Gender differences in tertiary healthcare*

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Objectives. We examine gender differences in access to and service within a publicly financed tertiary healthcare program in India.

Methods. We use claim-level administrative data from the program to estimate gender differences in access and services. We measure access using the distance the patient travels and service using the time for claim authorization, treatment and discharge, as well as the amount approved and paid. We use a regression framework to control for the influence of other patient characteristics, the type of procedure, hospital, and quarter of treatment to make precise gender comparisons.

Results. We find that women on average experience shorter interactions with the healthcare system with fewer days between surgery and discharge, reduced hospital revisits, and are less likely to travel to seek healthcare. We document heterogeneity in these results by hospital ownership type with significant differences in healthcare measures by gender in public hospitals. The effects are concentrated among women in child-bearing years.

Conclusion. This paper finds significant differences in healthcare utilization by gender in a large public health program in a developing country. Our analysis documents lower healthcare interactions for women as compared to men, both in terms of hospital stay as well as access to tertiary healthcare. Further, we find women in childbearing years face the brunt of these differences and that public hospitals perpetuate these differences.

Public Health Implications. Publicly operated health programs should enact policies to equalize access of women to tertiary healthcare.

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Patient gender can shape participation and outcomes in tertiary healthcare in numerous ways. Among these, women might seek care differently than men because the types and intensity of diseases vary, or because the willingness or ability to incur healthcare expenses is different. Women might have different experiences in the tertiary care system, with hospitals possibly directing fewer resources on their care, which could delay or decrease the quality of treatment. Using rich administrative data from a tertiary healthcare program in India, this paper examines whether women access hospitals at different rates than men and if they receive different care at hospitals.

The need for tertiary healthcare, especially in developing economies, is increasing rapidly. The high cost of non-communicable disease (NCD) treatment has motivated governments to establish public tertiary care facilities or subsidize care at private hospitals. Though nominally gender-neutral, media accounts point to gender differences in outcomes within these programs (Sabarwal, 2020).

Our analysis uses 2 million observations covering 938 procedures at 643 public and private hospitals under the Aarogyasri program in Andhra Pradesh in India. We estimate the influence of patient gender on the distance traveled to reach the hospital, with further distances indicating that the household is willing to invest more inpatient treatment. We also estimate the influence of gender on the days for the treatment procedure and discharge, as well as the amount the public insurer approves for treatment as a measure of care. Faster procedures and higher expenditures suggest better healthcare provision. Our regressions include individual level controls as well as hospital, procedure, village-of-residence, and time fixed effects to rule out systematic gender differences on these dimensions.

Our research contributes directly to the literature on how women access and experience healthcare. Previous studies have examined the case of gender differences in eye care treatment (Jayaraman et al., 2014), preventive care (Vaidya et al., 2012) and cardio-vascular care (Chhabra et al., 2016). Our main contribution is to examine gender differences in a large state-wide program that covers 80 million individuals and virtually every major tertiary care procedure. In contrast, existing research draws on small samples of data from a single hospital or procedure (Bertakis et al., 2000; Kapoor et al., 2019; Jayaraman et al., 2014), or focused on a specific population group (Redondo-Sendino et al., 2006). Our analysis is able to reveal more general gender differences in access and care, independent of the specific nuances of particular diseases, procedures, or hospitals.

Methods

Data: The primary data is from claim filings at a public health insurance program operating in the Indian state of Andhra Pradesh. The Rajiv Aarogyasri Scheme, or *Aarogyasri*, was launched in April 2007 as a public health insurance program to provide cashless tertiary-care to Below Poverty Level (BPL) households in the state. The program aimed at insuring poor individuals from catastrophic healthcare expenditures. Both private and government hospitals were enlisted to provide treatment for 994 surgical procedures. Each household was entitled to benefits up to Rs. 200,000 (USD 3300) which covered both hospitalization charges and patient transportation costs (La Forgia and Nagpal, 2012). Eligible households were automatically enrolled in the program, with reimbursements directly to the hospital at predefined rates.

Our dataset contains the universe of individual-level claims filed under this program between 2007 and 2015. A claim record includes the hospital that filed the claim, the dates of authorization, treatment and discharge, the amount approved and paid, as well as details of the surgery or procedure performed (in 29 surgical categories). Each claim record also includes the patient's gender, age, caste category, and village/ward of residence. We augment the claims data with the mean village-level literacy rate from the Census (Census of India, 2011). Using the information on claimant residence and hospital location, we also define two measures of accessibility as the distance traveled by a patient to receive healthcare.

We omit 56 procedures where only women or only men filed claims. We consider only first-time claims by a patient and generate a variable for the number of each patient's readmissions. We also exclude patients with age greater than 94 years (representing the 99.99 percentile of the age distribution). Finally, we drop 18,318 individual observations with one or more missing data fields from our final sample. These data restrictions yield a dataset with 2,001,249 unique observations.

This dataset has several attractive features. First, since the record of each claim was computerized and subsequently audited, the dataset accurately contains the complete census of all Aarogyasri users and claims. Concerns with self-reporting bias, missing data, and measurement errors that are salient with survey data are mitigated in this dataset. Second, we can identify repeat visits which helps track the patient history of individual claimants.

Table 1 shows that the average claimant age is 38.4 years and that men are 59% of

claimants. The average claim amount is INR 31,750 (approximately USD 420). The table shows that claim date to surgery date takes, on average, 42.6 days, and that patients spend close to seven days hospitalized after surgery until discharge. The average distance traveled by a patient to access a network hospital is close to 40.6 kilometers and 75% of surgeries in the program occur in a private hospital.

Table 1: Summary Statistics

	Overall mean	Female	Male
Average no of days from claim to surgery	42.63	43.52	42.02
	(45.65)	(46.84)	(44.81)
Days from surgery to discharge	6.94	6.98	6.91
	(10.34)	(10.44)	(10.26)
Claim amount	30289.44	29147.99	31072.49
	(26766.88)	(26898.07)	(26648.26)
Pre-authorization amount	33211.26	31681.41	34260.75
	(27843.64)	(27849.5)	(27790.97)
Distance between claim to hospital district (in kms.)	40.59	40.81	40.44
	(71.79)	(72.19)	(71.51)
Age of patients	38.38	39.45	37.65
	(20.14)	(19.81)	(20.34)
Female patients	.41	1	0
	(.49)	(0)	(0)
Backward caste	.53	.53	.53
	(.5)	(.5)	(.5)
Scheduled caste	.16	.16	.16
	(.36)	(.36)	(.36)
Scheduled tribe	.04	.04	.04
	(.2)	(.2)	(.2)
Other caste	.19	.18	.19
	(.39)	(.39)	(.39)
Minorities	.09	.09	.09
	(.28)	(.28)	(.28)
Others	0	0	0
	(.06)	(.06)	(.06)
Private hospital	.75	.74	.75
	(.43)	(.44)	(.43)
No of observations	2002407	814749	1187658

Notes: Data from Aarogyasri first time claims for the years 2007-15.

Measures: Patient gender can impact several tertiary care outcomes. The first are access costs borne by the patient or their family, which we proxy by the distance between the patient's residence and the hospital of treatment. Specifically, the distance between a patient's district of residence to the district of hospital location represents an extensive margin measure of willingness to travel outside own district to seek healthcare.

The outcome variables are the average number of days between claim date and surgery date, and the number of days between surgery and discharge date. We also examine healthcare expenditures, represented by the average of the preauthorization and claim amount for the surgery. Finally, readmission rates proxy for quality of care.

Model: We estimate the relationship between gender and healthcare variables via a fixed effects regression specification.

$$y_{ijvht} = \beta_0 + \beta_1 Female_{ijvht} + \beta_{\mathbf{2}} \mathbf{X}_{ijvht} + therapy_j + village_v + hospital_h + quarter_t + \epsilon_{ijvht} \quad (1)$$

We include controls for individual age and caste category as well as procedure fixed effects. Village fixed effects account for village-specific factors such as diet, culture, and occupational structure that might impactaccess to and use of tertiary care. Hospital fixed effects account for factors that are specific to a given hospital such as quality of care or specialization which could differentially influence male and female patients. Finally, the inclusion of year-quarter fixed effects helps control for seasonal factors as well as program evolution over time that could influence gender differences in utilization. Standard errors are clustered at the sub-district level. Thus, the essential comparison of differences by gender is within the hospital, within the surgical procedure for individuals from the same village in a particular year-quarter.

Results

Table 2 presents the main results. We interpret β_1 as the influence of being female on the outcome of interest after controlling for several other factors that might also impact access to and use of tertiary care. Column 1 examines gender differentials in the duration for processing claims, and Column 2 reports differentials in the length of post-procedure hospital stay. Women experience 0.16 fewer days ($p < 0.05$) between filing claims and when the procedure is carried out. This is also true for the time from procedure to discharge which is also 0.139 days lower ($p < 0.01$) for women than men. These results suggest shorter interactions of female patients with the healthcare system. In column 3, we do not find any difference in expenditures between men and women. Finally, we also find that women experience 0.009 percentage points lower readmissions, suggesting higher quality care.

Column 4 of Table 2 reports that women are 0.002 percentage points less likely to travel outside their district of residence for treatment compared to men ($p < 0.05$). Among patients who travel outside the district, women travel 0.592 kilometers less between claim and hospital districts as compared to men to access tertiary healthcare. The results are robust to alternate measures of distance traveled, such as shortest route driving distance

Table 2: Main Results

	Average days between claim and surgery (1)	Days between discharge and surgery (2)	Average of preauth and claim amount (in Rs.) (3)	Number of re-visits (4)	Travel outside district (yes/no) (5)	Distance between claim-hosp district (in kms.) (6)
Female	-0.160**	-0.139***	-3.234	-0.009***	-0.002**	-0.592***
	(.073)	(.016)	(13)	(.003)	(.00064)	(.19)
Mean	42.63	6.94	31750.35	.62	.42	97.2
SD	45.65	10.34	26938.92	2.23	.49	82.69
Village Fe	X	X	X	X	X	X
Surgery FE	X	X	X	X	X	X
Hospital FE	X	X	X	X	X	X
Quarter Year FE	X	X	X	X	X	X
R2	0.243	0.335	0.944	0.418	0.613	0.493
N	2001249	2001249	2001249	2001249	2001249	834798

Notes: All regressions include controls for age, caste and quarter of year and includes village, surgery code, and hospital fixed effects. All dependent variables are standardized with respect to male population. Standard errors clustered at the sub-district level.

as well as the crow flies distance between patient's home village and the hospital location. These results document differences in access to tertiary healthcare for females as compared to males, perhaps due to barriers to access better quality healthcare located at greater distances from patient residence.

Collectively, these results point to greater barriers for women in accessing the Aarogyasri system but experiencing a higher quality of care once they do.

Gender differences in tertiary healthcare by hospital type and patient age

International Institute for Population Sciences (2007) reports poor management in Indian hospitals resulting in lengthy wait times, inefficient staff and inconvenient hours of operation. Thus, we interact gender and private ownership of hospitals to study whether hospital ownership influences gender differentials in tertiary healthcare utilization. Table 3 shows that women in private hospitals spend on average 0.964 fewer days waiting for surgery compared to public hospitals.

Women get relatively faster surgeries in private compared to public hospitals (0.964 fewer days between claim approval and surgery), but slower discharges (0.163 longer days between surgery and discharge). Claim amounts are on average lower by 61.9 rupees for

Table 3: Results for Private Hospitals

	Average days between claim and surgery (1)	Days between discharge and surgery (2)	Average of preauth and claim amount (in Rs.) (3)	Number of re-visits (4)	Travel outside district (yes/no) (5)	Distance between claim-hosp district (in kms.) (6)
Female	0.507**	-0.237***	-61.905***	-0.034***	-0.027***	-2.158***
	(.2)	(.045)	(22)	(.0069)	(.0021)	(.36)
Pvt	-23.766***	-1.628***	1310.413***	0.074***	-0.071***	-8.921***
	(.48)	(.049)	(28)	(.008)	(.012)	(1.3)
Female × Pvt	-0.964***	0.163***	78.412***	0.034***	0.017***	0.268
	(.22)	(.048)	(26)	(.0078)	(.0026)	(.4)
Mean	42.63	6.94	31750.35	.62	.42	97.2
SD	45.65	10.34	26938.92	2.23	.49	82.69
Test Female × Private = Female	-.46	-.07	16.51	0	-.01	-1.89
P-val	0	0	.29	.88	0	0
Village Fe	X	X	X	X	X	X
Surgery FE	X	X	X	X	X	X
Hospital FE	X	X	X	X	X	X
Quarter Year FE	X	X	X	X	X	X
R2	0.147	0.308	0.944	0.414	0.403	0.378
N	2001253	2001253	2001253	2001253	2001253	834807

Notes: All regressions include controls for age, caste and quarter of year and includes village and surgery code fixed effects. All dependent variables are standardized with respect to male population. Standard errors clustered at the sub-district level.

women relative to men. However, hospital expenditure is greater by Rs. 78.4 for women relative to men in private facilities. Since our estimation controls for procedure fixed effects, these results suggest that females in public hospitals end up with lower expenses for the same therapy as compared to males. Our results also find 0.034 more readmissions for females as compared to males in private hospitals. Finally, we do not find statistically significant differences in women's likelihood to travel outside their districts for seeking treatment at private versus public hospitals (column 6 of table 3).

Several studies document the pervasive gender bias in health outcomes across age groups (Garg and Morduch, 1998; Pande and Yazbeck, 2003). We examine gender differentials in tertiary healthcare utilization by patient age. To do so, we interact gender with 5 different age groups including infancy, adolescence, working-age, and the aged. Based on Gao and Yao (2006) who finds strong effects on healthcare access for women during childbearing years, we further divide working-age individuals into childbearing (19-34 years in our sample) and non-childbearing age groups. Table 4 presents evidence on healthcare outcome variables. We observe that the differences in outcomes are mainly concentrated on 19-34-year-old females. In particular, 19-34-year-old females spend less time between claim date and surgery (-0.759 days, $p < 0.01$) and experience fewer re-visits to the hospital than males in the same age category (-0.027 re-visits, $p < 0.01$).[1] Overall, we also find no significant differences in outcomes during adolescence and old age.

Table 4 points to differences by gender across age groups in health care access. Females in the age groups of 19-34 years, as well as 35-64 years, are 0.005 percentage points less likely to travel outside their district of residence to seek healthcare. Conditional on traveling outside their district, females of childbearing ages are traveling 0.957 km less in distance compared to males in the same age category. This is true for the age-group 35-64 years as well (-0.703, $p < 0.05$). Here again, there are no differences in access for individuals in the 6-18 years and 65 and above years categories. Therefore, while healthcare services seem to be better for women especially during their childbearing years, healthcare access may be restricted for working-age women.

[1]Note that the comparison group is the differences in outcomes between me and women in the 0-5 age category.

Table 4: Results by Age Cohort

	Average days between claim and surgery (1)	Days between discharge and surgery (2)	Average of preauth and claim amount (in Rs.) (3)	Number of re-visits (4)	Travel outside district (yes/no) (5)	Distance between claim-hosp district (in kms.) (6)
Female	0.237	-0.095**	-56.882	-0.008**	0.002	0.217
	(.22)	(.046)	(39)	(.0035)	(.0019)	(.3)
6-18	-0.130	0.069	464.671***	-0.020***	-0.004*	-2.121***
	(.28)	(.046)	(47)	(.006)	(.0023)	(.39)
19-34	-0.136	0.199***	574.518***	0.043***	-0.002	-1.489***
	(.28)	(.049)	(48)	(.0067)	(.0022)	(.4)
35-64	0.356	0.375***	386.003***	0.002	-0.010***	-3.198***
	(.29)	(.048)	(49)	(.0068)	(.0022)	(.39)
65 and above	1.216***	0.378***	64.791	-0.165***	-0.017***	-4.602***
	(.3)	(.057)	(53)	(.0086)	(.0026)	(.45)
Female × 6-18	-0.372	0.134**	-47.800	-0.000	-0.000	0.095
	(.31)	(.059)	(54)	(.0063)	(.0025)	(.41)
Female × 19-34	-0.759***	0.034	95.700**	-0.027***	-0.005**	-0.957**
	(.26)	(.057)	(44)	(.007)	(.0024)	(.39)
Female × 35-64	-0.307	-0.107**	52.377	0.007	-0.005**	-0.703**
	(.24)	(.053)	(42)	(.0058)	(.0021)	(.34)
Female × 65 and above	-0.335	-0.057	89.639*	-0.017**	-0.004	-0.548
	(.29)	(.068)	(52)	(.0074)	(.0025)	(.38)
Mean	42.63	6.94	31750.35	.62	.42	97.2
SD	45.65	10.34	26938.92	2.23	.49	82.69
Village FE	X	X	X	X	X	X
Surgery FE	X	X	X	X	X	X
Hospital FE	X	X	X	X	X	X
Quarter Year FE	X	X	X	X	X	X
R2	0.243	0.335	0.944	0.418	0.613	0.506
N	2001249	2001249	2001249	2001249	2001249	2001249

Notes: All regressions include controls for caste and quarter of year and includes village and surgery code fixed effects. All dependent variables are standardized with respect to male population. Standard errors clustered at the sub-district level.

Discussion

This study documents gender differences in utilization as well as access to healthcare across tertiary healthcare systems in the Indian state of Andhra Pradesh. Using regression analysis, we find that women have lower wait times between claim dates and surgery as well as shorter post surgery stay. Additionally, we document that women do not travel as far to seek healthcare compared to men.

We place our results in the context of previous work that examines gender differences in healthcare utilization. Within the context of a similar program, Dupas and Jain (2021) documents disparities in access and utilization of healthcare programs in Rajasthan, India. Further, Jayaraman et al. (2014) suggest that women typically put off seeking care until their eyesight deteriorates considerably. Perhaps this characteristic explains why we find lower processing times for women as compared to men. Typically, fewer post-operative days of hospital stay indicates better quality of healthcare. Thus, our result of reduced post-operation stay for women suggests better quality healthcare over men.

The heterogeneity analysis provides additional insights by identifying women of child-bearing ages as the main driver behind this result. Intuitively, better quality healthcare would be most salient for vulnerable groups such as children and the elderly. However, our analysis suggests the opposite. An alternate explanation could be the higher opportunity costs of women of child-bearing ages that prompt shorter hospital stays.

The analysis examining outcomes using hospital ownership status shows women incur higher expenses in private hospitals as compared to government-owned hospitals, an outcome that is consistent the subsidized nature of public healthcare Thomas (2009). Private hospitals are faster at authorizing claims as compared to government hospitals and are also associated with longer hospital stays post-procedure. In the Indian context, previous studies find greater efficiency among private hospitals as well as reduced infrastructure constraints accruing to conditions like limited bed availability (Berman, 1998). This result suggests that private hospitals may be able to mediate the reduced exposure to healthcare for women who otherwise access public hospitals in the form of greater post operation stay as well as an increased number of readmissions.

Limitations: Causal interpretation of results presented in this paper is impeded by the inability to control for unobservable factors that prompt individuals to seek healthcare,

or to choose private versus public facilities.

Another limitation is that we cannot comment on the potential gender-based mismatch between health status and treatment. We are limited by the absence of data on patient health and clinical diagnosis, without which we can only offer correlational interpretation on results for post-surgical stay and readmission rates.

Public Health Implications

Tertiary care is increasingly important as the share of non-communicable diseases is increasing worldwide (WHO, 2018). Government-sponsored health insurance programs are important to treat tertiary conditions, especially in developing countries. The Aarogyasri health insurance program in the Indian state of Andhra Pradesh covers an extensive set of tertiary conditions and assists below-poverty families financially. However, the question remains whether this public health good is available equally to everyone in society.

This paper shows systematic differences by gender in use and access to public health services in developing countries. This points to the important role of targeting and information provision while implementing these programs, especially for socio-economically disadvantaged groups within the society. In particular, public health agencies may provide additional monetary or non-monetary incentives to increase the participation of females in these programs. Evidence from the United States suggests that such incentives increase female health-seeking behavior (Morgan et al., 2013). Within India, Powell-Jackson et al. (2015) finds that financial incentives can be an effective impetus in take-up and use of the Janani Suraksha Yojana program focusing on maternal health.

From a public health perspective, program participants may also be increased by providing sufficient complimentary services including transportation to and from these program centers. As shown by our estimates, middle-aged females may find it difficult to access these services compared to females in other age categories, indicating a need for auxiliary services to promote participation in government health programs.

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