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Abstract

This paper investigates whether an individual's relationship to the head of household and caste are associated with the level of his or her morbidity and, in the event of illness, the treatment received. Surveys of 279 households drawn from 30 villages in a region of upland Orissa were conducted in 2010 and 2013, yielding an unbalanced panel of 1580 individuals, 1076 of whom were present in both years. Whether judged by morbidity as the final outcome or three measures of treatment in the event of sickness, there is no evidence that female kin did worse than their male counterparts – except in the inherent difference arising from pregnancy. The upcoming generations of children and grandchildren enjoyed better outcomes, regardless of their sex and controlling for age. Members of the Other Backward Caste group enjoyed both better chances of getting treated in a hospital and lower morbidity than their Scheduled Tribe and Scheduled Caste counterparts. Viewed overall, the treatment an individual received depended rather on the character of the family's village – its topography and its place within the network of health facilities and all-weather roads.

Keywords: Kinship, caste, morbidity, medical treatment, rural India

JEL Classification: D13, H54, I10, I14, O15, O18

1 Introduction

It is said that blood is thicker than water. Yet an individual's exact kinship to the head of household almost invariably has some influence on his or her claims and burdens – rightfully or otherwise – in family life. These, in turn, can affect the individual's state of health; and in the event of illness, closer kinship may secure better treatment. The object of this paper is to investigate morbidity and certain aspects of treatment as indicators of well-being and resource allocation within households in upland Orissa, a poor and drought-prone area in the north-eastern part of India's semi-arid tract. No study of rural India can ignore caste, which is a fundamental feature of the social structure within which there are assigned roles and political competition for resources. Bailey's (1957) classic study of a highland village exemplifies and illuminates its pervasive influence in many spheres of life, which the passage of time has done rather little to weaken (Kumar, 2004). Caste therefore joins kinship at centre stage.

Communicable diseases account for the lion's share of the overall burden of morbidity. These hazards wax and wane with the climate and season, as do the barriers to getting treatment if the village has no all-weather road. The monsoon rains usher in malaria, other fevers and water-borne diseases, and *kutcha* (dirt) tracks can become impassable, except on foot – if then. As the land dries out during the brief winter and then the blazing summer season, these diseases retreat somewhat and the tracks become passable to bullock carts, bicycles and perhaps trucks once more.

The main health facilities are government hospitals and primary health centres (PHCs), which are supposed to provide essentially free treatment. In fact, substantial fees are frequently demanded, especially in hospitals; and staff, especially doctors, are often absent from PHCs (Chaudhuri *et al.*, 2006; Muralidharan *et al.*, 2010). There are also private practices, not a few of them run by doctors who hold positions in public facilities and so have the opportunity to acquire private clients. Since formal medical treatment, free or otherwise, involves someone in a journey of some sort, the nature of the village's connection to the main road network can exert a strong influence on whether and what kind of treatment is sought. It is rather rare for any medical practitioner other than a traditional healer, who typically lives in the neighbourhood and can travel on foot, to make a house-call. The journey to get treatment can therefore be an arduous one for those who fall sick.

To analyse the medical treatment individuals receive, their villages should be viewed as units within the network of roads and facilities as a whole. For this purpose, it is necessary to have a good measure of the trip from the village to each facility. The measure adopted here is the vector of the separate stretches, in km, on track, rural road and highway comprising the entire trip to the nearest hospital and PHC, respectively. These two least-distance measures are also, in the setting studied, almost surely least-time measures. They are independent – and this is vital – of villagers' actual choices. Such precision in defining the trip variables is essential if the effects of kinship and caste on treatment are to be reliably estimated.[1] For longer trip-times and higher trip-costs hinder the uptake of formal health care in other parts of the world (see, e.g., Wong *et al.*, 1987; Gertler and van der Gaag, 1990; Mwabu *et al.*, 1993), and one would expect much the same in upland Orissa. The present paper contributes to that literature. It goes further, however, in that it analyses a whole variety of factors that potentially affect morbidity as an *outcome*, as measured by the probability of falling sick and, conditional on doing so, the duration of an individual's bouts of illness.[2]

The data relate to 1580 individuals belonging to a panel of 279 households drawn from a spatially stratified sample of 30 villages. The investigation covers the *kharif* (monsoon) seasons of 2009 and 2013; 1076 individuals were present in both. Morbidity in *kharif* (July 1 – December 31) is much higher than in *rabi* (winter, January 1 – June 30); moreover, data for *rabi* 2009 were not collected.

The plan of the paper is as follows. Section 2 deals with the surveys and the data, covering the chief illnesses, their incidence, the familial relationships and all the other covariates. Section 3 investigates the association between individual morbidity and these diverse influences, using both single- and two-equation models. Treatment is the subject of Section 4, which analyses the factors influencing the choice of facility, the number of visits for treatment, and the monetary outlays on treatment and transport. The chief conclusions – notably, that the village's characteristics mattered most – are set out and briefly discussed in Section 5.

2 The Surveys and the Data

The surveys covered five contiguous administrative blocks, four in Bolangir District and one in Kalahandi District. Numerous tribal and Hindu communities make up the

[1]Klemik et al. (2009) investigate the effects of the quality of trip connections on the choice of facility in rural Tanzania. There appear to be no such studies for India's rural roads programme, PMGSY.

[2]Banerjee and Sachdeva (2015) find that PMGSY has promoted preventive health care, but as they remark in their conclusions, the data were lacking to say anything about outcomes.

population. The chief topographical features are small river basins and often densely forested hills. The region's poverty has made it a byword in India's political discourse.

A full description of the survey design is found in van Dillen (2008) and Bell and van Dillen (2014). The following account is correspondingly brief. The object of the original research project was to investigate households' vulnerability to drought and other natural shocks. Thirty villages were selected at random from randomly chosen spatial clusters (see van Dillen [2008] for a map depicting the region and the sampled villages). Eight households were then drawn at random from each village, such that each settlement within a village was represented. A resurvey carried out in the early months of 2010 covered the *kharif* season of 2009. Of the 240 households comprising the original sample, 236 (some of them splits of those earlier drawn) could be traced and interviewed. The most recent round covered the entire calendar year 2013 and comprised 279 households in all, 39 of them splits. These two rounds, in which detailed questions about health had a prominent place, yield the panel data for this paper. Of the 1291 individuals comprising the sample in 2009, 1076 were also present in the 2013 round, with death, (exogamous) marriage and above all outmigration claiming the other 215. Arrivals in the form of births, marriage and return migration yielded 289 newly present individuals in 2013.

A potentially important influence on levels of morbidity and levels of treatment is the rural roads programme, *Pradhan Mantri Gram Sadak Yojana* (PMGSY). The programme happened to start soon after the original survey work began, but the survey design preceded it and the households sampled were apparently quite unaware of its existence in the early rounds, as its implementation proceeded rather slowly. Six villages had received a new direct connection by the 2009 round and a further four by the end of 2013. Only one of the other 20 had a direct connection in 2001.

2.1 Illnesses

The main illnesses are communicable diseases of the acute kind, especially malaria, various other fevers and water-borne diseases, and then especially during the *kharif* season (see Table 1). Some individuals suffer from chronic conditions, such as sickle-cell anaemia, tuberculosis, rheumatism and alcoholism; but according to the respondents, the incidence of theses ailments was rather low. How those who drink view their relationship with the bottle, and how they speak of it to others, is known, however, to be frequently coloured by denial and social convention; this certainly holds in upland

Orissa.

As formulated in the questionnaire, a bout of acute illness is defined as one that prevented the individual from working or attending school. As with all self-reported conditions, there is no common standard here. The very poor may feel compelled to work however miserable they feel, and children may get off lightly, since official enforcement of attendance is unlikely to be strict. In the event, nearly all of the individuals reportedly suffering such a bout of illness in either season were also treated for it, if only by a traditional healer or 'rural practitioner', or simply with medicine from the local dispensary. It is quite possible that investigators and respondents alike conflated incapacitating illness with the decision to have it treated; so that those who took ill but received no treatment were almost invariably deemed to be fit for work or school, whatever their actual condition. This should be borne in mind when assessing, in particular, whether female members of the household suffered any degree of discrimination. With these reservations, the measure of an individual's morbidity is defined to be the total number of days of acute sickness he or she suffered in the season in question. Since nearly all the reportedly sick were treated, those who were too young to go to school or too old to work are also covered.

Morbidity overall was much higher in 2009 than in 2013: 566 individuals were treated for at least one bout of illness in 2009, but only 349 in 2013 (see Table 1). Abundant monsoonal rainfall in 2009 produced not only better crops, but also more abundant pathogens. The relative incidence of the various diseases differed, too ($\chi^2(5) = 60.4, p = 0.000$), with notably fewer cases of malaria and viral fevers in 2013.

2.2 Familial relationships, caste and the covariates

For present purposes, individuals must be distinguished not only by their age and sex, but also by their particular blood- or marital relationship to the head of household. For that relationship may independently influence what tasks an individual is assigned and his or her share in the family's budgetary outlays, especially those on food and medical care. This relationship is denoted by r_{kl}, where k denotes a generational-cum-blood or marital connection and $l\,(= 1, 2)$ the individual's sex. Thus,

- r_{11} denotes the head of household (almost invariably male) and r_{12} his spouse;
- r_{21} a son, r_{22} a daughter;
- r_{31} a grandson, r_{32} a granddaughter;

- r_{42} the mother;
- r_{72} a daughter-in-law;
- r_8 a catch-all for all others, including (infrequently) fathers and brothers.

All of the above are dummy variables, with r_{11} as the reference case.

These categories reflect how patriarchy and exogamy influence family structure in rural India. The senior male's father is usually deceased, or if still living and in the household, then too frail to bear the responsibilities of running it. There are joint households, in which brothers farm or run a business together, but these are rather rare nowadays. Sisters move out, usually as soon as they marry, at a rather young age. Daughters-in-law move in, expecting not only child-bearing duties, but also to be under their mother-in-law's thumb. The data conform to this pattern, with the attendant need to collect the rarer relationships into the residual category r_8.

The incidence and duration of morbidity, classified by these categories, are set out in Table 2. There are both striking uniformities and differences. In *kharif* 2009, there were sharp differences across generations in the incidence of falling sick; but conditional on that state, the means and standard deviations were all virtually the same, except for daughters-in-law, who suffered longer and more variably – doubtless because of pregnancy. In the drier conditions of *kharif* 2013, the incidence fell across the board. With one exception, so too did the conditional means, especially that of daughters-in-law. Spouses, were the exception: they suffered, on average, about the same as daughters-in-law in 2009. The explanation for this turnabout lies in the extensive splitting of households, which resulted in many of the daughters-in-law in 2009 being promoted to the status of spouse of the head of household. Childbearing apart, Table 2 indicates that what seems to vary, both across kinship and time, is the probability of falling sick, rather than the duration of sickness conditional on doing so. In such a disease environment, this is quite plausible, and it will be followed up in Section 3.

It is still essential to control for age. Five groups are defined: infants and toddlers, 0-4 years; school-age children, 5-15 years; young adults, 16-25 years; prime-age adults, 26-45 years; and old adults, over 45 years. They are assigned dummy variables, with prime-age adults forming the reference group. The status of young and prime-age adults, in particular, can each vary sharply across families. Many of the males are heads of household, but many others are sons. A fair proportion of the young-adult daughters have yet to move out; but many daughters-in-law of their age have already moved in. The average levels of morbidity and the associated standard deviations by relationship and age-group are set out in Table 3, whose most striking feature is the higher levels of morbidity among females of child-bearing age, especially those under 26. None of the differences among males seems noteworthy, the standard deviations being relatively large.

Caste may also influence outcomes; for beliefs about the sources of illnesses and how to treat them are arguably part of the family's larger view of the natural order. Scheduled Tribes (hereinafter STs) have general beliefs with important animistic elements, and patriarchy is less entrenched among them than in Hindu communities, which is arguably advantageous for their womenfolk. To give a specific example of a damaging belief, many ST's were firmly persuaded that a newborn should not be fed its mother's colostrum (van Dillen, 2006). Separate dummy variables are defined for Scheduled Castes (SCs) and the politically powerful group known as Other Backward Castes (OBCs), with STs as the reference group.

The other covariates are ordered into groups of characteristics at the household and village levels, respectively.[3] The household's productive endowments and its demographic structure generate both income and claims on the common pot. The main endowments are its ownership holding (in acres) and the numbers of adult males and females of working age (15 to 65 years). The head of household's educational attainment (in years of completed schooling) and sex are likewise potentially important. That person's schooling normally influences the household's overall productivity, and it may well influence nutrition, hygiene and the choice of medical treatment. Female heads of household may have special priorities; they are almost invariably widows.

The household's immediate environment is the village. Since communicable diseases are the main causes of morbidity, the village's total population is potentially in play, as are the proportions of its total area under irrigation and forest, which provide havens for pathogens and their vectors, like mosquitoes. There is also topography. Going beyond a settlement's altitude (in meters), three categories are distinguished: dry basins (geo1), riverine basins (geo2), and hilly, forested areas (geo3). All three are dummy variables, with geo1 as the reference category. The administrative block in which the village is located also has particular characteristics, environmental as well as infrastructural, that may influence morbidity.

One feature involving both the village and its block that is central to this study is the trip to a medical facility for treatment. This trip is described by the lengths and quality of the various stretches of paths and roads that constitute it. For each

[3]For a full table of the summary statistics, see Bell and van Dillen (2015).

village, the relevant trips are defined to be those to the nearest hospital and PHC, respectively. This definition places the village within the route network, and so is unaffected by villagers' actual choices of facility. The precise definition of the trip variables is deferred until Section 4.

3 Kinship, Caste and Morbidity

The central question is whether an individual's familial relationship, r_{kl}, and caste are associated with morbidity, controlling for his or her age and the household's and village's characteristics. Let y_{ijt} denote the level of morbidity experienced by individual i in village j in period t. To address this question, the form to be estimated is

$$y_{ijt} = \boldsymbol{\alpha} \cdot \mathbf{x}_{ihjt} + \sum_{k} \sum_{l=1}^{2} \beta_{kl} r_{iklt} + u_i + \eta_h + v_j + w_t + \epsilon_{ihjt} \, , \tag{1}$$

where $\mathbf{x}_{ihjt}$ is a vector of the covariates (caste and other controls) at time t, the terms u_i, η_h and v_j represent unobservable, time-invariant heterogeneity among individuals, households and villages, respectively, w_t represents a time-varying common shock, and ϵ_{ihjt} is a white noise term. It is assumed that w_t and ϵ_{ihjt} are serially uncorrelated. Let $t = 1, 2$ denote 2009 and 2013, respectively, and the dummy variable t_{13} a year fixed effect, which captures any difference between w_2 and w_1.

The importance of to distinguishing between the probability of falling sick at all in the season in question and the combined duration of any bouts of sickness is established in Section 2. These measures of morbidity are arguably governed by different processes. With this distinction in mind, two corresponding single-equation models are employed. The distinction is then explored in a unified way using a two-tier model, in which the first tier deals with the probability of falling sick at all and the second with the duration of sickness, conditional on falling sick.

Two alternative assumptions about the relationship between the unobserved components and the regressors come into consideration. Given that the 30 villages, as sampling units, appear in both years, but only about two-thirds of the individuals inhabiting them do so, there are good reasons to treat either the households or the villages as the group variable in the panel. Random-effects estimation then rests on the assumption that either the η_h or the v_j are uncorrelated with the $\mathbf{x}_{ihjt}$ and r_{iklt}, depending on the choice of group variable, whereas fixed-effects estimation allows the pattern of correlation to be arbitrary (Wooldridge, 2002: 251-2). The former is more efficient, but may be biased. For present purposes, however, the latter has a drawback of its own; for an individual cannot have fewer than zero days of sickness, and there is no conditional fixed-effects estimator for the tobit model. We have chosen a linear probability model (LPM) and a tobit model to yield random-effects estimates of the factors influencing, respectively, the probability of falling sick and the duration of sickness. To obtain fixed-effects estimates, we also employ an LPM, but least-squares for duration, thereby ignoring the censoring at zero days. The two sets of estimates, each with its particular weaknesses, are then compared. The two-tier model is Heckman's two-step, whose first stage is a probit model, and again there is no fixed-effects estimator.[4]

The choice between households and villages as the group variable depends, in part, on the question to be answered. Family relationships are here at centre stage, so it seems natural to choose the former, with the additional advantage that since the households do not move between villages, any unobserved heterogeneity among villages will be removed when using the fixed-effects estimator. There is, however, the complication that the number of households changed, from 236 to 279, almost wholly as a result of splitting; and the great majority of the splits were not associated with random, exogenous events – the death of the head of household was the prime example –, but were rather the decisions taken by the male members of the stem households, quite conceivably motivated by strife among their spouses. It seems better, therefore, to treat the households as constituted in 2009 as exogenous. If a split occurred, the various members of the stem household remain allocated to it in 2013 for the purposes of analysis; but some of them had new positions – heads of household instead of sons, their spouses promoted from the lesser status of daughters-in-law, and so forth. These changes in status provide the variation needed for fixed-effects estimation, with the implicit assumption that the general resources of the stem household would be available to provide some support to all its members, even after any split had dispersed them among the ensuing branch households.

As for robustness where the choice of group variable is concerned, it turns out that all the qualitative findings reported below also hold when villages are employed instead of households, the two sets of estimates being numerically quite close.[5]

[4]Nor are clustered standard errors an option with the random-effects estimator. The latter are available with maximum likelihood estimation, but convergence could not be obtained, with or without clustering.

[5]A full set of results is available from the authors upon request.

3.1 Morbidity: single-equation results

Eq. (1) is first estimated as an LPM, with the measure of morbidity transformed into the discrete variable $\{0, 1\}$ (not-sick/sick) as regressand. This transformation discards information, but it may reduce measurement errors relative to morbidity defined in days; respondents' answers show some digital preference. The LPM usually provides good estimates of the partial effects of changes in the regressors near the centre of their distribution (Wooldridge, 2002: 455), and it has the advantage that the marginal effects are provided directly by the estimated values of the parameters. Table 4 presents the results for the random- and fixed-effects estimators. The two sets of results are similar; as expected, the random-effects standard errors are mostly smaller.

Kinship certainly matters, especially when viewed against an overall crude morbidity rate of 0.346 (= 919/2656) in the combined sample over the two years. Controlling for age, children and grandchildren were less prone to suffer morbidity than the head of household, the reference case and almost invariably male. The point estimates for these offspring range between 8 and 15 percentage points lower, all them significant at the 5% and 10% levels for the random- and fixed-effects specifications, respectively. In contrast, there is an indication that wives – though not mothers and daughters-in-law – may have suffered higher morbidity, though the point estimates of 4.8 and 4.6 percentage points are not quite significant at conventional levels. The estimates for mothers and daughters-in-law are 6 to 11 percentage points lower, but only those for the former are significant at the 10% level. In this connection, it should be recalled from Section 2 that a fair number of daughters-in-law in 2009 had become spouses by 2013. These observed changes involve unobserved household as well as individual heterogeneity, and cannot be exploited without modelling the process of splitting, which is not attempted here. Other relatives (r_8) fared even better than grandchildren, both estimated coefficients being significant at the 1% level. To assess these apparent differences formally, there is the null hypothesis that the coefficients on all the variables $r_{12}, r_{21}, \ldots, r_8$ are the same. It is decisively rejected (see Table 5). Within this whole group, inspection of Table 4 suggests that there is little separating the coefficients on the children and grandchildren, whatever be their sex. This null hypothesis of equal effects is in no danger of rejection, as suggested by the univariate statistics in Table 2.

Turning to the duration of sickness, both estimators yield quite similar results, after allowing for censoring in the random-effects tobit specification and despite its wholesale neglect in the fixed-effects, least-squares one. Especially noteworthy is the substantial, positive and highly significant coefficient on the spouse dummy: adjusted for censoring, a wife suffered 1.35 days more days of incapacitating illness than her spouse; the corresponding fixed-effects estimate is 1.89 days. The likely culprit was the burden of childbearing, whose effects probably arose from more than just the pregnancies in the two seasons in question. This clear finding of excess morbidity did not, however, apply to mothers and daughters-in-law. The estimates for mothers are about −1.3 and −1.9 days for random- and fixed-effects, respectively, both significant at the 5% level. The estimates for daughters-in-law have opposite signs and are not at all significant. Those on the relationship variables denoting children and grandchildren are negative and absolutely quite large. The random-effects estimates are all significant at the 1% level or better; the fixed-effects counterparts are all less precise, but significant at the 10% level or much better. The null that the coefficients on all the variables $r_{12}, r_{21}, \ldots, r_8$ are the same is decisively rejected, but that concerning children and grandchildren alone is in no such danger (see Table 5).

Caste is also very much in play, as so often in rural India. There is some evidence that members of the OBC group enjoyed lower morbidity than their ST and SC counterparts; but since caste is immutable, any inferences about its influence can be drawn only from the random-effects estimator. The LPM yields a point estimate that is 7.6 percentage points lower than that for STs, the reference group, and it is significant at the 1% level. The corresponding estimate for the duration of sickness, at 0.94 days lower, is almost as sharp, being borderline at the 1% level. Comparing both estimates for SCs with the reference group STs, statistically speaking, there is nothing to choose between them. It so happens that villages in which OBCs are heavily represented may have stood a better chance of getting a PMGSY connection (Bell and van Dillen, 2015). Since the network variables control for the length and quality of the trip to the nearest health facilities, lower morbidity among OBCs may have resulted from better nutrition and hygiene – or more timely and better treatment in the event of illness. The latter possibility is taken up in Section 4.

The association between certain endowment variables and morbidity is striking by its absence. Neither the family's landholding nor its demographic composition is statistically significant in either specification; nor is the head's education. Both estimators yield a strikingly higher probability of morbidity among members of female-headed households: the estimated LPM coefficients of 14 and 22 percentage points are significant at the 5% and 1% levels, respectively. The estimated marginal effect from the tobit specification is an increase of 1.87 days for each and every family member, now borderline significant at the 5% level; but the fixed-effects estimate of 1.0 days is not significant.

The numerical details of the results for the other controls are reported in Bell and van Dillen (2015). Suffice it to say here that, controlling for their relationships within the family, very young children and those members beyond their prime years (over 45) suffered higher morbidity than the head of household. This age-specific pattern is no great surprise in itself; but accompanied as it is by lower morbidity among the two generations of offspring controlling for age, it suggests that the latter may be benefiting from specific investments in their health.

Finally, it should be noted that the general level of morbidity in 2009 was strikingly higher than in 2013. The probability of falling sick was fully 17 to 18 percentage points higher, and adjusted for censoring, there were 2.3 to 2.4 more days of sickness, all of them very precise estimates.

3.2 Morbidity: hurdle model results

To estimate this model, some identifying restrictions are needed: at least one regressor included in the first tier must be excluded from the second. The village's total population, the proportions of its area under forest and irrigation, and the environmental variables should all have some influence on the probability of falling sick, but none of them is arguably likely to affect the number of days of sickness, conditional on falling sick.[6] Heckman's two-step estimator yields the results reported in detail in Table 6.

Most of the statistically significant action takes place at the hurdle stage, whose specification is a probit model. At that stage, the estimates are somewhat more precise than their LPM counterparts in Table 4; but after adjustment for censoring, both sets are close in value. There are, however, several regressors whose coefficients are also statistically significant at the second, duration stage. In contrast to the results from the single-equation specifications, daughters-in-law had longer bouts of illness, conditional on falling sick, than the head of household, a finding significant at the 10% level. If so, the longer average bouts were almost surely connected with pregnancy. Controlling for familial relationship, the youth group aged 16-25 also suffered more days of illness. The potential influence of the household's female adults on all its members' health finds no confirmation here. Yet it is interesting that the above findings for members of families with a female head of household are also not confirmed: according to the two-step specification, they experienced neither a statistically significant higher probability of falling sick at all, nor, conditional on doing so, more days of sickness.

[6] Just over one half of all individuals who did so had but one bout of illness (Bell and van Dillen, 2015).

One finding connected with the environmental variables is also worthy of comment. The agriculturally good monsoon of 2009 had a potent, statistically significant effect on the probability of falling sick, but none on the duration of sickness, conditional on doing so. This is in keeping with expectations, given the kinds of diseases that flourish in the monsoon.

To sum up, these results from the hurdle model suggest that the various factors influencing morbidity worked rather more strongly on the probability of suffering an incapacitating ailment than on the duration of the ensuing incapacity, conditional on suffering the ailment in the first place, thus bearing out the simple story in Table 2.

4 Treatment

The actual choices of where and from whom individuals sought treatment in the event of need are suppressed in the reduced-form analysis of morbidity in Section 3, as are the number of visits for, and outlays on, treatment. We now investigate what factors influenced these choices. Data on the number of visits were collected only in the 2009 round, on outlays, only in 2013. Those for 2013 also covered the type of facility, but the exact details of the trip were not canvassed, only the outlays on transport.

Viewing villages as units in a network, the trip to a medical facility for treatment is made up of various stretches on paths, cart tracks and roads. The definition employed here involves two alternative trips, one to the nearest hospital, the other to the nearest PHC. This definition places the village within the route network, and so is unaffected by villagers' actual choices of facility. Thus, the trip to the nearest hospital is defined by the following elements, all in km:

- $h1\_d0$ denotes the stretch of *kutcha* track;
- $h1\_d1$ the stretch of PMGSY road;
- $h1\_d2$ the stretch of district (PWD) road;
- $h1\_d20$ the stretch of PWD road in poor condition;
- $h1\_d3$ the stretch of highway;
- $h1\_d20$ the stretch of highway in poor condition.

Likewise, the trip to the nearest PHC is defined by $h2\_d0, \ldots$. These descriptions of the village's position will be termed the network regressors. It should be remarked that a direct PMGSY connection almost invariably involves replacing the stretch hf_d0 with an hf_d1 $(f = 1, 2)$ of almost the same length. As noted above, there are also indirect connections, which involve a partial replacement of hf_d0 by a positive value of hf_d1. Both kinds of improvements may induce households to choose a different health facility, and hence a different trip after the end of the stretch hf_d1.

4.1 The choice of facility

Table 1 classifies those individuals who suffered at least one bout of disabling illness by the type of facility where they were treated and their chief ailment. There appears to be no particular association between the two, though it should be noted that private hospitals are, with the exception of a mission hospital, very modest facilities – more like a doctor's practice with a few beds. Combining them with private practices to ensure a sufficient count in each cell, and leaving out traditional healers, Fisher's exact test confirms that the null cannot be rejected, neither in *kharif* 2009 ($p = 0.81$), nor in *kharif* 2013 ($p = 0.12$).

Even if the nature of the chief ailment played no role in this decision, distance from the village and ease of travel ought to have done so. There is a sub-divisional hospital in Titlagarh (in Block 1), and a smaller hospital (a community health centre) in Blocks 2 and 5. There are others of both kinds in the neighbouring region, but they are correspondingly harder to reach. The administrative block in which a household resides ought, therefore, to be an important factor influencing its choice of facility or provider. Table 7 confirms that in 2009, there were indeed substantial differences among blocks where the choice between PHCs and public hospitals is concerned, whereby almost 90% of all the sick were treated in one or other of these two kinds of facilities. Ignoring other covariates, it appears that a public hospital in a block attracted many of the sick away from the PHCs.

As a spatial variable, the block is rather crude. It is also a household (and hence individual) characteristic common to all of the alternatives from which the household chooses. A salient characteristic of each facility is the trip that villagers must make in order to obtain treatment there, the nature of which varies over both villages and the facilities. As it turns out, those who chose a PHC always chose the nearest one, understandably enough. The great majority of those who sought treatment in a hospital also chose the nearest one, but some went farther afield, for whatever reason. Since each of the three hospitals located in the five blocks and four other hospitals in the surrounding region were so involved, all should qualify, in principle at least, as separate, possible alternative choices for all individuals. Constructing the associated trip variables for each and every village would be not only extremely arduous, but also heavily larded with guesswork. It seems defensible, therefore, to confine an individual's choice of hospital to the nearest one. Thus, the decision in question is defined to be choosing between the alternatives of the nearest PHC and hospital, respectively. The corresponding trip variables are the vectors $(h1\_d0, \ldots)$ and $(h2\_d0, \ldots)$, which are the mutually exclusive alternatives comprising $(h\_d0, h\_d1, \ldots)$.

A striking feature of the actual choices in 2009 is that not a single individual was treated in more than one type of facility, even though many suffered more than one bout of illness and quite a few suffered more than one ailment. In effect, therefore, the villagers' observed behaviour is indistinguishable from a situation in which the two public facilities constituted mutually exclusive alternatives, one pair for each village. Thus, McFadden's conditional logit model is employed to investigate households' actual choice between them. Dummies for the reported illnesses, with malaria as the reference category, are also included; for families were surely able to assess the nature and seriousness of the ailment pretty well when the decision had to be taken, especially as the categories of illness are broadly defined. The results for the 495 individuals who were treated in public facilities are reported in Table 8.

Kinship mattered, in some degree, where getting treatment in a hospital was concerned. Spouses, children, grandchildren, mothers and daughters-in-law all had odds ratios exceeding 1, with the head of household as reference case; but only that for granddaughters is significant at the 5% level, with startlingly good relative chances, which hardly conforms to the expectation that little girls would suffer relative neglect. Among these groups, the null hypothesis that the coefficients on all the relationship variables are the same cannot be rejected. The same holds for the restriction to spouses, children and grandchildren, and for the corresponding null for the age-groups.

Of the household variables, the head of household's educational attainment and the OBC dummy are statistically highly significant. It is not especially surprising that better educated heads of household should improve all family members' chances of getting treated in a hospital rather than a PHC, all else being equal. Those suffering a fever or respiratory ailment, however, were much more likely to visit the PHC, these ailments usually being less serious. As for caste, it now emerges that members of the

OBC group not only suffered less morbidity than the other caste groups, but that they were also more likely to be treated in a hospital.

Turning to location and infrastructure, the inhabitants of hilly, forested villages (geo3) had a low odds-ratio indeed, even controlling for their position in the road network. Those of relatively well-irrigated villages were somewhat more likely to be treated in a hospital (borderline significant at the 5% level). These findings suggest that income effects may have been at work, even though households' land and labour endowments had no significant effects. Villagers in Titlagarh Block (the reference Block 1) had comparatively easier access to its sub-divisional hospital. All the trip variables involving distance on all-weather roads without an adjustment for their condition are statistically significant at the 5% level or better, and that for a stretch of track is borderline at that level. Holding all other components of the trip constant, an extra km on a track, a PWD road or a highway to the hospital raised the probability that the sick were treated in the PHC, whereas an extra km on a PMGSY road lowered it.

This latter finding might suggest that replacing a *kutcha* track with a PMGSY road would induce some villagers to switch from PHCs to hospitals. In fact, no such conclusion can be drawn from the model in question if the first part of the journey to the main road network is common to both facilities, as is almost invariably the case. For the odds-ratio is a function of, *inter alia*, the vector of differences between the trip components $(h1\_d0, h1\_d1)$ and $(h2\_d0, h2\_d1)$, respectively, and both differences are necessarily zero, both before the PMGSY road is built and afterwards.[7]

To summarise, spatial factors, in the form of topography, the administrative block and the particular placement of the village in the road network connecting the village to the two facilities in question, had a statistically decisive influence on which kind of facility was chosen in 2009. In contrast, most of the usual socio-economic variables – family relationships, age, landholding, the head of household's education and sex, village population, etc. – played a rather subordinate role, if any at all. Kinship within the family mattered little, with the exception of surprisingly favourable treatment of granddaughters; but all stood better chances getting hospital treatment if the head of household was better educated. As for caste, OBCs were much more likely than STs (or SCs) to go to a hospital.

[7] Experiments with interaction terms involving the track and the lengths of the PWD and highway stretches yielded no definite results, which is hardly surprising in view of the very indirect link between such constructed variables and the policy intervention itself.

4.2 The number of visits

Preventive care was not explicitly covered by the survey. In 2009, there were indeed no recorded visits without a bout of illness, and only a couple of recorded bouts without a visit. In effect, an individual's total number of visits for treatment was positive if, and only if, he or she fell ill in the season in question. It is defensible, therefore, to investigate the observed number of visits without real concern for possible selection problems, employing a truncated Poisson regression on the 569 individuals reporting at least one visit. The mean number was 2.51, with a variance of 1.86, so there is no over-dispersion. Even so, robust standard errors are reported in Table 9.

It is the spatial and network variables that dominate the results once more. Indeed, not a single individual or family characteristic is significant, even at the 10% level, so their estimated coefficients are not reported. The inhabitants of well-irrigated villages made fewer visits, but tended to use the hospital rather than the nearest PHC (recall Section 4.1). Those living in Blocks 2, 3 and 4, who fell sick made fewer visits for treatment than their counterparts in Block 1, whereby the latter were also more likely to visit a hospital, presumably the sub-divisional one in Titlagarh. The coefficients on the stretch of PMGSY road to the nearest hospital and PHC, respectively, are essentially the same in size, albeit of opposite sign, and both are precisely estimated. The corresponding coefficients on the stretch of *kutcha* track, i.e., those relating to $h1\_d0$ and $h2\_d0$, respectively, are also precisely estimated and of opposite signs – albeit also the opposite of those of their PMGSY counterparts, $h1\_d1$ and $h2\_d1$. The coefficients of the hospital-trip variables involving PWD roads and highways in bad condition are both negative and significant at the 5% level; their counterparts to a PHC are positive, relatively large and precisely estimated.

In the light of these findings, it is important to investigate the effect of replacing part or all of a village's *kutcha* track with a PMGSY road on the number of visits for treatment. This is not at all the same thing as travelling additional kilometres on a PMGSY road holding all other stretches constant. As noted above, the first two components of the trip to the nearest hospital or PHC are usually common to both facilities: $(h1\_d0, h1\_d1) = (h2\_d0, h2\_d1)$. That being so, the effect of providing the road on any (cardinal) variable is, analogously to eq. (1),

$$\delta \cdot d0 \equiv (\alpha_{11} - \alpha_{10} + \alpha_{21} - \alpha_{20}) \cdot d0, \tag{2}$$

where $d0$ is the length of track replaced, α_{11} is the coefficient of $h1\_d1$, the other α's are analogously defined and δ is the net effect per km so replaced. (It should be noted that this expression also covers indirect connections.) The null hypothesis that the provision of such a road will have no effect on the total number of visits for treatment is expressed as the condition $\delta = 0$. The estimated value of δ is $-0.119\,(z = -2.46)$: the null is clearly rejected. Conditional on falling sick, the estimated marginal effect of replacing tracks with all-weather roads is a reduction of 0.247 visits per km. This might be interpreted to mean that the roads programme resulted in improved quality of care by inducing treatment in hospitals rather than PHCs. This is rather speculative, however. As noted in Section 4.1, McFadden's random utility model cannot reveal such an effect when there is a one-for-one replacement of road for track and this stretch is common to the whole trip to each of the two types of facilities.

4.3 Expenditures

Obtaining treatment involves time as well as money, and in choosing among facilities and modes of transport, the household can trade off one against the other. If the PHC is not too far off, the whole trip can be made on a bicycle – quite possibly with the ailing member of the family on the saddle and another pushing on foot. If there is no direct connection to the road network, the trip on the track must be made somehow, and if the case is a severe one, at least one other family member or friend will have to provide assistance, very likely all the way to the facility – direct connection or no. In order to investigate these choices fully, one needs data on trip-times, who accompanied the sick, waiting times in the facility, and monetary outlays on both transportation and treatment. Expenditures on treatment were canvassed only in the 2013 round, and though those on transportation were likewise, data on trip-times and the claims on the family's time were not. In what follows, therefore, we must make do with the total monetary outlays as the indicator of the full cost of obtaining treatment.

The summary statistics, classified by illness and facility, respectively, are reported in Table 10. It should be remarked that whereas the regulated daily wage on public works projects was Rs.130, the going agricultural rate was close to Rs.100. The overall average outlay therefore corresponded to about 15 days of work in cultivation. The distribution also exhibits marked right-hand skewness. Going into the details, the various outlays conform to expectations. Viral fevers and upper respiratory infections were relatively cheap to treat, pregnancies were expensive, and malaria, gastric diseases and the heterogeneous category 'other ills', which included rheumatism and tumours, were in between. Turning to facilities, treatment in hospitals, public or private, was relatively expensive, followed by that in a private practice, with PHCs, traditional healers and dispensaries all much cheaper and much the same. It should be noted that the category ‘dispensaries’ is a ragbag of what are properly termed facilities, village shops and ‘rural medical practitioners’, only some of whom were trained paramedics.

To investigate the influence of individual, family, village and network characteristics on total outlays, we regress the logarithm of the latter on the whole set of covariates. The specification is therefore a reduced form, with the actual choice of facility and mode of transport suppressed, both being arguably econometrically endogenous. As argued in Section 4.1, dummies for the categories of illness are also included. The estimates are reported in Table 11.

There is no support for the contention that other family members were more sparingly treated than the head of household or that, among themselves, particular kin were favoured – controlling for age, illness and everything else. The young, however, were less generously treated than prime-age adults – controlling for illness. This was the only statistically significant form of discrimination within the family; and none of the other individual or family characteristics mattered. As in Sections 4.1 and 4.2, it is the village’s topographical, locational and network characteristics that were the decisive influences, along with the ailment in question. Longer trips on PWD roads in poor condition and on highways were associated with statistically significant larger outlays, longer trips on PWD roads to PHCs with smaller ones.

5 Conclusions

The great majority of upland Orissa’s population are poor, even by the rather undemanding standard of the official poverty line. The environment in which they live must count as a hazardous one where communicable diseases are concerned, which account for the lion’s share of the disease burden.

What influence do kinship and caste, in particular, have on individual morbidity as the final health outcome? Taking the head of household – 95 percent of the sample were male – as the benchmark, and controlling for age and a whole variety of other covariates, children, grandchildren and the catch-all ‘other kin’ enjoyed lower morbidity on both measures, namely, the probability of falling sick and, conditional on doing so, its duration. Spouses did no worse on the first score, but when sick, they suffered longer. One might surmise that the latter finding is related to pregnancies, though not necessarily only to current ones. Yet there is some evidence that mothers were less likely to fall sick than the head of household, with shorter bouts of illness. Daughters-in-law, however, fared no better than their fathers-in-law. There were no statistically significant differences in morbidity between sons and daughters, or grandsons and granddaughters, or indeed between children and grandchildren. Pregnancy aside, therefore, there is no evidence of unequal *outcomes* among kin. In contrast, a comparison across families yields some evidence that all members of families with a female head of household suffered higher morbidity. Caste certainly mattered, too, regardless of an individual's sex. Members of the Other Backward Caste group enjoyed lower morbidity than their Scheduled Caste and Scheduled Tribe neighbours, again controlling for age and other covariates.

Turning to treatment, there is no evidence that kinship had any effect on the choice between a hospital and a PHC, with the rather startling exception that granddaughters were more likely to be treated in a hospital. Less surprising is the finding that all members of families with a better educated head of household were more likely to enjoy that advantage. The choice between the two facilities was governed rather by factors in the family's environment: the character of its village, the administrative block and, especially, the respective trips from the village to the nearest facility of each kind. Even so, members of the OBC group were much more likely, all else being equal, to be treated in a hospital. None of the individual or family characteristics influenced the number of visits for treatment. Once again, it was the block and the trip variables that influenced this choice. Finally, where total expenditures on treatment are concerned, the only evidence of discrimination within the family took the form of tighter outlays on the young than prime-age adults, who are the main bread-winners. The trip variables and the nature of the illness were the decisive factors.

To sum up, whether judged by morbidity as the final outcome or the three measures of treatment in the event of sickness, there is no evidence that female kin did worse than their male counterparts – except in the inherent difference arising from pregnancy. The upcoming generations of children and grandchildren enjoyed better outcomes, regardless of their sex and controlling for age, and they received inferior treatment only on the measure of total expenditures. As for caste, better by far to be an OBC, both in the chances of getting treated in a hospital and in the final outcome. Viewed overall, it was the family's village, with its topography and location within the network of facilities and all-weather roads, that really mattered most.

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Table 1: Incidence of acute diseases, classified by treatment facility

Kharif 2009

Disease	viral fever	gastro-enter.	'flu/ cold	malaria	OBGYN	other	total
PHC	85	8	31	108	12	20	264
	(32.2)	(3.0)	(11.7)	(40.9)	(4.5)	(7.6)	(100)
Gov. hosp.	71	11	24	101	11	13	231
	(30.7)	(4.8)	(10.4)	(43.7)	(4.8)	(5.6)	(100)
Priv. hosp.	0	1	1	7	1	1	11
	(0)	(9.1)	(9.1)	(63.6)	(9.1)	(9.1)	(100)
Priv. doc.	9	2	3	10	0	1	25
	(36.0)	(8.0)	(12.0)	(40.0)	(0)	(4.0)	(100)
Healer	14	1	6	11	2	1	35
	(40.0)	(2.9)	(17.1)	(31.4)	(5.7)	(2.9)	(100)
Total[a]	179	23	65	237	26	36	566
	(31.6)	(4.1)	(11.5)	(41.9)	(4.6)	(6.4)	(100)

Row percentages in parentheses.
H_0: combine private treatment and ignore healers. Fisher's exact test: $p = 0.81$.

Kharif 2013

Disease	viral fever	gastro-enter.	'flu/ cold	malaria	OBGYN	other	total
PHC	20	2	9	18	0	14	63
	(31.3)	(3.1)	(15.6)	(29.7)	(2.2)	(20.3)	(100)
Gov. hosp.	22	11	7	49	11	24	124
	(19.0)	(5.8)	(6.6)	(40.5)	(6.6)	(21.5)	(100)
Priv. hosp.	5	3	0	11	0	14	33
	(16.1)	(9.7)	(0)	(38.7)	(0)	(35.5)	(100)
Priv. doc.	14	2	9	28	1	18	72
	(18.4)	(1.3)	(11.8)	(36.8)	(0)	(23.3)	(100)
Healer	10	0	4	9	0	8	31
	(28.1)	(3.1)	(12.5)	(28.1)	(3.1)	(25.0)	(100)
Dispensary	7	0	11	4	0	4	26
	(30.8)	(0)	(38.5)	(15.4)	(0)	(15.4)	(100)
Total[a]	78	18	40	119	12	82	349
	(23.3)	(5.2)	(11.5)	(34.1)	(3.4)	(23.5)	(100)

H_0: also combining OBGYN and other, and ignoring dispensaries. Fisher's exact test, $p = 0.12$.
[a] $\chi^2(5) = 60.4, p = 0.000$.

Table 2: Sickness in the family, incidence and duration (days)

Kharif 2009

Variable	individuals	sick	mean	std. dev.	min	max
r_{11}	237	130 (58.4)	12.32	6.22	3	45
r_{12}	212	120 (56.6)	12.84	7.12	3	50
r_{21}	318	117 (36.8)	12.92	5.69	3	30
r_{22}	202	79 (39.1)	12.39	6.27	3	30
r_{31}	81	30 (37.0)	11.43	6.49	3	25
r_{32}	62	22 (35.5)	12.86	6.20	5	25
r_{42}	46	22 (47.8)	11.55	5.64	3	20
r_{72}	73	28 (38.4)	20.21	9.53	3	40
r_8	86	22 (25.6)	14.50	8.18	5	40
Total	1291	567 (43.9)	12.96	6.80	3	50

Row percentages in parentheses.

Kharif 2013

Variable	individuals	sick	mean	std. dev.	min	max
r_{11}	279	87 (31.2)	11.59	7.29	1	40
r_{12}	258	85 (32.9)	18.95	19.67	2	100
r_{21}	325	78 (24.0)	10.06	7.33	3	40
r_{22}	202	52 (30.7)	10.27	12.43	1	90
r_{31}	59	11 (18.6)	10.09	4.91	4	20
r_{32}	62	10 (16.1)	10.20	5.22	4	20
r_{42}	43	10 (23.3)	11.10	5.72	4	20
r_{72}	64	9 (14.1)	14.44	10.26	3	30
r_8	86	19 (22.1)	13.11	5.36	7	25
Total	1365	352 (25.8)	13.00	12.68	1	100

Table 3: Adult morbidity levels by relationship and age group, *kharif*

Relationship	r_{11}	r_{21}	r_{12}	r_{22}	r_{72}
Age-group					
16−25	2.41	3.36	8.97	2.64	5.54
	(6.81)	(6.60)	(20.69)	(5.70)	(10.3)
26−45	4.17	2.91	6.68	2.64	4.47
	(7.03)	(5.93)	(10.9)	(4.57)	(9.55)

Average number of days of sickness in *kharif*, 2009 and 2013 combined, s.d.s in parentheses.

Table 4: Morbidity, 2009 and 2013

	LPM [a]		Days(tobit) [b]		
Variable	coeff.	s.e.	coeff.	s.e.	$dy/dx\|_{y^*>0}$
Random effects					
r_{12}	.048	.030	3.69***	1.32	1.35
r_{21}	−.091**	.042	−5.18***	1.95	−1.62
r_{22}	−.117**	.049	−6.40***	2.19	−1.91
r_{31}	−.146**	.063	−7.86***	2.93	−2.14
r_{32}	−.153**	.071	−7.91**	3.17	−2.15
r_{42}	−.093*	.054	−4.39*	2.53	−1.32
r_{72}	−.081	.051	−1.90	2.46	−.61
r_8	−.185***	.068	−7.21**	3.40	−1.97
hhsex	.137**	.067	4.83**	2.30	1.87
SC	−.038	.030	−.99	1.38	−.33
OBC	−.076***	.024	−2.83**	1.18	−.91
t_{13}	−.169***	.023	−6.96***	1.02	−2.39

	LPM [c]		Days [d]	
Fixed effects				
r_{12}	.046	.031	1.89***	.66
r_{21}	−.083*	.048	−1.65**	.80
r_{22}	−.129**	.056	−2.43**	1.02
r_{31}	−.140*	.079	−2.48*	1.35
r_{32}	−.151*	.083	−2.15*	1.41
r_{42}	−.111*	.061	−1.88**	.85
r_{72}	−.065	.058	−.66	1.16
r_8	−.231***	.079	−2.69**	1.23
hhsex	.218***	.076	1.04	1.37
t_{13}	−.185***	.026	−2.28***	.45

238 groups (households). $n = 2656$, 919 uncensored obs. Robust s.e.'s, clustering for households. Other controls: age groups, males, females, children, trip variables.

[a] Linear probability model, discrete variable $\{0, 1\}$. R^2 (overall) = 0.0813. Wald $\chi^2(44) = 284.81$, $\rho = 0.028$.

[b] Wald $\chi^2(44) = 186.89$, log-likelihood = −4833.1, $\rho = 0.015$.

[c] Discrete variable $\{0, 1\}$. R^2 (within) = 0.0699, $F(18, 237) = 10.82$, $\rho = 0.139$.

[d] R^2 (within) = 0.055, $F(18, 237) = 8.99$, $\rho = 0.172$.

Table 5: Family, kinship and morbidity: tests of homogeneity

	discrete [a]		duration [b]	
Model				
Random effects [c]	chi-sq	p	chi-sq	p
$H_0(1)$	26.08	0.000	36.17	0.000
$H_0(2)$	1.96	0.582	2.20	0.532
Two-step [c]: $H_0(1)$	24.99	0.001	28.38	0.000
Two-step [c]: $H_0(2)$	2.71	0.438	0.27	0.966
Fixed effects [d]	F	p	F	p
$H_0(1)$	3.48	0.001	4.05	0.001
$H_0(2)$	0.99	0.400	0.84	0.472

The null hypotheses are: $H_0(1)$, that the coefficients of all the dummy variables $r_{12}, r_{21}, , \ldots, r_8$ are equal; and $H_0(2)$, that those of $r_{21}, , \ldots, r_{32}$ are equal.
[a] Probability of falling sick. [b] Duration of illness in days.
[c] With 7 and 3 d.f. for $H_0(1)$ and $H_0(2)$, respectively.
[d] F with $(8, 237)$ and $(3, 237)$ d.f., respectively.

Table 6: Morbidity, 2009 and 2013, hurdle model

	first tier		second tier	
Variable	coeff.	s.e.	coeff.	s.e.
r_{12}	.123	.082	3.11***	.99
r_{21}	−.284**	.117	−3.85**	1.72
r_{22}	−.353***	.131	−3.93**	1.95
r_{31}	−.455***	.174	−4.38*	2.58
r_{32}	−.485***	.189	−3.62	2.69
r_{42}	−.256*	.155	−1.46	1.87
r_{72}	−.275*	.150	3.59*	2.12
r_{8}	−.518**	.203	.40	3.17
age0-4	.316**	.141	1.36	1.97
age5-15	.174	.114	1.81	1.39
age16-25	.005	.101	3.10**	1.39
age46+	.120**	.084	.21	1.08
hhedu	.001	.009	.02	.11
hhsex	.155	.144	1.13	1.70
males	−.027	.031	−.05	.38
females	−.016	.033	−.39	.41
children	−.018	.020	.33	.25
SC	−.089	.080	.88	.96
OBC	−.203***	.069	−.13	.84
pop01/100	.116***	.030		
forest	.007	.005		
irrigation	.003	.006		
alt/100	−.062	.156		
geo2	−.033	.129		
geo3	−.059	.096		
t_{13}	−.481***	.062	−.19	1.53
cons	−.273	.396	9.40***	3.27
σ	9.46			
ρ	.364			
Mills ratio: λ	3.48	3.71		

$n = 2656$; 919 uncensored obs. Wald: $\chi^2(37) = 75.07$.
Controls: block dummies, network variables.

Table 7: Choice of treatment facility by block of residence, *kharif* 2009, 2013

Block	1	2	3	4	5	total
PHC	8	55	99	70	32	264
	(3.0)	(20.8)	(37.5)	(26.5)	(12.1)	(100)
Hospital	92	38	26	4	71	231
	(39.8)	(16.5)	(11.3)	(1.7)	(30.7)	(100)
Total	100	93	125	74	104	495

Row percentages in parentheses. Fisher's exact test: $p = 0.007$.

Block	1	2	3	4	5	total
PHC	11	6	11	4	12	44
	(25.0)	(13.6)	(25.0)	(9.1)	(27.3)	(100)
Hospital	14	41	21	26	37	139
	(10.1)	(29.5)	(15.1)	(18.7)	(26.6)	(100)
Total	25	47	32	30	49	183

Row percentages in parentheses. Fisher's exact test: $p = 0.015$.

Table 8: Choice of public facility, *kharif* 2009, conditional logit model

Variable	coeff.	s.e.	odds-ratio
hosp	2.95***	1.10	19.18
r_{12}·hosp	0.20	0.46	1.23
r_{21}·hosp	1.11	0.80	3.05
r_{22}·hosp	1.38	0.92	3.99
r_{31}·hosp	0.32	1.15	1.37
r_{32}·hosp	3.01**	1.45	20.31
r_{42}·hosp	1.44*	0.84	4.20
r_{72}·hosp	0.98	1.01	2.67
ownhold·hosp	−0.05	0.05	0.95
hhedu·hosp	0.18***	0.05	1.20
hhsex·hosp	−0.56	0.95	0.57
sc·hosp	0.35	0.42	1.42
obc·hosp	1.50***	0.42	4.49
pop01/100·hosp	−0.16	0.12	1.00
forarea·hosp	0.03	0.02	1.21
irrigation·hosp	0.07*	0.04	1.07
geo2·hosp	−1.40*	0.77	0.25
geo3·hosp	−2.47***	0.49	0.08
block2·hosp	−4.08***	0.72	0.17
block3·hosp	−3.72***	0.63	0.24
block4·hosp	−5.95***	0.87	0.003
block5·hosp	−1.86***	0.54	0.16
$hd0$	−0.89*	0.46	0.41
$hd1$	0.36**	0.15	1.44
$hd2$	−0.07**	0.03	0.93
$hd20$	0.19	0.18	1.20
$hd3$	−0.16***	0.04	0.85
fever·hosp	−0.99***	0.37	0.37
gastric·hosp	−0.36	0.85	0.70
other-ill·hosp	0.35	0.50	1.41

$n = 988$. Pseudo $R^2 = 0.540$. LR $\chi^2(32) = 369.6$. Log-likelihood $= -157.6$.
None of age-group and the other family characteristics is significant at the 10% level, not reported.

Table 9: Number of visits for treatment, all acute illnesses, 2009, truncated Poisson

Variable	coeff.	s.e.	$dy/dx\|_{y^*>0}$
irrigation	-0.036^{***}	0.008	-0.075
forest	0.010^{**}	0.005	0.021
block2	-0.859^{***}	0.195	-1.401
block3	-0.479^{***}	0.158	-0.875
block4	-0.675^{***}	0.161	-1.135
block5	-0.049	0.114	0.100
$h1\_d0$	-0.264^{***}	0.099	-0.546
$h1\_d1$	0.143^{***}	0.029	0.297
$h1\_d2$	-0.017^{**}	0.008	-0.035
$h1\_d20$	0.067	0.045	0.139
$h1\_d3$	-0.002	0.007	-0.005
$h1\_d20$	-0.028^{**}	0.014	-0.037
$h2\_d0$	0.395^{***}	0.105	0.817
$h2\_d1$	-0.132^{***}	0.033	-0.273
$h2\_d2$	0.041^{**}	0.017	0.084
$h2\_d20$	-0.079	0.059	-0.164
$h2\_d3$	-0.033	0.024	-0.069
$h2\_d20$	0.155^{***}	0.039	0.321
fever	-0.227^{***}	0.059	-0.463
gastric	0.034	0.162	0.072
other-ills	0.023	0.134	0.047
constant	1.107^{***}	0.228	

$n = 569$. Wald $\chi^2(44) = 182.1$. Pseudo $R^2 = 0.0774$. Robust s.e.'s and clustering for villages. None of the individual and family characteristics is significant at the 10% level, not reported.

Table 10: Combined expenditures on treatment and transport (Rs.), 2013

Variable	obs.	mean	std. dev.	min	max
Ailment:					
Viral fever	78	964.7	1133.4	30	7200
Gastro-enter.	18	2058.3	1711.9	220	6000
Influenza, respir.	40	595.3	529.8	100	3000
Malaria	119	1473.9	1517.6	100	8500
OBGYN	12	4680.8	4401.5	400	14300
Other	82	2488.4	3737.4	0	27000
Facility:					
PHC	63	655.0	456.6	5	2000
Govt. hospital	124	2327.9	3187.0	200	27000
Priv. hospital	33	2778.8	3118.6	300	13000
Priv. doctor	72	1698.1	1846.5	200	8600
Healer	31	612.3	484.7	30	2000
Dispensary	26	495.4	417.1	100	2000
Total	349	1643.0	2426.6	0	27000

Table 11: Estimated effects on log(combined expenditures), 2013

Variable	coeff.	s.e.	t
age0-4	−0.742	0.257	−2.88
age5-15	−0.500	0.224	−2.21
age16-25	−0.289	0.298	−0.97
age46+	−0.254	0.184	−1.38
forest	−0.010	0.009	−1.11
irrigation	−0.030	0.009	−3.20
geo2	−0.302	0.254	−1.19
geo3	−0.151	0.164	−0.92
block2	0.791	0.420	1.88
block3	0.262	0.215	1.22
block4	−0.025	0.225	−0.11
block5	0.180	0.193	0.93
$h1\_d0$	−0.091	0.106	−0.85
$h1\_d1$	−0.107	0.055	−1.93
$h1\_d2$	0.005	0.013	0.38
$h1\_d20$	0.276	0.057	4.86
$h1\_d3$	0.021	0.010	2.08
$h1\_d20$	−0.035	0.020	−1.75
$h2\_d0$	0.069	0.087	0.79
$h2\_d1$	0.123	0.075	1.64
$h2\_d2$	−0.016	0.022	−0.73
$h2\_d20$	−0.309	0.054	−5.71
$h2\_d3$	−0.005	0.029	−0.16
$h2\_d30$	0.081	0.063	1.27
fever	−0.534	0.173	−3.08
gastric	0.578	0.276	2.10
influenza	−0.665	0.262	−2.54
malaria	−0.183	0.202	−0.90
OBGYN	1.183	0.548	2.16
constant	7.230	0.473	15.29

$n = 349$. $R^2 = 0.2886$. Robust s.e.'s and clustering for villages.
None of the other individual and family characteristics is significant at the 15% level, not reported.

This paper investigates whether an individual's relationship to the head of household and caste are associated with the level of his or her morbidity and, in the event of illness, the treatment received. Surveys of 279 households drawn from 30 villages in a region of upland Orissa were conducted in 2010 and 2013, yielding an unbalanced panel of 1580 individuals, 1076 of whom were present in both years. Whether judged by morbidity as the final outcome or three measures of treatment in the event of sickness, there is no evidence that female kin did worse than their male counterparts – except in the inherent difference arising from pregnancy. The upcoming generations of children and grandchildren enjoyed better outcomes, regardless of their sex and controlling for age. Members of the Other Backward Caste group enjoyed both better chances of getting treated in a hospital and lower morbidity than their Scheduled Tribe and Scheduled Caste counterparts. Viewed overall, the treatment an individual received depended rather on the character of the family's village – its topography and its place within the network of health facilities and all-weather roads.

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