Effects of Physician Supply on Health Outcomes: Evidence from a Natural Experiment in Bangladesh*

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Abstract

We investigate the impact of increased physician supply on a wide range of health outcomes in underserved areas. In Bangladesh, a government intervention in 2013 boosted physician supply by over 25%. Leveraging the variations generated by the placement of these doctors in a two-way fixed-effects estimation strategy, we find that having one more doctor per 10,000 people reduces mortality rates by 13%, driven by a reduction in mortality from causes amenable to health care, such as diarrhea and related diseases and circulatory diseases, primarily stroke. We attribute this reduction to (a) an increase in doctor visits, (b) a shift in treatment-seeking from unqualified personnel to qualified physicians, and (c) an increase in the likelihood of hospitalization at government facilities conditional on illness. Our cost-effectiveness analysis indicates that the intervention costs $4,590 per life saved, suggesting that increasing the number of physicians in underserved developing regions can be a cheap yet effective intervention to promote better health outcomes.

JEL classification: I12, I15, I18
Keywords: Health outcomes, Physicians, Informal Care Provider, Mortality, Cost-effectiveness

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1 Introduction

Health outcomes and health services targeted to reduce maternal and infant mortality have generally improved in most low and middle-income countries (Victora et al., 2017). Health inequalities within most countries have also declined due to faster progress made by the poorest subpopulations (Wagstaff et al., 2014; Victora et al., 2017). Unfortunately, these positive trends are not universal. A significant fraction of developing countries continue to experience health inequalities as well as declines in health and healthcare access.[1] In particular, providing health care to people in remote and rural areas remains a key challenge. A shortage of qualified health service providers, especially in remote and rural areas, is often thought to be an underlying factor (Dolea et al., 2010).

In response to the shortfalls of health care providers, countries worldwide have implemented initiatives to increase access to health care in rural areas. However, the impact and efficacy of such policies remain unknown, given the lack of knowledge on the causal impact of an increase in the supply of physicians on healthcare utilization and health outcomes. For several reasons, it is important to measure these effects as greater availability of physicians does not guarantee improved health outcomes, particularly in developing countries. First, greater supply may not increase utilization in the presence of information frictions, influence, and dependence on informal healthcare providers. Second, doctor absenteeism, a problem that is more pervasive in developing countries (Duflo and Banerjee, 2011), might undermine the effect of an increased supply of doctors. For instance, in India's public health care sector, low utilization of government facilities is due to ineffective monitoring rather than resource limitations, resulting in provider absenteeism (Banerjee et al., 2008). Third, complementary inputs and hospital infrastructure may be equally important as physician efforts. The returns to more doctors may be limited if a hospital lacks the infrastructure to effectively operate physicians' services.

[1]For instance, a study of 64 developing countries for the period 1990-2011 reveals that health inequalities (measured in terms of the progress made by the poorest 40 percent of the population compared to the richest 60 percent) have risen in 42% of the countries, while health status in absolute terms has declined for the poorest 40 percent of the population in approximately a quarter of the countries (Wagstaff et al., 2014). Other studies report similar evidence (For a review, see Gwatkin, 2017)

In this paper, we exploit a natural experiment in Bangladesh to investigate the effects of physician supply on health outcomes. In order to improve health outcomes in disadvantaged rural areas, the government of Bangladesh appointed around 6,000 new physicians in 2014 through a highly competitive exam. This intervention increased the existing physician stock by around 25 percent. These newly recruited doctors were primarily posted in Upzila Health Complexes (UHCs) in their home upzila (sub-district, analogous to a county in the US).[2] These UHCs are primary health care facilities that cater to the needs to the rural population. These facilities are mainly responsible for providing advanced primary care, including maternal and child health care services, emergency obstetric care, as well as inpatient and outpatient care, including limited laboratory facilities for imaging and testing and knowledge-based health programs for disease control. We use the variation in physician density across regions generated by the mass-recruitment program, one of the largest such interventions globally, to estimate the effects of increased physician supply on local health outcomes and healthcare access.

We use two-way fixed effect estimates to show that an additional doctor per 10,000 population reduces mortality by around 0.726 deaths per 10,000 population (13% reductiom compared to the baseline mortality). Thus, the intervention, which increased the number of doctors by 0.11 per 10,000, resulted in a yearly decline in the mortality rate of 1.43 percent. To put this into context, the mortality rate in Bangladesh had been decreasing at an average rate of 0.9 percent annually between 2006 and 2015. Therefore, our estimated 1.43 percent decline is a remarkable improvement. To the best of our knowledge, this is the first evidence of a causal link between physician availability and all-cause mortality in a developing country.[3] Our cause-specific mortality analysis indicates that the observed decline in mortality is primarily attributed to a reduction in deaths related to treatable health conditions, such as circulatory diseases and diarrhea-related illnesses.[4] This highlights the significance of adequate healthcare resources in combating preventable deaths and underscores the potential

[2] https://www.banglanews24.com/health/article/24683/33rd-BCS-doctors-to-be-posted-own-UZ

[3] Carrillo and Feres (2019) and Okeke (2023) explore the effect of physician supply on infant mortality with mixed findings.

[4] Deaths amenable to health care are unnecessary untimely deaths that can be prevented by timely and effective medical care (Rutstein et al., 1976)

benefits of increased physician availability.

We then delve into the potential mechanisms. We find that the observed decline in mortality can be attributed to significant improvements in several healthcare utilization and access proxies. Firstly, the number of outdoor patient visits increased significantly. With each additional new doctor per 10,000 people, outdoor patient visits rose by approximately 27% of the baseline mean within a sub-district. Secondly, we find evidence of a shift in treatment-seeking behavior from the informal sector to formal healthcare providers. It is worth noting that the informal sector, including traditional healers, faith healers, and unqualified practitioners (i.e., quacks), has historically accounted for a substantial portion of total healthcare utilization, especially among the poorest rural population. Recent literature highlights the importance of provider quality in improving health outcomes (Okeke, 2023; Fink and Cohen, 2019; Das et al., 2016; Kruk et al., 2016). Thus, a shift from unqualified personnel to qualified physicians should result in better health outcomes. Lastly, we observed a significant increase in the likelihood of hospitalization among individuals reporting symptoms of illness within the last 30 days. This effect ranged from 4 to 6 percent of the baseline mean, suggesting a greater tendency to seek hospital-based care following the increased supply of physicians.

Among other health outcomes, we explore the effect of the intervention on child delivery practice and neonatal and infant mortality rates. We do not find any effect of physician supply on the probability that the child attendant is a doctor or the child was delivered in a hospital. Nor do we find any effect of increased physician supply on the probability of live births or the infant mortality rate. This result is consistent with the findings in Carrillo and Feres (2019) that increasing physician supply did not improve infant health outcomes in Brazil. This suggests that physicians and other healthcare professionals, such as trained health workers, midwives, and qualified birth attendants, may serve as substitutes for providing basic neonatal health. Indeed, Bangladesh stands out for its remarkable progress in reducing newborn mortality (UNICEF, 2018). Bangladesh has cut its newborn mortality rate from 64.2 deaths per 1,000 live births in 1990 to 20.1 per 1,000 today. Existing literature, media accounts, and donor organizations often attribute this decline to an increase in trained health workers (UNICEF, 2018; Rahman et al., 2021).

Our estimated mortality effects have implications for health inequality. We conduct a counterfactual analysis in which we ask the following question: by how much would spatial health inequality diminish if all currently vacant physician positions were filled? By stratifying our sample into regions with high (above median) and low (below median) vacancy rates, we find that filling all vacant positions would reduce mortality inequality between high and low vacancy regions by 23%. We also conduct a back-of-the-envelope calculation of the returns to such policies. We find that the cost per life saved was US$4590, suggesting that the increase in the number of physicians in rural areas can be a cheap but effective intervention to promote better health outcomes in the developing world.

We make several important contributions to the existing literature. First, this paper contributes to the debate on the role of informal healthcare providers in health systems where formal healthcare services are scarce. Several studies have documented that informal care providers in countries such as India, Bangladesh, and Uganda account for between 50-88% of all providers (Sudhinaraset et al., 2013), with the proportion even higher in rural regions (Ahmed et al., 2009). Given the difficulty of ensuring universal access to formal healthcare in rural and remote regions, several countries have officially endorsed the role of informal care providers. (Mullan and Frehywot, 2007). On the other hand, countries like India have abstained from integrating informal health care practitioners into the formal health care system because of the dilution of medical education standards (Sudhinaraset et al., 2013; Sundararaman et al., 2008). Prior research has generally suggested that the quality of care provided by informal providers is generally inferior to formal providers despite their greater utilization. Studies have documented that informal care providers lack the necessary training and knowledge to provide medical services (Ahmed et al., 2009; Chalker et al., 2000; Mignone et al., 2007) and are also less likely to adhere to national clinical guidelines (Chuc et al., 2001). As a potential solution to this issue, previous literature has suggested the role of training as a mechanism to help bridge the skill gap between medical doctors and informal care providers (Das et al., 2016; Garcia et al., 2003). Our evidence on the shift in treatment-seeking behavior from informal to formal care providers provides suggestive evidence that increasing physician supply might provide an effective solution to improving the quality of care received by rural populations.

Second, our paper contributes to the literature on the effect of an increase in physician supply on healthcare access, utilization, and health outcomes. Much of the evidence on the impacts on utilization comes from studies investigating the existence of supplier-induced demand, and the evidence is mixed (Fuchs, 1978; Busato and Künzi, 2008; Carlsen and Grytten, 1998). In the cases of utilization and health outcomes, several studies have investigated the relationship using cross-sectional variation where there is limited scope for causal inference. Studies that investigated the causal impact of physicians on health outcomes show mixed results (Carrillo and Feres, 2019; Okeke, 2023). Carrillo and Feres (2019) use quasi-random variation in the supply of primary care physicians in Brazil and finds that increasing physician supply increases health care utilization but does not lead to improved infant health outcomes. On the other hand, (Okeke, 2023) performed a randomized experiment in Nigeria and found that access to medically trained physicians (compared to lower-quality providers) helped to reduce mortality. Our findings provide new evidence of the importance of physicians in improving both healthcare utilization and infant mortality outcomes.

Our paper also contributes to the policy debate on effective strategies to improve health outcomes and health utilization in developing countries. Most of the evidence on demand for health care and health outcomes has either focused on the effects of the expansion of insurance coverage or extending eligibility for health insurance in developed countries (Currie and Gruber, 1996; Card et al., 2008; Sommers et al., 2012). Demand-side policies intended to improve health outcomes in developing countries have been found to be largely ineffective. These include conditional cash transfer programs (Lagarde et al., 2007); other unconditional financial incentive programs (Powell-Jackson et al., 2015); and removing out-of-pocket expenses and providing free healthcare service (Ansah et al., 2009). On the other hand, supply-side measures have been inadequately studied, and there is very little evidence of their efficacy (e.g., Carrillo and Feres (2019)). There is a large literature on the ineffectiveness of supply-side reforms identifying the lack of quality medical care as the likely mechanism (Das and Hammer, 2014), which has caused governments to roll out policies like pay-for-performance Gertler and Vermeersch (2013). Okeke (2023) has shown that rather than focus on improving healthcare resources like expanding the healthcare workforce, there may be a higher return to increasing the quality of medical care. We contribute to this literature by providing novel evidence on the efficacy of a very low-cost intervention - filling vacant positions in rural healthcare centers/hospitals.

The remainder of the paper is organized as follows: Section 2 discusses the institutional context and the intervention, Section 3 describes the data, and Section 4 discusses the empirical strategy. In Section 5, we present our main results as well as robustness and sensitivity tests, and Section 6 concludes.

2 Background

2.1 Overview of the Health System

Bangladesh is a developing country and one of the most densely populated regions in the world. The constitution of Bangladesh stipulates the provision of health services as the obligation of the government to ensure basic necessities of life for its population (Institute of Governance Studies, 2012). Due to its pluralistic nature, the health system in Bangladesh is managed by multiple entities, having different roles and functions, overlooking the overall structure and governance: the government, the private sector, the Non-Governmental Organisations (NGOs), and donor agencies. While the government, private sector, and NGOs primarily handle health service delivery, financing, and healthcare workforce employment, donor agencies offer policy guidance and financial support.

Health services provision in the public domain follows the country's national administrative pattern, which hierarchically runs from national to division, district, Upazila (sub-district), unions, and finally to the lowest administrative tier, wards. Despite this pyramidal structure, the Ministry of Health and Family Welfare (MOHFW) holds central administrative authority. Apart from overseeing financing and infrastructure development, the Ministry also manages the recruitment, transfer, posting, and remuneration of health service providers. The public sector healthcare infrastructure across the nation is built around the hierarchical administrative tier and includes primary, secondary, and tertiary healthcare facilities. Primary care facilities are provided at the bottom three administrative tiers, i.e., Upazila, unions, and wards.[5]

Central to the primary health care facilities are community clinics, which operate at the community level, delivering family planning, basic preventive care, nutrition service, and limited curative interventions to approximately 6,000 people on average (Zafri et al., 2021). These facilities are predominantly staffed by community health workers like health/ family welfare assistants without direct involvement of front-line healthcare providers, such as nurses or physicians. A majority of the health care needs at this level are met by informal providers, which include traditional healers, traditional birth attendants, faith healers, village doctors (without medical training), and drug vendors/retailers. In terms of provider density per 10,000 people, the informal sector accounts for more than 90% of the healthcare providers in Bangladesh. (DGHS, 2011).

Well-equipped primary care facilities, with a sufficient supply of qualified providers and equipment, are situated in each Upazila and are known as Upazila Health Complexes (UHCs).[6] A UHC is staffed with physicians, medical assistants, pharmacists, radiographers, and technicians to operate equipment and provides comprehensive healthcare services beyond the basics (Zafri et al., 2021). With UHCs, three distinct groups of physicians work: Medical Officers (MO), Residential Medical Officers, and Emergency Medical Officers. These centers deliver a wide array of services, including maternal and child health care services, inpatient and outpatient care services, and disease control. A few UHCs also provide specialty care. As of 2013, there were 436 hospitals at the Upazila level with a total bed capacity of 18,290 (DGHS, 2013). On average, a UHC caters to approximately 250,000 individuals within each Upazila (Alam et al., 2017).

[5]Secondary and tertiary healthcare facilities mainly provide advanced and specialty care to the urban population and consist of medical colleges, general hospitals, district hospitals, teaching hospitals, and specialty hospitals.

[6]The availability of qualified healthcare providers for primary care starts at the second lowest administrative tier, unions containing Union Sub-centres and Union Health and Family Welfare Centres (UHFWC). These facilities offer very limited primary and outdoor services because of their small numbers and 20 or 10-bed capacity.

2.2 Physician Recruitment Process

The recruitment process of physicians in the public sector is contingent upon the needs assessment done by the MOHFW periodically. This assessment involves an evaluation of the official number of posts vacant positions in comparison to the available pool of doctors. Occasional discrepancies may arise due to limitations in effectively monitoring staff attendance. Nevertheless, the Ministry of Public Administration (MoPA) relies on the recommendations from MoHFW to conduct offiical recruitment of doctors through the Bangladesh Civil Service (BCS) Examination.[7] Only individuals with Bachelor of Medicine and Bachelor of Surgery (MBBS) degrees are appointed as doctors under the health cadre.

The BCS is a highly competitive nationwide assessment administered in three stages, and as many as 200,000 - 250,000 candidates apply each year with a success rate ranging between 0.5% to 0.8%. The initial stage comprises a preliminary examination featuring exclusively multiple-choice questions. Subsequently, successful candidates proceed to a written test, followed by an interview assessment. Final scores and rankings are determined on the basis of a combined evaluation of performance in the two assessments. Although needs-based, on average, around 400 physicians are recruited under the health cadre every year.

2.3 Mass Recruitment of Physician Program

In Bangladesh, the healthcare workforce suffers critical challenges, marked by scarcity, a mismatch in skills, and a glaringly unequal distribution of physicians, nurses, and other healthcare professionals (WHO, 2015; Ahmed et al., 2013). As of 2013, with only 80% of the registered 64,434 physicians available within the country, the physician-population ratio of 3 per 10,000 population was staggeringly low compared to the WHO projected target of 23 required to achieve the MDG targets (WHO, 2006). Moreover, there was also an imbalance in the health workforce composition, with only 0.4 nurses and 0.24 technologists available per physician - a ratio that fell well below the WHO recommendation of three nurses and five technologists per physician. This was further exacerbated by the fact that a majority of the physicians were concentrated in the urban regions (with an urban-rural physician ratio of

[7] This recruitment process extends beyond the health sector and encompasses recruitment in various administrative and non-administrative positions in different ministries, spanning areas /cadres, such as administration, education, economics, police, taxation, and foreign affairs.

18.1:1), leaving the impoverished rural population, especially in remote regions, dependent on informal health care providers for their healthcare needs. Indeed, approximately 35% of the doctors served 15% of the total population living in the four major cities in Bangladesh, while less than 20% of the entire health workforce catered to the rural areas, which accounts for 70% of the population (Ahmed et al., 2011).

One of the factors contributing to the shortage and ill-distribution of physicians in Bangladesh lies in the considerable gap between sanctioned and filled-up positions in rural regions. As per the Bangladesh Health Facility Survey 2014, only 59% positions designated for physicians in the UHCs were filled, and the proportions were less than 25% at even lower administrative tiers, specifically at the union level (NIPORT, ACPR and ICF International, 2014). To address the shortage of physicians and fill up the vacant positions, the MoHFW urged the Public Service Commission to appoint 6,033 physicians for the 33rd round of the BCS examination. With the total count of registered physicians under the Directorate General of Health Services (DGHS) and Directorate General of Family Planning (DGFP) standing at 16,433 in 2013, this new wave of appointments promised to augment the physician supply in the public sector by an impressive 40%. This initiative by the MoHFW marked an unprecedented effort to reinforce the health workforce. Out of a total of 193,059 candidates applying for the 33rd BCS exam, 8,529 applicants secured positions in various administrative and non-administrative positions in the government sector, Of these 6,033 applicants were employed under the health cadre. Figure 1 shows the number of physician appointments done by the MoHFW in the public sector for the period 2008-2018 and in each BCS exam cohort. Due to bureaucratic delays in the hiring process, recruitment could extend beyond a year. For example, while no appointments were made in 2009 and 2015, 2013 witnessed two separate rounds of physician appointments within the same year.

Physicians recruited through the BCS examination receive a monthly salary in accordance with government pay scales. Those appointed in 2014 startedw with a monthly salary of BDT 20,370 ($\approx$ 263 USD), which was later adjusted to BDT 53,060 ($\approx$ 682 USD) following a pay scale upgraded in August 2015. Despite the lower wages compared to the private sector, physicians working in the public sector, view it as a lucrative opportunity, valuing factors such as prestige, social status, personal security, and relative job security as compelling incentives (Rashid, 2019). In addition to the monthly salary, these physicians are entitled to exclusive non-monetary benefits reserved for BCS exam-recruited employees.[8]

3 Data

To evaluate the impacts of an increase in the supply of physicians on health care utilization and outcomes, we rely on a diverse set of data sources. Each dataset provides critical insights into the healthcare landscape of Bangladesh. We first obtain administrative records on the number of sanctioned posts and number of recruited physicians at each Upzila from the Directorate General of Health Services (DGHS). The administrative files are supplemented with data on mortality and child delivery practice reported in different Sample Vital Registration Survey rounds. Finally, we utilize the Household Income and Expenditure Survey for evidence of the effects on treatment-seeking behavior. The following subsections offer detailed descriptions of individual datasets employed in our analysis.

3.1 Administrative Data

Our administrative data comes from the Management Information System (MIS) of the Directorate General of Health Services (DGHS), which operates the MOHFW. The dataset includes information on sanctioned and posted physicians at the upzila level, spanning the years 2013 to 2015. The average number of physicians per upzila in 2013 was around 11 against 22 sanctioned posts, indicating a significant vacancy rate. Following the intervention, the average number of physicians each upzila surged to 16, marking a 50 percent increase from the 2013 figures. In addition to data on physicians, we also collected information on various healthcare facilities at the Upzila level. The summary statistics of these facilities can be found in Panel A of Table 1. Notably, the healthcare facility landscape remained largely unchanged during the intervention period.

[8]Government hospitals offer unique facilities and professional growth opportunities that foster enriching patient interactions. These avenues not only enhance one's medical expertise but also enable supplementary income through practice during off-duty hours. Beyond monetary gains, physicians in the public sector also enjoy non-pecuniary advantages, including elevated social standing, prospects for administrative leadership roles allowing them to exercise power, and a higher level of job security in comparison to their counterparts in the private sector.

We also collected administrative information for each of the Upzila Health Complex (UHC) for three years-2013, 2014, and 2015. In our study, we use a balanced sample of 412 UHCs. The average number of doctors in these facilities in 2013 was 7.58, which increased to 9.84 in 2014 after the intervention took place (Panel B of Table 1). Alongside physician counts, we also collected data on the utilization of UHC facilities, encompassing metrics such as outdoor patient visits, bed occupancy, death rates, and both minor and major surgeries.

3.2 Sample Vital Registration Survey (SVRS)

To estimate the program's impact on one of our main outcome variables, i.e., child delivery practice, we draw on multiple rounds of Sample Vital Registration Survey (SVRS). SVRS is an nationally representative survey conducted annually by the Bangladesh Bureau of Statistics (BBS) and offers granularity at the upzila level. SVRS uses 11 data recording schedules to gather comprehensive information on household demographics, births, deaths, migration, marriage, disability, HIV/AIDS, and contraceptive use.

We compiled the birth modules of the Sample Vital Registration Survey (SVRS) for three rounds from 2013 to 2015. These modules are merged modules with the household module to incorporate household demographic characteristics. Our primary outcomes of interest are: (1) Whether the child was delivered in a hospital, (2) Whether the child was born in a hospital or a clinic, (3) Whether the child's attendant was a doctor, (4) Whether the child's attendant was a skilled professional and (5) The probability of live-birth as opposed to still-birth. Additionally, we calculate the mortality rate at the upzila level using the death module of the survey. This involves tallying the total number of deaths and sample size at the upzila level, then computing the mortality rate per 1,000 individuals by scaling the death count proportionally.

3.3 Household Income and Expenditure Survey

For insights into individual health-seeking practices, we turn to the Health module of Household Income and Expenditure Survey (HIES) 2015-16. HIES is a nationally representative survey that is conducted every five years. The survey provides a broad socio-economic out-look, including critical health related information. The Health module contains information on illness and treatment-seeking behavior. Merging this module with the household module allows us to control for household demographic characteristics. Subsequently, we integrate this survey data with the administrative records on the number of physicians at the upzila level. Our primary outcomes of interest were: (1) The likelihood of an individual seeking treatment when experiencing an illness, (2) The likelihood of an individual seeking treatment in a UHC when experiencing an illness, (3) The likelihood of hospitalization conditional on seeking treatment and (4) The likelihood of seeking treatment from unqualified personnel and traditional healers.

4 Empirical Approach

This section outlines our main empirical methodology. While Our data indicates the number of sanctioned doctors remained the same over the three years in our sample, Figure 3 revaels a notable 30% increase in the number of doctors posted at the UHC increased by 30 percent, attributed to the policy. We exploit this variation to explore the effect of increased recruitment of physicians. Importantly, there were no major changes in other government healthcare facilities during this period. The number of different establishments such as community clinics and Upzila Health and Family Welfare Center, as well as the number of beds at the UHC showed negligible changes (Table 1). Consequently, any observed effects on health outcomes can be ascribed to changes in physician supply.

To estimate the effect of the increase in the supply of physicians on various health outcomes, we mainly rely on a two-way fixed effects model. Our analysis draws on upzila level panel data from 2013 to 2015. Furthermore, we complement our approach through an instrumental variable strategy to strengthen the robustness of our identification. The IV specifications and results are reported in the Appendix.

To estimate the relationship between physicians recruited in the public sector, health-seeking behavior, and health outcomes, we run the following two-way fixed effect regression model:

$$y_{it} = \alpha_0 + \alpha_1\ D_{it} + \Pi\ X_{it} + \gamma_i + \delta_t + u_{it} \tag{1}$$

where, y_{it} is the outcome of interest for upzila i in year t. D_{it} denotes the number of physicians in a upzila i during year t. α_1, the coefficient associated with D_{it}, is our main coefficient of interest. X_{it} is a set of upazila-level controls that vary over time, such as upzila population, number of different health facilities within each upzila, and other socio-economic variables. γ_i are the upzila fixed effects and δ_t are year fixed effects. Upzila fixed-effects account for the time-invariant unobserved characteristics of the Upzilas. Factors like seasonal variation in health outcomes, macroeconomic conditions, national policies, and shocks common to all upazilas are purged using year-fixed effects. We cluster the standard error at the upzila level to account for serial correlation within upazilas.

5 Main Results

5.1 Results for Mortality Rates

The main outcome we consider is the mortality rate. To this end, we calculate the upazila-level mortality rate per 1,000 people using data from the Sample Vital Registration Survey spanning from 2013 to 2015. This data is then merged with administrative records on the number of physicians posted in each upzila. We first start off with some descriptive evidence. Figure 5 shows the trend in mortality in two groups of upzilas categorized by whether they had an above or below median number of physicians (normalized per 1,000 population) in 2014. It is evident that Upzilas with an above-median number of physicians witnessed an immediate decline in the mortality rate following the posting of newly recruited physicians in those regions. Conversely, Upzilas with physicians below the median saw an increase in the mortality rate. In these areas, the mortality rate remained relatively stable over the three-year period, while in others, there was an initial sharp decline which then plateaued in 2015. Overall, due to progress made by above-median upzilas, the mortality gap between the two regions converged over time. This provides the first signs of effect of the intervention on health outcomes.

The regression results are shown in Table 9. We find that the increase in the supply of physicians led to a substantial decline in the mortality rate. Column (1) only includes the year fixed effects and the Upzila fixed effect with no other controls in a standard two-way fixed effects model. Column (2) additionally includes socio-economic controls like the number of community clinics, the number of health and family welfare centers, and the population. The results substantiate our earlier visual observations in Figure 5. Specifically, an additional doctor per 10,000 people lowered the mortality rate by 13 percent. Furthermore, the effect slightly increases to 14 percent when we account for socio-economics factors, reflecting the prevailing conditions in the upzilas.

5.2 Results for Mortality Rates by Age And Causes of Death

To better understand the underlying factors contributing to the substantial effects observed, we delve into the sources of heterogeneity. In Table 10, we segregate the impact on mortality across various age subgroups. Our findings reveal, that the effect on mortality is largely driven by improvements for the older adults group i.e. people in the range of age 40-60. Across the different age subgroups, the estimated effect is only statistically significantly different from zero for the 40-60 years old.

Table 11 presents estimates categorized by causes of death. We employ several broad diseases categories across the different columns in Table **??**. In Column (1), we observe that that increasing the number of physicians leads to a reduction in mortality across the top 5 causes of death in Bangladesh, including cancer, heart disease, stroke, pneumonia and respiratory disease. As elaborated in Appendix Table A.6, when we estimate seprately for each diseases within this group, we find a marginally statistically significant result for mortality caused by stroke (52%). The estimates translates to an notable policy impact, with mass recruitment of physicians decreasing stroke-related mortality by 5.8%. In Column (2), we also find significant effect on mortality caused by diarrhoea related diseases. The substantial reduction stroke-related mortality further underscores the significant on circulatory diseases as observed in Column (3). In this context, we also find significant impacts on mortality linked to rheumatic diseases. However, for other broad disease categories, such as respiratory, infectious and parasitic diseases, we report no statistically significant impacts.

5.3 Interpreting Magnitudes

To provide a meaningful context for the magnitude of our estimates, we conduct a counterfactual experiment, to assess the potential impact on the mortality gap between different regions if all vacancies at the upzila level in all regions were filled. For the purpose of this exercise, we divide the entire sample into regions with above and below the median normalized vacancy. At baseline, there is a mortality difference between these two groups is 27 percent, with the mortality rate at 5.83 per 1,000 population in above-median normalized vacancy regions and 5.56 per 1,000 population for the below-median regions. The respective vacancies in the two regions are 11.22 (normalized - 0.61 per 10,000) and 4.66 (normalized - 0.16 per 10,000). Using our estimates of a reduction of 0.726 per 1,000 people, as a result of an additional physician posted, the counterfactual mortality if all the vacancies in both groups of regions were filled would be 5.75 (above median) and 5.53 (below median). This would correspond to a counterfactual mortality gap of 0.22. So, simply by plugging all the vacancies in different regions of Bangladesh, our estimates imply the mortality gap could be reduced by 18 percent. The calculation is illustrated in Figure ??.

To provide an additional context for our estimates of reduction in mortality due to an increase in the supply of physicians, we look at different studies evaluating different strategies to reduce the mortality gap between regions. In a randomized experimental study conduction by Okeke (2023), the results show that medical treatment administered by physicians, as opposed to other medical health providers, can reduce the newborn mortality gap between rural and urban regions in Nigeria by 20 percent. Our results align closely with those of a separate study that assessed the impact of implementing free universal primary health care coverage in Turkey, conducted by Cesur et al. (2017).

6 Potential Mechanisms

We now delve into the potential mechanisms that could account for the significant improvements in mortality outcomes observed. Several factors may contribute to the enhanced mortality outcomes resulting from an increased number of physicians stationed at the UHCs. First, increased physician availability encourages greater utilization of health care. Second, the influx of newly posted doctors could lead to improved access to medical services for the local pollution. Third, increased presence of doctors might influence patients' treatment-seeking behaviour, potentially steering them away from informal care providers, and thereby raising the overall quality of care. Fourth, it is worth considering that the newly posted doctors possess higher proficiency compared to the current existing healthcare workforce. This aspect may not be immediately evident, as the new recruits could range from fresh graduates (potentially less experienced) to individuals with years of private sector experience before their UHC postings. Finally, given the existing body of evidence regarding physician absenteeism at UHCS, it is possible that the new recruits are exerting more effort and delivering superior care. While we will explore the first three mechanisms, it is important to note that the last two aspects fall outside the scope of our available data.

6.1 Utilization of Healthcare Facilities

We commence our investigation of the mechanism explaining the effects of the augmented physician supply on mortality by assessing the impact on utilization. As outlined in Table 2, the result reveal a significant surge in patients' outdoor visits. Specifically, an additional physician per 10,000 population corresponds to a substantial increase of 684 visits, representing approximately 26 percent upturn from the baseline mean in 2013 (Column 4).

We next proceed to evaluate changes in outpatient visits, stratified by gender and children. The findings, detailed in Columns 1-3 of Table 2 indicate relatively larger effects for male and children. Although the estimated effects do not exhibit statistical significance, they provide valuable insights.

Our estimates suggest that the total number of outdoor visits by males and females increased by 322 counts (37 percent increase) and 124 counts(10 percent increase), respectively, due to an additional doctor, although none of the effects are significant at any conventional levels. The number of outdoor visits for children increased by 48 percent of the baseline mean, and the effect is significant at the 5 percent level. The results are robust to the inclusion of different socio-economic controls.

We then look at the heterogeneity in the treatment effect by the intensity of healthcare facilities. To this end, we rank all the upazilas in terms of available healthcare facilities through Principal Component Analysis (PCA) and use the first principal component to create a health-facility index. We then define upazilas below the median value as *Backward regions*. Upzilas above the median values is referred to as *Forward regions*. Table 3 shows that the treatment effect on the total number of outdoor visits is much higher in the backward regions than in the forward regions, and the difference is statistically significant. Quantitatively, the point estimates are 1050(44 percent increase) in lagged regions and 273 (10 percent increase, insignificant). This suggests that lagging regions benefited more from the policy change. The results are consistent with the fact that the backward regions were more dependent on informal healthcare providers, which changes with the availability of more physicians in formal healthcare facilities, which we also examine in this study.

In order to compare the results to existing estimates, we convert the estimated marginal effects into elasticity using the means of the outcome variable and physician rate per 10,000 population across all three years. Given the average outdoor visit rate is 2,600 counts, and the average number of physicians is 0.39 (both expressed as per 10,000 population), the implied elasticity is around 0.10. The magnitude is slightly smaller than the estimates in the prior literature. For instance, Carrillo and Feres (2019) estimates an elasticity of 0.3 for Brazil following the MPP program, which recruited foreign nationals as physicians. On the other hand, Okeke (2023) finds having a doctor increases the probability of receiving prenatal care provided by a doctor in Nigeria by 22 percentage points in facilities previously served by mid-level healthcare providers without a medical degree. Estimates from the literature on physician-induced demand suggest an elasticity in the range of 0.1-0.3 (Fuchs, 1978; Stano, 1985).

6.2 Treatment-seeking behavior

We now investigate the effects of the increase in the supply of physicians on treatment-seeking behavior. In this regard, we test whether the pattern of healthcare utilization changes from informal providers to formal ones. To this end, we use the 2016 round of the Household Income and Expenditure Survey (HIES). We merge this survey data with the administrative data on the number of physicians at the Upzila level. One caveat associated with using the HIES data is that it is only available for one year, prohibiting us from controlling for upzila fixed effect. To this end, we take advantage of the panel nature of the physician data and remove the upzila and year-fixed effects from these variables. More precisely, we run the following regression:

$$D_{it} = \alpha_0 + \gamma_i + \delta_t + u_{it} \tag{2}$$

Where, D_{it} is the number of physicians in Upzila i at year t, and γ_i are the upzila fixed effects and δ_t are year fixed effects. We then denote $\widetilde{D_{it}}$ as the number of physicians net of upzila and year-fixed effects and define it as follows:

$$\widetilde{D_{it}} = D_{it} - \alpha_0 - \gamma_i - \delta_t \tag{3}$$

We then run the following OLS regression:

$$y_{it} = \alpha_0 + \alpha_1 \Delta\widetilde{D_{it}} + \Pi\ X_{it} + u_{it} \tag{4}$$

Where, $\Delta\widetilde{D_{it}}$ is the change in the number of physicians between 2013 and 2015, and X_{it} is a set of household-level and upzila level socio-economic controls that vary over time.

Given the fact that an increase in the supply of physicians is likely to increase the availability of physicians in rural regions, one could plausibly expect an increase in the utilization of healthcare services provided at healthcare facilities and a reduction in utilization from informal providers. We report the results in Table 4. First, we look at whether individuals are more likely to seek treatment in Upzila Health Complexes (UHC) or in a government facility conditional on illnesses or seeking treatment (Columns 1-4). Chronically ill individuals who require routine checkups increases the probability of seeking treatment at UHCs by 1.23 percentage point, which represents a 60 percent increase in the likelihood relative to the baseline in 2013. The likelihood of seeking treatment for individuals, who suffer certain symptoms of illness, increased by 2.5 percentage points against a baseline mean of 4.6 percent. Similarly, if an individual for any reason seeks treatment, the probability of visiting the UHC increases significantly as a result of the increase in the supply of physicians. In terms of admission to a facility offering formal care, we also observe an increase in the tendency to get hospitalization at registered government facilities following certain health conditions/injuries.

The results from the estimation of treatment-seeking behavior from informal providers are reported in Columns 5 and 6. We find a large and significant decline in treatment-seeking from unqualified health-service providers such as drug sellers at the pharmacy store or traditional healers–One additional new doctor reduced the likelihood of seeking treatment from the sellers at the drugstore by 11 percentage points against a mean of 32.5 percent (33 percent reduction). The corresponding decline in the likelihood of seeking treatment from any unqualified personnel was 10 percentage points (26 percent reduction relative to the baseline). The magnitudes and directions suggest there is a great degree of substitution in utilisation of the services provided in formal health care facilities and non-formal providers.

We then explore the heterogeneity in the treatment effect by rural and urban locations. All the Upzila health complexes and other government health care facilities, where the government doctors are mostly placed, are located in the Upzila Centres, which are urban in nature. We, therefore, explore whether the benefits are limited to the urban population only or some of the benefits also accrue to the rural people. Table 5 suggests there is some evidence of improvement in the health-seeking behavior of people from rural areas. However, the treatment effect is much higher for urban people, and our tests show that the differences are statistically significant.

We also explore the heterogeneity in the treatment effect by poverty status. To this end, we divide the sample into two groups: those who live below the poverty line and those above the poverty line. The results are reported in Table 6. It is evident that both poor and non-poor people benefit from the increase in the supply of physicians. While the treatment effect is marginally higher for the poor population with regard to most of the outcomes, the Chow test reveals that the differences are not statistically significant. Using the results, we also conduct a counterfactual experiment in which we ask how many "physician-equivalent" would be needed to explain the gap in health-seeking behavior between the poor and the non-poor. In our sample, the share of people seeking treatment from unqualified personnel conditional on illness is 45% for the poor people, while it is 36% for the non-poor. Our estimates suggest a 1 additional physician-equivalent would reduce the probability of seeking treatment from an unqualified professional by 10.7%, therefore 0.84 "physician-equivalents" (normalized per 10,000 population) would be needed to bridge the gap in treatment-seeking behavior between the poor and non-poor.

Our estimates suggest an alternative strategy for improving the quality of care in developing countries. In developing countries like Bangladesh, informal health care providers constitute more than 50% of the overall size of the health care industry (Sudhinaraset et al., 2013). Due to the high availability and utilisation of untrained medical providers, the quality of public health care in developing countries suffers. Some studies have investigated the impact of training informal providers to bridge the gap between care provided in public health care facilities and that provided by informal providers (Das et al., 2016). On the other hand, Guerrero et al. (2020) suggests conditional cash transfer programs effectively reduce care received from informal providers by about 25 to 37 percent. Our estimates suggest similar magnitudes of effect are possible by investing in improving the supply of health care resources for instance physician recruitment.

6.3 Waiting Time

Long waiting time is an important public health problem that arises from a mismatch between the demand and supply of health care services. We investigate the impact of the sharp increase in the supply of physicians on waiting time in government facilities. Table 7 shows the results of the supply-side policy. Column (1) shows the effects on the time taken by individuals to reach the facility conditional on suffering chronic illness. We observe no significant impacts on the time taken to reach the provider. This is plausible as the policy was not accompanied by increased investment in building more facilities and hence improving health care access. In Column (2), we found the policy reduced the waiting time at health care facilities by 13% (or equivalent to 3.6 minutes) relative to the baseline mean of 25 minutes average. We find no significant impact on waiting time for individuals seeking treatment after suffering from some symptoms of illness or individuals who report of just seeking treatment (Columns 3 and 4). Although the magnitude of the effect is small compared to average waiting time even in emergency departments, the results signal towards an improvement in healthcare access which is critically tied to patient health and satisfaction.

6.4 Child Delivery Practice

Having provided evidence on how an increase in physician supply could change treatment-seeking patterns and healthcare utilization, we now examine the effect on child delivery practice which measures the quality of neonatal care. To this end, we merge three rounds of the Sample Vital Registration Survey with the corresponding year's administrative data on the number of physicians at the upzila level. The outcome variables we consider are whether a child was delivered in a hospital or a clinic and whether the birth attendant was a doctor or a nurse. As seen in Table 8, the likelihood of a child being delivered in a hospital or a clinic increases with the number of physicians (2.2 percent), albeit the effect is only marginally significant (Column 2). The increase in the supply of doctors also led to a significant increase in the probability that a childbirth attendant was a doctor or a nurse (2.5 percent). We, however, do not observe any discernible effect on the probability of live birth. Through these results, we provide further evidence that the increased availability of doctors in public healthcare facilities led to improved quality of care through the increased probability that medical care was provided by qualified healthcare professionals and in quality healthcare facilities. To give our estimates some context in the literature, Okeke (2023) also provided evidence of switching delivery of newborns from homes to community health centers by around 7-8 percent following the posting of doctors in the villages of Nigeria. Similar to our findings, Carrillo and Feres (2019) also found no effect on the probability of new births as a result of the MPP program in Brazil.

6.5 Cost Effectiveness Calculation

In this section, we use our estimates on mortality effect to compute the value of the policy of increasing the supply of physicians in the public sector in Bangladesh by 25%, as well as impute the program's cost-effectiveness in terms of cost per life saved.

6.5.1 Benefit of the Mass Recruitment of Physician

To compute the value of mass recruitment of the program, it is important to understand that the mortality rate computed in Section 5.5 is already adjusted for the population and encompasses individuals of all age groups. We use upazila-specific mortality, supply of doctors as well as the upazila-specific population to compute the mortality effects estimate. We sum over the population across all the upazilas to compute the population likely to be affected by the policy in 2014 and arrive at a figure of 130,302,559. Given that the intervention increased the number of doctors by 0.11 per 10000 people, this would therefore imply that the number of people that were saved by the intervention can be calculated as 130,302.559 $\times$ 0.11 $\times$ 0.76 (the last number comes from Table 9, and the first number is expressed as 000's)= 10,893.

We calculate the value of the mass recruitment program by multiplying the number of lives with the Value of a Statistical Life (VSL) to get a ballpark estimate of the benefits generated by the program. Some papers have used estimates of lifetime earnings to derive the value of lives saved, but the standard practice in the literature is to use the VSL. While the estimates of VSL are scarce for developing countries, there are only a handful of studies reporting VSL estimates for Bangladesh (Mahmud et al., 2019; Miller, 2000; Hammitt and Robinson, 2011). Most of the estimates are based on the benefit transfer approach from VSL estimates in developed countries and are very scattered, ranging from 15,000 USD up to 205,000 USD. We apply the estimates of Mahmud et al. (2019), who use a contingent valuation method in the context of air pollution in Bangladesh, to derive estimates in the range of 17,480 - 22 463 USD. Multiplying the VSL by the estimates of the number of lives saved suggests the mass recruitment program for physicians generated about 190.4 - 244.7 million USD. These benefits, of course, are a lower estimate as they ignore other health benefits due to the increased availability of physicians.

6.5.2 Cost Effectiveness

We impute the cost of the program using mainly the physicians' salaries. Given the total number of physicians recruited in 2014 was 6,033, the largest cost of the program is equal to 36 million USD (500 USD per physician per month for 12 months). Even if we conservatively use 14 million USD as an estimate for other implementation costs, the total cost of the program is unlikely to exceed 50 million USD for a year. This implies that every 1 USD invested in the program returned 3.81 USD - 4.89 USD. This implies that overall the cost per life saved is around 4,590 USD. Considering the burden of disease disproportionately falls on developing countries, the estimates of cost per life saved show increasing the supply of physicians can be remarkably effective and cost-effective in improving health disparities in those regions.

7 Conclusion

While there has been a marked improvement in the health outcomes of the general population in developing countries in recent years, meeting people's health needs in remote and rural areas remains a key challenge. Limited access to physicians is often touted as the main contributing factor, and hence, it is often suggested that policies aimed at increasing access to primary care physicians can lead to better use of healthcare services and ultimately improve health outcomes. However, empirical research is very limited to support these claims. We aim to fill this void by harnessing a natural experiment whereby the government of Bangladesh increased the number of physicians in the country by more than 25% to investigate whether increasing the number of doctors in rural areas can improve health outcomes.

We find that the intervention improved several health outcomes, including increased outdoor patient visits and child deliveries in hospitals or clinics. Additionally, the likelihood of seeking treatment in a government facility increased significantly, while the probability of seeking treatment from unqualified practitioners decreased. All these improvements in healthcare access and utilization resulted in a decline in the death rate. Our results are robust to different specification and falsification tests.

Our findings have several policy implications. First, deploying doctors to underserved areas can be beneficial and can help reduce health inequality between the lagging and forward regions. Our naive cost-effectiveness exercise suggests that increasing the number of physicians in lagging areas is a cost-effective way to improve health outcomes in the developing world. Second, to the extent expanding the doctor supply in many developing countries is comparatively easier, producing doctors is a worthwhile investment.[9] Hence, programs to direct more resources to increase the stock of physicians may be important for public health.

Our results should be interpreted with a few caveats in mind. First, our paper concentrates on the impact of an intervention that influenced the supply of entry-level doctors and does not investigate whether the availability of specialized doctors impacts improving health outcomes. For instance, we found no effect on the infant mortality rate. One reason behind this could be that the infant mortality rate responds more to increased access to obstetricians/gynecologists (Currie et al., 1995) than entry-level physicians. Second, The policy might have impacted other important aspects of overall welfare, such as patients' satisfaction, local health expenditure, and or labor market for physicians. However, these aspects were not examined in this study, and exploring these aspects may be vital when assessing the efficiency of interventions regulating physician distribution. Finally, We can not shed light on the long-term effect of the policy due to data limitations.[10] The government policy in Bangladesh requires the newly recruited doctors to stay in the underserved areas for at least three years, after which they might be eligible for transfer to the big cities. Thus, it is imperative to explore whether the effects that we observe in the short run persist in the long run. Answering these questions can be an avenue for future research.

[9]Unlike in developing countries like the United States where medicine is a graduate degree, and residency training is required, in many developing countries, medicine is an undergraduate degree, and no residency is necessary for the license.

[10]We could collect administrative data on the upazila-wise distribution of physicians for only three years.

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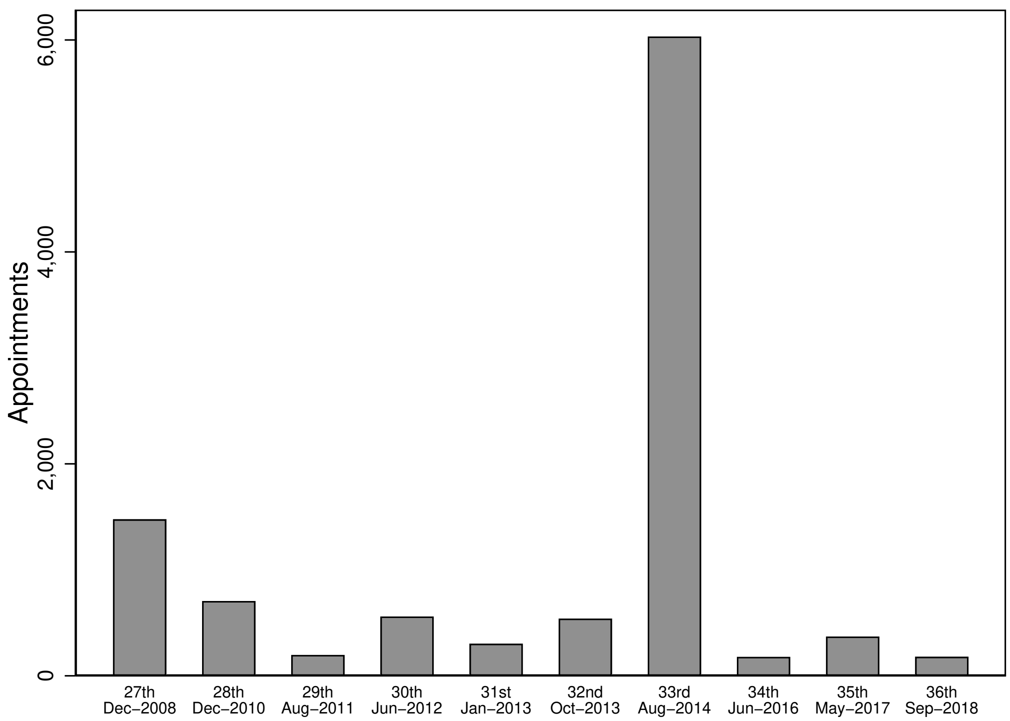
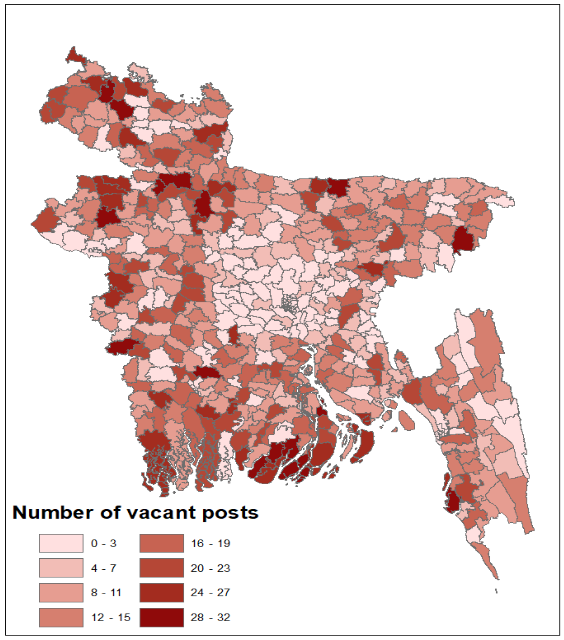
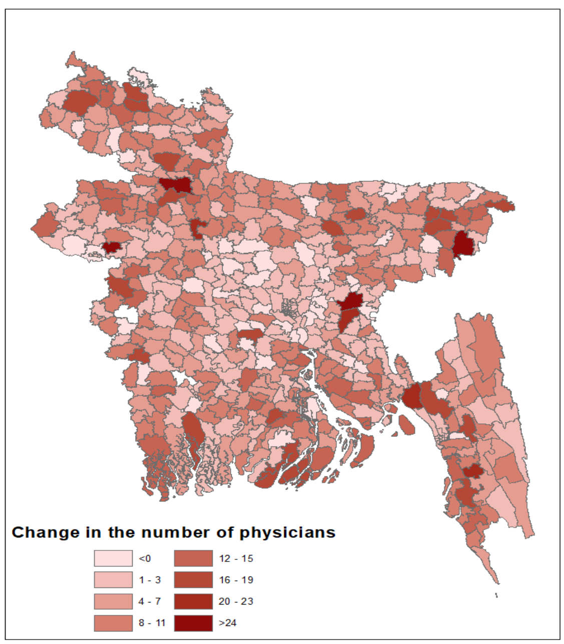


Figure 1: Physician Recruitment in the Public Sector for each BCS cohort and Month-Year of Appointment

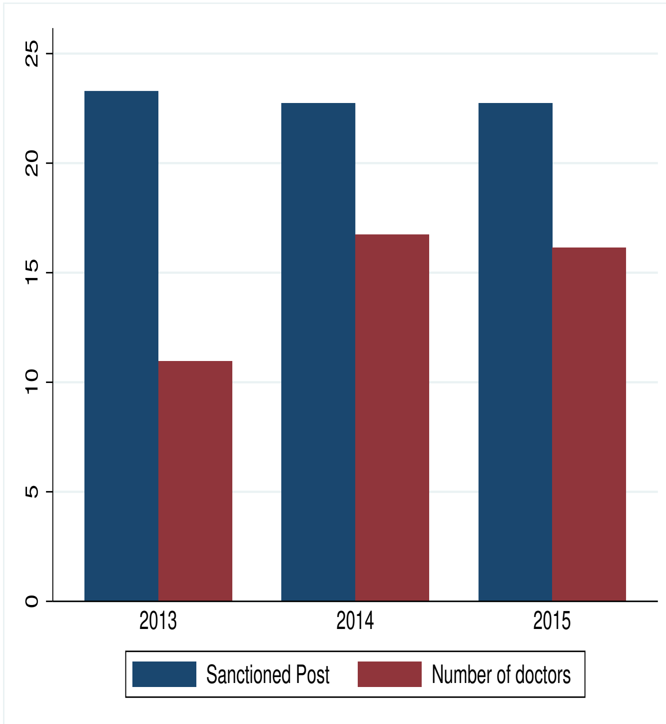


(a) Number of vacant Posts

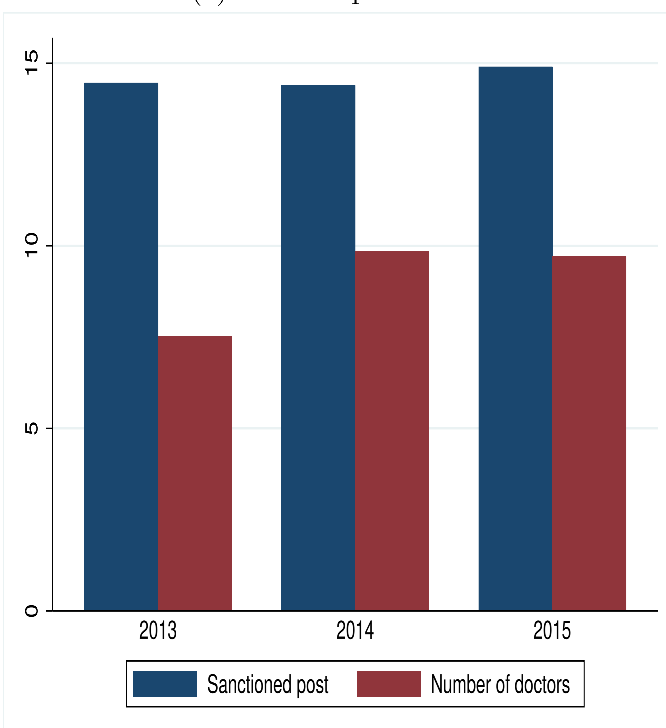


(b) Number of new physicians

Figure 2: Spatial Distribution of Vacant Posts and Newly Appointed Physicians



(a) At the Upzila Level



(b) At the Upzila Health Complex Level

Figure 3: Comparison of Sanctioned and Number of Physicians Posted during the period 2013-2015

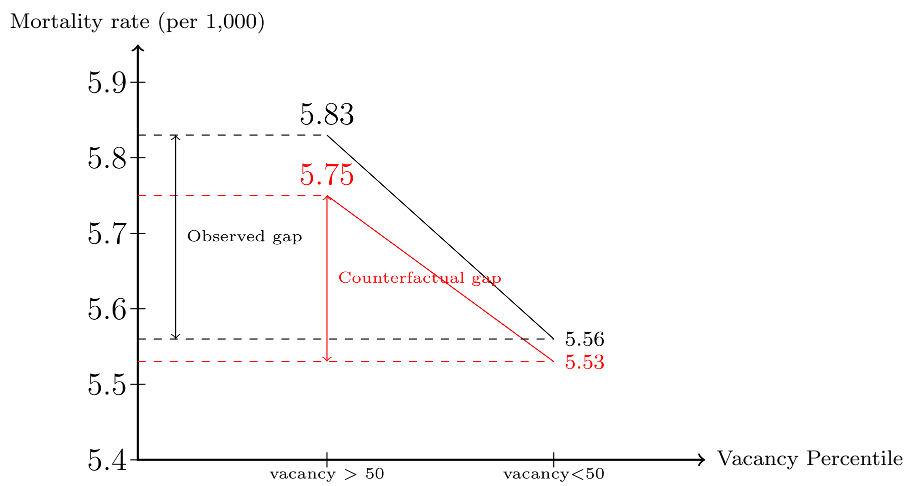


Figure 4: Mortality Gap and Vacancy Plugged

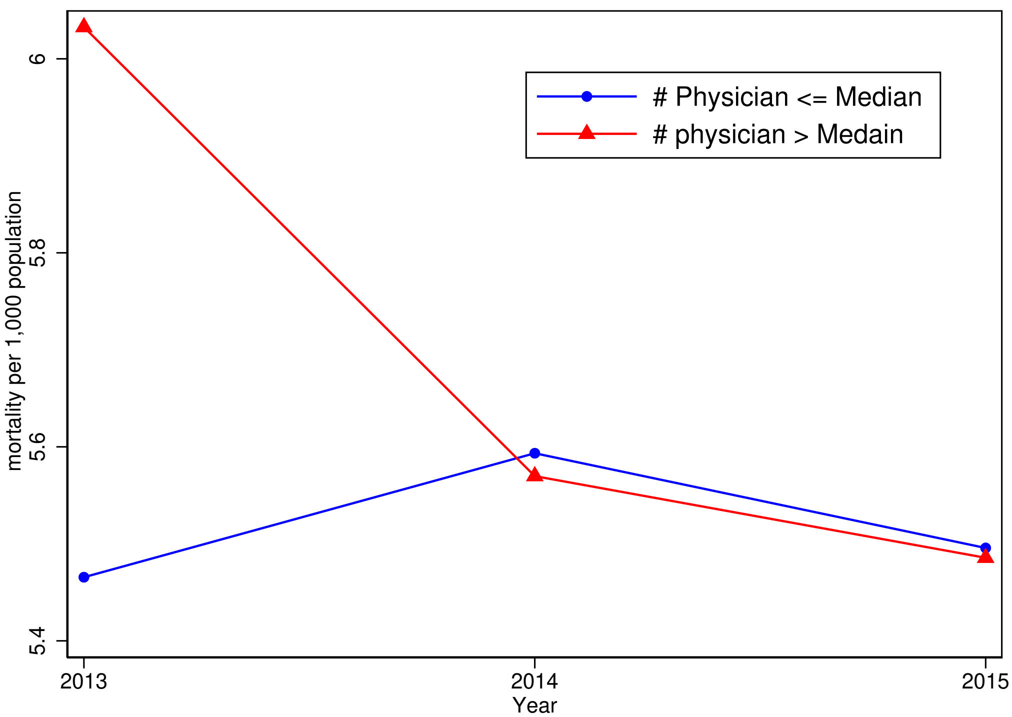


Figure 5: Trends in Mortality Rates

Figure shows the mortality rate per 1,000 of the population in two groups of Upzilas segregated by above and below the median number of physicians per 10,000 of population

Table 1: Summary Statistics

	2013		2014		2015	
	Mean	SD	Mean	SD	Mean	SD
Panel A: Facilities at the Upzila Level: N=470						
Number of physicians	10.70	7.62	16.21	8.21	15.61	8.28
Number of sanctioned posts	22.31	8.06	21.73	8.78	21.73	8.58
Health and Family Welfare Centre	6.03	3.67	6.49	4.05	7.85	4.41
Community clinics	26.80	12.75	27.17	12.76	28.15	12.86
Private Clinics	3.79	6.98	4.21	7.98	4.61	8.84
NGO clinics	0.81	1.14	0.88	1.23	0.73	1.09
Population	274065	141119	277397	143456	280654	146994
Panel B: Upzila Health Complex (UHC): N=412						
Number of physicians	7.58	5.03	9.84	5.62	9.71	6.02
Number of vacant posts	6.73	5.24	4.63	3.86	5.10	4.06
Number of outdoor visits: male	19160	10019	17553	9494	18875	19822
Number of outdoor visits: female	26312	14060	25511	13768	27534	24521
Number of outdoor visits: child	11580	7543	11648	8435	13202	12343

Notes: Data are at the UHC level. All the variables in Panel A are normalized by per 10,000 population.

Table 2: Effect of Physicians Supply on Number of Outdoor Visits

	Number of outdoor visits			
	Male	Female	Children	Total
VARIABLES	(1)	(2)	(3)	(4)
Number of physicians	322.3	123.7	248.1**	688.8**
	(210.7)	(121.8)	(98.79)	(276.5)
Observations	1,230	1,230	1,230	1,232
R-squared	0.675	0.737	0.639	0.800
Upzila fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	yes	yes	yes	yes
Mean of the dependent variable	880.3	1200	516.5	2596

Notes: Data are at the UHC level. . Each regression controls for year and upzila fixed effects. Each regression control for the number of beds in the UHCs, the number of community clinics, sanitation and drinking water facilities. All the outcome variables and the number of physicians is normalized by per 10,000 population. Robust standard errors are in the parenthesis. *** indicates significance at 1, ** at 5, and * at 10 percent level.

Table 3: Heterogeneity in the Effect of Physicians Supply on Number of Outdoor Visits

	Number of outdoor visits			
	Male	Female	Children	Total
VARIABLES	(1)	(2)	(3)	(4)
Panel A: Backward regions				
Number of physicians	673.1	47.46	347.3*	1,052*
	(507.2)	(176.3)	(191.9)	(554.1)
Observations	613	613	613	615
R-squared	0.621	0.848	0.578	0.866
Upzila fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	yes	yes	yes	yes
Mean of dependent variable	799.1	1102	502.3	2403
Panel B: Forward regions				
Number of physicians	19.25	104.8	149.6	273.7
	(116.0)	(154.2)	(108.2)	(261.6)
Observations	617	617	617	617
R-squared	0.736	0.680	0.729	0.751
Upzila fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	yes	yes	yes	yes
Mean of dependent variable	961.5	1298	530.6	2790

Notes: Data are at the UHC level. . Each regression controls for year and upzila fixed effects. Each regression control for the number of beds in the UHCs, the number of community clinics, sanitation and drinking water facilities. All the outcome variables and the number of physicians is normalized by per 10,000 population. Robust standard errors are in the parenthesis. *** indicates significance at 1, ** at 5, and * at 10 percent level.

Table 4: Effect of Physicians Supply on Treatment Seeking Behaviour

VARIABLES	(1) Probabilty of seeking treatment at UHC conditional on suffering chronic illness	(2) Probabilty of seeking treatment at UHC conditional on having symptoms of illness in last 30 days	(3) Probabilty of seeking treatment at UHC conditional on seeking treatment	(4) Probability of hospitalization at government facility	(5) Consulting pharmacy/dispensary	(6) Consulting any unqualified personnel
Change in the number of physicians	0.0123***	0.0251***	0.0296***	0.0180***	-0.109***	-0.0970***
	(0.00338)	(0.00506)	(0.00566)	(0.00414)	(0.0105)	(0.0110)
Constant	0.0241***	0.0626***	0.0659***	0.0280***	0.377***	0.435***
	(0.00588)	(0.00932)	(0.0114)	(0.00581)	(0.0431)	(0.0431)
Observations	30,512	35,110	31,226	31,226	31,206	31,226
R-squared	0.001	0.004	0.005	0.003	0.012	0.010
Mean of the dependent variable	0.0205	0.0458	0.0519	0.0505	0.325	0.373

Notes: Notes: Data is from the Household Income and Expenditure Survey (HIES) 2016. Data are at the individual level. Each regression control for household controls as well as the number of beds in the UHCs, the number of community clinics, private clinics, sanitation and drinking water facilities. The number of physicians is normalized per 10,000 population and is net of Upzila and year-fixed effects. Standard errors are clustered at the Upzila level. *** indicates significance at 1, ** at 5, and * at 10 percent level.

Table 5: Effect of Physicians Supply on Treatment Seeking Behaviour: Rural vs. Urban

VARIABLES	(1) Probabilty of seeking treatment at UHC conditional on suffering chronic illness	(2) Probabilty of seeking treatment at UHC conditional on having symptoms of illness in last 30 days	(3) Probabilty of seeking treatment at UHC conditional on seeking treatment	(4) Probability of hospitalization at government facility	(5) Consulting pharmacy/dispensary	(6) Consulting any unqualified personnel
Panel A: Rural sample						
Change in the number of physicians	0.00599	0.0179***	0.0206***	0.0164***	-0.0556***	-0.0461***
	(0.00379)	(0.00532)	(0.00602)	(0.00471)	(0.0121)	(0.0127)
Constant	0.0126*	0.0470***	0.0483***	0.0233***	0.358***	0.424***
	(0.00691)	(0.0103)	(0.0130)	(0.00671)	(0.0442)	(0.0464)
Observations	22,354	26,101	23,148	23,145	23,128	23,145
R-squared	0.002	0.003	0.003	0.003	0.012	0.012
Mean of the dependent variable	0.0195	0.0427	0.0484	0.0478	0.321	0.367
Panel B: Urban sample						
Change in the number of physicians	0.0339***	0.0616***	0.0724***	0.0240***	-0.246***	-0.232***
	(0.00759)	(0.0130)	(0.0143)	(0.00887)	(0.0221)	(0.0225)
Constant	0.0577***	0.115***	0.125***	0.0428***	0.431***	0.468***
	(0.0133)	(0.0209)	(0.0231)	(0.0103)	(0.0676)	(0.0596)
Observations	8,158	9,009	8,081	8,081	8,078	8,081
R-squared	0.008	0.017	0.020	0.002	0.025	0.021
Mean of the dependent variable	0.0231	0.0532	0.0606	0.0572	0.334	0.387

Notes: Notes: Data is from the Household Income and Expenditure Survey (HIES) 2016. Data are at the individual level. Each regression control for household controls as well as the number of beds in the UHCs, the number of community clinics, private clinics, sanitation, and drinking water facilities. The number of physicians is normalized per 10,000 population and is net of Upzila and year-fixed effects. Standard errors are clustered at the Upzila level. *** indicates significance at 1, ** at 5, and * at 10 percent level.

Table 6: Effect of Physicians Supply on Treatment Seeking Behaviour: Poor vs. Non-Poor Households

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Probabilty of seeking treatment at UHC conditional on suffering chronic illness	Probabilty of seeking treatment at UHC conditional on having symptoms of illness in last 30 days	Probabilty of seeking treatment at UHC conditional on seeking treatment	Probability of hospitalization at government facility	Consulting pharmacy/ dispensary	Consulting any unqualified personnel
Panel A: Poor						
Change in the number of physicians	0.0242**	0.0261	0.0331*	0.0139	-0.137***	-0.107***
	(0.0104)	(0.0159)	(0.0176)	(0.0107)	(0.0269)	(0.0284)
Constant	0.0414***	0.0999***	0.118***	0.0116	0.450***	0.521***
	(0.0142)	(0.0365)	(0.0402)	(0.0148)	(0.0849)	(0.0871)
Observations	4,504	6,190	5,426	5,426	5,419	5,426
R-squared	0.006	0.006	0.007	0.003	0.009	0.006
Mean of the dependent variable	0.0206	0.0485	0.0551	0.0319	0.397	0.450
Panel A: Non-Poor						
Change in the number of physicians	0.0105***	0.0252***	0.0294***	0.0187***	-0.104***	-0.0949***
	(0.00356)	(0.00520)	(0.00583)	(0.00449)	(0.0114)	(0.0119)
Constant	0.0218***	0.0597***	0.0624***	0.0277***	0.380***	0.437***
	(0.00638)	(0.00956)	(0.0118)	(0.00660)	(0.0458)	(0.0453)
Observations	26,008	28,920	25,803	25,800	25,787	25,800
R-squared	0.001	0.004	0.004	0.002	0.008	0.006
Mean of the dependent variable	0.0205	0.0453	0.0513	0.0542	0.310	0.358

Notes: Notes: Data is from the Household Income and Expenditure Survey (HIES) 2016. Data are at the individual level. Each regression control for household controls as well as the number of beds in the UHCs, the number of community clinics, private clinics, sanitation and drinking water facilities. The number of physicians is normalized per 10,000 population and is net of Upzila and year-fixed effects. Standard errors are clustered at the Upzila level. *** indicates significance at 1, ** at 5, and * at 10 percent level.

Table 7: Effect of Physicians Supply on Waiting Time

VARIABLES	(1) Waiting time to reach provider conditional on suffering chronic illness (hours)	(2) Waiting time at Provider conditional on suffering chronic illness (hours)	(3) Waiting time at provider conditional on on having symptoms of illness in last 30 days (hours)	(4) Waiting time at provider conditional on seeking treatment (hours)
Change in the number of physicians	-0.00920	-0.0551*	0.0183	0.0194
	(0.0686)	(0.0300)	(0.0265)	(0.0265)
Constant	0.729***	0.416***	0.306***	0.305***
	(0.0515)	(0.0324)	(0.0188)	(0.0188)
Observations	9,431	9,435	31,163	31,149
R-squared	0.007	0.003	0.004	0.004
Mean of Dependent Variable	0.754	0.430	0.321	0.321

Notes: Notes: Data is from the Household Income and Expenditure Survey (HIES) 2016. Data are at the individual level. Each regression control for household controls as well as the number of beds in the UHCs, the number of community clinics, private clinics, sanitation, and drinking water facilities. The number of physicians is normalized per 10,000 population and is net of Upzila and year-fixed effects. Standard errors are clustered at the Upzila level. *** indicates significance at 1, ** at 5, and * at 10 percent level.

Table 8: Effect of Physicians Supply on Childbirth

VARIABLES	(1) Child delivered in a hospital	(2) Child delivered in a hospital/clinic	(3) Child attendant is a doctor	(4) Child attendant is a doctor/nurse	(5) Probability of live birth
Number of physicians	0.00542	0.00910*	0.00564	0.0109**	-0.00155
	(0.00466)	(0.00505)	(0.00481)	(0.00529)	(0.00120)
Constant	0.197*	0.245**	0.0839	0.310***	0.971***
	(0.102)	(0.111)	(0.103)	(0.114)	(0.0198)
Observations	24,275	24,275	24,275	24,275	24,275
R-squared	0.113	0.198	0.181	0.187	0.025
Upzila fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	yes	yes	yes	yes	yes
Endline mean	0.228	0.411	0.288	0.440	0.989

Notes: Data are at the individual level. Data is from Sample Vital Registration Survey (SVRS). Each regression control for household controls as well as the number of beds in the UHCs, the number of community clinics, private clinics, sanitation and drinking water facilities. The number of physicians is normalized by population. Each regression includes Upzila and year-fixed effects. Standard errors are clustered at the Upzila level. *** indicates significance at 1, ** at 5, and * at 10 percent level.

Table 9: Effect of Physicians Supply on Mortality

VARIABLES	(1) Mortality rate per 1000 population	(2) Mortality rate per 1000 population
Number of physicians	-0.726**	-0.760**
	(0.348)	(0.345)
Constant	6.562***	5.844***
	(1.824)	(1.953)
Observations	1,267	1,267
R-squared	0.418	0.420
Upzila fixed effects	Yes	Yes
Socio-economic Controls	No	Yes
Year fixed effects	yes	yes
Mean of the dependent variable	5.578	5.578

Notes: Data are at the Upzila level. Each regression controls for year and upzila fixed effects. Each regression control for the number of beds in the UHCs, the number of community clinics, sanitation, and drinking water facilities. All the outcome variables and the number of physicians are normalized per 10,000 population. Robust standard errors are in the parenthesis. *** indicates significance at 1, ** at 5, and * at 10 percent level.

Table 10: Effects of Physicians on Mortality by Age Groups

	Age Group					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	0-1	1-5	5-15	15-40	40-60	60+
norm_upz_doc_total	0.0397	-0.0295	-0.193	0.0424	-0.534**	-0.0856
	(0.188)	(0.112)	(0.119)	(0.241)	(0.251)	(0.392)
Constant	0.488	0.192	0.539	0.578	0.464	3.583***
	(0.729)	(0.182)	(0.329)	(0.435)	(0.734)	(1.320)
Observations	1,267	1,267	1,267	1,267	1,267	1,267
R-squared	0.364	0.402	0.400	0.395	0.431	0.409
Upzila fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	yes	yes	yes	yes	yes	yes
Baseline mean	0.662	0.173	0.240	0.618	1.015	2.963

Notes: Data are at the Upzila level. Each regression controls for year and upzila fixed effects. Each regression control for the number of beds in the UHCs, the number of community clinics, sanitation, and drinking water facilities. All the outcome variables and the number of physicians are normalized per 10,000 population. Robust standard errors are in the parenthesis. *** indicates significance at 1, ** at 5, and * at 10 percent level.

Table 11: Effects on Mortality by Causes of Death

VARIABLES	(1) Top 5 Causes	(2) Diarrhoea Related	(3) Circulatory Diseases	(5) Respiratory Diseases	(6) Pregnancy Related	(7) Digestive Diseases	(8) Infectious and Parasitic Diseases	(9) Kidney Diseases
No. of Physicians	-0.464*	-0.0865*	-0.456*	-0.0496	0.0425	-0.0505	0.132	-0.0867
	(0.267)	(0.0511)	(0.239)	(0.221)	(0.0720)	(0.0457)	(0.189)	(0.186)
Constant	2.663***	0.0552	1.405**	0.679	-0.0266	0.0520	0.361	1.048*
	(0.748)	(0.0597)	(0.592)	(0.503)	(0.0787)	(0.0846)	(0.406)	(0.575)
Observations	1,267	1,267	1,267	1,267	1,267	1,267	1,267	1,267
R-squared	0.417	0.348	0.434	0.409	0.333	0.448	0.441	0.398
Upzila fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Baseline mean	1.920	0.0213	1.296	0.751	0.0435	0.0713	0.563	0.642

Notes: Data are at the Upzila level. Each regression controls for year and upzila fixed effects. Each regression control for the number of beds in the UHCs, the number of community clinics, sanitation, and drinking water facilities. All the outcome variables and the number of physicians are normalized per 10,000 population. Robust standard errors are in the parenthesis. *** indicates significance at 1, ** at 5, and * at 10 percent level.The causes of death are coded and categorized following the International Statistical Classification of Diseases and Related Health Problems (ICD-10). The top 5 causes of mortality in Bangladesh are cancer, heart disease, respiratory disease, pneumonia, and stroke. Disaggregated Causes for individual Death Causes Groups are reported in the Appendix

Online Appendices

A Instrumental Variable Approach

A.1 Empirical Specification

The decision rule for the placement of the recruited physicians was that they would be posted to their home upazila, given there are vacant posts (See Figures 1 and 2). We exploit this decision rule to find an instrument for the endogenous variable of concern, the supply of physicians. More precisely, We use the number of vacant posts in the previous year as an instrument for the change in the supply of physicians over two years. The first-stage regression is as follows:

$$\Delta D_{it} = \alpha_0 + \alpha_1 \ V_{i,t-1} + \Pi \ X_{it} + \gamma_i + \delta_t + u_{it} \tag{5}$$

Where, ΔD_{it} is the change in the number of physicians between the two periods, and $V_{i,t-1}$ is the number of vacant posts in the previous year. X_{it} are a set of upazila-level controls that vary over time, γ_i are the upzila fixed effects, and δ_t are year fixed effects. Upzila fixed effects account for the time-invariant unobserved characteristics of the districts. Shocks that are common to all upazilas are purged using year-fixed effects.

In the second stage, we run the regression of the following form:

$$y_{it} = \alpha_0 + \alpha_1 \ \widehat{\Delta D_{it}} + \Pi \ X_{it} + \gamma_i + \delta_t + u_{it} \tag{6}$$

Where, y_{it} are the outcomes of interest, and $\widehat{\Delta D_{it}}$ are the estimates of the change in the supply of physicians obtained from the first stage of the Instrumental Variable Regression.

In order for the number of vacancies in the previous year to be a valid instrument for the change in the number of physicians in the current year, it must satisfy two conditions. The first one is the relevance condition, i.e., the number of vacancies in the previous year is significantly correlated with the change in the number of physicians in the current year. We test the validity of this assumption by running the regression specified in Column (2). The first stage IV results are reported in Appendix Table A.1. In column (1), we only control for upazila and year-fixed effects. In column (2), we add other socio-economic controls such as the number of beds in the UHCs, the number of community clinics, sanitation, and drinking water facilities. In column (3), we further add Upazila-specific time trends. Across all specifications, the first-stage regression is significant at a one percent significance level. The F-stat is greater than 10 across all columns, and the Partial R-squared is also quite high. These suggest that the number of vacant posts in the previous year is highly correlated with the change in the supply of physicians.

The second assumption that the instrument needs to satisfy is *exclusion restriction.* In the context of this study, this condition requires that the number of vacant posts in the previous year would not affect the outcome variables except through its impact on the change in the supply of physicians. Given that the number of vacant posts is upazila-specific (backward upazilas have more vacancies), once we control for upzila fixed effects, this instrument should not directly affect the outcome variables. We also control for some other time-varying upzila characteristics to eliminate further concerns.

A.2 Results

We now discuss the instrumental variable results. In Appendix Table A.2, we present the findings for patients' outdoor visits. The total number of outdoor visits rose notably due to the increase in the number of doctors (Column 4). Specifically, an extra physician per 10,000 individuals results in 639 more visits or a 24% increase in total outdoor visits compared to the pre-intervention mean (2013). The effect is significant at the 1 percent level of significance. We also analyze the changes in outpatient visits by males, females, and children, separately, as shown in Columns 1-3 in Appendix Table A.2. and find that all three groups benefited from the intervention.

The results for treatment-seeking behavior from formal and informal healthcare providers are presented in Appendix Table A.3. We see that conditional on having symptoms of illness, the probability of seeking treatment at the Upzila Health Complexes (UHC) increased by 75% relative to the pre-intervention mean. The probability of hospitalization at government facilities also increased significantly. We observe a significant reduction in seeking treatment from unlicensed providers like traditional healers or drugstore vendors. With the addition of one new doctor, the probability of seeking treatment from drugstore vendors decreased by 15 percentage points, which is a 45% reduction from the mean of 32.5%. Additionally, seeking treatment from other unqualified providers dropped by 11 percentage points (30% reduction relative to baseline). These findings indicate a significant shift in utilizing formal healthcare facilities instead of non-formal providers due to the increase in physician supply.

We then explore the effect of physician supply on child delivery practices. As shown in Appendix Table A.4, the likelihood of a child being delivered in a hospital/clinic increases by 6.4% with the increase in the number of physicians(Column 2). Furthermore, the probability of a doctor or nurse serving as a childbirth attendant significantly increased by 6.9%. However, as was the case with the two-way fixed effects estimates, we found no discernible impact on the likelihood of live birth.

Finally, we look at the effect of the increased physician supply on mortality rates. Appendix Table A.5 presents the regression outcomes, which reveal that the increase in physician supply led to a considerable reduction in the mortality rate. Specifically, with one extra doctor per 10,000 people, the mortality rate decreased by * percent to 1o percent. However, the effects are insignificant at the 10 percent significance level.

B Appendix Figures and Tables

Table A.1: IV: First Stage Results

VARIABLES	Change in the number of physicians (1)	(2)	(3)
Number of vacancies in the previous year	0.180***	0.203***	1.134***
	(0.0303)	(0.0341)	(0.192)
Year fixed effects	Yes	Yes	Yes
Upzila fixed effects	No	No	Yes
Other controls	No	Yes	Yes
Observations	808	808	808
R-squared	0.104	0.111	0.523
F-stat	26.04	11.98	10.09

Data are at the Upzila level. Base year is 2014. Each regression controls for year and upzila fixed effects. Each regression control for the number of beds in the UHCs, the number of community clinics, sanitation and drinking water facilities. The number of physicians and the number of vacancies is normalized by population. Standard errors are clustered at the upzila level. *** indicates significance at 1, ** at 5, and * at 10 percent level.

Table A.2: Effect of Physicians Supply on Number of Outdoor Visits: IV Estimates

	Number of outdoor visits			
	Male	Female	Children	Total
VARIABLES	(1)	(2)	(3)	(4)
Change in the number of physicians	231.7**	252.7*	145.9	629.6***
	(99.53)	(131.1)	(123.2)	(237.1)
Observations	806	806	806	808
Number of Upzilas	411	411	411	411
Upzila fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	yes	yes	yes	yes
Baseline mean	897.7	1215	523.2	2604

Notes: Data are at the UHC level. Base year is 2014. Each regression controls for year and upzila fixed effects. Each regression control for the number of beds in the UHCs, the number of community clinics, sanitation and drinking water facilities. All the outcome variables and the number of physicians is normalized by population (per 10,000 people). Robust standard errors are in the parenthesis. *** indicates significance at 1, ** at 5, and * at 10 percent level.

Table A.3: Effect of Physicians Supply on Treatment Seeking Behaviour: IV Estimates

VARIABLES	(1) Probability of seeking treatment at UHC conditional on suffering chronic illness	(2) Probability of seeking treatment at UHC conditional on having symptoms of illness in last 30 days	(3) Probability of seeking treatment at UHC conditional on seeking treatment	(4) Probability of hospitalization at government facility	(5) Consulting pharmacy/dispensary	(6) Consulting any unqualified personnel
Change in the number of physicians	0.0100	0.0342**	0.0362**	0.0199*	-0.147**	-0.110*
	(0.0110)	(0.0159)	(0.0184)	(0.0102)	(0.0663)	(0.0662)
Observations	30,512	35,110	31,226	31,226	31,206	31,226
R-squared	0.001	0.004	0.004	0.003	0.011	0.010
2015 mean	0.0205	0.0458	0.0519	0.0505	0.325	0.373

Notes: Data are at the individual level. The base year is 2014. Each regression control for household controls such as household size, monthly expenditure, and poverty dummy, as well as upazila-level controls such as the number of beds in the UHCs, the number of community clinics, private clinics, sanitation, and drinking water facilities. The number of physicians is normalized by population and is net of Upzila and year-fixed effects. Standard errors are clustered at the Upzila level. *** indicates significance at 1, ** at 5, and * at 10 percent level.

Table A.4: Effect of Physicians Supply on Childbirth: IV Estimates

VARIABLES	(1) Child delivered in a hospital	(2) Child delivered in a hospital/clinic	(3) Child attendant is a doctor	(4) Child attendant is a doctor/nurse	(5) Probability of live birth
Change in the number of physicians	0.0262	0.0642**	0.0499*	0.0691**	-0.00922
	(0.0262)	(0.0277)	(0.0271)	(0.0289)	(0.00618)
Observations	24,477	24,477	24,477	24,477	24,477
R-squared	0.115	0.200	0.182	0.189	0.026
Upzila fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	yes	yes	yes	yes	yes
Baseline mean	0.228	0.411	0.288	0.440	0.989

Notes: Data are at the individual level. Data is from Sample Vital Registration Survey (SVRS). Base year is 2014. Each regression control for household controls such as mother's age, sex of the child, and household economic condition as well as Upzila-level controls such as the number of beds in the UHCs, the number of community clinics, private clinics, sanitation and drinking water facilities. The number of physicians is normalized by population. Each regression includes Upzila and year fixed effects. Standard errors are clustered at the Upzila level. *** indicates significance at 1, ** at 5, and * at 10 percent level.

Table A.5: Effect of Physicians Supply on Mortality: IV Estimates

	Death Rate per 1,000 People	
VARIABLES	(1)	(2)
Change in the number of physicians	-1.497***	-1.422***
	(0.514)	(0.492)
Observations	830	830
R-squared	0.579	0.587
Upzila fixed effects	Yes	Yes
Year fixed effects	yes	yes
Endline mean	5.578	5.578

Notes: Data are at the upzila level. Data is from Sample Vital Registration Survey (SVRS). Base year is 2014. Upzila-level controls include the number of community clinics, private clinics, sanitation and drinking water facilities. The number of physicians is normalized by population. Each regression includes Upzila and year fixed effects. Standard errors are clustered at the Upzila level. *** indicates significance at 1, ** at 5, and * at 10 percent level.

Table A.6: Effect on Mortality by Top 5 Causes

	Cancer	Respiraotry Disease	Pneumonia	Heart Disease	Heart Stroke
VARIABLES	(1)	(2)	(3)	(4)	(5)
Number of Physicians	-0.0273	-0.0687	-0.00540	0.0351	-0.398*
	(0.156)	(0.137)	(0.0762)	(0.0913)	(0.207)
Constant	0.978***	0.837***	-0.214	0.247	0.815*
	(0.333)	(0.291)	(0.217)	(0.200)	(0.459)
Observations	1,267	1,267	1,267	1,267	1,267
R-squared	0.411	0.405	0.404	0.420	0.473
Upzila fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	yes	yes	yes	yes	yes
Baseline mean	0.496	0.219	0.233	0.221	0.751

Notes: Data are at the upzila level. Data is from Sample Vital Registration Survey (SVRS). Base year is 2013. Upzila-level controls include the number of community clinics, private clinics, sanitation and drinking water facilities. The number of physicians is normalized by population. Each regression includes Upzila and year-fixed effects. Robust Standard Errors are reported. *** indicates significance at 1, ** at 5, and * at 10 percent level.

Table A.7: Effect on Mortality by Circulatory Diseases

VARIABLES	(1) Hypertension	(2) Heart Disease	(3) Stroke	(4) Rheumatic Fever	(5) Rheumatic Disease	(6) Brain Hemorrhage
Number of Physicians	0.0275	0.0351	-0.398*	0.00380	-0.118**	-0.00634
	(0.0927)	(0.0913)	(0.207)	(0.0182)	(0.0522)	(0.0598)
Constant	0.0692	0.247	0.815*	-0.131	0.121**	0.284**
	(0.226)	(0.200)	(0.459)	(0.117)	(0.0519)	(0.127)
Observations	1,267	1,267	1,267	1,267	1,267	1,267
R-squared	0.421	0.420	0.473	0.428	0.369	0.379
Upzila fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	yes	yes	yes	yes	yes	yes
Baseline mean	0.164	0.221	0.751	0.0109	0.0479	0.101

Notes: Data are at the upzila level. Data is from Sample Vital Registration Survey (SVRS). Base year is 2013. Upzila-level controls include the number of community clinics, private clinics, sanitation and drinking water facilities. The number of physicians is normalized by population. Each regression includes Upzila and year-fixed effects. Robust Standard Errors are reported. *** indicates significance at 1, ** at 5, and * at 10 percent level.

Table A.8: Effect on Mortality by Respiratory Diseases

VARIABLES	(1) Asthma	(2) Respiratory Disease	(3) Pneumonia	(4) Pulmonary Edema
Number of Physicians	0.0292	-0.0687	-0.00540	-0.00472
	(0.110)	(0.137)	(0.0762)	(0.0598)
Constant	0.185	0.837***	-0.214	-0.128
	(0.253)	(0.291)	(0.217)	(0.120)
Observations	1,267	1,267	1,267	1,267
R-squared	0.456	0.405	0.404	0.385
Upzila fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	yes	yes	yes	yes
Baseline mean	0.254	0.219	0.233	0.0445

Notes: Data are at the upzila level. Data is from Sample Vital Registration Survey (SVRS). Base year is 2013. Upzila-level controls include the number of community clinics, private clinics, sanitation and drinking water facilities. The number of physicians is normalized by population. Each regression includes Upzila and year-fixed effects. Robust Standard Errors are reported. *** indicates significance at 1, ** at 5, and * at 10 percent level.

Table A.9: Effect on Mortality by Pregnancy, Childbirth and Puerperium Diseases

VARIABLES	(1) Pregnancy Complications	(2) Childbirth Complications	(3) Postpartum Hemmorhage	(4) Abortion Complications	(5) Antepartum Hemmorhage	(6) Peurperal Disease
Number of Physicians	0.00733	0.0255	-0.00486	0.0205	-5.34e-06	-0.00600
	(0.0160)	(0.0640)	(0.00600)	(0.0244)	(0.0128)	(0.00537)
Constant	-0.00566	-0.0497	0.0465	-0.0183	-0.0117	0.0121
	(0.0216)	(0.0519)	(0.0370)	(0.0417)	(0.0293)	(0.0134)
Observations	1,267	1,267	1,267	1,267	1,267	1,267
R-squared	0.386	0.330	0.344	0.365	0.336	0.337
Upzila fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	yes	yes	yes	yes	yes	yes
Baseline mean	0.0146	0.00468	0.00213	0.0119	0.0103	0

Notes: Data are at the upzila level. Data is from Sample Vital Registration Survey (SVRS). Base year is 2013. Upzila-level controls include the number of community clinics, private clinics, sanitation and drinking water facilities. The number of physicians is normalized by population. Each regression includes Upzila and year-fixed effects. Robust Standard Errors are reported. *** indicates significance at 1, ** at 5, and * at 10 percent level.

Table A.10: Effect on Mortality by Diseases of the Digestive System

VARIABLES	(1) Gall Bladder Disease	(2) Peptic Ulcer	(3) Appendicitis
Number of Physicians	-0.0341	-0.0233	0.00689
	(0.0360)	(0.0261)	(0.00834)
Constant	-0.0180	0.0715	-0.00146
	(0.0584)	(0.0620)	(0.00623)
Observations	1,267	1,267	1,267
R-squared	0.368	0.536	0.337
Upzila fixed effects	Yes	Yes	Yes
Year fixed effects	yes	yes	yes
Baseline mean	0.0322	0.0390	0

Notes: Data are at the upzila level. Data is from Sample Vital Registration Survey (SVRS). Base year is 2013. Upzila-level controls include the number of community clinics, private clinics, sanitation and drinking water facilities. The number of physicians is normalized by population. Each regression includes Upzila and year-fixed effects. Robust Standard Errors are reported. *** indicates significance at 1, ** at 5, and * at 10 percent level.