GENDER DIFFERENTIALS IN EYE CARE: ACCESS AND TREATMENT

Rajshri Jayaraman
European School of Management and Technology, Berlin

Debraj Ray
New York University, New York

and

Shing-Yi Wang
The Wharton School, University of Pennsylvania, Philadelphia

April 25, 2013

SUMMARY

Background. A central feature of many developing countries is the presence of significant gender differentials in health outcomes. We study one potential factor which can account for this; namely, that females seek treatment later than males, and contrast this pathway with the hypothesis that females receive differential care at the medical facility.

Methods. We examine gender differentials in the seeking and treatment of eye care. We study diagnostic and surgical outcomes using a unique dataset comprising a sample of 60,000 patients who sought treatment over a 3-month period in 2012 at the Aravind Eye Hospital in India. We distinguish between symptomatic and asymptomatic illness.

Findings. At the time of presentation to an eye care facility, women have worse diagnoses than men across all available indicators of symptomatic illness. They have lower visual acuity and pinhole visual acuity, are more likely to be sight-impaired, are more likely to be advised surgery, or diagnosed for cataract. In contrast, males and females do not differ significantly in their "best corrected" visual acuity and the bulk of the evidence indicates no gender differences in other indicators of surgical care — time to surgery, surgery duration, the incidence of post-operative complications, and the seniority of attending medical personnel. For asymptomatic disease, there is no significant difference between males and females when looking at two correlates of glaucoma: intraocular eye pressure and a high cup-to-disk ratio.

Interpretation. The findings for symptomatic illness suggest that women seek treatment later than men for perceptible illness. That no such gender differential exists for asymptomatic disease suggests that women do not necessarily go for regular preventive checkups at a lower frequency than men. We find no systematic evidence that women and men receive differential medical treatment.

Funding. International Growth Centre.

Acknowledgements We are very grateful to the staff of Aravind Eye Hospital, in particular Ganesh Babu and R.D. Thulsiraj. We also thank Abraham Holland and Misha Sharma at the center for Microfinance for providing invaluable local project management, Amelie Schiprowski for excellent research assistance, and Dr. Tomasz Mlynczak for his medical expertise.

1. Introduction

Many developing countries display significant gender differentials in health outcomes. The most dramatic evidence of this is excess female mortality, as seen in the low ratio of women to men, notably in India and in China (1; 2). This excess mortality is not confined to newborns (or pre-natal selection by gender) and infants. Recent research by Anderson and Ray (3; 4) as well as the 2011 *World Development Report* (5) argues that the bulk of excess female mortality in India and sub-Saharan Africa is at older ages, not just birth, infancy and early childhood as previously emphasized (6; 7; 8; 9; 10; 11; 12). This suggests that gender bias in health outcomes is pervasive and spans several age groups.

Presumably, there are numerous underlying pathways for these discrepancies, ranging from differential care at home to differential medical care once treatment is sought, not to mention other intervening factors, such as diet, stress and occupational structure. The main objective of this paper is to study one possible factor, but a fundamental one; namely, that females *seek* treatment later than males. We contrast this pathway with the hypothesis that females *receive* differential care at the medical facility. We do so by studying eye care in a major Indian hospital.

Three factors motivate our focus on eye care. First, there is the intrinsic importance of vision: it directly affects productivity and well-being. But of course eye care is not alone in this regard. The second factor — and in this respect eye disease is truly distinct — is that different aspects of it, such as visual acuity, myopia, cataract onset or glaucoma, are measurable with relatively high precision. Using these objective measures of disease intensity, it is possible to evaluate the extent to which eye health has deteriorated at the time of seeking care. Third, some eye diseases *are perceived as they evolve*, while others are not. The most obvious example of a symptomatic disease is the deterioration of vision: loss of acuity is immediately and directly linked to the perception of that deterioration. On the other hand, conditions such as glaucoma are asymptomatic until the disease has reached an advanced stage.

This distinction allows us to separate two notions of gender-based neglect in the seeking of care. One is that females do not go for regular, preventive checkups at the same frequency as males. In this case we would expect to see across-the-board discrepancies in the severity of illness (conditional on presentation at a care facility) irrespective of the symptomatic nature of the disease. On the other hand, if there is gender-based delay only in responding to the perceived onset of illness, we should expect to observe gender differences in disease progression at the time of presentation for symptomatic diseases, but no such differences for asymptomatic diseases.[1] To a large extent, our data allows us to do just that.

We summarize our findings. At the time of presentation to an eye care facility, women have worse diagnoses than men across all available indicators of symptomatic illness. They have lower visual acuity and pinhole visual acuity, they are more likely to be sight-impaired, and are more likely to be advised surgery or diagnosed for cataract.[2] In contrast, males and females do not differ significantly in their "best corrected" visual acuity and there are no gender differences in other indicators of surgical care, including

[1]As far as symptomatic disease is concerned, the above approach is valid independent of whether the incidence of the disease in question varies systematically across males and females, as long as the perception of disease is gender-independent.

[2]There is a small literature that studies gender bias in children's access to care in India; see, e.g., (13; 14; 15). These papers find that families are more likely vaccinate boys relative to girls, travel longer distances for their care, and incur larger expenditures for them. Such biases are entirely consistent with our findings.

time to surgery, surgery duration, the incidence of post-operative complications, and the seniority of attending medical personnel.[3] Finally, for asymptomatic disease, there is no significant difference between males and females for two correlates of glaucoma: intraocular eye pressure and a high cup-to-disk ratio. The bias appears to lie in the differential seeking of care following illness, not in treatment.

2. Methods

Sample. We use data from the Aravind Eye Hospital (Aravind, for short) — an extraordinary network of eye care facilities based in Madurai, India. Aravind has four main channels of service provision in the region: rural field camps set up on an *ad hoc* basis (usually over weekends), vision centers in semi-rural areas, and two state-of-the-art hospitals located in Madurai, one heavily subsidized, and the other providing services at market rates. The volume is enormous: close to a million patients, on average, have been served every year for 36 years. The economic philosophy of Aravind is one that uses high-end facilities in medical care to subsidize more spartan approaches, without stinting in any way on the medical care itself. This approach has been much studied in both developed and developing countries as a business model (several case studies of Aravind exist, including one developed at the Harvard Business School).

Our database of over 60,000 patients is drawn from the Madurai district catchment area between May and August of 2012. The data span the paid hospital and subsidized hospital in the district capital, Madurai, as well as numerous vision centers and eye camps that operated in the region over this period. Specifically, there is information on: (i) a population of 13,422 *new outpatients* arriving at vision centers between June–August, recording the initial diagnosis as well as vision corrections, if any; (ii) a random sample of 16,155 *new outpatients* arriving at field camps, the paid hospital and the subsidized hospital between May–July, recording the initial diagnosis as well as any vision corrections that were made; (iii) a population of 29,591 *cataract patients*, whose surgeries were performed in the paid and subsidized hospitals between June–August, recording the details of the surgical procedure that was followed, as well as subsequent follow-up; and (iv) a subsample of 1000 *glaucoma patients*, who first registered between 2007–2010.

Measures of Illness. Using the first group of measures outlined below, we examine whether symptomatic visual impairments and eye disease are more severe for women than men at presentation. The second group of measures, corrective procedures, allows us to investigate gender differentials in medical treatment. The third group of measures, pertaining to asymptomatic ocular disease, permits us to explore gender differences in general (or preventive) eye care.

1. *Symptomatic Ocular Disease*. Visual acuity, which measures the ability to see, is tested for all outpatients using the Snellen Tumbling-E eye chart. We convert this measure into a continuous variable with range $[0, 1]$, where 1 is perfect (i.e. $6/6$ or $20/20$) vision and 0 corresponds to cases in which only hand movement, finger counts or light could be perceived at best. Rather than reporting outcomes for each eye separately, we follow the common convention of taking the maximum of right- and left-eye visual acuity. Our measure can be roughly interpreted as the relative distance at which the patient would have to be located in order to see as clearly as a person with perfect vision.

Cataract is a clouding of the eye lens typically manifested at later ages (50+). As in more routine vision problems that need correction, cataract is symptomatic except perhaps in its earliest stage. Outpatients

[3] Unequal or prejudicial *treatment* at the medical facility has received significant attention in high-income societies (16; 17; 18; 19; 20; 21; 22; 23).

are routinely examined by ophthalmologists who diagnose cataract and advise surgery. Diagnosis and surgery advice are measured as binary variables. Pinhole visual acuity, which is an additional indicator of centrally located, advanced cataract, is also recorded; the measure parallels our index of visual acuity.

2. *Medical Care*. We record best corrected vision, which is visual acuity after refractive correction, as well as pinhole visual acuity after cataract surgery. We use three measures for cataract surgery patients: time elapsed between admission and surgery (for patients who were operated on the same day as admission), whether the patient spent the previous night at the hospital, surgery duration, and the surgeon's medical qualifications. Finally, we have two measures of cataract patient follow-up: whether or not there were post-operative complications and whether or not the patient came later than their instructed post-operative appointment, typically scheduled for one month following the operation.

3. *Asymptomatic Ocular Disease*. Glaucoma, an eye condition resulting in damage of the optic nerve, is asymptomatic until quite advanced,[4] upon which it leads to progressive and irreversible loss of vision. The early stages of glaucoma are highly correlated with the results of different tests, such as the measurement of cup-to-disc ratio, scores on a visual field test, and intra-ocular eye pressure. We record this information.

Statistical Analysis. We estimate the following regression model:

$$y_i = \alpha + \beta_1 \text{Female}_i + \gamma \text{Age}_i + \delta \mathbf{z}_i + \beta_2 \mathbf{z}_i * \text{Female}_i + \varepsilon_i$$

where y_i is the outcome of interest for patient i, "Female" is a dummy variable equal to 1 if patient i is female, "Age" is the patient's age in years, and $\mathbf{z}_i$ is a vector consisting of three dummy variables indicating whether the patient presented at a field camp, at the subsidized hospital or at a vision center, taking the paid hospital as the baseline. We permit two-way interactions between location dummies and the gender variable. Our main coefficients of interest are β_1 and β_2 which indicate whether or not there exists a gender differential and whether this differential is exacerbated or ameliorated in camps, vision centers and subsidized hospitals, relative to the paid hospital. In the cataract surgery regressions, we include additional controls pertaining to the patient's general health status prior to surgery.

We estimate all reported regression equations with ordinary least squares using the 'reg' command in STATA 12. (In the case of binary dependent variables, this amounts to estimating a linear probability model, but probit and logit regressions produce qualitatively equivalent results.) In each of our tables, robust standard errors are reported in parentheses under the coefficient estimates, and 1, 2, and 3 stars next to an estimated coefficient indicate that it has a p-value less than 0.10, 0.05 and 0.01, respectively.

3. Symptomatic Ocular Disease

Table 1 examines correlates of symptomatic ocular disease. Columns 1–2 considers all new outpatients, column 3–5 considers new outpatients aged 41+, and column 6 considers all cataract surgery patients. In these and all succeeding tables, each column records the coefficient estimates of a separate regression, the dependent variable of which is mentioned in the column heading, while explanatory variables are mentioned in the row headings.

Columns 1–3 consider three vision measures. Column 1 indicates that females come in with significantly lower visual acuity, the difference being around 8% of the mean, which is 0.61. Patients at the camps and

[4] It is not unusual to find glaucoma in a patient who seeks care for something else entirely, perhaps a routine check-up or because of some other complaint.

	Visual acuity w/o glasses [1]	Perfect vision [2]	Sight impaired [3]	Surgery advised [4]	Cataract diagnosed [5]	Pinhole acuity [6]
Female	***-0.047	***-0.068	***0.050	0.018	***0.006	-0.010
	(0.010)	(0.014)	(0.019)	(0.013)	(0.002)	(0.006)
Age	***-0.011	***-0.015	***0.015	***0.009	***0.005	***-0.005
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Camp	***-0.049	0.003	***0.156	***0.167	***-0.022	***-0.166
	(0.009)	(0.013)	(0.017)	(0.013)	(0.002)	(0.006)
Female*Camp	***-0.048	**-0.039	***0.082	***0.142	***0.006	-0.001
	(0.013)	(0.017)	(0.024)	(0.019)	(0.002)	(0.008)
Subsidized Hospital	***-0.085	***-0.071	***0.169	***0.310	***-0.021	***-0.102
	(0.012)	(0.015)	(0.023)	(0.019)	(0.002)	(0.006)
Female*(SubsHospital)	0.012	0.007	-0.035	***0.068	***0.007	***-0.028
	(0.015)	(0.020)	(0.031)	(0.026)	(0.003)	(0.008)
Vision Centre (VC)	***0.036	***0.075	***0.042	***-0.031	***0.260	
	(0.008)	(0.011)	(0.015)	(0.012)	(0.008)	
Female*(VC)	-0.002	0.005	0.029	-0.003	***0.045	
	(0.011)	(0.016)	(0.022)	(0.017)	(0.011)	
Constant	***1.114	***1.063	***-0.538	***-0.282	***-0.270	***1.033
	(0.008)	(0.012)	(0.024)	(0.020)	(0.012)	(0.012)
Observations	22,990	22,990	12,957	17,190	17,190	28,918
R-squared	0.393	0.366	0.128	0.154	0.233	0.090

TABLE 1. **Correlates of Symptomatic Ocular Disease** *Note.* In the regressions with outlet controls, "paid hospital" forms the baseline. Columns 1-2 pertain to the full sample of outpatients; the sample in columns 3–5 comprises outpatients aged 41+; the sample in column 6 comprises cataract surgery patients. Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

subsidized hospital present with worse vision than at the paid hospital or the vision centers. Moreover, camps also exacerbate the gender *differential*. Because camps cater to the poorest patients, this suggests that both the average deficiency in vision and the gender differential are highest among the poor.

Column 2 shows that a significantly larger fraction of males present with perfect visual acuity scores.[5] Once again, eye camp patients display an accentuated gender differential. Column 3 studies *sight impairment*, defined as a condition in which visual acuity is 2/6 or below. Females are approximately 5 percentage points more likely to be sight-impaired. The difference is high, given that the average incidence of sight impairment is around 28%, and yet again, gender differentials (as well as average impairment) are accentuated in the camps.

[5] Why might a patient with perfect acuity go to an eye care facility to begin with? The answer must lie in some incident that caused temporary discomfort, such as debris in the eye or ancillary occurrences that might be suggestive of an eye problem but are not, such as recurrent headaches.

Columns 4–6 consider three other measures of symptomatic disease. The first is surgery advisement, which often (though not exclusively) has to do with cataract. Our second outcome is the diagnosis of cataract. Third, we record pinhole visual acuity in the full cataract surgery patient sample. The test is a measure of potential best vision,[6] but if a cataract is advanced or centrally situated, the reduced light through the pinhole will lower patient score. Therefore, low acuity on the pinhole is correlated with advanced cataract, as well as real loss of potential vision, such as degeneration of the retina.

Column 4 indicates that females are significantly more likely to be recommended surgery than males. The insignificant "female effect" in the first row indicates that baseline category of "paid hospital" does not exhibit any gender differential, but the positive and significant interaction terms for camps and the subsidized hospital indicate sizable gender differentials in these locations. Column 5 studies the binary variable "cataract diagnosis". Once again, we see that women are significantly more likely than men to be diagnosed with cataract, conditional on arrival at a clinic. The difference is present for all types of facilities, and is significantly higher at the vision centers. Finally, column 6 examines pinhole visual acuity among cataract surgery patients of all ages, prior to surgery. The location controls here refer to the place at which the patient initially presented as an outpatient, which in our sample does not include vision centers. Again, the verdict is unambiguous: females have worse pinhole acuity than males and this gender gap is driven by subsidized hospital and not paid hospital patients.

It is remarkable that so many distinct indicators of care point to a unified conclusion: that females appear to seek medical care systematically later than males. We note that this conclusion stands irrespective of the incidence of such disease in the population at large. For instance, the results do not change in their interpretation even if women biologically tend to be afflicted by cataract to a far greater degree than men. All that matters is the stage of a symptomatic disease at which an individual seeks attention.

We note two qualifications. First, there may be sex-based differences in disease perception, in which case gender differentials would arise even without any discrimination. We are not aware of any study that examines this question, and see no reason to entertain such an assumption. Second, even in the absence of intrinsic differences, there may be differences in the "technology of perception" induced by socioeconomic background. For instance, consider differential school attendance: lower female attendance might make for later detection. Similarly, differences in occupational structure could be related to differential rates in perception. These potentially important issues lie beyond the scope of the current paper.

4. Medical Care

It can be argued that gender health differentials are exacerbated by the discriminatory nature of the care itself. Table 2 explores this possibility. In column 1 of the table, there is no suggestion that best corrected visual acuity after refractive correction in outpatients is worse for females than for males. Indeed, by this metric, females are actually better off than males in the paid and subsidized hospitals (the negative interaction terms offset the positive female effect for vision centers and camps). Column 2 reports on visual acuity post-cataract surgery; the sample this time is the set of all cataract patients. Here, the results do indicate that women fare worse than men following surgery, holding constant their pre-surgery health characteristics.

[6] A pinhole occluder (an opaque disk with a small hole in it) is used to test the strength of the patient's "potential" vision. The pinhole temporarily eliminates refractive errors because the line of sight is restricted to pass through the center of the lens.

	Best corrected vision [1]	Post-Operative visual acuity [2]	Stayed at least one night [3]	Surgery Wait if same day [4]	Surgery duration [5]	Surgeon is medical officer [6]	Post-operative complications [7]	Late follow up [8]
Female	0.028**	-0.022***	-0.039***	-7.572**	-1.650*	0.002	-0.003	0.003
	(0.012)	(0.007)	(0.012)	(3.407)	(0.977)	(0.005)	(0.004)	(0.012)
Age	-0.004***	-0.002***	-0.004***	-0.256	-0.028	-0.000	0.000	-0.001***
	(0.000)	(0.000)	(0.001)	(0.167)	(0.057)	(0.000)	(0.000)	(0.000)
High Blood Pressure		-0.014***	-0.038***	5.905*	0.632	0.005	0.002	-0.012
		(0.004)	(0.013)	(3.358)	(1.050)	(0.007)	(0.003)	(0.009)
Cardiovascular condition		-0.007	0.041**	-5.848	-2.681**	0.008	-0.001	0.041**
		(0.011)	(0.021)	(4.341)	(1.314)	(0.007)	(0.007)	(0.021)
Hypertension		0.012	0.015	10.528***	0.878	0.004	0.011**	-0.021
		(0.008)	(0.015)	(3.822)	(1.249)	(0.005)	(0.005)	(0.014)
Diabetes		-0.003	0.020	1.079	0.911	0.001	0.002	-0.010
		(0.008)	(0.014)	(3.752)	(1.212)	(0.005)	(0.005)	(0.013)
Pinhole visual acuity		0.353***	-0.192***	-21.077***	-1.002	0.023**	-0.172***	-0.019
		(0.006)	(0.022)	(6.666)	(1.714)	(0.010)	(0.007)	(0.013)
Camp	-0.149***	-0.220***				-0.467***	-0.027***	0.219***
	(0.020)	(0.007)				(0.010)	(0.005)	(0.013)
Female*Camp	-0.058*	0.011				-0.019	-0.003	-0.018
	(0.031)	(0.008)				(0.012)	(0.005)	(0.016)
Subsidized Hospital	-0.121***	-0.266***				-0.417***	-0.018***	-0.023
	(0.030)	(0.007)				(0.009)	(0.004)	(0.014)
Female*(Subsidized Hospital)	0.033	0.008				-0.026**	-0.004	-0.026
	(0.043)	(0.009)				(0.012)	(0.005)	(0.017)
Vision Centre	0.125***							
	(0.009)							
Female*(Vision Centre)	-0.037***							
	(0.012)							
Constant	0.960***	0.529***	0.936***	165.472***	15.559***	0.954***	0.153***	0.345***
	(0.010)	(0.013)	(0.039)	(12.968)	(3.952)	(0.020)	(0.011)	(0.027)
Observations	8,717	18,603	6,494	2,905	6,489	23,718	23,718	18,687
R-squared	0.257	0.427	0.019	0.010	0.001	0.187	0.082	0.059

TABLE 2. **Correlates of Medical Care** *Note.* The sample in columns 1 contains all new outpatients. The sample in columns 2-9 contains cataract surgery patients. In the regressions with outlet controls, "paid hospital" forms the baseline. Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Two factors might account for this difference relative to the results for best corrected vision. First, while the disease in question may be reversible (e.g., cataract with no further complications), the medical staff have not done enough to reverse the gender differential that existed pre-surgery. Alternatively, the gap in postoperative acuity may reflect a deeper malaise with vision, such as retinal degeneration, which may have accompanied the cataract and caused irreversible damage.

While the data do not permit us to directly address the distinction, we can examine other aspects of the surgical process to see if there is any gender differential on those counts. The subsequent columns in Table 2 do this. Since hospital stay and medical treatment are likely to depend on the patient's prior medical condition, we control for pre-surgery health characteristics with the inclusion of pre-surgery visual acuity and four binary variables indicating whether ($= 1$) or not ($= 0$) a patient has high blood pressure, a cardiovascular condition, hypertension, or diabetes, prior to surgery.

Columns 3–5 capture the duration of patients' hospital stay and surgery (data available for the paid hospital). Column 3 suggests that females are less likely to spend an extra night as inpatients prior to surgery. Controlling for pre-surgical medical conditions and given that patients at this hospital are paying out of pocket, this possibly reflects the fact that women are less likely to register early at hospitals. By contrast, columns 4 and 5 explore decisions made by medical staff at the hospital. The results indicate that for patients whose surgery transpires on the same day as their hospital admission, females are moved faster to surgery, with a waiting time about 7 minutes shorter. Column 5 indicates that surgery times for women are slightly shorter than than for men, but the difference is less than two minutes and is only significant at the 10% level.

Column 6 shows that females at the subsidized hospital are less likely to be operated upon by a full Medical Officer or Senior Medical Officer than by less experienced Fellows and "post graduate" Residents who also perform surgery. This differential is absent in the paid hospital, and is insignificant for camps. Well over 50% of the sample is operated upon by a Medical Officer, so the gender differences at the subsidized hospital, while significant, are small. Still, one might be concerned that women face more postoperative complications as the result of being treated by less qualified surgeons. However, Column 7 indicates that complications are practically nonexistent, as are any gender differences in complications. This suggests that the assignment of medical officers to patients corresponds to the complexity of the case rather than the gender of the patient. Finally, late followups by patients are also a concern. The sample average is around 30% and significantly higher for the poorer patients who originally came in via the camps. But, as column 8 indicates, there are no gender differentials to speak of.

We have already seen that gender differentials are high at the level of access. Following treatment, those differentials are nonexistent or small. We must conclude that there is little evidence of differential *treatment* of males and females, though some differences in initial conditions appear to persist post-surgery.

5. Asymptomatic Disease

We study two indicators of glaucoma, a disease that is largely asymptomatic at an advanced (and irreversible) stage. One is the cup-to-disc ratio, used to assess progression. This ratio compares the diameter of the "cup" of the optic disc with the overall diameter of the disc. There is population variation in the ratio, but glaucoma causes the ratio to grow. A second indicator is intraocular eye pressure (IOP), which measures fluid pressure within the eye. Ocular hypertension refers to elevated values of IOP, and it is an important correlate of glaucoma.

	Cup Disc Ratio		IOP	
	[1]	[2]	[3]	[4]
Female	*-0.013	-0.102	-0.086	-0.020
	(0.007)	(0.079)	(0.078)	(0.137)
Age	***0.002	***0.013	**0.010	**0.010
	(0.000)	(0.004)	(0.005)	(0.005)
Camp			***0.245	*0.238
			(0.091)	(0.134)
Female*Camp				0.010
				(0.169)
Subsidised Hospital			***-1.690	***-1.515
			(0.131)	(0.224)
Female*(Subsidised Hospital)				-0.315
				(0.265)
Vision center			***-1.754	***-1.720
			(0.112)	(0.156)
Female*(Vision center)				-0.069
				(0.226)
Constant	***0.635	***14.982	***15.809	***15.778
	(0.020)	(0.262)	(0.268)	(0.266)
Observations	849	10,743	10,743	10,743
R-squared	0.058	0.001	0.053	0.054

TABLE 3. **Correlates of Glaucoma – Asymptomatic, Ages 41+** *Note.* The Cup Disc Ratio sample (column 1) pertains only to glaucoma patients treated at hospitals. The IOP sample (columns 2-4) comprises new outpatients. In the regressions with outlet controls, "paid hospital" forms the baseline. Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3 reports on gender differentials in these indicators among the patients in our sample. Note that with asymptomatic disease, population incidence does matter in interpreting the findings. Fortunately for our purposes, studies on gender as a risk factor for glaucoma are inconclusive. Previous research (24; 25; 26; 27) finds no association between sex and the prevalence of glaucoma,[7] particularly for primary open-angle variety, the most common form of glaucoma. There is also little or no connection between the *correlates* of glaucoma that we examine here, and gender; see, for instance (28) and (29) for intraocular eye pressure,[8] and (30) for cup-to-disc ratios. With that in mind, Table 3 suggests that when the disease in question is *asymptomatic*, as glaucoma in its early stages tends to be, there is no significant difference between males and females. Females in our glaucoma patient sample have a slightly lower cup-to-disc ratio (column 1) and there is no difference at all in intraocular eye pressure for outpatients (columns 2-4). Either individuals of both genders in India go in for preventive health checkups at similar intervals, or more likely, they do not go in for such checkups at all. In any event there is no discernible gender

[7]Some of these studies do find significant results, but running in either direction on gender.

[8]There is some evidence that women tend to have higher IOP following menopause.

differential. In our opinion, this contrast between symptomatic and asymptomatic disease is an important finding.

6. Summary and Discussion

We document gender differentials in the seeking of eye care. Such differentials are significant along many dimensions. Females present with lower uncorrected visual acuity than males. They have a lower incidence of perfect vision. They are more likely to be sight-impaired. They are more likely to be advised surgery. They are more likely to be diagnosed for cataract. They have lower pinhole visual acuity, which is a separate indicator for the existence of disease quite apart from the need for refractive correction.

All these differences are robust to the inclusion of age as a control, as well as to the use of controls for different eye care facilities, entered with or without interaction with gender. We also observe that these indicators (for males and females together) are generally at their nadir at the eye camps, where at the same time the gender differentials for many of these indicators are at their widest. This is true even relative to the paid hospital, where the proportion of seriously ill patients could reasonably have been expected to be higher. This suggests that the poorest individuals, who predominantly attend the camps, have the lowest average rate of access and also the largest differential in access between males and females.

Yet, following the refractive correction that takes place during the visit, males and females do not differ significantly in their "best corrected" visual acuity. In this respect, the medical facility appears to fully compensate for the initial gender discrepancy. That is not entirely the case, however, for *post-operative* visual acuity, where differences remain. Without further investigation, it is hard to say what causes the discrepancy in visual acuity after surgery. It could be irreversible disease, or lack of full compensation in care. To further investigate this, we look at other indicators of surgical care received: time to surgery, surgery duration, post-operative complications, and the seniority of medical personnel during operations.

Women in the paid hospital are less likely to be admitted at least one night before cataract surgery. This likely reflects the reluctance of the individual or family (rather than the doctor) to admit women into hospitals early. There is no gender differential in followup after surgery. As for treatment by hospital staff, female surgery outpatients are kept waiting for a shorter time than male outpatients between admission and surgery. While females are less likely to be treated by a medical officer in subsidized hospitals, but this does not seem to have any repercussions in terms of surgical procedure. Surgery duration for females is marginally shorter, and there are no gender differentials in post-operational complications.

Finally, when the disease in question is asymptomatic, as glaucoma in its early stages tends to be, there is no significant difference between males and females. Neither a high cup-to-disk ratio nor intraocular eye pressure is significantly different across gender. That supports our presumption that for diseases that are initially asymptomatic, there is no significant difference between males and females at presentation (We use secondary information to argue that there is not a large difference in the population to begin with.). It is precisely when a disease is linked to the direct perception of it, as in the case of bad eyesight that requires simple correction, that males and females seem to present differently. On the assumption that perception itself is not gender-specific, males (or the parents of males) appear more responsive to their perceptions of ill-health.

Improving health outcomes in developing countries is, first and foremost, of central intrinsic importance. Resolving gender-based health inequalities remains at the forefront of development policy. However, we need to know where the inequalities lie. In particular, we need to understand whether inequality exists at the level of access or at the level of treatment. This paper takes a first step in that direction. To be sure, there are many other issues that are inextricably tied up at the intersection of economics, sociology, culture and health, which influence these differences and warrant further study.

REFERENCES

[1] Coale AJ. Excess female mortality and the balance of the sexes in the population: an estimate of the number of "missing females". The Population and Development Review. 1991;p. 517–523.

[2] Coale AJ, Demeny P, Vaughan B. Regional model life tables and stable populations. vol. 41. Academic Press New York; 1983.

[3] Anderson S, Ray D. Missing women: age and disease. The Review of Economic Studies. 2010;77(4):1262–1300.

[4] Anderson S, Ray D. The Age Distribution of Missing Women in India. Economic and Political Weekly. 2012;47:87–95.

[5] World Bank. World Development Report. World Bank Washington D.C.; 2011.

[6] Jha P, Kumar R, Vasa P, Dhingra N, Thiruchelvam D, Moineddin R. Low male-to-female sex ratio of children born in India: national survey of 1.1 million households. The Lancet. 2006;367(9506):211–218.

[7] Das Gupta M. Explaining Asia's missing women: A new look at the data. Population and Development Review. 2005;31(3):529–535.

[8] Sudha S, Rajan SI. Female demographic disadvantage in India 1981–1991: sex selective abortions and female infanticide. Development and Change. 2002;30(3):585–618.

[9] Deaton A. Looking for boy-girl discrimination in household expenditure data. The World Bank Economic Review. 1989;3(1):1–15.

[10] Oster E. Proximate sources of population sex imbalance in India. Demography. 2009;46(2):325–339.

[11] Pande RP, Yazbeck AS. What's in a country average? Wealth, gender, and regional inequalities in immunization in India. Social Science & Medicine. 2003;57(11):2075–2088.

[12] Garg A, Morduch J. Sibling rivalry and the gender gap: Evidence from child health outcomes in Ghana. Journal of Population Economics. 1998;11(4):471–493.

[13] Borooah VK. Gender bias among children in India in their diet and immunisation against disease. Social Science & Medicine. 2004;58(9):1719–1731.

[14] Pandey A, Sengupta PG, Mondal SK, Gupta DN, Manna B, Ghosh S, et al. Gender differences in healthcare-seeking during common illnesses in a rural community of West Bengal, India. Journal of Health, Population and Nutrition. 2011;20(4):306–311.

[15] Mishra V, Roy TK, Retherford RD. Sex differentials in childhood feeding, health care, and nutritional status in India. Population and development review. 2004;30(2):269–295.

[16] Abuful A, Gidron Y, Henkin Y. Physicians' attitudes toward preventive therapy for coronary artery disease: Is there a gender bias? Clinical cardiology. 2005;28(8):389–393.

[17] Daly C, Clemens F, Sendon JLL, Tavazzi L, Boersma E, Danchin N, et al. Gender differences in the management and clinical outcome of stable angina. Circulation. 2006;113(4):490–498.

[18] Ayanian JZ, Epstein AM. Differences in the use of procedures between women and men hospitalized for coronary heart disease. New England Journal of Medicine. 1991;325(4):221–225.

[19] Glader EL, Stegmayr B, Norrving B, Terént A, Hulter-Åsberg K, Wester PO, et al. Sex differences in management and outcome after stroke a Swedish national perspective. Stroke. 2003;34(8):1970–1975.

[20] Chang AM, Mumma B, Sease KL, Robey JL, Shofer FS, Hollander JE. Gender bias in cardiovascular testing persists after adjustment for presenting characteristics and cardiac risk. Academic Emergency Medicine. 2007;14(7):599–605.

[21] Petrea RE, Beiser AS, Seshadri S, Kelly-Hayes M, Kase CS, Wolf PA. Gender differences in stroke incidence and poststroke disability in the Framingham Heart Study. Stroke. 2009;40(4):1032–1037.

[22] Schulman KA, Berlin JA, Harless W, Kerner JF, Sistrunk S, Gersh BJ, et al. The effect of race and sex on physicians' recommendations for cardiac catheterization. New England Journal of Medicine. 1999;340(8):618–626.

[23] Chandra A, Staiger DO. Identifying provider prejudice in healthcare; 2012. Mimeo, Harvard University.

[24] Varma R, Paz SH, Azen SP, Klein R, Globe D, Torres M, et al. The Los Angeles Latino Eye Study: design, methods, and baseline data. Ophthalmology. 2004;111(6):1121–1131.

[25] Hoffmann EM, Zangwill LM, Crowston JG, Weinreb RN. Optic Disk Size and Glaucoma. Ophthalmology Clinics of North America. 2007;52(1):32–49.

[26] Quigley HA. Number of people with glaucoma worldwide. British Journal of Ophthalmology. 1996;80(5):389–393.

[27] Klein B, Klein R, Sponsel W, Franke T, Cantor L, Martone J, et al. Prevalence of glaucoma. The Beaver Dam Eye Study. Ophthalmology. 1992;99(10):1499–1504.

[28] Senol D, Murat A, Taylan YA, Kenan G. Sex-related differences in intraocular pressure in healthy young subjects. Perceptual and Motor Skills. 2003;96(3):1314–1316.

[29] Mitchell P, Smith W, Attebo K, Healey P. Prevalence of open-angle glaucoma in Australia. The Blue Mountains Eye Study. Ophthalmology. 1996;103(10):1661–1669.

[30] Huynh SC, Wang XY, Rochtchina E, Crowston JG, Mitchell P. Distribution of optic disc parameters measured by OCT: findings from a population-based study of 6-year-old Australian children. Investigative ophthalmology & visual science. 2006;47(8):3276–3285.