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WHO BEARS THE DISTANCE COST OF PUBLIC PRIMARY HEALTHCARE? HYPERTENSION AMONG THE ELDERLY IN RURAL INDIA*

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Abstract

Hypertension is one of the most prevalent NCDs in the world. Its prevalence is especially high among the elderly, a demographic groups on the rise in middle and low income countries. Extant medical literature calls for early detection to prevent aggravation of problems when old. In this paper, we investigate whether diagnosis of hypertension among adults aged 45 and above, is correlated with geographic access to primary public healthcare services, after accounting for a rich set of potentially confounding covariates. Our study focuses on rural India where access to public primary health services is especially poor but hypertension rates are high. We find that hypertensive adults belonging to poor households, face a distance cost of public primary health facilities- and are 8 percent less likely to be aware of their hypertension when Primary Health Centres are 10 km away. Since almost 27 percent of villages in India are at least 10 km away from PHCs, this exclusionary effect is significant. Our analysis suggests that even though public primary facilities are poorly staffed and managed in India, and private care is popular, geographical expansion of public primary facilities can still play an active role in NCDs and public primary health financing should take heed of the need for such expansion.

Key words: Hypertension, Elderly, Ageing, Distance, Primary Care
JEL Classifications: I14, I15, I18, J14

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1 INTRODUCTION

There is global acknowledgement of the need to manage and reduce chronic illnesses to reach the target set by the Sustainable Development Goal (SDG 3.4) of slashing premature mortality from NCDs by 2030. Hypertension (elevated blood pressure of 140/90 mmHg or higher), a risk factor for cardiovascular and renal morbidity and mortality, contributes to around 25 % of NCD burden globally (*W*orld Health Organization et al., 2021). A bulk of this burden is concentrated in developed countries like the United States, where roughly half the individuals had biomarkers for hypertension in 2017-18 (Chobufo et al., 2020). However, the problem is even more grave for low and middle income countries where high prevalence rates (excess of a third of the population) co-exist with low awareness and diagnosis rates. An overwhelming two-thirds of adults with hypertension live in such regions-often unaware of their condition and are, thus, without treatment.[1]

The prevalence of hypertension is higher among the elderly all over the world. According to the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC-7), hypertension occurs in more than two-thirds of individuals after the age of 65 (Chobanian et al., 2003). The age-profile of hypertension presents a grim challenge to many countries in the global south, with rising proportion of elderly in their population; by 2050, two-thirds of the world's population over 60 years will live in low and middle income countries.

The impact of these changing demographics on NCDs such as hypertension is especially challenging in the global south where many countries lack good health facilities and continuity of care; within such countries, the poor often have less access to health services and universal health care (UHC) is merely given lip service by governments (Peters et al., 2008). In this paper, we seek to study hypertension detection in India, a large developing country with poor public health infrastructure, rising share of the elderly and with more than half the elderly suffering from hypertension. In particular, this paper seeks to investigate whether detection of hypertension among adults aged 45 and above[2], is correlated

[1] https://www.who.int/news-room/fact-sheets/detail/hypertension

[2] The choice of this age group, mostly middle-aged and elderly individuals, is explained below.

with geographic access to public primary healthcare services, after accounting for a rich set of potentially confounding covariates. Our study focuses on rural India where access to public primary health services is especially lackadaisical.

Poor awareness of one's hypertension status is a universal problem. Only 45% of hypertensive adults (aged 30 to 79) are aware of their condition (World Health Organization, 2023). India echoes the global problem- only 42.5 % of those in the age group 15-49 are aware that they have hypertension in rural India.[3] (Prenissl et al., 2019). Awareness of one's hypertension status is higher among the elderly, at 54.3%, presumably due to diagnosis that coincides with the treatment or diagnoses of other co-morbidities (which might themselves be a product of one's hitherto undiagnosed hypertensive status). Hence, while this paper is motivated by the problem of the hypertensive among the elderly, the sample looks at adults aged 45 and above-as hypertension sets in at these ages and detecting early is a potentially important public health strategy.

Primary Healthcare is the recommended gateway for management of NCDs all over the world. However, rural primary health services are very fragmented in India. In 2020, there were 24,918 Primary Health Centres (PHCs) operating in India, with each expected to cater to a population of 20,000 in hilly/tribal areas and 30,000 in the plains. Sub-centres-smaller primary health care units- are more numerous but they too cater to around 5000 people.[4] Thus, access to primary care is likely to be varied across the population and motivates our question.

Our question is especially relevant given the recent policy developments in India which call for investments in primary healthcare through Health and Wellness Centres (HWC).

In order to study the association between distance to the nearest public primary health services (sub-centres and PHCs in India) and detection of hypertension, we use information on 12842 adults (45 and above) spanning 1352 villages in rural India that exhibit hypertension bio-markers (measured blood pressure at the time of survey) or take drugs to control hypertension (report being diagnosed with hypertension at some point). These data are sourced from the Longitudinal

[3]The proportions are slightly higher at 47.9 % in urban India

[4]For the levels of prevalence in our dataset, each PHC must spend 86940 minutes or 180 working days every year on 15-minute consultations with hypertensive patients alone.

Ageing Survey of India Main Wave - I (2017-2019) and contain rich information on individual, household and village characteristics. They also contain information, for each village, on distance to the nearest sub-centre and PHCs, and select private health facilities.[5]

Primary health facilities follow, as explained above, stated population guidelines but the exact spatial allocations at a more granular level are not transparent. It is therefore likely that they are correlated with many factors that also correlate with health seeking behaviour of those with hypertension. While our endeavour is to provide an association, we control for a host of village level factors that are potentially likely to determine health facility allocation-population, literacy rates, social and religious composition and village infrastructure (as proxied by other public amenities). We also control for socio-economic variables at the household level and individual level-including health related factors (co-morbidities) that may predict, when aggregated in a community, where health centres are set up.

Using multivariate regression analyses, we find that the distance cost of PHCs is varied- the poorest (bottom wealth quartile) hypertensive adults face a distance cost of public primary health centres, but such access does not affect diagnosis among other wealth groups. The effect on the poorest is not small- a primary health centre being 10 km away is associated with 3.6 percentage points lower rate of hypertension diagnosis-which is a 7.8 percentage effect given that only 46% of the poor hypertensive are aware of their condition. A whopping 25 % villages in our sample have PHCs that are more than 10 km away-so the estimated marginal effect is meaningful to public health discussions. We are unable to find any association between distance to sub-centres and hypertension diagnosis rate.

We test the robustness of our results and its possible causal interpretation by estimating a specification with village fixed-effects to burnish the confounding effect of village-level omitted variables. We find that, relative to other groups, the poorest are more sensitive to distance cost of primary healthcare. Further, we undertake bound analysis suggested by Altonji et al., 2005 and Oster, 2019 and find that the correlation of unobservables and distance to the PHCs have to at least eight times the correlation between all observable variables and the

[5] We use alternate sources of data to match distances of villages from the nearest Community Health Centres (CHCs) and district hospitals.

relevant distance variable to offset the result. Heterogeneity analysis yields that the association of distance to PHC with hypertension diagnosis is very similar across many dimensions of interest, like gender, caste, and level of development of the state.

The results in this paper inform the debate on public funding of healthcare in countries with low state capacity such as India. Existing literature finds relatively low utilization of public primary facilities in many low income countries. In some cases, such as in Africa, patients do not automatically seek health care at the closest or lowest cost provider, but rather seek high-quality care (even at higher cost) when they estimate that such care will significantly improve outcomes (Leonard, 2014). In India too, estimates from select surveys suggest that as many as 67% people bypass public primary care facilities, though bypassing is lower in areas with more competent physicians (Rao and Sheffel, 2018; Rao et al., 2023). However, low usage has been linked to other reasons in India: insufficient diagnostic equipment and drugs, long wait times and insufficient time with providers (Pakhare et al., 2015;Gabert et al., 2017; Elias et al., 2018) leading to a "normalisation" of the absence of reliable primary care services for chronic illnesses in India, in rural India specifically (Kane et al., 2022). However, access registered as the second most important reason for non-utilisation of public facilities in the case of hypertension patients.(Kujawski et al., 2018)[6] Further, our research question is different from some of the existing literature in that we focus on detection of hypertension, whereas the literature has focused on treatment seeking behaviour. Moreover, we link accessibility to health outcomes, and not just health-seeking behaviour.

A public policy response to the poorly functioning primary health system in India has been an attempt to strengthen existing health facilities-upgrading PHCs and sub-centres and relabelling them as Health and Wellness Centres- an initiative of the *Ayushman Bharat* scheme of the government. The impact of these interventions are less well studied though a recent evaluation of a scheme that provided a new mid level provider (non-physician practitioner) to all existing public primary health facility in Rajasthan was found to have increased diagnosis

[6]As many as 32 % of non utilizers of public facilities cited this reason. The most common reason was technical quality which was only slightly higher at 39 %

of hypertension of patients by 67 %. (Agte and Soni, 2023). It also increased the load of patients, pointing out to great benefits from increasing capacity of existing public health facilities-however, it is not clear if this served those who live further away from PHCs and sub-centres. While such an increase in quality is desirable and must be an integral part of a policy towards universal health coverage, our paper shows that geographical spread is important, even at the low quality that it has historically provided. With better quality, the effects will only be multiplied.[7]

There is a growing literature on hypertension in India, that addresses how to improve hypertension treatment among the elderly. About 50 percent of the elderly (above the age of 60) are found to be hypertensive in all India surveys but only 27.5 % of the hypertensive have their BP under control (Kothavale et al., 2022). Given such poor control, studies have focused on evaluation of recent government initiatives to control hypertension. India Hypertension Control Initiative (IHCI) is one such initiative that has been studied in its inception phase-where standardized protocols of testing and medication in existing public heath centres have been found to improve blood pressure control (Kaur et al., 2023). Other papers focus on ways to detect hypertension early using predictive models (Sathish et al., 2016) or on protocols to standardize hypertension management in primary care settings (Satish et al., 2019), but the literature on screening for hypertension in rural settings, is less abundant. An exception is Bai et al., 2021 that looks at behavioral interventions to attend screening camps for hypertension. However, the study focuses on the demand side with the supply side assured through high quality health camps in the village. Our study complements the study by looking at the supply side access issues and its impact on detection.

The last strand of literature we contribute to is the one that explores health of the elderly in India. Most of this literature looks at catastrophic health expenditure of the elderly in the context of social protection. According to WHO, 2019, if the current trends of health care continue globally, 5 billion people will be unable to access health care by 2030. Of these the elderly population are a vulnerable group and require a different approach to health care as they are often less able

[7]Our study period pre-dates Ayushman Bharat. But access issues remain since upgradation is not accompanied by an increasing spread of primary health care-especially PHCs.

to pay for health services. This is especially serious in a developing country like India, where according to national surveys[8], around 80 % of households use their household income and savings as the major source of health financing and only 17 % of the citizens have health insurance. According to Gupta et al., 2016, the cumulative annual expenditures on Out Patient Care, in addition to hospitalizations, are especially large for households that have the elderly. This is especially significant in the discussions around Universal Health Coverage- as pointed out earlier, like much of the middle and low income countries, India is undergoing a demographic transitions with the elderly population in many states of India poised to cross 15-20 % population share by 2036 (MoHFW, 2016). Our paper contributes directly to this literature by looking at a health problem that is common among the elderly and how the public primary health access can potentially lead to an early detection.

The paper is organized as follows: Section 2 gives the background on hypertension in India and situates this work in the context of public policies to combat it. In section 3, we discuss the data used for this analysis. A summary of the data with descriptive patterns is explored in section 4. A multi-variate empirical model is described in section 5. We discuss the results from this empirical exercise in section 6. While our analysis is association in nature, we also provide evidence, in section 7, that the results may be causal- we do so by provide results from exercises suggested by Altonji et al., 2005 and Oster, 2019. We also provide some heterogeneity results in section 8. We conclude with a discussion in section 9.

2 BACKGROUND

Hypertension is a chronic disease characterised by heightened blood pressure in the body's vessels, leading to hardening of arteries and veins in one's body. In turn, this prevents the vessels from transporting requisite amounts of blood through the vascular system. Reduced supply of blood affects organ functions, and is a risk factor in kidney and heart diseases (Collaboration et al., 2002; Huang et al., 2014). This leads to an elevated risk of mortality among hypertensive indi-

[8]National Sample Survey report 2017-18.

viduals. In the US, for example, mortality rates among hypertensive individuals are 41% higher than their non-hypertensive peers (Ford, 2011).

Roughly 1.3 billion individuals between 30 and 79 years of age suffer from hypertension, and it is estimated that close to half of them are unaware of their hypertension status (Mills et al., 2020). The prevalence rates are substantially higher[9], and the diagnosis rates are dramatically lower in developing countries (Mills et al., 2020). Combined with more precarious health systems, the mortality effects of hypertension are substantial in the LMICS. Roughly 90% of all deaths related to hypertension occur in developing countries (Zhou et al., 2021). As life expectancy inches upwards in these countries, many of them confront dual burdens associated co-prevalence of high mortality from communicable and non-communicable diseases (Bygbjerg, 2012). In this context, it is important to study hypertension as it represents the largest modifiable risk-factor associated with mortality from chronic diseases (Yusuf et al., 2020). Gearing the healthcare systems in LMICs - historically designed to reduce infant and maternal mortality - towards addressing these emerging trends requires serious inquiry into factors associated with effective screening and treatment of these diseases in emerging economies (World Bank, 2022).

The Indian epidemiological profile mimics these trends - recent large-scale survey by ICMR-NCDIR finds that 28.5% of surveyed adults were hypertensive (Amarchand et al., 2023). That is, they either displayed biomarkers of hypertension on the day of survey or had been diagnosed with hypertension in the past. Less than a third of these individuals were aware of their status, and only one of every eight hypertensive individuals were on appropriate medication (Amarchand et al., 2023). While these indicators - awareness and treatment - improved with age, other research suggests that the ability to control the progression of diseases and associated comorbidities decreases among the elderly (Wu et al., 2023). This points to the crucial role of early-age diagnosis of the disease.

In addition to diagnosis, India's healthcare system confronts challenges on continuum of care for hypertensive patients. A health-facility survey across two districts in India, for example, found that the lower-level health facilities did not

[9] The age-standardized prevalence rate for hypertension are 28.5% and 31.5% for HICs and LMICs, respectively (Mills et al., 2016)

have adequate availability of first-line pharmaceuticals to help control hypertension (Gabert et al., 2017). A survey of health facilities from north Indian states of Punjab and Haryana corroborated these findings, as they reported that only 60% of the surveyed facilities had stocks of anti-hypertensive medication (Prinja et al., 2015) In large national surveys, households having members diagnosed with hypertension, routinely cite the poor quality of public health facilities as a key reason for using private healthcare (Kujawski et al., 2018).

Recognising the glacial increase in the contribution of non-communicable diseases to mortality in India, the government has adopted the "25 by 25" goal - a target that seeks to lower mortality from NCDs by 25% by 2025. As a part of this target, the government has also targeted lowering the prevalence of elevated blood pressure by 25%. To acheive this goal, the government has launched the Indian Hypertension Control Initiative (IHCI) in 2017. Rolled out in two phases, the intervention was primarily aimed at improving detection and treatment protocol information among key frontline health workers, alongside ensuring that BP drugs were available at these health facilities.

3 DATA

We use the Longitudinal Ageing Survey of India (LASI) to make our central claims. We source data from its first wave, conducted between 2017 and 2019, to derive our key results on the effects of inaccessible primary care on diagnosis of hypertension. Conducted by renowned international institutions[10] in collaboration with the National Programme for the Healthcare of the Elderly, the survey interviewed a nationally representative sample of 72,250 individuals aged 45 and above[11], residing in all states of India outside Sikkim[12]. We use a subset of this data for our analysis, focusing on 13,006 individuals who are 45 and above, reside in rural areas, and exhibit biomarkers of hypertension or are on hypertension medication, at the time of the interview.

[10] These academic institutions responsible for conducting the survey were - International Institute of Population Sciences, Mumbai (India), Harvard T.H. Chance School of Public Health, Cambridge (USA), and the University of Southern California (USC).

[11] The sample includes some individuals below 45 years of age, whose spouses are older than 45.

[12] Interviews in Sikkim were conducted in 2021.

We focus on this sample for two reasons. First, the burden of distance in rural areas is likely to exceed the burden in urban areas as formal healthcare is sparse. Conditional on seeking outpatient care, individuals living in urban areas report shorter traveling distances and also report having more primary care facilities in their immediate vicinity[13], thereby making rural residents relatively more susceptible to the concerns of inaccessible healthcare. Second, while the motivation of our study is the high hypertension prevalence among the elderly (ages 60 and above), we include, in addition to the elderly, individuals aged 45 to 50, because it is the age-group where hypertension is most likely to arise, though often "silent"-indeed, a significant proportion (65.6%) of individuals who are aware of their hypertension status at the time of the survey had been diagnosed before the age of 60 (Figure 1). Further, given that early detection of hypertension is a prudent strategy for hypertension control, it is important to look at issues of diagnosis in the age group 45 to 59. After 60, the awareness of one's hypertension status rises, though by then hypertension may already be out of control (We explore this hypothesis later in section 8).[14]

4 SUMMARY STATISTICS

This section presents the relevant summary statistics for the sample of interest. We define, as is standard practice, a person to suffer from hypertension if their average systolic pressure is above 140 mm Hg and/or their average diastolic pressure is above 90 mm Hg across three blood pressure readings. In addition, we define a person as hypertensive if they have been diagnosed as hypertensive or/and are on medication to control blood pressure. The sample of hypertensive individuals, then, includes those with diagnosed hypertension or those with the biomarkers of hypertension. All 12,842 individuals in our sample are hypertensive. 58 percent of them are females. Other characteristics of the sample are reported in Table 1.

[13]The average distance travelled by an outpatient care-seeking individual is 10.7 kilometres in urban areas, compared to 16.1 kilometres in rural areas.

[14]Of those considered hypertensive by the definition elucidated earlier, the awareness rates are 6% higher for the elderly (60+) individuals compared to individuals in the age group 45-59.

Only 54 % of hypertensive patients are aware of their status(Table 2).[15] Of the 6943 people who have been diagnosed (a significant fraction of whom are elderly), the average age when they got detected is around 56, which motivates why we look at individuals 45 and above. 20 % of the hypertensive are at a more advanced stage of hypertension (second or higher stages with systolic pressure of 180 and diastolic pressure of 90 mm Hg).

Hypertension awareness varies by gender in our sample with larger proportion of women aware of their status (Table 3).[16] Women are detected two years earlier than men. Further, in order to examine if hypertension awareness has a wealth gradient, we define wealth quartiles using a wealth index constructed using principle component analysis. The index is constructed using 25 indicators that reflect ownership and quality of a set of assets commonly found in households across India. We use the set of assets employed by Mohanty et al., 2023, one of the earliest papers using LASI data. We define those in the poorest quartile as *poor* and others with a relatively higher wealth index as *non-poor*. It is clear that the poor in India are much less likely to be aware of their hypertension awareness-only 46 percent of the poor who are hypertensive are aware of their hypertension status while this proportion is higher at 57 % for the non poor (Table 3). As Figure 2 shows, hypertension awareness rises almost monotonically with wealth. The non-poor are aware of their hypertension status 2 years earlier as compared to the poor. It is not the case though that the poor are in a better health condition than the non-poor-an equal proportion of them in-fact have stage 2 hypertension.

The impact of age on hypertension is interesting and reflects growing awareness of hypertension for younger cohorts. Those in the age group 45-60 are less aware of their hypertension status as compared to those who are 60 and above. But significantly, those who got detected in the 45-60 age group did so relatively early at an average age of 47 as compared to the older cohort, who though more aware of their hypertension status (perhaps due to interaction with health facilities due to co-morbidities), have got detected only in their 60s (at an average age of 62.36).[17]

[15] We assume that patients are aware of their status through clinical diagnosis.

[16] It is not the case however, that hypertension is more prevalent among women.

[17] This could also be partly due to early onset of hypertension for the more recent 45-60 year old cohort

Given the low awareness of hypertension, our paper investigates the role played by access to public primary care- sub-centres and primary health centres. The motivation to do so is that such free primary health facilities are the first point of contact of individuals, especially the poor, to the local health systems. However, as pointed out above, access to primary health facilities is varied. In our sample of 1352 villages, we note that there is considerable heterogeneity in access to public primary health care (Table 4).[18] The mean distance to a sub-centre is 2.45 km but the standard deviation is a high 4.65 km-while 55.4% villages have a sub-centre within 1 km, 19 % of the villages have a sub-centre atleast 5 km away, with almost 6.5 % of them further away by 10 km. Public primary health centers (PHCs) are, not surprisingly, further away as they serve a larger group of villages. The mean distance is 6.59 km but the standard deviation is as high as 7 km. While 21.4 % villages are less than 1 km away from a public PHC, more than a quarter of the villages are more than 10 km away.

Relatively less is known about how sub-centres and PHCs are distributed across space-as explained earlier, the allocation rule for such facilities follow population norms at the aggregate level. We present one interesting dimension in which there is heterogeneity-household wealth. This dimension is especially relevant as we saw that awareness also has a wealth gradient. As can be seen in Figure 3, PHC and sub centre access is strongly correlated to household wealth. Therefore, we control for household wealth as it is potentially a confounding variable in our regression analysis.[19]

The raw correlation of distance to public primary health facilities and hypertension diagnosis are negative. While for the case of subcentres it is -0.044, it is -0.056 for PHCs. These correlations have a wealth gradient-as can be seen in Figure 4, the negative impact of access for subcentres and PHCs are larger for the poor. These negative associations are especially significant since the poor are less likely to visit private healthcare facilities for paid services.

[18]We present these summary statistics at the level of the village since access is largely a village level variable. A summmary of our data at the level of the individual, Table 12, also paints a similar picture.

[19]While controlling for household wealth in all our multivariate regressions below purges our analysis of this spurious correlation, it also removes the impact of this large inequity in access that is driven by wealth.

The access to public primary healthcare facilities are likely to be correlated to other characteristics of the villages that the individuals live in. Some of these characteristics are reported in Table 4. We account for these characteristics in our regression analysis. We turn to this in the next section.

5 EMPIRICAL MODEL

The unconditional correlation between hypertension diagnosis and access to a public primary healthcare facilities are likely to be driven by a host of factors. While in this paper, we do not claim to have estimated a causal relationship, we estimate partial correlations, after taking account of a rich set of characteristics: at the level of an individual, household and village.

To be more precise, let the index *ihvb* denote the individual i belonging to household h living in village v located in a sub-district (referred to as a block) b. The dependent variable of interest is a dichotomous variable $Diag_{ihbv}$, which takes the value 1 if an individual has been diagnosed with hypertension, 0 otherwise. The two independent variables of interest are distance to the nearest primary sub-centre, denoted by $Dist_{SUBC(vb)}$ and distance to the nearest PHC, denoted by $Dist_{PHC(vb)}$. In our main specifications, we include both of them, since they play, in principle, different roles; sub-centres are the first point of contact with the public primary health system, with PHCs being the next level. In practice, where people go to first can vary depending on distances and availability of adequate resources-for example, available personnel-at sub-centres. The distance to the two facilities may also be correlated, and inclusion of both helps us tease out the association with access to each facility. Knowing these associations are important in particular for policy recommendations.[20]

Our analysis is cross-sectional in nature. Access to public health facilities can correlate with a host of community and geographical variables that also determine, independently, hypertension diagnosis. To remove some of those confounding differences, we include block fixed effects (α_b)-hence differences in block characteristics, such as administrative capacities, geographical terrains, affluence

[20]In the robustness section 7, we discuss the results when we instead use the distance to the nearest sub centre or PHC $Dist_{min(PHC,SUBC)}$- interestingly, it is not the case that sub centres are always closer than PHCs.

or development at the level of a block are partialled out from the estimated correlation. Further to account for differences across villages that may correlate with health care access, we control for a host of village level characteristics: population, share of population that belong to Scheduled Castes (SC), Scheduled Tribes (ST), the sex ratio of the village, the share of population that is Hindu, a similar share for Muslims, male and female literacy rates and a village level measure that reflects how many amenities, outside of health facilities, are present in the village.[21] We refer to the vector of all the village level characteristics as V_{vb}.

Hypertension awareness is likely to correlate with household and individual characteristics. Among household characteristics, we consider the household size, human capital of the household (proxied by number of literate and the number of graduate members in the household), the dependency ratio and whether the household is poor (as defined above). We denote the vector of these household characteristics as X_{hvb} We control for a large number of individual characteristics-among demographic characteristics, we account for whether the individual is a female, the age, years of schooling, an indicator for whether the individual is a widowed, dichotomous variables that indicate whether the person is Muslim, Sikh or Christian (the reference category includes Hindus and other religions), dummy variables that classify individuals as SC, ST or OBC respectively (with the other caste categories as the reference group); among health characteristics we include the body weight and its square, Body Mass Index (BMI)[22], waist-hip ratio and its square, ADL index[23], an indicator that the individual self reports serious mobility issues; among habit deleterious to health, we include whether the individual smokes tobacco or consumes alcohol. Further, we control for the individuals living arrangement, using dummies indicating whether they live with spouse and others, children and others, spouse and children, or others only, with living alone as base category. We also control for childhood health using a dummy variable that captures self-reported childhood health status. We refer to all these

[21]The facilities we consider are primary, middle and post-secondary schools, library, local grocery shop, post office, police station, bus station, rail station, public toilet and bank branch.

[22]BMI is derived by dividing the individuals weight in kilograms by the square of their height in metres, and represents a measure of weight-for-height.

[23]Activities of Daily Living (ADL) are activities of daily living are activities related to personal care. They include bathing or showering, dressing, getting in and out of bed or a chair, walking, using the toilet, and eating.

characteristics as Z_{ihvb}.

The empirical model we estimate is a linear probability model given by:

$$Y_{ihvb} = \alpha_b + \beta_1 Dist_{PHC(vb)} + \beta_2 Dist_{SUBC(vb)} + \gamma * V_{vb} + \delta * X_{hvb} + \sigma * Z_{ihvb} + \epsilon_{ihvb} \quad (1)$$

The parameters of interest are β_1 and β_2. We calculate robust standard errors clustered at the level of village, since the two access variables of interest vary at that geographical level.

We have also observed in Figure 4 that the relationship of hypertension diagnosis and distances is different for the poor and non-poor. Hence in an alternate specification, we estimate a model that allows the marginal effect of the distances to vary by whether a household is poor or non-poor. To do this, we tweak the specification above to allow for an interaction of each of the distance variables by the indicator for whether the household is poor.

While we do not claim to have a clean causal effect, it is pertinent to ask what kinds of variables can confound our estimated effect. Since the variables of interest-the distance to sub centres and PHC vary at the village level, it is likely that village characteristics which are omitted confound the estimated effects. To explore the impact of any such bias, we estimate an alternate specification which includes village fixed effects α_v that absorb any village level variation. In such a case the absolute effect of the distances cannot be estimated as they vary at the level of the village. However, we can estimate the differential effect of the access variables by whether a household is poor. Therefore we estimate

$$Y_{ihv} = \alpha_v + \zeta_1 Dist_{PHC(v)} * poor + \zeta_2 Dist_{SUBC(v)} * poor + \delta * X_{hv} + \sigma * Z_{ihv} + \epsilon_{ihv} \quad (2)$$

The parameters of interest here are ζ_1 and ζ_2 and reflect whether, relative to others in the village, diagnosis among the poor is differentially affected by the distance cost.

6 MAIN RESULTS

We begin with looking at the average impact of distances to sub-centre and PHC in Table 5. For ease of presentation, we re-scale the distances so that a one unit change represents a change in distance by 10 km. In column (1), we estimate a specification where only distances to the two facilities are included. We also include block fixed effects in this specification. Column (2) adds village level demographic covariates where as in Column(3) we add household and individual level characteristics. Results cannot rule out that the distances to sub-centres and PHCs do not matter for hypertension diagnosis, when impacts are averaged across the full sample. While in column (1) we find that the distances are negatively correlated with hypertension diagnosis, when we control for various covariates these estimates become insignificant.

However, as alluded above, the unconditional distance gradients, as depicted in Figure 4, point out to a much larger negative distance cost for the poor. Hence, we present, in Table 6 results of an estimation exercise, where the distances are interacted with *Poor*. Columns (1) to (3) are analogous to the previous table, but now with interactions. It is now apparent that the brunt of distance cost, particular in the case of PHCs, is differentially borne by the poor. A 10 km increase in distance to the nearest PHC decreases hypertension awareness by 4.1 percentage points for the poor as compared to other households. The absolute impact of distance on the poor is also negative at 3.3 percentage points and has a p value of 0.03[24]. Given that only 46 % of the poor are aware of their hypertension status, this represents a 7.8 % effect. This effect is not small in magnitude, and is equivalent to the impact of around 5 years of schooling (as estimated in the specification, described later). Given that almost 27 % of our sample villages have PHCs more than 10 km away, this comparative static is important to take note of, and highlights to an important public health issue for a geographically left out population. The association of distance to sub-centres for hypertension awareness doesn't differentially affect the poor with an insignificant coefficient of the interaction. While the un-interacted estimate is also insignificant, calculation of marginal effects for the poor and non poor reveals a significant effect of distance for the former: the estimated marginal effect of a 10 km change in distance to the nearest sub-centre is -0.025, though it is much noisier with a p value of 0.093. Around 7 % of our sample villages have sub-centres more than 10 km away.

Estimating the interactions with the full sample imposes some parametric

[24]It is the sum of the coefficient of distance to PHC and the interaction term

restrictions-that the coefficients of all variables, save the distance are the same across the wealth quartiles-in particular for the poor and the others. We relax this assumption by estimating Equation 1 for each wealth quartile and report the results in Table 8. For obvious reasons, we drop the variable indicating household wealth status from this specification. We find that consistent with the results above, distance cost only affects the bottom 25 % poor household. The coefficient of the distance to PHC is significant with a p value of 0.011 and has a slightly higher point estimate of the marginal effect of 3.6 percentage points. Hence, if anything the distance cost of PHCs is higher- around 8 percent of the base effect. The association of distance to the nearest sub-centre is much noisier and points out that the effect is much less robust. This is not surprising as Sub-centres are generally less functional in rural India-it is likely that the effect is vary varied but on an average insignificant. This points out, that closer access to Sub-centres of average quality, as they exist in India, are unlikely to increase hypertension detection.

How confounded are the estimated partial correlations? Since distances vary at the level of village, village level omitted variables are likely to be the biggest threat to a causal interpretation. Thus we estimate specification (2) which includes village fixed effects. The results are presented in column (5) of Table 6. The coefficient of the distance to nearest PHC is not only significant at 5 percent but also very similar in magnitude to the specification with block fixed effects. These suggest that village level omitted variables that correlate with the placement of PHCs are not likely to contaminate our results.

Among other results (using estimates in Column (3) in Appendix Table A2), we find that the poor have lower hypertension detection than others by 2.9 percentage points, even when they have access to PHCs and Sub-centres. Women are almost 11 percentage points more likely to be aware of their hypertension status than men, everything else the same. Individuals from the disadvantaged communities- especially STs - are less likely to have their hypertension detected than general caste categories (the reference group). STs are 4.4 percentage points less likely to have their hypertension detected than the reference group. Higher educated individuals are more likely to be aware of their hypertension status, as are those living in households with larger number of individuals that can read or write. Household demographics has a more complicates relationship with awareness-individuals are less likely to be detected if they have a larger number of individuals in their household. The more the number of dependents, the larger the chance that an individual is aware of their hypertension status.[25]

One of the ways that an individual may be aware of their hypertension is as a un-intended consequence of their seeking treatment for other morbidities, some of which may be triggered or exacerbated by hypertension. Therefore, not surprisingly, we find that hypertension awareness is higher among those whose self reported morbidity is higher.

7 ROBUSTNESS

7.1 BOUND ANALYSIS

In the absence of a strong identification strategy, the coefficients that we estimate are likely to pick up some spurious correlation driven by omitted variables. How robust are these results to some departures from exogeneity? We have shown that the omitted variables are unlikely to be at the village level, but they may be at the level of the individual or household. We assess the extent of potential bias due to exclusion of such variables in the model following the strategy developed by Altonji et al., 2005 and Oster, 2019. This methodology is based on the idea that selection on observables can provide a useful guide to assess selection on unobservables. Since the use of this method is now standard, we do not explain the logic in detail. Instead, we specify how we calibrate parameters needed for the exercise. The method can be used to evaluate the bounds on only one coefficient-since our main specification involves an interaction, we cannot use it. Instead we use the results in column (1) in Table 8, where we run a regression for only the bottom quartile-the poor. We are interested in evaluating the bounds on the coefficient of distance to primary health centre-with some abuse of notation we refer to it as β_1.[26]

[25] All the households, by survey design, have older members-hence a higher dependency ratio indicates that there are lesser number of younger adults in the households. The presence of such adults may impose other more immediate needs that take away from the healthcare of the elderly.

[26] We run equation 1 only for the poor.

We start with a baseline regression where hypertension diagnosis is regressed on distance to nearest PHC and other village level controls (excluding the distance to sub-centre, a potentially endogenous variable), since it is clear that village level omitted variables are unlikely to be the cause of any bias. Subsequently, we add individual and household controls: our assumption is that the correlation between the distance to PHC and individual and household level variables convey some information about the correlation between the distance to PHC and omitted variables at the level of the individual or household. The relationship between the two correlations is parameterised by δ, an unknown parameter (more on this below). As a second step, we need to posit R^2_{max}, the R^2 of a hypothetical regression which accounts for all the omitted variables that are correlated with the variable of interest. Given the lack of a known R^2_{max}, we follow Oster, 2019 suggestion and set R^2_{max} as 1.3 times the R^2 of the regression that controls for all the observable covariates that we have used in our regression (control regression). Since the R^2 in our main specification is 0.31, we set $R^2_{max} = 0.41$. The robustness check suggested by Oster, 2019 is that the interval $[\beta_1(control), \beta_1((min(1.3 * R^2, 1), \delta = 1)]$ should not contain 0. It is indeed true in our case. As can be seen in Table 11, $\beta_1(0.41, \delta = 1) = -0.044$. Moreover, we provide the value of δ for which β_1 would become 0. The obtained value of -7.81 is high since Oster, 2019 found that the average value of δ was 0.545 with 86% of the values of δ in well identified studies falling within $[0, 1]$. Alternatively, we show that even when $R^2_{max} = 1$, β is never 0 when $\delta = 1$.

Thus, this exercise indicates that the estimated coefficient of distance to nearest primary health centre is robust to potential omitted variable bias. However it is important to also point out that the values taken for this bound analysis are necessarily ad-hoc. Therefore we provide some additional robustness exercises below.

7.2 NEAREST PUBLIC PRIMARY CARE

While we have estimated the distance cost of PHCs and sub-centres separately, an individual's hypertension may be potentially diagnosed at the nearest public primary facility, irrespective of whether it is a sub centre or a PHC. Hence, in an alternate specification in Table 7, we consider, instead of the distance to sub centre and to PHC separately, only one access variable, wherein we consider the distance to the nearest sub-centre *or* PHC: we denote it by $Dist_{min(PHC,SUBC)}$. Analogous to specifications above, we consider its interaction with whether the household is poor. Further, we also look at an intra-village comparison of the poor and non poor in the sensitivity of hypertension diagnosis to access, defined in this way. Our results show that there is a distance cost of the nearest primary facility-while the point estimates are larger, the access variable has a relatively lower mean, since sub centres are mostly, though not always nearer. We are ambivalent in the interpretation of this coefficient-it is possible that it is an average effect of a mix of PHC and sub-centres, each with a very heterogeneous effect. However, the fact that these results indicate that primary health access, defined in an alternate way, still has an impact on hypertension diagnosis, is reassuring.

7.3 OTHER HEALTH FACILITIES

It is possible that villages that are close to primary health care centres are developed and have both private clinics and hospitals as well public secondary and tertiary health centres-Community Health Centres (CHCs) as well as district hospitals. If so, it may be the case that what we pick up as the impact of the access to PHCs is attributable to the presence of these health facilities. We do not control for the distance to these facilities in our main specification as the location of these facilities, in particular private facilities, is likely to be endogenous. However, in this section, we explore if our estimated coefficient attenuates a lot if we account for these facilities.[27] In Table 10, we present results from two estimation exercises-in column (2), we include, in our main specification, the distance to the nearest private clinic or hospital; in column (3) we include (instead) the distance to the nearest CHC and district hospital. The sample size in column (3) is different since the location of CHCs and district hospitals is sourced from a different source-data for the state of West Bengal was not available in this data source. When contrasted with column (1), which presents the results of our baseline re-

[27]Also we do not wish to interpret the coefficient of the distance to these facilities given the potential endogeneity in their location.

gression, we find the coefficient remains almost similar in column (2). In the case of results in column (3), we compare the point estimates to those reported in column (4) where we estimate our baseline specification but for a sample that excludes West Bengal. The point estimate in column(3) stays significant and comparable to that obtained in column(4).

7.4 VILLAGE LEVEL INCOME

While we show results that suggest that village level omitted variables are unlikely to confound our point estimate of the distance cost, we are not able to completely rule out the impact of an important confounder-the level of prosperity of the village.[28] However, the prosperity of the village may itself be a result of better health of its population which makes it a potential endogenous variable. However, in the spirit of the previous exercise, we control for a proxy of village level income in order to see if our point estimate of interest remains stable. We proxy village level income by night lights luminosity.[29] Column (2) in Table 9 reports the result of this estimation and finds that inclusion of night lights per-capita implies almost the same marginal effect of distance for the poor in its absolute value as well as relative to the non-poor.

To conclude, our results survive some robustness checks. While we still insist on cautious interpretation of our results, our additional analysis points out to a high probability that access to PHCs is a critical dimension for hypertension diagnosis for the poor.

8 HETEROGENEITY

In this section we explore if the distance cost differs by demographics. We limit our analysis to the poor as it is apparent that they bear the brunt of the distance cost.

[28] An argument we have made earlier is that the coefficient of the interaction (which is the relative impact of distance for the poor), remains unchanged when accounting for village fixed effects-however, the overall effect may well be different and given that it is not identified in this specification, we cannot rule this out completely.

[29] Given lack of village level income data, this is often used in the literature on growth as a proxy for the GDP of the region.

8.1 Age

Early detection may need individuals to have easy access to PHCs when they are relatively younger, for example in the age group 45-60. To address this issue, we look at the cohort aged 45-60: the presence or absence of PHCs for them can answer the question of whether PHC access matters for relatively early detection of hypertension. Column (1) in Table 15 reports the result of this exercise- we find that the effects are negative and in-fact larger in magnitude than for the over-all population. The impacts for those 60 and above are lower in magnitude and while the point estimate remains negative, it is insignificant.[30] When individuals are 60 and above and morbidities increase, access may not be an issue, as individuals seek health care at all cost, when symptoms surface. Moreover, the regressions for those 60 and above are besotted with an additional issue- that we may have selection in survival based on detection-this problem is likely get more acute with age. That the results are driven by the age group 45-60 is then reassuring because our results are then unlikely to be contaminated by such selective mortality.

The results for the age group 45-60 also address the issue of early detection. As pointed out above, early detection is an important part of hypertension control strategy. Clearly access to PHCs around middle age is important for early detection. Early detection, in turn is important for controlling hypertension-either through treatment or/and life style changes. This can be seen for our sample too in Table 12-if we consider the population 60 and above (and for the moment, keeping the issue of selective mortality aside), we see that detection before the age of 55 (a rough proxy for early detection under the assumption that most hypertensive patients start showing higher BP post 45) is negatively correlated with the occurrence of Stage 2 hypertension (a systolic pressure above 180 and diastolic pressure above 100).[31]

[30]While the result pointing out to the distance cost for the age group 45-60 is more robust, there is no significant difference between the coefficient of distance to PHCs across the two age groups. This could be because the coefficient for the age group 60 and above is estimated with a lot of noise.

[31]An argument can be made that those who are detected earlier as those who are afflicted with hypertension earlier. It is virtually impossible to detect onset of hypertension barring periodic screening. But our results suggest that it is not the case that those who are screened early are necessarily individuals on a worse trajectory of hypertension.

8.2 Sex and Caste

To explore whether distance cost varies by sex and by caste, we run regressions for each of the groups separately. As Table 16 shows, the impact of distance cost is more robust for females as compared to males. Similarly, we find that the impact of distance to PHCs is insignificant for SC/ST households where as it is significant for households of other castes (includes OBCs).[32] We cannot however claim that the coefficients across males and females as well as between SC/ST and other castes are different from each other as statistical tests cannot rule out the hypothesis that they are the same.[33]

8.3 BIMARU States

BIMARU states in India(Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh) are more underdeveloped with poor health outcomes. We explore whether the distance costs bind for BIMARU states differently as compared to other states. When we run separate regressions for individuals in Table 14 for BIMARU and other states, we find a robust distance cost in BIMARU states; the coefficient of distance to PHC for non BIMARU state is not significant. However, when we test if the coefficient of the relevant distance variable differs across the two kinds of states, we cannot reject the null hypothesis that they are the same.

9 DISCUSSION AND CONCLUSION

In this paper we have shown that PHC expansion can be beneficial for hypertension diagnosis. How expensive would such expansion be? As a thought experiment, we provide a back of the envelope calculation of the cost of opening a PHC in villages which are currently more than 10 km away from such facilities. We focus on five large states of India that need the highest numbers of PHCs by this metric. To calculate the number of PHCs necessary, we sum the population of villages located more than 10 kilometre away from the nearest PHC and divide

[32] We club SC and ST household together to have enough sample size in each regression. While issues differ across the two caste categories, they are considered as the historically backward community.

[33] These can be gauged by looking at Appendix Table A2

it by 30,000. The latter is chosen because India's public health norms, laid down by the federal government, mandate setting up 1 PHC for over 30,000 individuals. Table 17 lists the states and the number of additional PHCs necessary to meet the norms in these states. The central Indian state of Madhya Pradesh, for example, requires 239 additional PHCs to comply with the population-to-PHC ratio envisaged under National Rural Health Mission (NRHM). We assume that these additional PHCs would be located in regions where the placement has the greatest bite on reducing average distance to health facility.

We need two additional estimates to arrive at the figures provided in the table. The state expenditures on health are measured in 2019-20 and obtained from Budget Analysis performed by PRS Legislative Research[34]. These are used as denominators for Columns (3) and (4) in Table 17. The numerators are obtained by multiplying the requirement listed in Column (2) by cost of setting up the PHC obtained from recent PHC expansion in Tamil Nadu, which suggests that setting up a PHC entails capital non-recurring expenditures of Rs. 44.3 lakh and recurring annual expenditures of Rs. 41 lakh (Govt. of TN, 2014)[35]. Using these estimates, we find that states must devote between 1 and 4 % of their health budgets to bring the health facilities closer to their populace, potentially bridging the diagnosis inequality estimated in this paper.

To conclude, our results suggest that opening PHCs may have benefits in terms of hypertension detection since the poor are likely to be undiagnosed if PHCs are distant. This is ofcourse only one advantage of having PHCs closer-given that other NCDs-like diabetes and Cardio-vascular diseases share similar problems of non detection, such an expansion is likely to have a much larger impact, in particular for communities which have poor access to primary health care.

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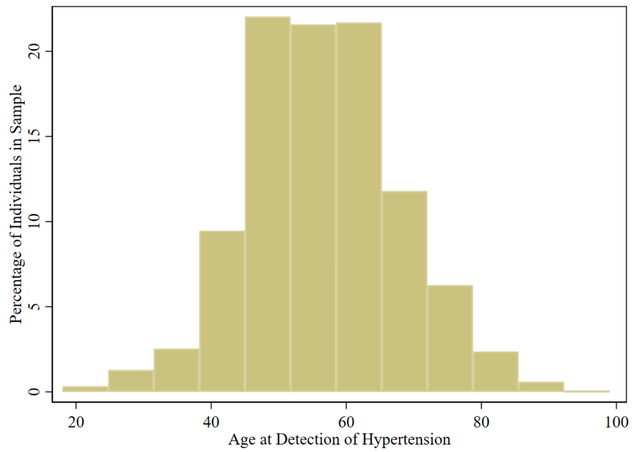
[34] For undividied Andhra Pradesh, we sum up the health budgets of Telangana and Andhra Pradesh. See here for an example of Budget Analysis from Maharashtra: https://prsindia.org/budgets/states/maharashtra-budget-analysis-2019-20.

[35] We do not adjust these numbers for inflation. Additionally, the literature finds large differences in costs of setting up and operationalising PHCs, with operational costs ranging from Rs. 1.2 crore in recent estimates from Gujarat (Gupta et al., 2022) to Rs. 88 lakh in other states (Prinja et al., 2016). We use these numbers as they report operational and capital costs separately.

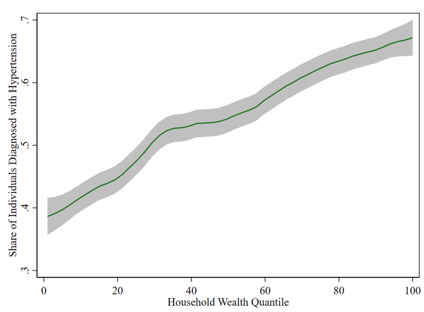
10 FIGURES

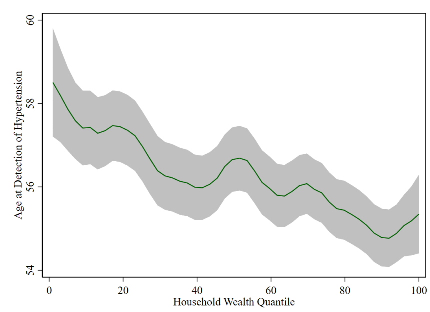
Figure 1: Age of Detection among those diagnosed with Hypertension , Rural India



Notes. This figure shows the histogram of age of detection among individuals diagnosed with hypertension in our sample. N=6943. Sample weights from LASI are used during the construction of the histogram. *Source*: *Longitudinal Ageing Survey of India Main Wave - I (2017-2019)*

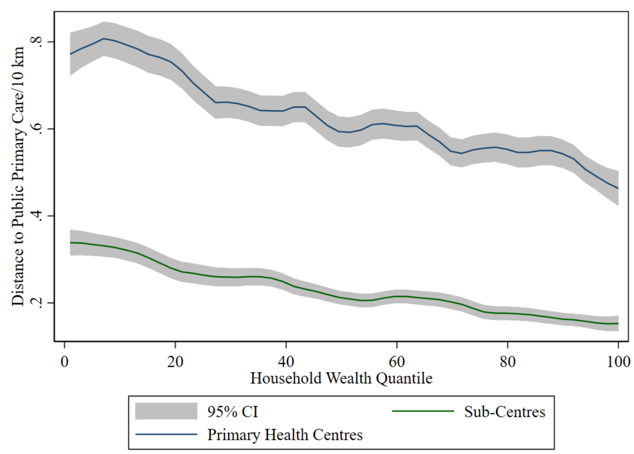
Figure 2: Hypertension Diagnosis Parameters Across Household Wealth Quantile

[] 

[] 

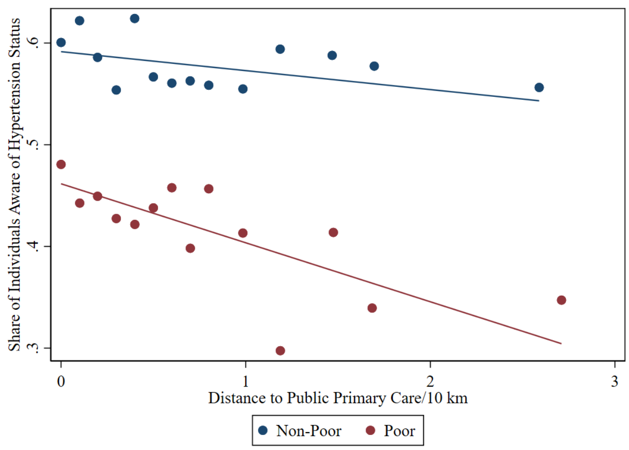
Note. This figure plots a local polynomial curve to show how various hypertension diagnosis parameters - diagnosis rate in Figure (a) and Age-at-Detection in Figure (b) - differ across household wealth. The x-axis in both figures shows the percentile of household wealth, calculated using an asset index. The y-axis shows the propensity of detecting hypertension among 13006 adults in (a), and the age at detection of hypertension among 7200 diagnosed hypertensive individuals in (b). The gray band shows a 95% confidence interval around the mean. At higher levels of household wealth, individuals are more likely to be detected with hypertension, and know their hypertensive status at an early age. *Source*: *Longitudinal Ageing Survey of India Main Wave - I (2017-2019)*

Figure 3: Distance to Primary Healthcare, by Household Wealth



Notes. This figure plots a local polynomial curve showing the average distance from primary care facilities - Sub-centres and Primary Health Centres (PHCs) - by household wealth for 13006 individuals in our sample. Thus, the y-axis is the average distance to these facilities, measured in kilometres. The x-axis has household wealth quantiles. The gray band shows the 95% confidence interval. We see that Sub-centres are located closer than PHCs at all levels of household wealth, but these gaps become narrower at higher wealth. The average distances to both facilities is lower for individuals in richer households. *Source*: *Longitudinal Ageing Survey of India Main Wave - I (2017-2019)*

Figure 4: Effect of Distance from Primary Care on Diagnosis Rates for Hypertension, by Household Wealth



Notes. This figure uses binscatter plot to show differences in diagnosis rates of hypertension among individuals belonging to poor and non-poor households, located at different distances from the nearest PHC. A household is poor if it falls in the bottom 25% of the wealth distribution. Two patterns emerge - at any distance, the diagnosis rates among poor households are lower than their non-poor counterparts, and the diagnosis rates fall more sharply for poor households located further away from primary care. *Source*: *Longitudinal Ageing Survey of India Main Wave - I (2017-2019)*

11 TABLES

Table 1: Summary Statistics, Characteristics of Sample Individuals

Characteristic	N (1)	Mean (2)	Standard Deviation (3)
Demographics			
Sex: Female	12842	0.58	0.49
Age	12842	62.0	10.5
Religion: Christian	12842	0.03	0.18
Hindu	12842	0.83	0.37
Muslim	12842	0.09	0.28
Sikh	12842	0.03	0.18
Caste: SC	12842	0.21	0.41
ST	12842	0.10	0.30
OBC	12842	0.46	0.50
Socio-Economic characteristics			
Years of Education	12842	2.89	4.19
Widow	12842	0.28	0.45
Currently Working	12842	0.43	0.50
Health & Behavioral characteristics			
Weight	12842	54.2	12.9
BMI	12842	22.5	4.58
Waist-Hip Ratio	12842	0.93	0.08
ADL Index	12842	0.14	0.21
Consumes Alcohol	12842	0.16	0.36
Smokes Tobacco	12842	0.38	0.48
Household characteristics			
Household Size	12842	4.96	2.78
Dependency ratio	12842	0.46	0.30
Number Literates	12842	2.46	1.94
Number Graduates	12842	0.33	0.77
HH in Lowest Wealth Quartile	12842	0.23	0.42

Notes: This table reports the summary statistics of 12842 middle-aged and elderly individuals included in our sample. These individuals either possess biomarkers of hypertension or self-report hypertension diagnosis. The entries in Column (1) show the number of villages, those in Column (2) report the mean of the characteristic, and Column (3) populates the standard deviation for reported means. We use survey weights provided by LASI for these calculations.
Source: *Longitudinal Ageing Survey of India Main Wave - I (2017-2019)*

Table 2: Summary Statistics, Outcomes of Sample Individuals

	(1) N	(2) Mean	(3) SD
Hypertension Awareness	12842	0.54	0.50
Stage 2 or higher Hypertension	12842	0.20	0.40
Age at Detection	6943	56.4	11.4

Notes: This table reports the summary statistics of 12842 middle-aged and elderly individuals included in our sample. These individuals either possess biomarkers of hypertension or self-report hypertension diagnosis. The entries in Column (1) show the number of individuals, those in Column (2) report the mean of the characteristic, and Column (3) populates the standard deviation for reported means. We use survey weights provided by LASI for these calculations.s
Source: *Longitudinal Ageing Survey of India Main Wave - I (2017-2019)*

Table 3: Summary Statistics II, Outcomes of Sample Individuals

Characteristic	N	Mean	Standard Deviation
	(1)	(2)	(3)
Panel A: By Gender			
Male			
Hypertension Awareness	5506	0.49	0.50
Stage 2 or Higher Hypertension	5506	0.20	0.40
Age at Detection	2630	57.9	11.2
Female			
Hypertension Awareness	7336	0.58	0.49
Stage 2 or Higher Hypertension	7336	0.19	0.39
Age at Detection	4313	55.5	11.4
Panel B: By Wealth			
Non-Poor			
Hypertension Awareness	10116	0.57	0.50
Stage 2 or Higher Hypertension	10116	0.20	0.40
Age at Detection	5827	56.0	11.3
Poor			
Hypertension Awareness	2726	0.46	0.50
Stage 2 or Higher Hypertension	2726	0.20	0.40
Age at Detection	1116	58.0	11.4
Panel C: By Age			
45-60			
Hypertension Awareness	5522	0.52	0.50
Stage 2 or Higher Hypertension	5522	0.18	0.38
Age at Detection	2869	47.2	6.70
60+			
Hypertension Awareness	7320	0.56	0.50
Stage 2 or Higher Hypertension	7320	0.21	0.41
Age at Detection	4074	62.4	9.66

Notes: This table reports the summary statistics on hypertension outcomes of 12842 middle-aged and elderly individuals included in our sample. The entries in Column (1) show the number of individuals, those in Column (2) report the mean of the characteristic, and Column (3) populates the standard deviation for reported means. We use survey weights provided by LASI for these calculations.There are three panels that report the means for the population, and separately by gender, wealth status and age. The sample size is smaller for the last entry in each panel as it is conditional on diagnosis of hypertension.
Source: *Longitudinal Ageing Survey of India Main Wave - I (2017-2019)*

Table 4: Summary Statistics, Sample Villages

Characteristic	N (1)	Mean/Share (2)	Standard Deviation (3)
Distance to Primary Care			
Sub-centres			
Average Distance	1352	2.45	4.65
d $<$ 1 km	749	55.4%	
1 km $\leq$ d $<$ 5 km	343	25.4%	
5 km $\leq$ d $<$ 10 km	170	12.6%	
d $\geq$ 10 km	88	6.5%	
Primary Health Centres			
Average Distance	1352	6.59	7.07
d $<$ 1 km	289	21.4%	
1 km $\leq$ d $<$ 5 km	331	24.5%	
5 km $\leq$ d $<$ 10 km	372	27.5%	
d $\geq$ 10 km	360	26.6%	
Other Characteristics			
Demographics			
Population/1000	1352	3.88	5.23
Share SC	1352	0.16	0.17
Share ST	1352	0.19	0.33
Sex Ratio (F per M)	1363	958.3	95.2
Share Hindu	1352	0.72	0.34
Share Muslim	1352	0.12	0.24
Socioeconomic Characteristics			
Share Literate (M)	1352	0.66	0.14
Share Literate (F)	1352	0.52	0.15
Share Non-Health Public Assets	1352	0.49	0.25

Notes: This table reports the summary statistics of 1352 villages whose residents are included in our sample. The entries in Column (1) show the number of villages, those in Column (2) report the mean of the characteristic or the share of the villages who exhibit a characteristic, and Column (3) populates the standard deviation for reported means. While other characteristics are self-explanatory, the share of non-health public goods reflects how many public facilities are present out of a basket of 11 facilities - primary, middle and higher public school, library, kirana store, post-office, police station, bus and rail stations, public toilet and bank branch. *Source*: *Longitudinal Ageing Survey of India Main Wave - I (2017-2019)*

Table 5: Estimated Effects of Primary Health Care Accessibility on Hypertension Diagnosis

Coefficient	(1)	(2)	(3)
	Outcome: Detection of Hypertension		
$Dist_{PHC}$	-0.012	-0.005	-0.005
	(0.0083)	(0.0083)	(0.0078)
$Dist_{SUBC}$	-0.026**	-0.013	-0.012
	(0.0107)	(0.0107)	(0.0104)
Block FE	Y	Y	Y
Village Covars		Y	Y
HH & Indi Covars			Y
N	12842	12842	12842
R-Sqaured	0.118	0.121	0.184

Notes: This table reports the results from OLS regression to estimate the effect of distance from primary care on hypertension diagnosis rates. The diagnosis of hypertension as the outcome variable across all columns. The models in Columns (1)-(3) have block fixed-effects. In Column (1), we use distance from the nearest PHC and Sub-centre as the explanatory variables. There are no additional covariates. We progressively add additional covariates in (2)-(5). Column (2) adds village covariates like village population, share of population from marginalized castes and tribes, availability of non-health public goods, and village literacy rates. Column (3) adds household and individual covariates to the specification. The brackets contain robust standard errors clustered at the village level. **** p<0.01, ** p<0.05, * p<0.1*

Source: *Longitudinal Ageing Survey of India Main Wave - I (2017-2019)*

Table 6: Estimated Effects of Primary Health Care Accessibility on Hypertension Diagnosis, Interaction

Coefficient	(1)	(2)	(3)	(4)
	Outcome: Detection of Hypertension			
$Dist_{PHC}$	0.000	0.006	0.008	
	(0.0089)	(0.0091)	(0.0086)	
$Dist_{PHC} * Poor$	-0.030**	-0.031**	-0.041***	-0.038**
	(0.0151)	(0.0150)	(0.0142)	(0.0164)
$Dist_{SUBC}$	-0.012	-0.003	-0.004	
	(0.0136)	(0.0135)	(0.0137)	
$Dist_{SUBC} * Poor$	-0.028	-0.026	-0.018	-0.016
	(0.0212)	(0.0213)	(0.0201)	(0.0245)
Block FE	Y	Y	Y	
Village FE				Y
Village Covars		Y	Y	
HH & Indi Covars			Y	Y
N	12842	12842	12842	12842
R-Squared	0.123	0.126	0.186	0.261

Notes: This table reports the results from OLS regression to estimate the effect of distance from primary care on hypertension diagnosis rates. The diagnosis of hypertension as the outcome variable across all columns. The models in Columns (1)-(3) have block fixed-effects, while Column (4) reports results from specification with Village Fixed Effects. In Column (1), we use distance from the nearest PHC and Sub-centre, and their interaction with a dummy variable indicating that a household is in bottom 25% of income distribution, as the explanatory variables. There are no additional covariates. We progressively add additional covariates in (2)-(4). Column (2) adds village covariates like village population, share of population from marginalized castes and tribes, availability of non-health public goods, and village literacy rates. Column (3) adds household and individual covariates to the specification. Column (4) reports results from specifications with village fixed-effects. The brackets contain robust standard errors clustered at the village level. **** p<0.01, ** p<0.05, * p<0.1*
Source: *Longitudinal Ageing Survey of India Main Wave - I (2017-2019)*

Table 7: Estimated Effects of Primary Health Care Accessibility on Hypertension Diagnosis, Interaction

Coefficient	(1)	(2)	(3)	(4)	(5)
	Outcome: Detection of Hypertension				
$Dist_{min(PHC,SUBC)}$	-0.019	-0.008	-0.007	-0.009	
	(0.0192)	(0.0196)	(0.0191)	(0.0190)	
$Dist_{min(PHC,SUBC)} * Poor$	-0.060*	-0.057*	-0.052*	-0.052*	-0.067*
	(0.0306)	(0.0303)	(0.0289)	(0.0288)	(0.0356)
Block FE	Y	Y	Y	Y	
Village FE					Y
Village Covars		Y	Y	Y	
HH & Indi Covars			Y	Y	Y
N	12842	12842	12842	12842	12842
R-Squared	0.123	0.126	0.186	0.186	0.261

Notes: This table reports the results from OLS regression to estimate the effect of distance from primary care on hypertension diagnosis rates. The diagnosis of hypertension as the outcome variable across all columns. The models in Columns (1)-(4) have block fixed-effects, while Column (5) reports results from specification with Village Fixed Effects. In Column (1), we use distance from the nearest PHC and Sub-centre, and their interaction with a dummy variable indicating that a household is in bottom 25% of income distribution, as the explanatory variables. There are no additional covariates. We progressively add additional covariates in (2)-(5). Column (2) adds village covariates like village population, share of population from marginalized castes and tribes, availability of non-health public goods, and village literacy rates. Column (3) adds household and individual covariates to the specification. Column (4), in addition, controls for potentially endogenous distances to private health facilities. Column (5) reports results from specifications with village fixed-effects. The brackets contain robust standard errors clustered at the village level. **** p<0.01, ** p<0.05, * p<0.1* *Source*: *Longitudinal Ageing Survey of India Main Wave - I (2017-2019)*

Table 8: Estimated Effects of Primary Health Care Accessibility on Hypertension Diagnosis (by Wealth Quartiles)

Coefficient	(1) bottom 25%	(2) 25-50%	(3) 50-75%	(4) above 75%
	Outcome: Detection of Hypertension			
$Dist_{PHC}$	-0.036**	0.001	0.007	0.004
	(0.0141)	(0.0169)	(0.0166)	(0.0140)
$Dist_{SUBC}$	-0.014	0.006	0.022	-0.035
	(0.0160)	(0.0233)	(0.0283)	(0.0242)
N	2686	2741	3249	4055
R-Squared	0.313	0.271	0.216	0.203

Notes: This table reports the results from OLS regression to estimate the effect of distance from primary care on hypertension diagnosis rates. The diagnosis of hypertension as the outcome variable across all columns. They control for the most saturated specification - block FE, household, individual, and village characteristics from Column (3) of Table 6. **** p<0.01, ** p<0.05, * p<0.1*
Source: *Longitudinal Ageing Survey of India Main Wave - I (2017-2019)*

Table 9: Estimated Effects of Primary Health Care Accessibility on Hypertension Diagnosis With SHRUG Covariates

Coefficient	(1)	(2)
	Outcome: Detection of Hypertension	
$Dist_{PHC}$	0.009	0.009
	(0.0094)	(0.0094)
$Dist_{PHC} * Poor$	-0.038**	-0.038**
	(0.0153)	(0.0153)
$Dist_{SUBC}$	-0.006	-0.005
	(0.0146)	(0.0146)
$Dist_{SUBC} * Poor$	-0.017	-0.018
	(0.0208)	(0.0208)
N	12094.000	12094.000
R-Squared	0.186	0.186

Notes: This table reports the results from OLS regression to estimate the effect of distance from primary care on hypertension diagnosis rates. Column (1) use the specification from Column (3) of Table 6, while Column (2) supplements the specification with additional control variables from SHRUG. **** p<0.01, ** p<0.05, * p<0.1* *Source*: *Longitudinal Ageing Survey of India Main Wave - I (2017-2019)*

Table 10: Estimated Effects of Primary Health Care Accessibility on Hypertension Diagnosis With CHC & DH location

Coefficient	(1) Main Spec.	(2) Priv. Fac.	(3) Main Spec.	(4) CHC/DH
	Outcome: Detection of Hypertension			
$Dist_{PHC}$	0.008	0.005	0.009	0.009
	(0.0086)	(0.0086)	(0.0091)	(0.0092)
$Dist_{PHC} * Poor$	-0.041***	-0.040***	-0.039***	-0.038***
	(0.0142)	(0.0143)	(0.0146)	(0.0147)
$Dist_{SUBC}$	-0.004	-0.006	-0.005	-0.005
	(0.0137)	(0.0135)	(0.0142)	(0.0142)
$Dist_{SUBC} * Poor$	-0.018	-0.018	-0.018	-0.018
	(0.0201)	(0.0200)	(0.0207)	(0.0207)
N	12842	12842	12172	12172
R-Squared	0.186	0.186	0.187	0.188

Notes: This table reports the results from OLS regression to estimate the effect of distance from primary care on hypertension diagnosis rates, by adding additional variables to specification from Column (3) of Table 6. Columns (1) and (3) replicate the specification, with Column (3) aligning the sample size to data availble for Column (4). Column (2) controls for distances to private facilities - clinics and hospitals - to the specification. Column (4) controls for distances to secondary public health facilities - CHC and District Hospitals. **** p<0.01, ** p<0.05, * p<0.1* *Source*: *Longitudinal Ageing Survey of India Main Wave - I (2017-2019)*

Table 11: Oster Bounds Analysis

	Coefficient on $Dist_{PHC}$ from Column (1) of Table 8				
	Uncontrolled	Controlled	Identified (Estimated Bias)		
			$R^2_{max} = 0.41$		$\delta = 1$
			β_s for $\delta = 1$	δ for $\beta = 0$	R^2_{max} for $\beta = 0$
β_s	-0.032	-0.036	-0.044	-7.81	0.31
R^2	0.008	0.31			

Notes: This table reports the results from OLS regression with the detection of hypertension as the outcome variable. *Source*: *Longitudinal Ageing Survey of India Main Wave - I (2017-2019)*

Table 12: Estimated Effects of Early Detection of Hypertension on Having Stage-2 Hypertension Later in Life

Coefficient	(1)	(2)	(3)	(4)
	Outcome: Stage 2 Hypertension			
Early Detection	-0.062***	-0.048***	-0.048***	-0.048**
	(0.0142)	(0.0142)	(0.0142)	(0.0142)
Sample Size	7428	7428	7428	7428
R-Squared	0.083	0.088	0.089	0.09

Notes: This table reports the results from OLS regression to estimate the effect of the age-at-diagnosis on the propensity of displaying biomarkers for Stage-2 hypertension on the day of the interview. Across all columns, the outcome variable is the presence of Stage-2 hypertension biomarker on the day of interview. We limit ourselves to the sample of individuals aged 60 or above. Early detection is described as being detected before 50 years. The models used to estimate parameters across columns contain block fixed-effects. We progressively add covariates in moving from Column (1) through (4). In Column (1), no additional covariates are used, but Column (2) contains individual and household-level covariates. Column (3) adds village level covariates, and Column (4) controls for distances to primary health facilities alongside their interaction with household wealth, and distances to private health facilities. **** p0.01, ** p0.05, * p0.1*
Source: *Longitudinal Ageing Survey of India Main Wave - I (2017-2019)*

Table 13: Heterogeneous Effects - SC/ST

Coefficient	(1) SC/ST	(2) Others
	Outcome: Detection of Hypertension	
$Dist_{PHC}$	-0.022	-0.068**
	(0.0197)	(0.0289)
$Dist_{SUBC}$	-0.000	-0.055
	(0.0209)	(0.0395)
N	1462	1264
R-Squared	0.415	0.348

Notes: This table reports the results from OLS regression with the detection of hypertension as the outcome variable. We limit our sample to the individuals belonging to the bottom quartile of household wealth. We show whether the distance has different effects for scheduled caste and scheduled tribe individuals.
**** p0.01, ** p0.05, * p0.1*
Source: *Longitudinal Ageing Survey of India Main Wave - I (2017-2019)*

Table 14: Heterogeneous Effects - BIMARU States

Coefficient	(1) BIMARU States	(2) Others
	Outcome: Detection of Hypertension	
$Dist_{PHC}$	-0.047**	-0.022
	(0.0213)	(0.0187)
$Dist_{SUBC}$	0.018	-0.028
	(0.0314)	(0.0206)
N	1201	1525
R-Squared	0.311	0.350

Notes: This table reports the results from OLS regression with the detection of hypertension as the outcome variable. We limit our sample to the individuals belonging to the bottom quartile of household wealth. We show whether the distance has different effects for scheduled caste and scheduled tribe individuals.
**** p0.01, ** p0.05, * p0.1*
Source: *Longitudinal Ageing Survey of India Main Wave - I (2017-2019)*

Table 15: Heterogeneous Effects - Age

Coefficient	(1)	(2)
	Outcome: Detection of Hypertension	
	45-60	60+
$Dist_{PHC}$	-0.050*	-0.016
	(0.0295)	(0.0179)
$Dist_{SUBC}$	-0.004	-0.036*
	(0.0338)	(0.0209)
N	1016	1710
R-Squared	0.493	0.371

Notes: This table reports the results from OLS regression with the detection of hypertension as the outcome variable. We limit our sample to the individuals belonging to the bottom quartile of household wealth. Column (1) reports the result for 45-60 years old, while Column (2) focuses on elderly above 60 years. **** p0.01, ** p0.05, * p0.1*

Source: Longitudinal Ageing Survey of India Main Wave - I (2017-2019)

Table 16: Heterogeneous Effects - Gender

Coefficient	(1) Female	(2) Male
	Outcome: Detection of Hypertension	
$Dist_{PHC}$	-0.044**	-0.031
	(0.0188)	(0.0239)
$Dist_{SUBC}$	-0.008	-0.009
	(0.0245)	(0.0256)
N	1643	1083
R-Squared	0.375	0.465

Notes: This table reports the results from OLS regression with the detection of hypertension as the outcome variable. We limit our sample to the individuals belonging to the bottom quartile of household wealth. Column (1) reports the result for 45-60 years old, while Column (2) focuses on elderly above 60 years. **** p0.01, ** p0.05, * p0.1*

Source: Longitudinal Ageing Survey of India Main Wave - I (2017-2019)

Table 17: Tentative Estimates of Additional Investments in Public Health Infrastructure

State	No. of PHCs	Non-Recurring Costs (%age of Health Budget 2019-20)	Recurring Annual Costs (%age of Health Budget 2019-20)
(1)	(2)	(3)	(4)
Madhya Pradesh	239	1.0	0.9
Andhra Pradesh	153	0.4	0.4
Maharashtra	119	3.3	3.1
Rajasthan	104	3.5	3.2
Jharkhand	97	1.0	1.0

Notes: This table reports tentative estimates for additional capital and operational expenditures necessary to create additional health infrastructure that might potentially bridge the gap in diagnosis rates for underserved populations in five (now six) large states of India.

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Appendix

Table A1: Estimates of the Effect of Distance on Hypertension Diagnosis

Coefficient	(1)	(2)	(3)
	Outcome: Detection of Hypertension		
$Dist_{PHC}$	-0.012	-0.005	-0.005
	(0.0083)	(0.0083)	(0.0078)
$Dist_{SUBC}$	-0.026**	-0.013	-0.012
	(0.0107)	(0.0107)	(0.0104)
Village Covariates			
Public Goods Q2		-0.007	-0.009
		(0.0163)	(0.0153)
Public Goods Q3		-0.013	-0.020
		(0.0169)	(0.0157)
Public Goods Q4		0.006	0.002
		(0.0181)	(0.0172)
Popn./1000		0.001	0.000
		(0.0016)	(0.0016)
Share SC		-0.022	0.018
		(0.0419)	(0.0415)
Share ST		-0.171***	-0.065
		(0.0440)	(0.0436)
Share Hindu		-0.000	0.017
		(0.0257)	(0.0244)
Share Muslim		0.041	0.022
		(0.0325)	(0.0318)
Sex Ratio		-0.000	-0.000
		(0.0001)	(0.0001)
Share Literate (M)		0.107	0.138
		(0.1264)	(0.1182)
Share Literate (F)		0.178	0.036

	(0.1130)	(0.1068)
Indi. & HH Covars		
Sikh		0.015
		(0.0429)
Christian		0.031
		(0.0249)
Muslim		0.016
		(0.0202)
Age		0.001**
		(0.0006)
Female		0.111***
		(0.0140)
SC		-0.004
		(0.0147)
ST		-0.051**
		(0.0218)
OBC		0.017
		(0.0125)
Childhood Health		-0.038***
		(0.0138)
Live With Spouse+Others		0.009
		(0.0302)
Live With Spouse+Children		0.003
		(0.0311)
Live With Others+Children		0.029
		(0.0233)
Live With Others Only		-0.020
		(0.0286)
Years of Edu		0.004***
		(0.0014)
Widow		-0.005
		(0.0254)
Currently Working		-0.055***

			(0.0105)
Dependency Ratio			0.045**
			(0.0205)
HH No. Graduates			0.001
			(0.0068)
HH No. Literate			0.015***
			(0.0043)
HH Size			-0.008***
			(0.0029)
ADL Index			0.086***
			(0.0227)
Morbidity Index			3.902***
			(0.2516)
Weight			0.020***
			(0.0033)
$Weight^2$			-0.000***
			(0.0000)
BMI			-0.035***
			(0.0096)
BMI^2			0.001***
			(0.0002)
Waist Hip Ratio			-0.059
			(0.4274)
$WaistHipRatio^2$			0.077
			(0.2164)
Consumes Alcohol			-0.045***
			(0.0134)
Smokes Tobacco			-0.017
			(0.0109)
Constant	0.559***	0.472***	0.080
	(0.0070)	(0.0914)	(0.2317)
Block FE	Y	Y	Y
Village Covars		Y	Y

HH & Indi Covars			Y
N	12842	12842	12842
r2	0.118	0.121	0.184

Table A2: Estimates of the Effect of Distance on Hypertension Diagnosis, Interaction

	(1)	(2)	(3)	(4)
Coefficient				
	Outcome: Detection of Hypertension			
$Dist_{PHC}$	0.000	0.006	0.008	
	(0.0089)	(0.0091)	(0.0086)	
Poor	-0.072***	-0.065***	-0.029*	-0.023
	(0.0171)	(0.0171)	(0.0174)	(0.0190)
$Dist_{PHC} * Poor$	-0.030**	-0.031**	-0.041***	-0.038**
	(0.0151)	(0.0150)	(0.0142)	(0.0164)
$Dist_{SUBC}$	-0.012	-0.003	-0.004	
	(0.0136)	(0.0135)	(0.0137)	
$Dist_{SUBC} * Poor$	-0.028	-0.026	-0.018	-0.016
	(0.0212)	(0.0213)	(0.0201)	(0.0245)
Village Covars				
Public Goods Q2		-0.011	-0.012	
		(0.0161)	(0.0152)	
Public Goods Q3		-0.019	-0.024	
		(0.0166)	(0.0156)	
Public Goods Q4		0.002	0.000	
		(0.0179)	(0.0171)	
Popn./1000		0.001	0.000	
		(0.0016)	(0.0016)	
Share SC		-0.021	0.015	
		(0.0414)	(0.0412)	
Share ST		-0.157***	-0.062	
		(0.0432)	(0.0432)	
Share Hindu		-0.001	0.016	
		(0.0250)	(0.0243)	
Share Muslim		0.038	0.019	
		(0.0314)	(0.0314)	

Sex Ratio	-0.000	-0.000	
	(0.0001)	(0.0001)	
Share Literate (M)	0.110	0.131	
	(0.1236)	(0.1165)	
Share Literate (F)	0.124	0.016	
	(0.1105)	(0.1050)	
HH & Indi. Covars			
Sikh		0.012	-0.022
		(0.0426)	(0.0519)
Christian		0.030	0.041
		(0.0249)	(0.0272)
Muslim		0.017	-0.016
		(0.0203)	(0.0239)
Age		0.001**	0.002**
		(0.0006)	(0.0006)
Female		0.109***	0.108***
		(0.0140)	(0.0144)
SC		0.000	-0.005
		(0.0147)	(0.0159)
ST		-0.044**	-0.051**
		(0.0218)	(0.0234)
OBC		0.020	0.018
		(0.0125)	(0.0141)
Childhood Health		-0.038***	-0.038***
		(0.0138)	(0.0145)
Live With Spouse+Others		-0.001	-0.009
		(0.0302)	(0.0306)
Live With Spouse+Children		-0.009	-0.019
		(0.0312)	(0.0318)
Live With Others+Children		0.016	0.017
		(0.0234)	(0.0240)
Live With Others Only		-0.033	-0.040
		(0.0287)	(0.0293)

Years of Edu	0.004***	0.004**
	(0.0014)	(0.0014)
Widow	-0.004	-0.016
	(0.0252)	(0.0255)
Currently Working	-0.053***	-0.053***
	(0.0105)	(0.0109)
Dependency Ratio	0.050**	0.036*
	(0.0205)	(0.0210)
HH No. Graduates	0.002	0.001
	(0.0067)	(0.0070)
HH No. Literate	0.012***	0.009**
	(0.0043)	(0.0045)
HH Size	-0.008***	-0.008**
	(0.0029)	(0.0030)
ADL Index	0.090***	0.089***
	(0.0227)	(0.0234)
Morbidity Index	3.877***	3.613***
	(0.2507)	(0.2491)
Weight	0.020***	0.019***
	(0.0033)	(0.0034)
$Weight^2$	-0.000***	-0.000***
	(0.0000)	(0.0000)
BMI	-0.036***	-0.032***
	(0.0096)	(0.0099)
BMI^2	0.001***	0.001***
	(0.0002)	(0.0002)
Waist Hip Ratio	-0.085	-0.118
	(0.4281)	(0.5305)
$WaistHipRatio^2$	0.091	0.119
	(0.2167)	(0.2743)
Consumes Alcohol	-0.045***	-0.038***
	(0.0133)	(0.0139)
Smokes Tobacco	-0.016	-0.021*

			(0.0108)	(0.0112)
Constant	0.571***	0.515***	0.164	0.184
	(0.0079)	(0.0900)	(0.2326)	(0.2568)
Block FE	Y	Y	Y	
Village FE				Y
Village Covars		Y	Y	
HH & Indi Covars			Y	Y
N	12842	12842	12842	12842
r2	0.123	0.126	0.186	0.261

Table A3: Estimates of the Effect of Distance on Hypertension Diagnosis, Wealth Quartile

	(1)	(2)	(3)	(4)
Coefficient	bottom 25%	25-50%	50-75%	Top 25%
	Outcome: Detection of Hypertension			
$Dist_{PHC}$	-0.036**	0.001	0.007	0.004
	(0.0141)	(0.0169)	(0.0166)	(0.0140)
$Dist_{SUBC}$	-0.014	0.006	0.022	-0.035
	(0.0160)	(0.0233)	(0.0283)	(0.0242)
HH & Indi. covars				
Sikh	-0.900***	0.385***	0.088	-0.015
	(0.1045)	(0.1425)	(0.0866)	(0.0534)
Christian	-0.045	0.046	-0.022	0.110**
	(0.0649)	(0.0553)	(0.0466)	(0.0515)
Muslim	0.027	-0.057	0.001	-0.022
	(0.0461)	(0.0466)	(0.0445)	(0.0399)
Age	-0.001	0.000	0.001	0.003***
	(0.0012)	(0.0013)	(0.0013)	(0.0011)
Female	0.095***	0.101***	0.094***	0.129***
	(0.0285)	(0.0326)	(0.0303)	(0.0275)
SC	0.006	-0.014	-0.018	0.015
	(0.0429)	(0.0379)	(0.0338)	(0.0255)
ST	-0.067	-0.089*	-0.032	0.023
	(0.0456)	(0.0503)	(0.0499)	(0.0485)
OBC	-0.006	0.023	0.002	0.064***
	(0.0368)	(0.0348)	(0.0273)	(0.0196)
Childhood Health	-0.052*	0.005	0.003	-0.083***
	(0.0293)	(0.0295)	(0.0303)	(0.0259)
Live With Spouse+Others	0.002	-0.090	-0.042	-0.008
	(0.0513)	(0.0619)	(0.0729)	(0.0902)
Live With Spouse+Children	0.045	-0.096	-0.042	-0.056
	(0.0583)	(0.0641)	(0.0731)	(0.0887)

Live With Others+Children	0.013	-0.090*	-0.000	-0.062
	(0.0435)	(0.0532)	(0.0618)	(0.0742)
Live With Others Only	0.022	-0.125**	0.041	-0.154*
	(0.0510)	(0.0610)	(0.0735)	(0.0833)
Years of Edu	0.003	0.004	0.005*	0.003
	(0.0044)	(0.0037)	(0.0030)	(0.0023)
Widow	-0.019	-0.012	0.006	0.049
	(0.0466)	(0.0499)	(0.0530)	(0.0530)
Currently Working	-0.070***	-0.057**	-0.047**	-0.035*
	(0.0223)	(0.0235)	(0.0217)	(0.0203)
Dependency Ratio	0.068*	0.048	0.083*	0.058
	(0.0408)	(0.0468)	(0.0461)	(0.0435)
HH No. Graduates	-0.004	0.003	0.013	-0.000
	(0.0516)	(0.0218)	(0.0174)	(0.0087)
HH No. Literate	0.023**	0.011	0.018*	-0.002
	(0.0102)	(0.0097)	(0.0094)	(0.0081)
HH Size	-0.014**	-0.010	-0.008	-0.002
	(0.0066)	(0.0064)	(0.0063)	(0.0054)
ADL Index	0.086*	0.084	0.126**	0.061
	(0.0510)	(0.0538)	(0.0514)	(0.0442)
Morbidity Index	5.229***	3.902***	3.265***	3.588***
	(0.7699)	(0.5474)	(0.4905)	(0.3832)
Weight	0.024***	0.026***	0.019**	0.013**
	(0.0087)	(0.0092)	(0.0080)	(0.0063)
$Weight^2$	-0.000**	-0.000**	-0.000**	-0.000*
	(0.0001)	(0.0001)	(0.0001)	(0.0000)
BMI	-0.067**	-0.051**	-0.045**	-0.009
	(0.0259)	(0.0211)	(0.0219)	(0.0190)
BMI^2	0.001**	0.001**	0.001**	0.000
	(0.0006)	(0.0004)	(0.0004)	(0.0003)
Waist Hip Ratio	0.556	-1.629	2.343	-0.338
	(0.4957)	(1.6862)	(1.5033)	(0.4424)
$WaistHipRatio^2$	-0.211	0.785	-1.129	0.248

	(0.2092)	(0.8944)	(0.8039)	(0.1984)
Consumes Alcohol	-0.059**	-0.060**	-0.025	-0.033
	(0.0279)	(0.0290)	(0.0292)	(0.0267)
Smokes Tobacco	-0.021	0.013	-0.027	-0.024
	(0.0228)	(0.0240)	(0.0235)	(0.0211)
Village Covars				
Public Goods Q2	-0.022	-0.030	0.013	-0.045
	(0.0279)	(0.0295)	(0.0309)	(0.0317)
Public Goods Q3	0.021	-0.027	-0.091***	-0.018
	(0.0319)	(0.0326)	(0.0312)	(0.0308)
Public Goods Q4	0.033	-0.055	-0.033	0.017
	(0.0367)	(0.0351)	(0.0347)	(0.0312)
Popn./1000	0.002	0.003	-0.002	-0.001
	(0.0032)	(0.0030)	(0.0027)	(0.0025)
Share SC	-0.018	-0.056	0.066	0.007
	(0.0971)	(0.0920)	(0.0790)	(0.0709)
Share ST	-0.158*	-0.159*	-0.055	0.077
	(0.0891)	(0.0825)	(0.0934)	(0.0905)
Share Hindu	-0.048	-0.003	-0.016	0.110**
	(0.0426)	(0.0536)	(0.0505)	(0.0443)
Share Muslim	-0.011	0.063	0.037	0.153***
	(0.0467)	(0.0677)	(0.0635)	(0.0581)
Sex Ratio	-0.000	-0.000	-0.000	-0.000
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Share Literate (M)	-0.346	0.635***	0.093	0.207
	(0.2163)	(0.2342)	(0.2612)	(0.2478)
Share Literate (F)	0.437**	-0.365	-0.243	0.142
	(0.2021)	(0.2238)	(0.2314)	(0.2149)
Constant	0.329	1.159	-0.764	-0.173
	(0.3601)	(0.8251)	(0.7425)	(0.3222)
N	2686	2741	3249	4055
r2	0.313	0.271	0.216	0.203