts the sample to IPs only and includes the mean competence of MBBS providers in the district. Columns 4-6 then repeat these specifications with state fixed-effects.

Three findings are particularly noteworthy. First, providers with an MBBS degree perform better than those with other or no degree. Having an MBBS degree is associated with 28 percentile points higher rankings on the knowledge score (Table Z), which corresponds to an XX% increase in the likelihood of correct diagnosis and XX% in the likelihood of correct case management. Part of this advantage reflects a larger number of non-MBBS providers in states where knowledge is lower overall and therefore the MBBS advantage reduces significantly once we include state fixed-effects in Column 4. Worryingly, there is little association between provider age and knowledge; the coefficient is qualitatively small and significant only in the specification without state fixed-effects. Given the substantial age variation in our sample, this suggests that the quality of new entrants is similar to those who entered 30-40 years earlier, leaving little room for improvements in medical education over time.

Second, provider characteristics account for just 18% of the overall variation in knowledge compared to the 32% of the overall variation in our data that arises due to differences across states. This has fundamental implications for policy. As Figure 5 shows, it implies for instance, that the average MBBS doctor in Jharkhand and Bihar is at the 25th percentile of the knowledge distribution compared to the 75th percentile in states like Tamil Nadu and Gujarat, with similar patterns for non-MBBS providers. It also implies that in India, *qualifications do not imply quality.* Providers without an MBBS degree in half the states are more medically knowledgeable than fully trained MBBS doctors in the other half and the knowledge of an *informal provider* in Gujarat or Tamil Nadu is substantially higher than that of a full trained MBBS provider in Bihar or Jharkhand.

Finally, the knowledge of providers in the public and private sector follow similar patterns– states where public providers are more knowledgeable are also those where private providers are more knowledgeable and this relationship continues to hold at the level of the district once we include state fixed-effects (Table Z, Column M). Across all explanatory variables, the competence of the public sector is the one that is most strongly associated with the knowledge of private providers and IPs. This relationship remains equally strong when we include state fixed-effects, suggesting that even within states, districts where public sector providers are more knowledgeable are also those where the private sector providers are more knowledgeable. Development in India does not crowd-out informal providers–it increases their knowledge.

4.3 Policy Simulations and Discussion

These findings are not surprising for those who have reported on the dominance of private sector IPs in studies scattered through India. However, the density of health markets at the level of the village and the remarkable stability of the informal sector across states has significant ramifications for ongoing debates in Indian health care. With the majority of primary care delivered by IPs, the country simply cannot afford to outlaw 75% of its primary care workforce without a replacement strategy. Several such "replacement strategies" have been proposed and in illustrative simulations, we provide *rough* calibrations of what three different policies will imply in terms of quality and per-patient costs. These are 'naive' simulations intended to illustrate the complexities associated with any policy change. For instance, we assume limited behavioral responses among patients and that providers themselves will not choose to relocate or re-skill. Despite these 'brave' assumptions, these simulations add value for two reasons. To begin with, we focus on policies that have been proposed and/or are being actively implemented and whose effect will depend on (a) demand and supply-side responses and (b) the pre-existing situation. There are no estimates for the former anywhere in the literature for India, and this is the first paper to provide a detailed picture of the latter. At the very least these data help illustrate how policy changes can have varied effects across Indian states.

This exercise also forces us to ask *why* we see certain changes and what explains the differences in policy responses across states. As a specific example consider a 'simple' village that has 2 private providers with high and low quality and high and low prices. If the government constructs a public clinic, patients will substitute away from both high and low quality providers towards the public sector because visits in the public sector are free. How many patients each private provider loses depends on the quality of the public sector compared to that in the existing private clinics, as well as the sensitivity of patients to price and quality. Quality in the village will then depend on the quality and fees (or cost) of each provider weighted by the final clinic shares. The per patient cost will depend on the share of patients in the public sector, the wages of public sector doctors and the fees of private sector providers. [5] Since the policy impacts in our simulations use our data on the number of providers, per-patient costs, quality and patient shares in each sampled village, they force a deeper understanding of the structure of rural health markets in these contexts.

Figure X shows the starting point for our policy simulations. The vertical axis shows cost per patient in Indian Rupees while the horizontal axis shows the average quality for primary care patients in percentile terms. Here, for cost computations we use (self-reported) fees in private clinics and the total salary cost of the facility divided by the patient-load for public clinics. For quality, we weight the quality of every provider in our vignettes sample by their share of primary care patients in that market. Appendix Table A.Z shows state-wise estimates for each of these variables.

The significant variation in per-patient price and quality is immediately obvious, with a per-patient cost of Rs.15.85 in Andhra compared to Rs.48.40 in Gujarat. In Bihar, the average patient quality is at the 20th percentile of the quality distribution compared to the 75th percentile for states like Karnataka and Kerala. Most striking about this variation is that Indian states divide into two very distinct groups. The first group (Group 1) includes states like Uttar Pradesh, Bihar and Madhya Pradesh, but also Gujarat and Orissa, which are arguably on the same frontier where higher quality (Gujarat) comes at substantially higher costs. There is a hint of a policy choice, as states like Bihar and UP appear to have 'traded-off' lower quality for lower costs. The

[5]Since public sector doctors are paid on a fixed salary while private sector providers charge a fee per patient, the per-patient cost in a village can be written as C(i) = Wpub/Totalpatients + Fprivate*Shareprivate, where Wpub are the wages in the public sector, Fprivate are per-patient fees in the private sector and Shareprivate are the share of total patients in the private sector.

second group (Group 2) includes the four Southern States of Kerala, Karnataka, Tamil Nadu and Andhra Pradesh, but also Assam, which have all achieved substantially higher levels of quality at much *lower per-patient costs*. If we were to think of the price-quality trade-off as a 'production possibility frontier', the data suggest that there are two different frontiers in India with Group 2 states operating at a significant quality *and* budgetary advantage relative to Group 1 states. As we see next, this idea of 'two nations' is fundamental to the impacts of the policies we simulate.

4.3.1 Making AYUSH providers public

Our first simulation examines the proposal that AYUSH providers should become part of the regular public workforce. Perhaps, down-skilling, combined with smart task-shifting, could allow the public sector workforce to expand and decrease its reliance on MBBS providers. This, for instance, is the primary care strategy embodied in India's new plan called Ayushman Bharat. We first note that this need not lead to expansions in access, since many villages *already* have access to AYUSH providers in the private sector, and it is likely that the policy would primarily shift existing AYUSH from the private to the public sector. Furthermore, while there are potential financial savings for patients, in our data, AYUSH in the public sector receive a monthly salary of Rs.14,500 relative to their earnings in the private sector at Rs.6,200. This implies that the total savings to patients may be smaller than the fiscal outlay by governments as they seek to bring in AYUSH into the public sector. At the national level, where health budgets are raised through taxes, such a program may therefore increase the total health budget.

We simulate this policy by moving all existing AYUSH providers in the private sector into the public sector in the same village. We adjust their cost to the average public AYUSH monthly salary in that state, and increase their patient loads by 50%, taking these patients equally from each non-MBBS private sector provider in the village. Therefore we do not change provider availability or total patient demand and the effects on cost per patient depend on the total demand, the availability of private AYUSH to shift (as measured by current patient load), and the relative price of the public AYUSH in each state.

In our simulation, this policy increases costs among the states in Group 1 due to the salaries necessary to support the new public workforce. The effects on quality are limited at best: the quality of AYUSH providers is simply not that different than other non-MBBS providers. In some states, like Jharkhand and Himachal Pradesh, the relatively high salaries of existing publicly-employed AYUSH providers means that the policy is expensive to implement, and in some, the private AYUSH who would be transferred to the public sector are lower-quality than the current providers visited by patients, reducing average quality overall. In sharp contrast, Group 2 states see almost no change. In these states, the salaries of AYUSH in the public sector as well as their quality is very close to non-MBBS providers in the private sector and therefore moving them from one sector to the other does not substantially change the equilibrium.

4.3.2 Expanding the public sector

The second proposal looks at expanding the public sector to those villages where there is currently no public option. This policy has received widespread support among public health professionals who strongly believe that primary care should be financed and provided for by the state. We simulate this policy by assuming that the market share of the public sector in these 'new' villages will be identical to the average market share in villages with a public sector clinic. We also assume that the quality of new public sector clinics will be equal to the state average in existing public clinics. We then use the prevailing state average salary costs to determine the per-patient costs after this reform. Again, we do not assume any new patient demand. We should note that this is COMPARE TO DATA ON SHARES

Again, the wide dispersion of salary costs and public-sector quality across states means that the impacts of this policy vary widely across states. In Group 2 states with well-developed public sectors already, there are again no meaningful changes. In some Group 1 states, like Himachal Pradhesh and West Bengal, public-sector costs are salaries are lower and quality is better than the status quo, leading to significant improvements in average quality and relatively controlled costs. In a third group, composed of states like Madhya Pradesh and Haryana, the low quality of the public providers combined with the low patient demand means that the policy is extremely expensive with no meaningful impact on quality.

4.3.3 Quality regulation

The third idea addresses the wide variation in medical knowledge across states and has been advanced by the central government after it dissolved the Medical Council of India and replaced it with a group of nominated leaders. In one version of this proposal, the granting of medical degrees by individual institutions would be replaced by a centralized examination. But what should these cutoffs be? And would MBBS and AYUSH providers be subject to the same tests (and cutoffs)? What if an informal provider chose to take the test and scored above the cutoff–should he or she then be allowed to practice medicine? Our final simulation provides some answers to these important questions.

Figure X shows the fraction of villages with access to a high quality provider under three different definitions. Our first definition starts with the status quo–a provider is defined to be high quality if he/she has an MBBS degree. As shown previously, this implies that only 12% of villages have access to 'quality' medical care, with wide variation across states (Figure Xa). ONE LINE

COMMENT ACROSS STATES

Figure Xb then presents an alternate 'state-level' knowledge-based definition of effective quality, where we redefine access to quality as access to a provider with at least the average knowledge of MBBS providers *within* the state. If quality and qualifications were identical, we should see a decline in the number of villages that satisfy this criterion; by assumption half of existing MBBS providers will be below the quality cutoff. Instead, we find a substantial *increase*. This is because most villages have multiple IPs and the quality of these IPs varies considerably. COMMENT.

Finally, we move to a criterion-based definition of quality, where we instead define quality as effective if the village has at least one provider with above average competence in our sample; this corresponds to a 67-100% chance of accurately diagnosing and treating the 4 diseases in our medical vignettes. With this benchmark COMMENT.

In nearly all states, any policy that restricts access based on quality cutoffs has devastating impacts. Since most villages are served only by private providers without formal degrees, their removal means that these villages find themselves with no providers at all. Again, such a policy reinforces existing inequalities. Those states that already have substantial access to high-quality providers see almost no impact, but those states with poor quality in both public and private sectors suffer doubly. In Bihar, for example, existing quality is low and the alternative public-provision policies only reduce quality – but the removal of low-quality providers nearly eliminates any meaningful access to medical care at all.

4.3.4 Summary

Across all simulations, we see one striking pattern: Group 1 states, which we earlier estimated to have high quality and low per-patient costs are relatively unaffected by these policy changes. These states have relatively robust public sectors that closely match the private sector in per-patient costs and quality. Shifting providers from one sector to the other does not change costs-per-patient, even if it can decrease out-of-pocket costs. In Group 2 states, the impact of the simulated policies is both large and variable. Costs are not controlled, and the quality impacts depend heterogeneously on the specific composition and distribution of providers in that state's rural sector. Depending on the specific policy, costs and quality can either increase or decrease.

This heterogeneity of policy impacts highlights the dilemma facing any national Indian rural health policy. Population size in many villages is too low for economies of scale to kick in yielding low returns to public provision of high-quality health care in any location except the densest and richest states. Variation across states simultaneously causes the impacts of any given policy to be unpredictable and diverse: in some, like Gujarat, shifting care to AYUSH yields improvements in quality at little cost, but reliance on public PHCs is costly with little quality return. Conversely, in West Bengal, AYUSH have high costs and low quality, but investment in public PHCs appears to produce reasonable returns.

The policy environment seems to be cursed by a structure of "the best and the rest". In some states, development progress and population density have created the economies of scale necessary to support high-quality provision of care for most of the population. In those states, health outcomes seem to be structurally robust to intervention; there is an equilibrium where both cost and quality are competitively balanced across sectors and adjustments to patient choice on the margin have little effect. In the others, economies of scale and integrated markers do not yet exist and therefore costs and qualities remain extremely diverse across villages. These health markets are unstable, and policy changes can have extreme impacts, but the consequences are unpredictable and depend critically on the precise composition of the market and the dispersion of patients across villages in terms of access and quality.

5 Limitations

This, more than any of our other work on health, is a paper that leads with its chin with multiple grounds for legitimate criticism. We are (painfully) aware of some of them, and we divide these into two categories. In the first category are 'data' limitations. We know how to solve these issues and could repeat this study without replicating these mistakes. The second category are conceptual problems without an easy answer. These are problems that need to be further discussed if we are to make progress in this important arena. We indicate each of these as (Data) or (Conceptual).

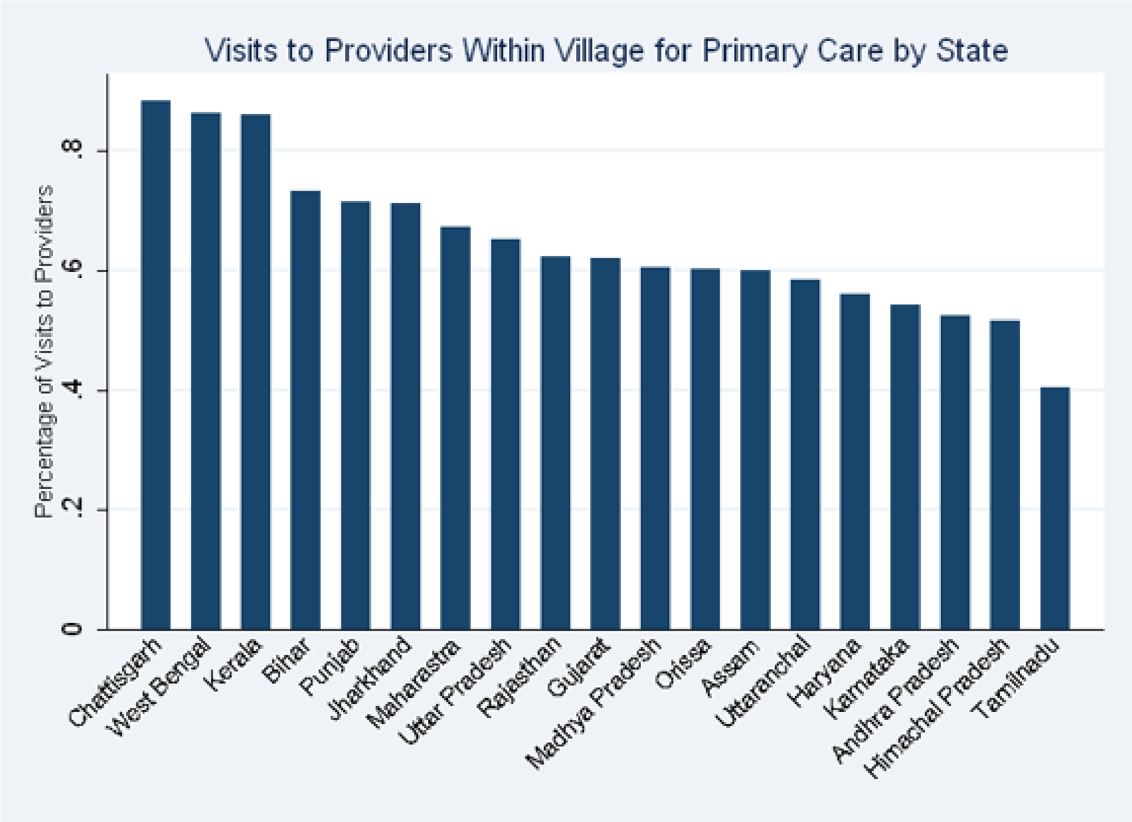
Incomplete Information (DATA) One fundamental insight from this work is that we need to conceptualize the Indian health care environment as markets with multiple providers. In this environment, sampling from among health care providers can be very misleading. Vast differences in the number of providers in each village implies that the average quality will decline in a state if there are more low quality providers–even if it has the same number of *high* quality providers as another state. We believe that substantial progress can be made in this environment through a village sampling strategy, where villages are first chosen at random and then *all* providers within the village are covered in the survey as in Das et al. (MP study). Such a strategy will allow us to compute multiple sufficient statistics that include the mean, but could also include the quality of the best provider. Combined with data on market shares, we believe this to be the most policy-relevant data for understanding the Indian context. The current study implements this strategy for provider availability, but then returned to a sample of providers for quality. Consequently, our simulations on quality regulation may be biased since we will (almost surely) have missed some high quality providers in each state.

Out-dated Information (DATA) Our data collection was finalized in 2010, and there could have been substantial changes to the rural landscape since then. We don't think that these changes will have affected the *composition* of the rural workforce as more recent studies from specific geographies point to similar patterns. See, for instance, Gautham and others[GSS+14] for the states of Uttarakhand in North India and Andhra Pradesh in South India; Das and others in West Bengal and most recently, Shailaja Chandra and others in Uttar Pradesh. However, what has almost certainly changed since 2010 are the prices of services in the private sector, both due to inflation and changes in the demand for health care. The relative per-patient cost of a primary care visit in the public versus private sector could have also changed due to the revision of doctors' salaries and the public pay scale in several states. As a result, the cost implications of various policy proposals will be quantitatively different now, but we believe that the overall patterns and questions that these simulations raise will be qualitatively similar.

Construction of Markets (CONCEPTUAL) Even with a provider census within sampled villages, the construction of markets remains a challenge. In our Madhya Pradesh study, two-thirds of the care was sought within the village, and typically, there was one additional cluster outside the village, usually on the highway. Consistent with studies of bypassing, Das and Mohpal (2016, Health Affairs) have demonstrated a distance-quality trade-off, with the quality of visited providers increasing in the distance from the household. As Figure Appendix Figure X shows, this bias is not constant across states. Our household survey showed that primary care visits in the states of Chhattisgarh, West Bengal and Kerala are predominantly within the village–in these cases, our market-share weighted estimates of quality, which we use for our simulations are reasonable approximations. However, there are several states where the share of visits within the village is below 60% and in Tamil Nadu, it drops to 40%. For the states of Andhra Pradesh, Himachal Pradesh and, particularly Tamil Nadu, our weighted quality estimates are likely a lower-bound. How to address this problem in a state like Tamil Nadu is unclear. Our team's experience was that with a better transport system, people often take the bus to the town for their health care needs, so that "urban" and "rural" availability and quality may be similar. Larger catchments substantially increase the cost and complexity of surveys such as these and further progress may require administrative data for instance, through insurance claims.

Defining Qualty (CONCEPTUAL) We use knowledge of the correct treatment as our measure of quality. We have shown previously that knowledge represents the maximum quality that patients can receive, but there is a usually a significant gap between clinical practice and knowledge. Although this should not bias the variation across states as practice and knowledge are strongly correlated, it does imply that most of our estimates are upper-bounds of the care that patients actually receive. We have also abstracted away from the use of unnecessary treatments,

Figure 1: Private non-MBBS provider share, by normalized state SES



but these may be important in their own right. For instance, the widespread use of antibiotics and India's high rates of anti-microbial resistance are a particular concern. If correct management also implied less use of unnecessary medicines, this would be less of a concern. Unfortunately, Appendix Figure X shows that providers who were more likely to give the correct treatment were also *more likely* to give unnecessary antibiotics, driven to a large extent by the greater use of unnecessary antibiotics among fully trained MBBS providers. This pattern differs from a common wisdom that informal providers are responsible for AMR in India and raises the difficult problem of how to weight correctly treating the patient versus the incorrect use of antibiotics. The weights could depend on the condition; for self-limiting illnesses, the correct use of antibiotics will receive a higher weight and for serious conditions like a heart attack, correctly treating the patient is paramount. Given the patterns in our data, the inclusion of unnecessary medicines substantially complicates the picture and deserves full attention in its own right.

Behavioral Responses (CONCEPTUAL) Finally, our simulations do not take into account behavioral responses. Consequently, they are not meant to provide specific policy guidance but rather to highlight that under certain behavioral assumptions, these policies can yield a variety of results. The broad point remains that these policies are currently being advocated without any estimates of key elasticities in the rural market for care, largely driven by models that do not account for the variation in quality and price within each market. This limitation therefore reflects a broader problem with policy proposals in this area.

6 Conclusion

Our data highlight multiple features of the primary care environment in India that are at odds with current perception among researchers and policy makers. We first clarify that most full-time rural health care providers in India are IPs and therefore technically "illegal" and outside the ambit of health policy at it currently stands. Put simply, most primary health care in rural India is in the hands of providers who don't legally exist. This explains why, despite repeated assertions since at least the J.P. Bhore committee in 1954 that the Indian government will remove informally trained providers from the primary care market, implementing any such policy has proven to be extremely difficult. Across state variation then shows that the dominance of IPs decreases very slowly with development; the idea that "as states grow richer and the public sector becomes better" IPs will vanish just does not hold in our data. Instead we find that as states develop and (especially) the quality of public sector providers improves, IPs themselves become more knowledgeable, keeping up with their competitors in the public and private sector. The fundamental point that qualifications does not imply knowledge is germane to the later policy simulations that highlight multiple responses in Group 1 states that are quite difficult to predict ex ante. Having cast doubt on several policies, we highlight two areas where the mental model needs to change for progress to be made.

The first is that we need to better understand and communicate to Indian and global policy-makers the fundamental "Aggregator Problem" in rural health care. In sparsely populated rural locations, the maximum patient load of a clinic is severely limited by geography. Because of the structure of transport networks, larger health facilities in central markets and cities are easier to access than the "next village". People may visit the clinic in their village; if they have something more serious they will go to the highway; and if they have something really major they will take a bus and go the city. But people will almost never travel from one village to another, because it usually requires going to the highway anyway and then taking another peripheral road out into another village.

In this world it is essentially impossible for any rural clinic to expand its catchment population outside the village it is in. Paying full-time salaries to staff in clinics that are operating at substantial under-capacity is an extremely expensive way to provide care in these areas, as our cost calculations for the public sector demonstrate. This problem poses an especially challenging trade-offs as additional staff spending for crowded urban clinics are likely to be used to capacity, whereas the same spending in rural clinics is mostly wasted due to excess capacity. Therefore we need to promote a clear understanding of why spatial features make the per-patient costs of public primary care so high in rural areas, allowing for better decision making about capacity allocation.

The second point is that the existing dense network of rural health care providers needs to be understood as a market. Since it is primarily a private market forces of price and choice are core determinants to the actual quality of care delivered to patients, and understanding these provider networks in this context is an open field for study. We cannot emphasize enough that the complexity of health markets needs to be embraced, rather than shied away from and once we allow for the possibility of patient choice multiple policy opportunities become available. What we now need to understand is (1) how well care-seekers are able to identify and afford higher-quality service as they need it; (2) how well provider prices accurately reflect the quality of their practice; and (3) how responsive the overall quality of services is to local socioeconomic status. If it is true that higher quality providers already exist and are recognized by the population, then the key dimension of quality improvement may not be the skill of the "average" provider, but the value-for-money in an individual's choice set.

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Caseload regressions

	Number of Patients	State Characteristics	State FE	Private Only	State Characteristics	State FE	Private Share	State Characteristics	State FE
Private Provider	-18.04***	-18.10***	-19.27***						
	1.97	1.96	1.93						
MBBS Provider	14.91***	13.80***	9.39***	15.36***	14.63***	10.44***	-0.21***	-0.20***	-0.18***
	1.53	1.54	1.57	1.34	1.35	1.40	0.04	0.04	0.04
Provider is Male	0.21	1.35	2.97**	1.15	2.08	3.26**	0.00	-0.00	-0.01
	1.33	1.33	1.32	1.29	1.29	1.28	0.02	0.02	0.03
Village population size	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00**	0.00***	0.00***
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Have Grade 10 Education	0.06	0.27	1.27	-0.49	-0.35	0.39	0.29	0.29	0.25
	6.44	6.39	6.26	5.61	5.56	5.43	0.38	0.37	0.37
Have Grade 10+2 Education	1.43	1.83	2.26	1.11	1.22	1.36	0.30	0.29	0.26
	6.43	6.38	6.25	5.60	5.55	5.42	0.38	0.37	0.37
Have Advanced Education	2.47	3.32	3.88	1.54	2.16	2.51	0.32	0.31	0.27
	6.43	6.38	6.25	5.60	5.56	5.43	0.39	0.37	0.37
Have No Other Occupation	3.56***	3.07***	2.62***	3.49***	2.96***	2.61***	0.01	0.01	0.01
	0.69	0.70	0.69	0.61	0.61	0.60	0.01	0.01	0.01
Are Now Aged 40-60	0.54	0.53	0.32	0.54	0.61	0.50	0.01	0.02	0.02
	0.66	0.66	0.65	0.59	0.59	0.58	0.01	0.01	0.01
Are Now Aged 60+	-2.02	-1.92	-2.67**	-2.20**	-2.14**	-3.08***	0.05***	0.05***	0.05***
	1.25	1.24	1.22	1.10	1.09	1.07	0.02	0.02	0.02
State mean of household SES index		3.62***			4.05***			0.02	
		0.74			0.66			0.01	
State Under-5 Mortality Rate		-0.06***			-0.03			0.00*	
		0.02			0.02			0.00	
Public Sector Present				3.16***	2.21**	1.84**	-0.54***	-0.55***	-0.55***
				0.94	0.94	0.93	0.04	0.04	0.04
Constant	22.54	21.23	33.99	4.71	0.97	11.13	0.67	0.61	0.71
	6.85	6.97	6.91	5.78	5.87	5.88	0.39	0.39	0.37
N	2625.00	2625.00	2625.00	2488.00	2488.00	2488.00	847.00	847.00	847.00
r2	0.29	0.31	0.34	0.15	0.17	0.21	0.75	0.75	0.75

Competence regressions

	Competence Percentile	State FE	Private Only	State FE
MBBS Provider	0.28***	0.09***	0.16***	0.06**
	0.03	0.03	0.03	0.03
Provider Male	-0.08***	-0.02**	-0.11***	-0.05**
	0.01	0.01	0.03	0.03
Provider Age	-0.002***	0.000	0.000	-0.001
	0.000	0.000	0.001	0.000
Public Provider	-0.06*	0.07**		
	0.03	0.03		
District Mean SES		0.07***	-0.03**	0.02
		0.02	0.01	0.03
District Mean Public Competence			0.62***	0.53***
			0.03	0.04
Constant	0.51	0.54	0.17	0.34
	0.02	0.04	0.04	0.07
N	2974.00	2968.00	1303.00	1303.00
r2	0.18	0.50	0.33	0.49

Average costs per patient

	Public MBBS	Private MBBS	Public non-MBBS	Private non-MBBS
Andhra Pradesh	13.60	20.27	5.97	18.80
Assam	25.33	11.50	13.33	49.00
Bihar	7.61	107.50	15.00	27.24
Chhattisgarh	31.45	47.50	29.62	26.38
Gujarat	102.82	30.00	22.00	29.24
Haryana	33.58		39.61	29.40
Himachal Pradesh	51.11		64.49	24.71
Jharkhand		46.67	33.82	34.15
Karnataka	21.50	42.50	18.53	19.05
Kerala	9.28	58.06	7.15	57.05
Madhya Pradesh	14.71	45.00	49.17	22.28
Maharashtra	17.50	20.00	30.78	26.30
Odisha	32.52		31.44	33.82
Punjab	40.11	20.00	20.71	20.28
Rajasthan	27.55	41.53	58.33	33.18
Tamil Nadu	12.78	23.33		23.33
Uttar Pradesh	21.87	65.00	25.86	16.84
Uttarakhand		5.00	0.98	16.44
West Bengal	12.60	48.40	12.58	28.79

Average reported salary/income

	Public MBBS	Private MBBS	Public non-MBBS	Private non-MBBS
Andhra Pradesh	20271.54	10714.29	6742.86	5479.17
Assam	22800.00	26000.00	16000.00	9511.00
Bihar	23333.33	7000.00	15000.00	3517.48
Chhattisgarh	17300.00	5500.00	7246.15	3490.25
Gujarat	91170.11	5000.00	17111.11	9392.31
Haryana	44500.00		25192.33	4919.25
Himachal Pradesh	23000.00		22444.00	6218.75
Jharkhand		6000.00	11500.00	3484.40
Karnataka	17677.00	14500.00	12634.09	8797.62
Kerala	15919.12	9083.33	12427.38	7959.46
Madhya Pradesh	25000.00	1500.00	17701.67	3620.09
Maharashtra	21000.00	1500.00	23237.50	9378.79
Odisha	25085.71		16005.09	5078.95
Punjab	22312.50	0.00	8750.00	4876.56
Rajasthan	22725.00	20766.67	19881.25	4644.42
Tamil Nadu	26931.17	13982.00		5944.44
Uttar Pradesh	22111.11	37500.00	14350.00	3142.91
Uttarakhand		0.00	520.00	4871.83
West Bengal	29693.57	11952.17	20242.00	3191.60

Simulation costs per patient

	PHCs Everywhere	Public AYUSH	Status Quo
Andhra Pradesh	22.42	15.51	15.85
Assam	15.61	20.71	20.49
Bihar	42.33	25.12	26.74
Chhattisgarh	46.39	32.63	27.98
Gujarat	113.48	47.81	48.40
Haryana	68.97	40.94	33.19
Himachal Pradesh	49.38	49.93	32.71
Jharkhand		43.69	34.49
Karnataka	26.00	24.49	23.50
Kerala	25.71	19.81	27.72
Madhya Pradesh	56.56	42.44	24.21
Maharashtra	45.95	41.22	27.19
Orissa	74.54	48.76	40.37
Punjab	34.80	24.81	23.50
Rajasthan	62.08	53.55	39.38
Tamil Nadu	24.41	18.57	19.17
Uttar Pradesh	47.94	30.29	22.75
Uttaranchal		10.70	14.56
West Bengal	36.69	34.92	29.46

Figure 2: Providers per village in each state, by state under-5 mortality rate

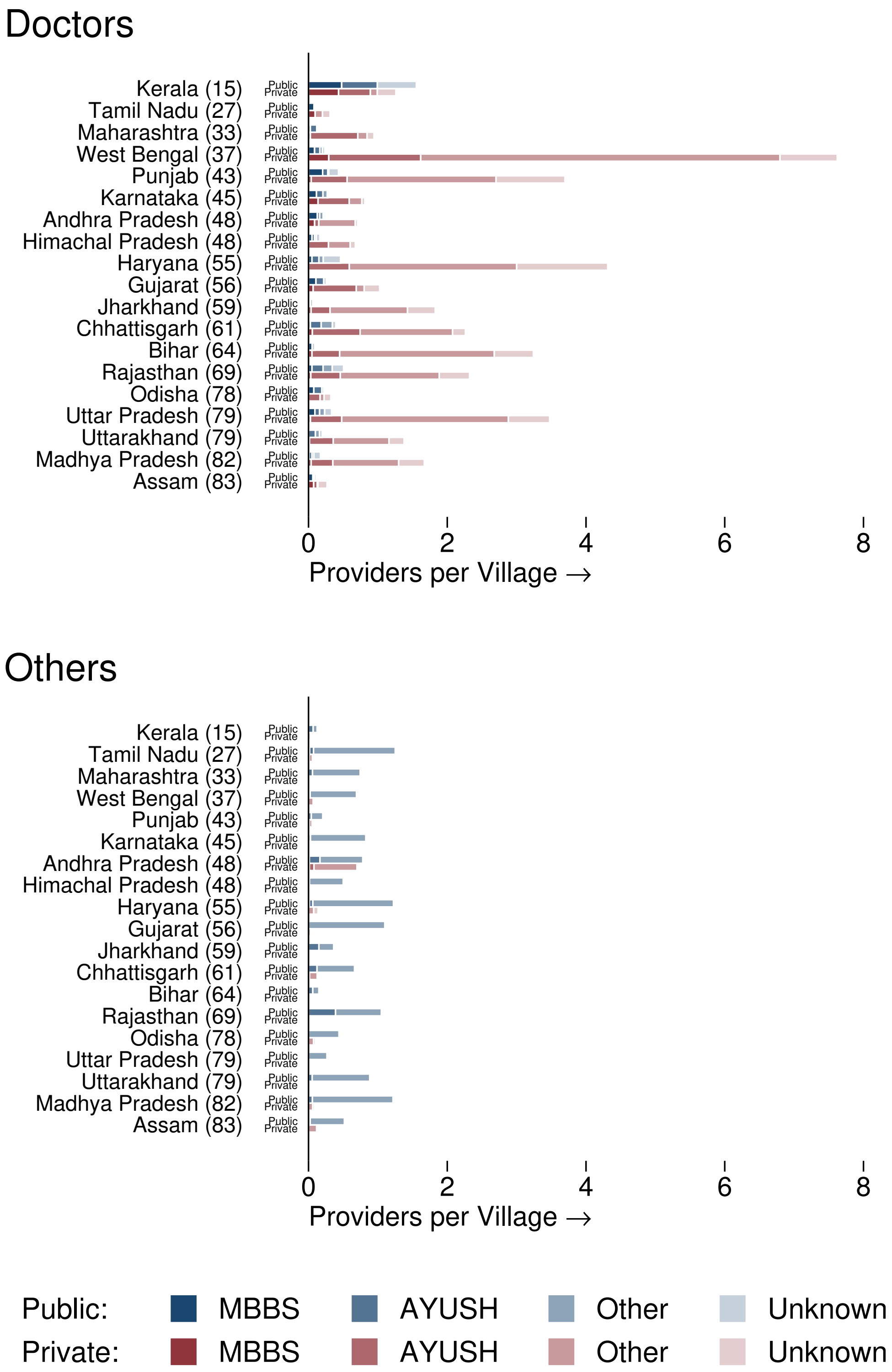

Figure 3: Characteristics of doctors by sector and qualification

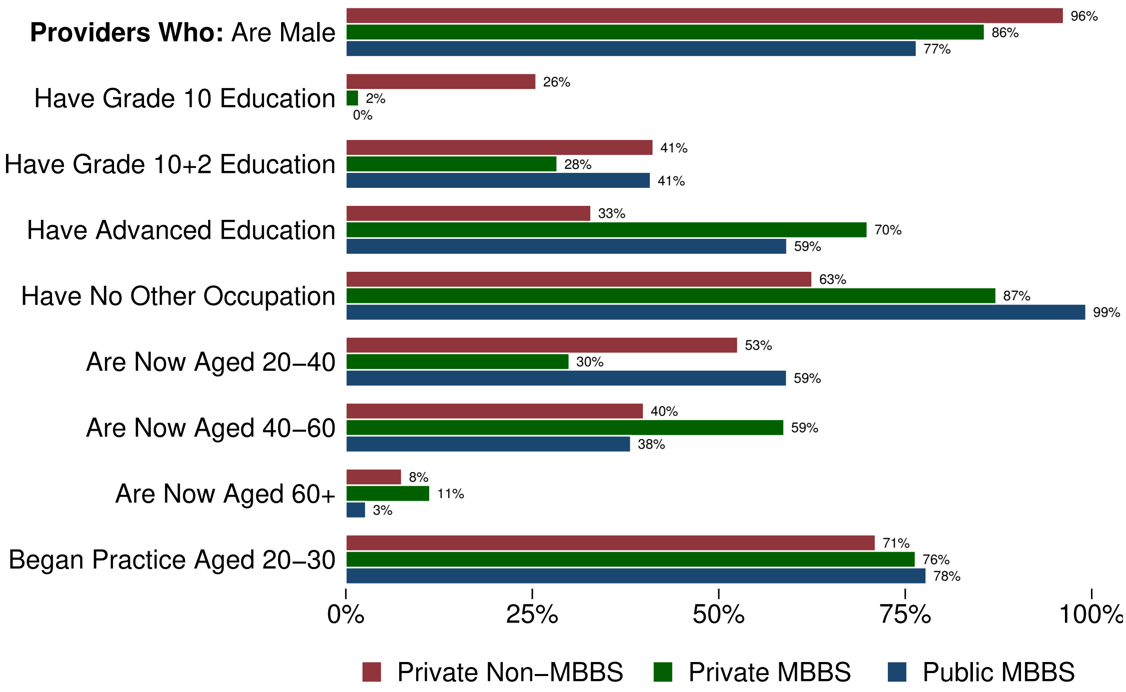

Figure 4: Private non-MBBS share of doctors, by normalized state SES

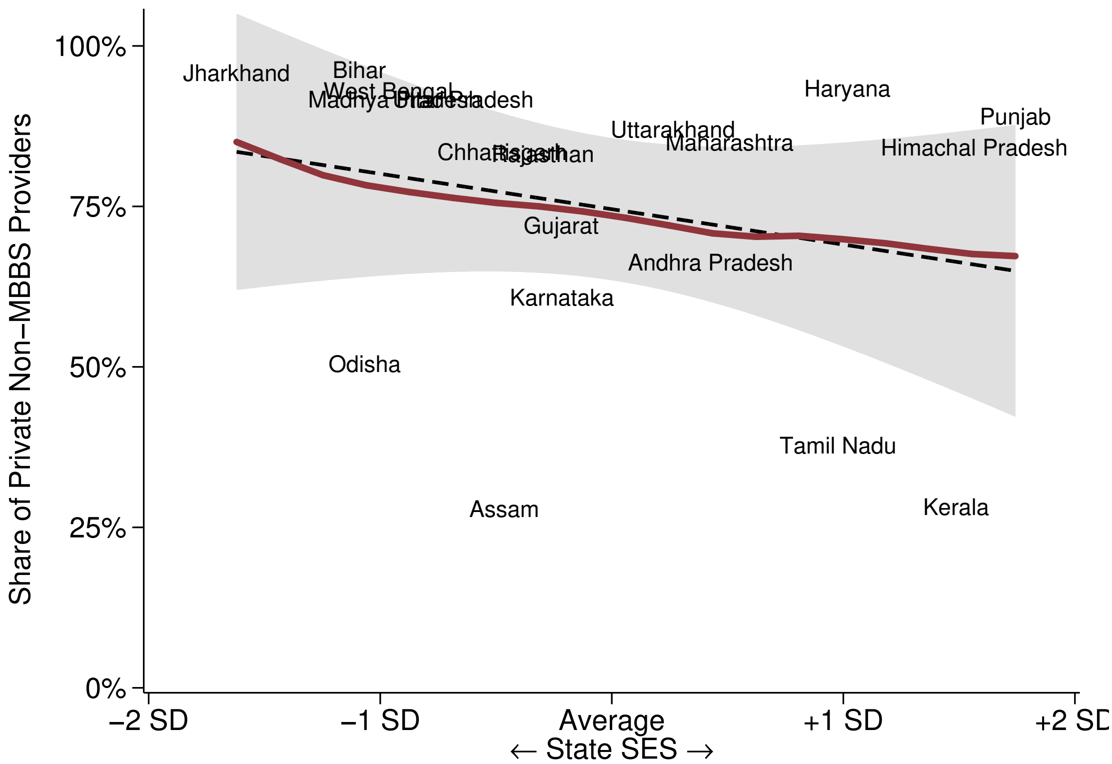

Figure 5: Doctor workday duration, by sector, qualification, and reported time per patient

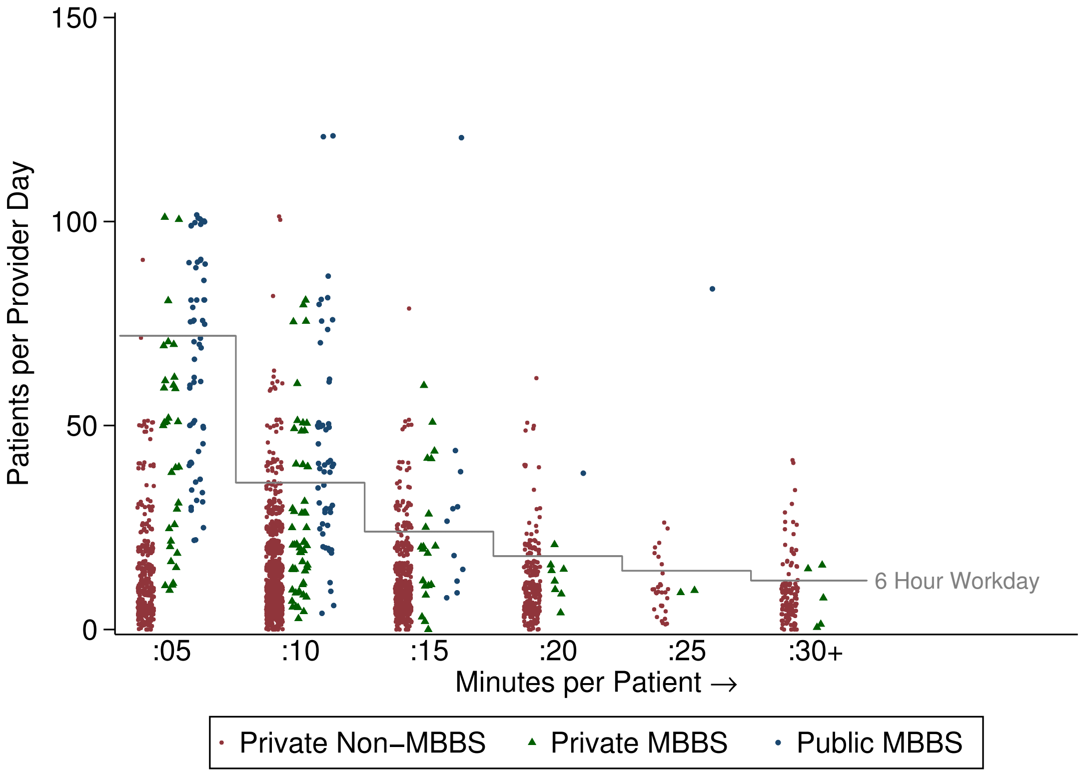

Figure 6: Performance of doctors on vignettes

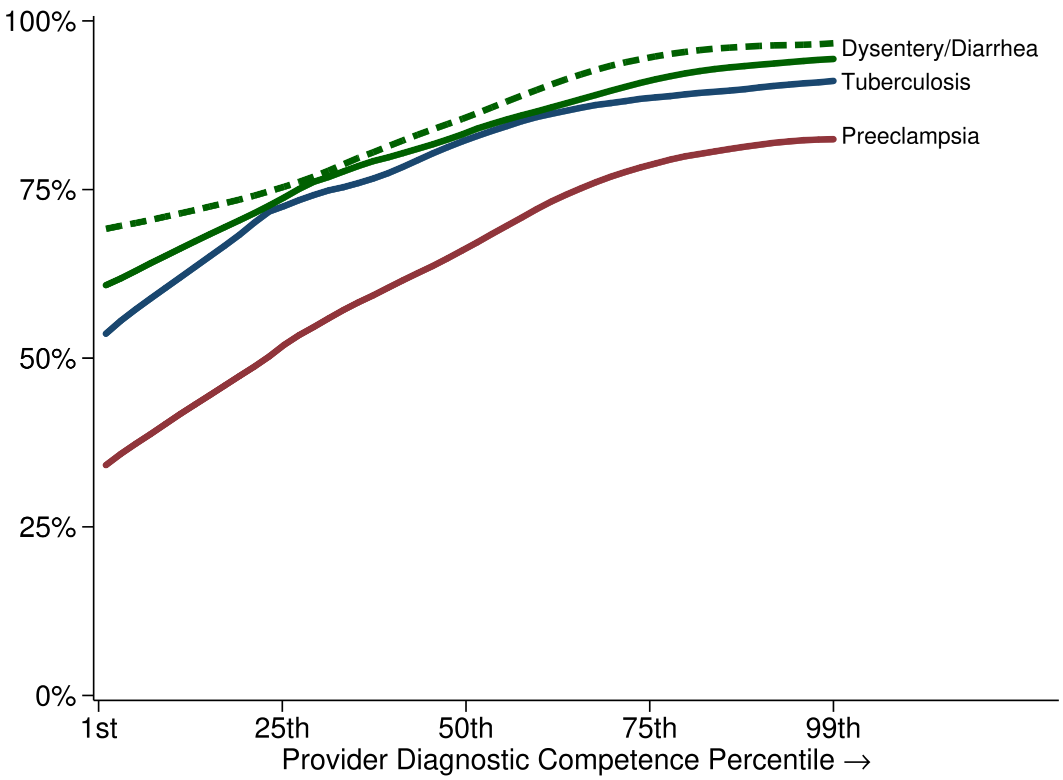

Figure 7: Competence range of doctors by state and qualification

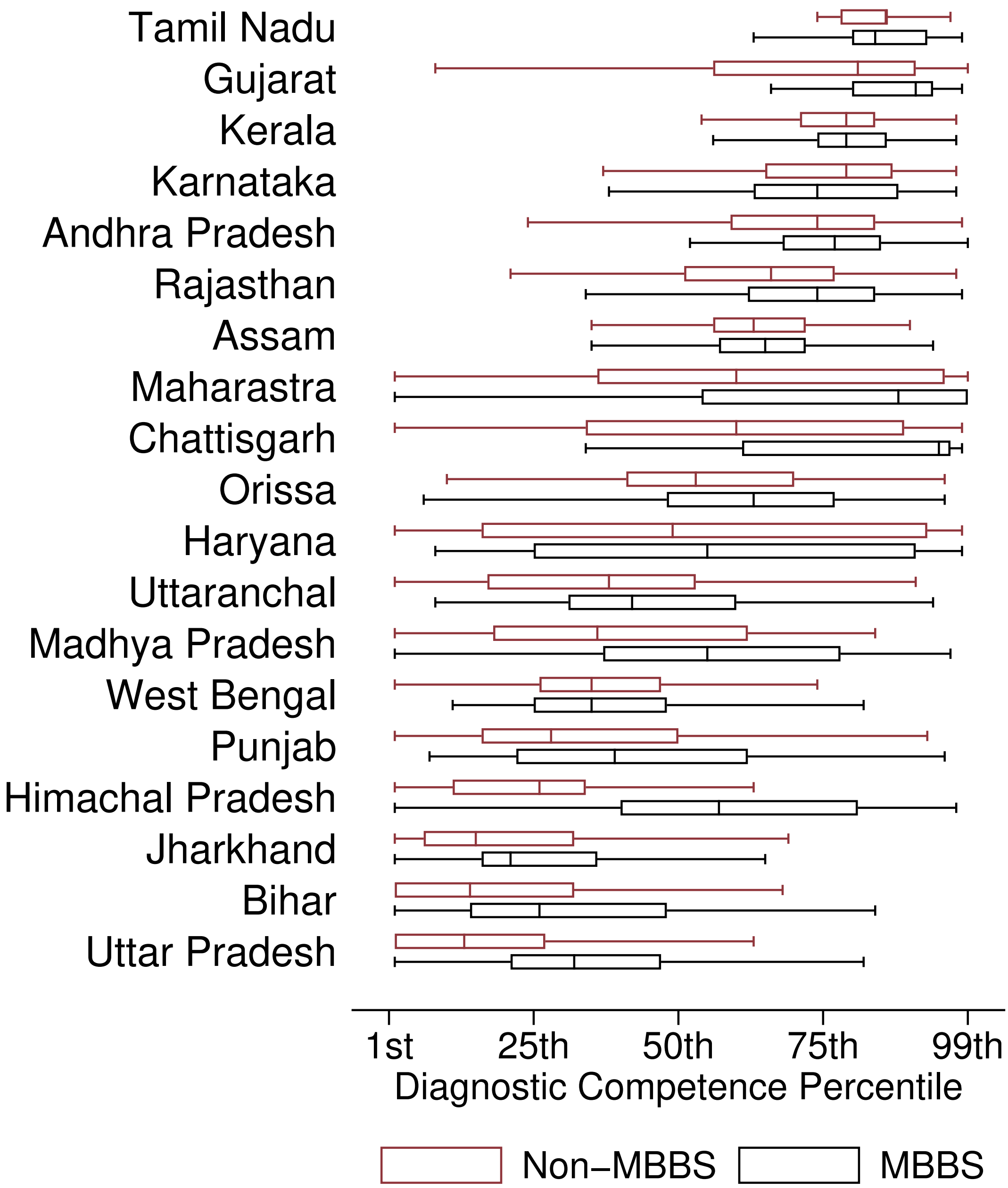

Figure 8: Proportion of doctors who treated all three conditions correctly

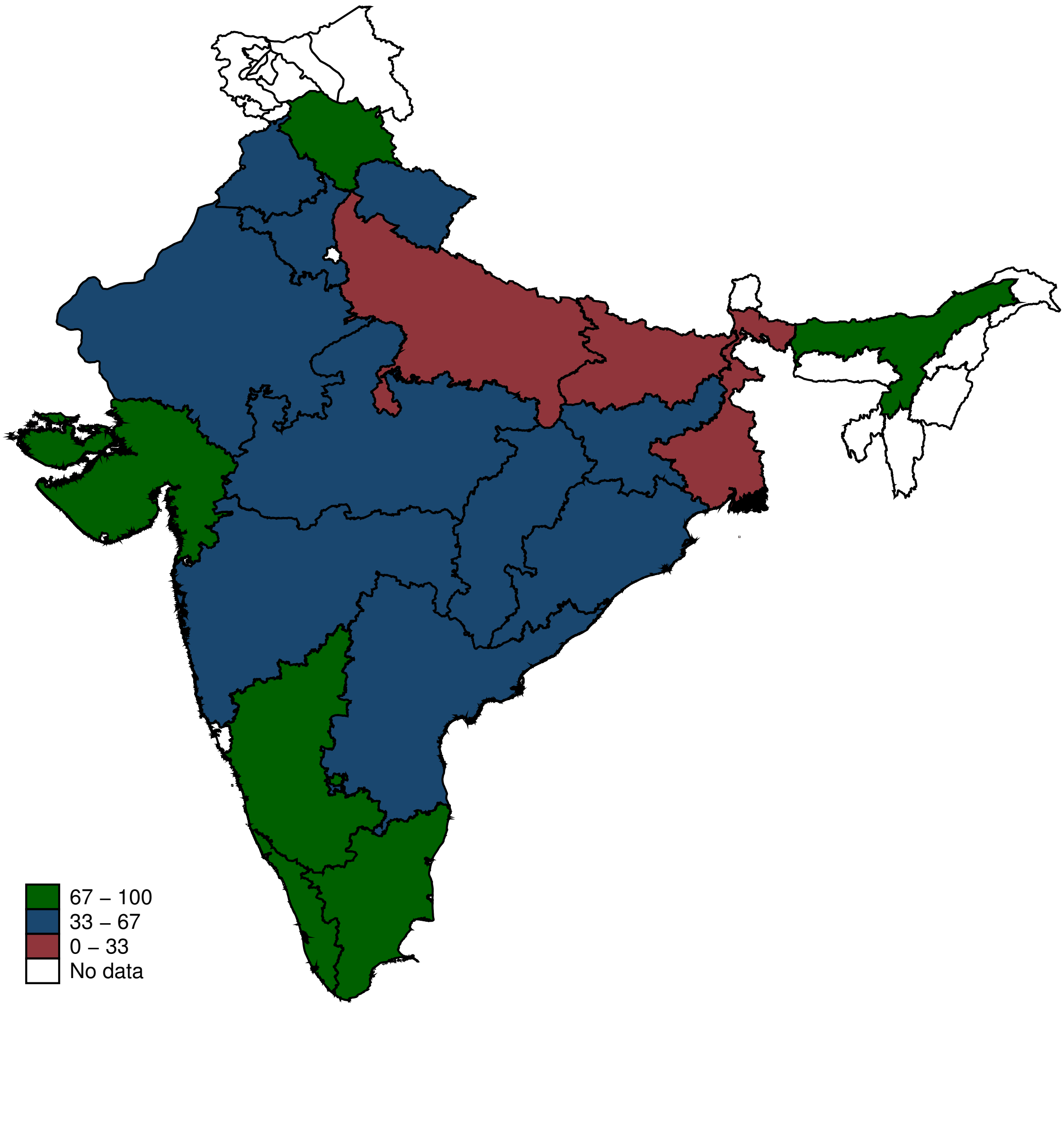

Figure 9: Competence of public and private doctors across states

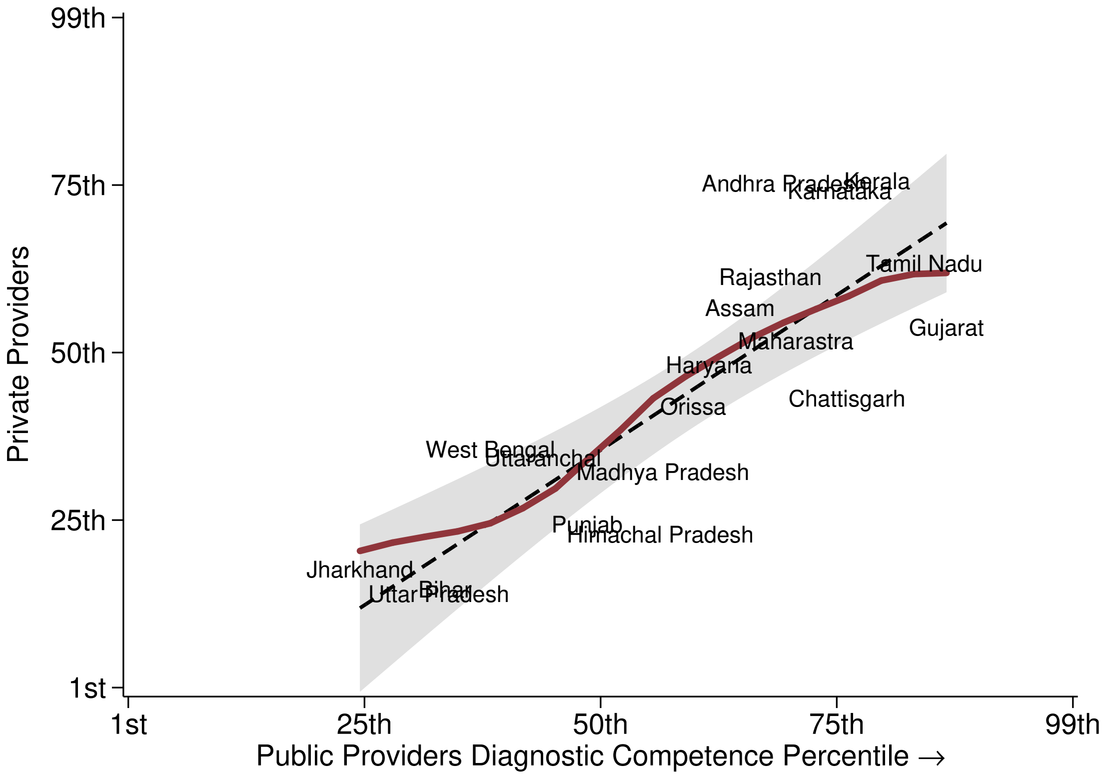

Figure 10: Cost and quality of care across states, status quo

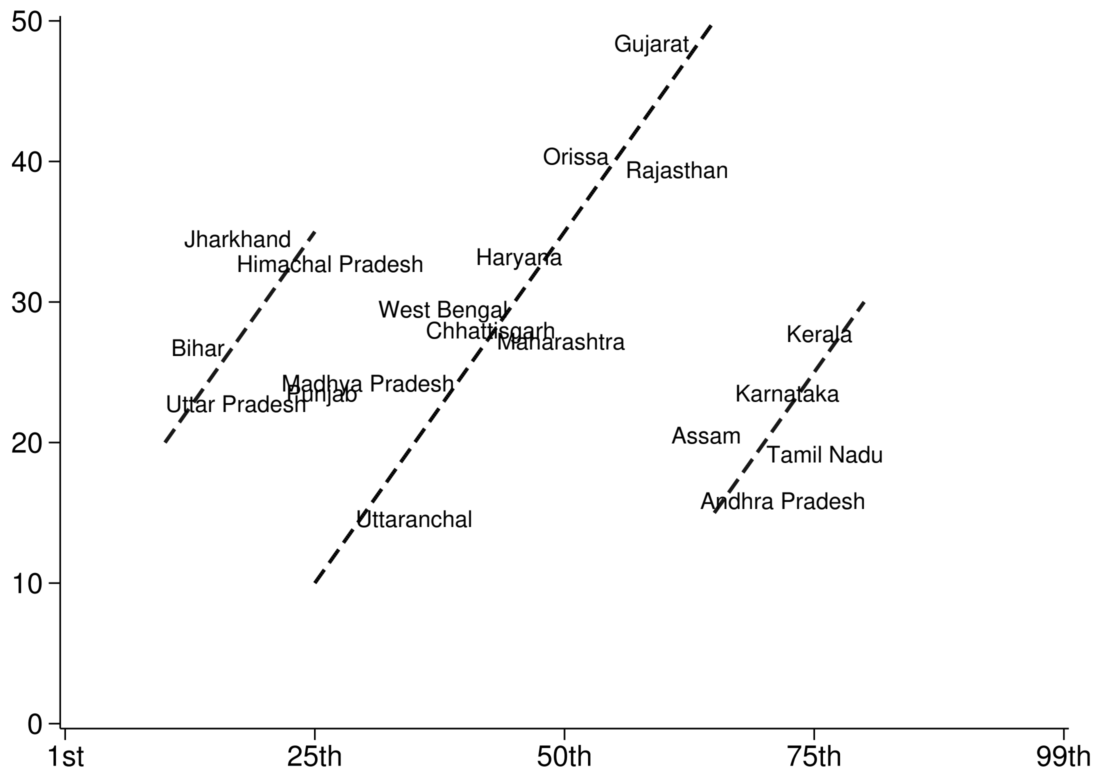

Figure 11: Cost and quality of care across states, status quo and Simulation 1

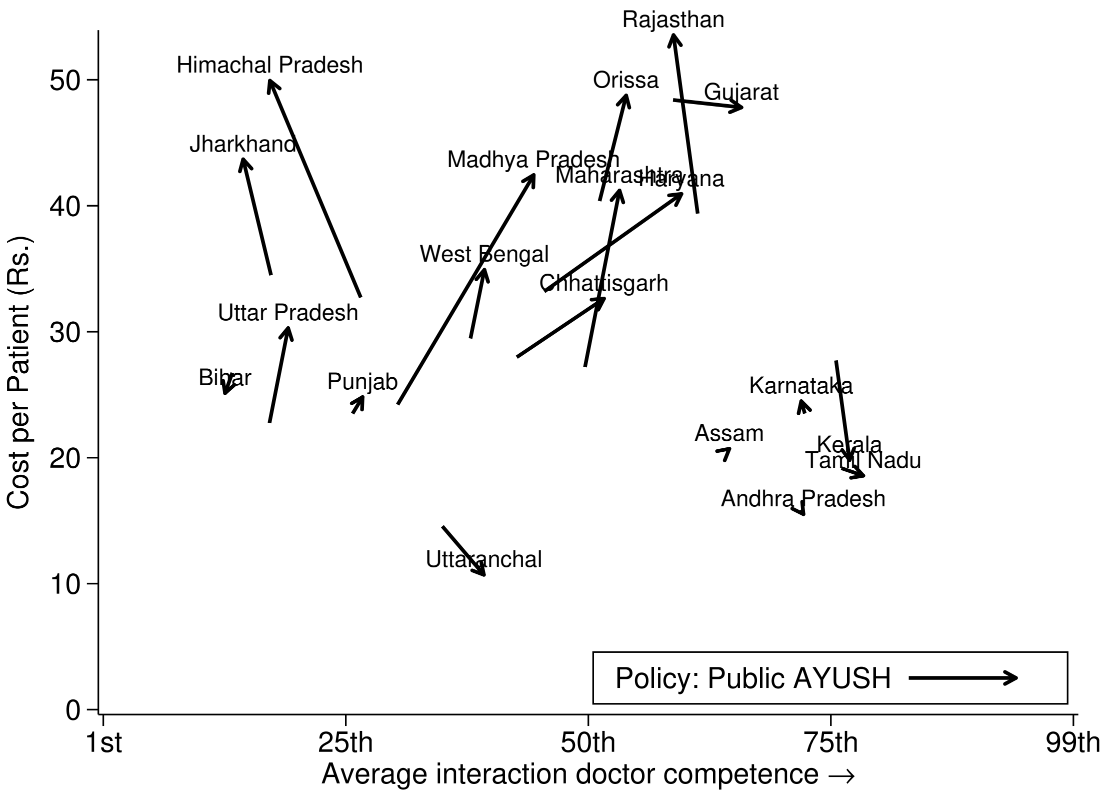

Figure 12: Cost and quality of care across states, status quo and Simulation 2

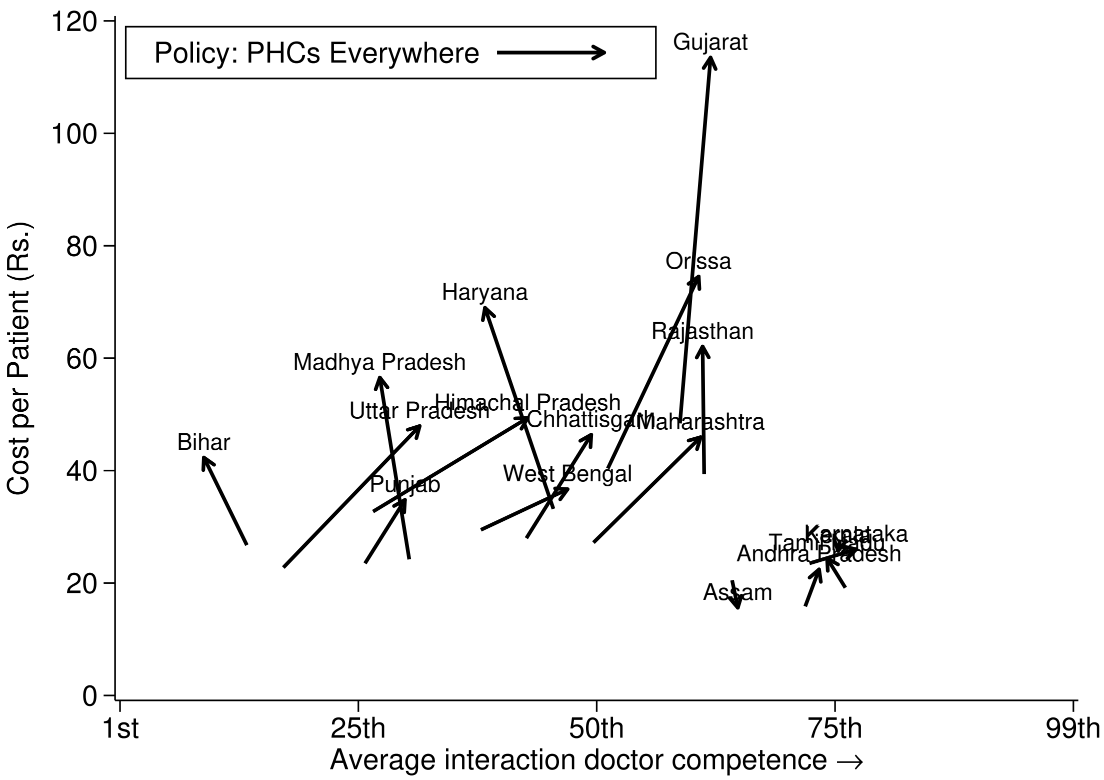

Figure 13: Quality and availability of care across states, status quo and Simulation 3