Coping with the incidence of an infectious disease: Household strategies and their consequences

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Abstract

An unexpected illness can impose an enormous economic burden on poor uninsured households, if they are unable to cope with the immediate impact of higher healthcare expenditures and lower income. In this paper we examine financing mechanisms used by households to pay for treatment expenses and then use panel data to examine the coping strategies employed by poor households affected by an infectious disease (*visceral leishmaniasis*) in eastern India. We find that most households use unsecured loans to finance treatment expenses, and then rely on the labour market and livestock sales to cope with the debt service requirements of these loans. The labour supply coping derives from an increase in hours worked by females and younger workers, some of whom drop out of school. While the labour market does allow households to compensate for the loss of work effort of those affected by the disease, this is at lower wages, which results in households being unable to smooth consumption.

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I. Introduction

A health shock, i.e. an unexpected illness or injury, can impose an enormous economic burden on poor, uninsured households and be a major cause of poverty.[1] Higher healthcare expenditures and a possible loss in income lowers economic well-being in the immediate term, and the impact can persist if the disruption of an already-precarious balance between income and expenditure results in a significant alteration of a household's asset-liabilities portfolio.

There has been much interest in poor households' ability to weather health, and other types of, economic shocks. Several studies have examined households' ability to insure consumption, and some have specifically focused on health shocks (Cochrane 1991; Paxson 1993; Rosenzweig and Wolpin 1993; Townsend 1994; Kochar 1995 {Wagstaff, 2007 #288; Dercon and Krishnan 2000; Gertler and Gruber 2002; Skoufias and Quisumbing 2005; Wagstaff 2007; Linnemayr 2010; Islam and Maitra forthcoming). Most of the studies that have examined the impact of health shocks have relied on self-reported measures of health, the exception being Linnemayr (2010)'s examination of the impact of HIV/AIDS.

The economics literature has tended to treat a health shock fairly uniformly, often measuring it in terms of self-reported measures of morbidity and mortality, but all health shocks aren't created equal. They vary in uncertainty of incidence, severity, persistence, and inter-individual transmissibility. An infectious disease is a particularly pernicious health shock because often the risk is ever-present, infection is not easily detected, downturns in health can vary in incidence and severity, the effects can persist for long periods of time because of compromised immune systems, and the burden can multiply with inter-individual transmission.

Visceral leishmaniasis (VL), known as *kala azar* in India, is a vector-borne infectious disease caused by the parasite *Leishmania donovani*, and it is transmitted by the bite of a sand fly, a tiny insect smaller than a mosquito. The disease is endemic in the northeastern part of the Indian sub-continent and several other countries in the Middle East, northern Africa, and South America. It is estimated that, worldwide, there are 500,000 new cases each year (Singh, Picado et al. 2010). The disease requires specialized diagnosis and treatment, which is expensive and can last a few weeks during which the affected person, and those caring for them, can also suffer a loss in income. The economic burden can be particularly severe because extended dormancy and similarity of symptoms with other diseases can easily lead to delayed diagnosis and prolonged treatment.

[1] In a multi-country qualitative study conducted as part of the background research for the World Bank's World Development Report (2000) on poverty, respondents consistently noted the centrality of unexpected health expenditures as a prime cause of their poverty (Narayan and Petesch, 2002).

Several studies have estimated the economic burden imposed by infectious diseases (Russel 2004; Sharma, Bern et al. 2006; Sundar, Arora et al. 2010) (Ramaiah, Das et al. 2000), and there are estimates of the costs of VL in India (Sundar, Arora et al. 2010), Bangladesh(Anoopa Sharma, Bern et al. 2006) , and Nepal (Rijal, Koirala et al. 2006). Despite considerable variation in these estimates there is little doubt that, for the affected households, the VL represents an enormous economic burden. For example, Rijal et. al (2004) estimate that the mean total (direct and indirect) costs of treatment for VL is US$ 113.64, while Sundar et. al (2010) estimate median total costs per patient to be US$127, and Hasker et. al (2010) estimate the costs to be around $100.

Households cope with the economic burden of a disease, or any other income shock, in multiple ways. They use savings (Paxson 1993), borrow(Rosenzweig and Wolpin 1993), sell assets(Kazianga and Udry 2006), increase labour supply(Kochar 1999; Rose 2001; Cameron and Worswick 2003), withdraw children from school to put them to work (Jacoby and Skoufias 1997), and engage in various informal risk management arrangements {Rosenzweig, 1989 #852}. Differences in preferences, prices, and resources imply variation in the particular combination of coping mechanisms used by households, and while it is generally accepted that households with fewer human and physical assets are less able to insure themselves against these shocks, the sequencing and effectiveness of these coping mechanisms remains a less researched area. One exception is a mixed methods study in Burkina Faso which shows that households first mobilize savings, then look to sell assets, take loans, and increase income via diversification and wage labour (Sauerborn, Adams et al. 1996).

This paper contributes to the literature on health shocks and coping mechanisms by examining the coping strategies used by households affected by visceral leishmaniasis in one endemic district in eastern India. Data for this study were collected as part of a large probabilistic incidence survey in which almost 15,000 households were screened and potential VL cases were invited for a clinical interview. During the clinical interview VL cases were confirmed on the basis of case history, and medical records. The study of economic impact was an add-on component to the incidence survey and took the confirmed VL cases as the starting point and interviewed the constituent households in two rounds in December 2006 and March/April 2007. During this “baseline survey” data were collected on illness and treatment experience and household economic functioning during the 12 months preceding the interview. A group of comparison households from the same villages were also interviewed in the same survey. These two groups of households were re-interviewed twice and similar data on illness experience and economic functioning were collected over a 16-month period. The resulting panel of VL-

affected households and comparison households is used to analyze the coping strategies used by households.

The paper is organized as follows. In section II we describe the surveys and data. Section III presents the results of our analyses. We first describe disease experience and the immediate impact of the disease on healthcare expenses and income. Next we examine data on the financing of treatment expenses by households affected by the disease. Thereafter, we use panel data on disease-affected households and the comparison group to assess the coping strategies employed by households. Section VI presents conclusions and the policy implications of our results.

II. Data

This study was designed to piggyback on a large "incidence" survey aimed at developing population-level estimates of the incidence of VL in East Champaran district, Bihar (India).[2] The incidence survey employed a stratified multi-stage design and interviewed 14,223 households in two rounds, the first (Round 1) in December 2006 and the second (Round 2) in April-May 2007; the district was stratified into high, medium, and low-prevalence strata, and a two-stage design was used within each strata. "A trained interviewer visited each selected household and asked the household head or a responsible adult whether any of the household members was currently suffering from VL, experiencing a fever for more than 2 weeks, had been diagnosed with VL, died from VL, or died from an illness with a fever lasting longer than 2 weeks in the last 12 months. All individuals who met at least one of these criteria were considered possible VL cases. The possible cases, or informants (if the affected individual had died or was unavailable), were invited for a clinical interview conducted the same day by the survey team's medical doctor. The survey doctor either diagnosed a current case of VL or a case in the past 12 months based on a combination of: the clinical inter-view, the diagnosis received at the time of the illness, diagnostic test results, medications prescribed, reported signs and symptoms, and the rk39 test result." (Das, Samuels et al. 2010).

The initial screening identified 471 possible cases of VL and of the 450 who reported for the clinical interview, VL was (clinically) diagnosed in 227 individuals.[3] This implies a stratum-weighted incidence rate of 21.9 per 10,000 per year (Das, Samuels et al. 2010). The difference between self-diagnosed incidence, based on a commonly used criterion - two weeks of sustained high fever - and clinical diagnosis is noteworthy, and highlights the scope for substantial measurement error in self-

[2] The Appendix includes a map of the study site.
[3] Of the diagnosed cases 149 had survived the disease, 14 had died from VL, and 64 were active cases.

reported measures of health shocks. The 227 cases were from 194 households, hereafter referred to as VL households.

A baseline household survey was conducted soon after the clinical interview, and interviewers were able to contact 182 of the 194 VL households; these had 209 VL cases. In order to measure the immediate and direct impact of the disease, detailed data was collected on disease experience, treatment expenses, and income loss associated with the disease. In keeping with the way cases were identified in the incidence survey, the reference period for these data was 12 months.[4] The survey also collected data on household composition, schooling, income, expenditures, assets, and debt, and the reference period for most of these measures was the 12 months preceding the baseline survey.

In a study design with retrospective case identification contemporaneous measurement of disease experience and household economic functioning is unavoidable. One important implication of this design is that very few measures of household economic functioning truly reflect pre-disease conditions; in fact, most measures, at least in theory, are influenced by disease experience. This is certainly true of our main outcome measure – standard of living - which is directly influenced by the unexpected increase in treatment expenditures, but it is also the case with many of the covariates which reflect survey-date conditions. Given the centrality of the (treatment) assignment mechanism in the potential outcomes framework, we pay particular attention to this issue in the choice of covariates in section V, but acknowledge that in the literal sense only a handful of our covariates are truly pre-disease measures.

In each of the administrative blocks of the study area a (quasi) random sample of comparison households was selected from the same villages as the clinically-identified VL cases. These households had not had a VL case during the 12-month reference period. Selection from the same villages as the VL cases ensures that the comparison group is comparable in terms of endemicity of the disease, but also raises issues related to unobserved factors associated with disease incidence which we discuss in the following section. Four households were selected from each village in the high-incidence stratum, three per village in the medium-incidence stratum, and two per village in the low-incidence stratum. No specific criteria were used for selecting these households; instead selection was based on interviewer judgment of similarity in outward appearance (dwelling size and condition, and living conditions). The two groups of households are largely comparable though there are some distinct differences in household age-composition, and credit market engagement which we discuss in detail in Section V.

[4] For those who had ongoing treatment at the time of the baseline survey, and those who received additional treatment after the baseline survey post-baseline data was collected in the follow-up surveys.

Two follow-up surveys, eight months apart, sought to re-interview all 182 households with a VL case, and the 91 comparison households without a VL case. Only six households were lost to follow up, and so we have a final sample of 267 households, 178 with at least one VL case during the baseline reference period of 12 months, and 89 without a case during the same time period. Most of the 178 households, 155 to be precise, had only one VL case during the baseline reference period. During the 16-month follow up period households reported 17 new cases of VL,[5] all but one of which were in the VL households.

III. Results

An infectious disease is a particular type of health shock and can have a varied impact on households depending on who is infected, their immunity, transmissibility of infection to others in the household, and various aspects related to the choice of healthcare provider, diagnosis, and treatment. We collected detailed data on the entire treatment pathway for each patient, including incidence and treatment of new VL cases.[6] This allows us to describe disease experience of the household in considerable detail, and develop estimates of the immediate economic impact of the disease. In section A we present these results, before turning to the financing of treatment expenses in section B, and an analysis of household coping strategies in section C.

A. Disease experience and the immediate economic impact of VL

The retrospective identification of cases over a 12-month period implies considerable variation in the timing of disease experience in relation to the baseline survey. Forty-seven percent of the 209 VL cases had the first episode of sustained high fever, a commonly used measure of initial diagnosis of VL, more than six months prior to the baseline survey, 18 percent between four and six months, and 34 percent within three months of the survey. We are able to overcome the truncation bias inherent in retrospective data on duration-dependent events, by re-interviewing all VL cases in the two follow-up surveys.[7] More distant events can still imply greater measurement error, and we address this in the regression models by including a variable for duration between first high fever and the baseline survey.

[5] Unlike the initial clinical identification of VL cases (during the baseline reference period) these new cases were not clinically identified, but self-reported by households.

[6] Unlike the baseline survey wherein incidence was clinically verified, new cases in the follow-up surveys, in both groups of households, were self-reported.

[7] Ten percent had ongoing treatment at the time of the baseline survey, and another 10 percent received additional treatment after the baseline survey.

Seasonality of disease incidence also introduces variation in a retrospective survey: almost two-thirds of the VL cases had disease onset during the winter and spring months (November to April). With the baseline survey conducted in December 2006 and March\April 2007, seasonality is closely associated with the truncation bias, so addressing the former, in effect, addresses the later.

The greatest source of variation in economic impact is via treatment pathways, and this is directly related to the choice of healthcare provider, timing of diagnosis, and treatment effectiveness. Treatment pathways have been analyzed in detail elsewhere; here we present an overview.[8] Typically, the first treatment is symptomatic and obtained from a local provider (v*aid, hakim, jholachap* or a chemist) who is not trained to diagnose and treat VL; as a result only seven percent are diagnosed with VL. The second treatment shows a large shift towards trained medical practitioners (private doctors and public providers), and while this does lead to an increase in diagnosis, almost 40 percent of VL cases are still undiagnosed at this point. By the third treatment 80 percent of cases are diagnosed, and most treatment is at trained practitioners, but varying treatment adherence and effectiveness means that 22 percent continue to require four or more treatments. During the study period the most commonly used VL treatment was a course of Sodium Antimony Gluconate (SAG) which, if completed, lasted four weeks. However, late diagnosis, increasing resistance to SAG and the need for more expensive treatments (Amphotericin B and miltefosine), and incomplete adherence by patients, all led to lengthier duration of treatment for most individuals; median days of treatment per individual were 55, with a quarter receiving treatment for up to 40 days, and a quarter more than 70 days.

The net result of variation in treatment pathways is variation in treatment expenses: mean treatment expense per individual is Rs 5482 ($134), but a quarter spends no more than Rs 2396 ($58) and a quarter has treatment expenses in excess of Rs 7100 ($173). Treatment expenses also vary with age and sex, though these demographic factors have a much greater bearing on income loss because only 51 percent of the cases are adults, and 57 are males (Table 1), and in the study area children and women less than half the hours worked by adult men. Only 36 percent of VL cases reported losing income, and mean (self-reported) income loss is Rs 2738 ($65).[9] Putting treatment expenses and income loss together suggests that the mean (immediate) economic impact of the disease on an individual is, Rs 8220 ($200). Even though treatment expenses make up, on average, two-thirds of the

[8] Treatment pathways are analyzed in detail in Research for Development India Pvt. Ltd. (2010).

[9] Amongst those who did lose work days, on average, 144 work days were lost due to illness, and the associated mean income lost was Rs 7,632 ($186). This implies that the average income loss per day was Rs 53 ($1.29), which is very comparable with the daily wage rate for casual labor (during this time period).

economic impact of VL, it is the remaining one-third representing income loss that drives large differences in economic impact.

The household level impact of the disease is the sum of individual-level impacts, and any other income lost by those who care for household members affected by *VL*. The 209 individuals who had *VL* belong to 178 households, with 87 percent of households having one *VL* case during the baseline survey reference period, and 13 percent more than one. We estimate mean economic impact of *VL* on a household to be Rs 10,158 ($248); 63 percent of this is due to treatment expenses and 37 percent a result of income loss. Households with more than one VL case naturally have higher treatment expenses and income loss, but they are also reflect higher intra-household transmissibility which is evident in the greater incidence of new VL cases in the post-baseline survey period.

VL households are poor by most any measure**.** Three-quarters live in thatched dwellings with mud floors, have no toilet facilities, and draw drinking water from a tube well (Table 1). They own few consumer durable assets of any value. In terms of a consumption-based measure of well-being,[10] mean per-capita expenditure for a VL household over a six-month period is Rs 5134 ($122) which amounts to only about Rs 28 per person per day, and is well below the dollar-a-day indicator used to gauge absolute poverty around the world. An alternative measure, per-adult equivalent expenditure, better accounts for differences in age composition and economies of scale, and the mean value of this measure, at Rs 10,203 ($243) is almost twice the per-capita estimate but still very low.[11] Livelihood is closely tied to agriculture with 58 percent reporting "own-farm activities" as a source of income, and 47 percent owning agricultural land (Table 3). Land holdings are small, on average only 1.22 acres, and mean value of land owned is Rs 78,910 ($1879). Fifty-three percent of households also own some livestock, which is a more liquid asset, but mean livestock holdings are only Rs 3,573 ($89) which is less than five percent of land value. Wage income, primarily from seasonal agriculture, is another important source of income and 73 percent of VL households reported casual labor as a source of income. Remittances (35 percent) and foraging (20 percent) are other important sources of income.

The disease amounts to a substantial economic shock for these households. One way to contextualize the magnitude of the impact is to compare it with mean monthly household expenditure of a *VL* household of seven individuals (Rs 5,295: $129), and mean monthly food expenditures (Rs 3,019:

[10] In the baseline survey the expenditure measure is based on detailed data on food (25 items) and non-food expenditures (clothing, fuel, housing, education, health, etc) over a 12-month reference period.
[11] We use Bihar-specific scaling factors (for age composition and economies of scale) from Meenakshi and Ray (2002).

$74). The mean economic impact of *VL* on a household is equivalent to about two months total expenditure and three months expenditure on food.[12] There is, of course, variation in the magnitude of the economic shock because treatment expenses are not uniformly high for all households,[13] and not all households lose income (Figure 1), but there is little doubt that on average the disease imposes a substantial economic burden on poor households.

B. Financing treatment expenses

Infection occurs via the bite of a sand fly and VL can be dormant for extended stretches,[14] but at some stage there are some obvious symptoms, particularly sustained high fever, which lead individuals to seek treatment. Treatment necessitates out-of-pocket expenditure because, in the study area, there is no health insurance and less than 15 percent of treatments take place at public providers, which are cheaper than private providers, but not entirely costless.[15]

Financing of treatment expenses represents the first step in coping with the economic impact of a disease. The surveys asked direct questions on how treatment expenses were financed; individuals could provide up to two responses. We analyze this information at the household level by aggregating responses of all VL cases in a household. Most households (88 percent) used unsecured loans, though 12 percent also mortgaged land or other assets. The widespread use of credit suggests that access to credit markets is not constrained, even though access terms may be quite different.[16] Other sources are also salient: 35 percent used savings, 13 percent sold assets, and five percent used remittances and other sources (Table 2). Fifty-one percent of households reported using more than one of these sources, typically unsecured loans and savings.

The choice of a financing source is likely to be influenced by ownership and prices of household assets, interest rates, household preferences, and the amount that needs to be financed (treatment expenses). We next examine variation in the use of these sources with a set of instrumental variables

[12] Variation in treatment expenditures and even greater variation in income loss also imply substantial heterogeneity in the immediate impact of the disease (Figure 1).

[13] Those who have timely diagnosis, and those who receive treatment at public facilities have treatment expenses less than half those who are treated by private doctors.

[14] Extended dormancy of the disease is the reason why we do not use the term “infected”

[15] Diagnosis and treatment (type, sequence, sources, and expenditures) is analyzed in some detail in Research for Development India Pvt. Ltd (2010).

[16] These responses on financing of treatment expenses have content validity. A separate (credit) section of the questionnaire collected information on the purpose for all loans taken by a household, and these data show that 87 percent of loans taken after the first occurrence of high fever in a household were for treatment.

(two-stage least squares) regression models with binary (0/1) dependent variables for each source,[17] and explanatory variables that capture household preferences (demographic factors), resources (land ownership and receipt of remittances), and financing requirements (VL treatment expenses). Since VL treatment expense is endogenous we instrument it by regressing it on a set of household characteristics and three identifying variables: number of VL cases in the household, months from the first incidence of sustained high fever in the household and its squared term. We do not report these results here other than to note that all three identifying variables are relevant (they influence treatment expenses but not the choice of a financing source) and statistically significant.

Table 2 shows that there is little differentiation between households in the use of unsecured loans, and other sources, but the results of regressions for use of savings, asset sales, and collateralized loans suggest differences related to access to cash income, asset limitations on borrowing terms, and recourse to asset sales amongst those with a high expense burden. The positive and significant coefficient for household receipt of remittances in the regression explaining use of savings indicates that households with cash income (from remittances) are more likely to report using savings. Similarly, the significant negative coefficient for landless households in the regression for financing via mortgaged land and assets is also consistent with the inability of these households to secure collateralized loans. The economic burden imposed by treatment expenses plays no role in the use of credit, or savings, but it has a large effect on financing via asset sales; those with higher treatment expenses are more likely to sell assets. These findings point to interesting differences in the strategies households follow in order to meet the immediate cash requirements of medical treatment, but what stands out more is the extensive reliance on credit by almost all households. How households cope with increased indebtedness is, therefore, the real issue to consider.

C. Household coping strategies

Coping with the increased indebtedness, savings reduction, and asset depletion induced by a disease requires fundamental adjustments in household expenditures and income, which can be accomplished in multiple ways. Households can reduce and reallocate expenditures, increase labour earnings, and reorient household production activities to increase income. These can be accomplished by withdrawing working-age children from school, migration of adults for work, temporary residential relocation of household members, increase in labour force participation of previously unemployed household

[17] Table 2 reports the results of linear probability models. The results are almost identical to those obtained with instrumental variable probit models (results available on request).

members, and increase in hours of work, particularly in wage employment. Identifying a causal relationship between disease and any of these coping strategies, in a non-experimental setting, is difficult because they can be a normal part of a household's management of resources over the life cycle and influenced by many other factors.

We base initial identification on the basis of comparisons of various variables relevant to coping strategies between surveys and between VL households and the comparison group. If VL households are similar to the comparison group then changes in these variables between the surveys in the two groups might be related to disease incidence. In effect we use the logic of the potential outcomes framework which underpins much of the modern treatment evaluation literature, and a difference-in-difference estimator to identify the use of various coping strategies. In our application of the Rubin causal model, VL incidence is the treatment [sic] of interest. Instead of assuming unconfoundedness between disease and potential outcomes, we assume that the unobserved factors associated with disease incidence are time-invariant, and thus differenced out when we take differences between surveys. To the extent they are time-varying, our results will be biased.

One other complication is that our baseline survey is not a pre-treatment measurement, but reflects conditions either contemporaneous with disease experience or soon after all VL treatments have been completed. It thus already incorporates some of the initial impact of the disease, though this will differ depending on the timing of incidence during the baseline survey. Our comparison of measurements between the baseline survey and the two follow-up surveys thus reflects changes in, not actual use, of coping strategies. If we do not observe any difference between surveys it could be either because the coping strategy was not used, or because once used (in the baseline survey) the relevant variable did not revert to its pre-disease level, i.e. it reflects a more permanent change. Conversely if we do observe significant change its inference will depend on the direction of change: a decline might reflect conditions reverting to pre-disease levels, i.e. a transitory impact, and an increase might reflect adoption of additional mechanisms or increase in intensity of use. We therefore have to compare differences in the VL group with those in the comparison group, hence the difference-in-difference estimator, but also be careful in interpreting the baseline difference between the two groups.

We begin by examining differences between disease-affected (VL) households and the comparison group to determine whether the two groups are comparable in terms of pre-disease

characteristics.[18] Table 3 presents means, standard deviations, and normalized differences (between the two groups) for variables that most closely reflect pre-disease conditions.[19] Following Imbens and Wooldridge's rule of thumb we focus particular attention on normalized differences greater than one-fourth, but also comment on differences greater than one-tenth(Imbens and Wooldridge 2009). While the two groups of households are similar in many respects, there are large differences along some dimensions indicating that the groups are not well-balanced in terms of at least some observable covariates. VL households have, on average, one more young (15 years and younger) household member than comparison households, and this translates to a difference in household size; the normalized difference for the former is 0.38, and for the latter 0.265.[20] The two groups are also different in the extent of their credit market engagement. Only 16 percent of VL households borrowed for consumption purposes prior to the illness,[21] while 60 percent of comparison households did the same; the normalized difference is 69 percent. Differences in borrowing for production and treatment purposes are smaller but still above, the more conservative, threshold of 0.10, and thus indicative of a generally lower level of credit market engagement amongst VL households. It is worth noting that data for the later surveys do not indicate such a sharp difference in borrowing patterns. VL households are also less likely to own land, have less acreage of cultivable land, and be more likely to have wage income.[22] These patterns are consistent with the observed caste differences between the two groups: VL households are more likely to be from scheduled castes and other backward castes, which are social groups at the bottom of the socioeconomic ladder in India. While the normalized differences in these variables, along with the difference in household head's marital status, are all lower than 0.25, together

[18] Since the comparison group of households was selected (quasi) randomly from the same villages as the VL households, and all data were collected with the same survey instrument geographical and measurement comparability is ensured (Heckman, Ichimura, Todd 1997).

[19] Normalized difference $\Delta_x$is the difference in sample means of the two groups divided by the square root of the sum of the two sample variances$\Delta_x = \frac{\bar{X}_1 - \bar{X}_0}{\sqrt{S_1^2 + S_0^2}}$

[20] We examined differences in various age composition variables and selected this age cutoff because employment data indicate that, in all three surveys, labor force participation rates of those above 15 are distinctly different from those 15 and younger.

[21] Pre and post-illness borrowing was determined by comparing the loan uptake date with the date for the first episode of sustained high fever (typically the first obvious symptom of VL). This necessarily introduces an observational (duration) bias into the comparison of the two groups because with varied timing of onset of disease during the 12-month reference period, the observation period for pre-illness loans is necessarily shorter for VL households; for nonVL households it is the entire 12 months. We try to minimize the bias by using only dummy variables for the loan purpose instead of other available information (on number, amount, and source of all loans) but it is quite possible that the measures are still influenced by recall bias.

[22] These variables, in particular acreage, could be affected by the causal factor (illness) but data from the three surveys suggest that there were no land sales during the study period, and income earning sources were also relatively stable.

they point to a somewhat lower physical resource base in VL households; an index based on a principal components analysis of these resource variables has a normalized difference of 0.14. On the whole then while there are some clearly identifiable differences between these two groups of households, these might not be large enough to imply radically different time trends in income and consumption. We can, therefore, proceed with a difference-in-difference estimation strategy under the assumption that differencing will eliminate time-invariant sources of heterogeneity.

We begin with descriptive statistics on household expenditures, well-being measures, and variables representing potential coping strategies for each of the surveys in the two groups of households. These provide an overview of various aspects of the economic functioning of households over a 16-month period, and facilitate interpretation of the regression results that follow.

Table 4 suggests that households affected by VL are unable to insure consumption and, depending, on the consumption measure used, experience a decline in significant decline in well-being, while those not affected by the disease experience an increase in well-being over the same observation period. In a separate paper we have examined this issue in some detail (Desai and Sarnoff 2012), and so we do not discuss these results in detail other than to note the main patterns. Well-being, as measured by real per-capita, per-adult equivalent expenditures, and per-adult equivalent food expenditures consistently declines in VL households, but in the comparison group (nonVL households) it increases between the baseline survey and the first follow-up survey, and then shows a small decline in the second follow-up survey. Depending on the well-being measure used, the net change between the baseline survey and the second follow-up survey is a 13 to 15 percent decline in VL households and a four to 12 percent increase in the comparison group. The only difference with the other well-being measure, real per-adult equivalent non-health expenditures, is that it in VL households it exhibits a small increase (2 percent) between baseline and first follow-up, but then, consistent with the other measures declines in the second follow-up survey.

The small decline in well-being in nonVL households between the two follow-up surveys is a bit of a side story to the economic dimensions of VL, but it provides an interesting check on the interpretation of the data. Examination of the details of household expenditures in the two groups over the three survey periods shows that the drop in well-being in nonVL households in the second follow-up survey is due to a large (5 percent) increase in health expenditures. This was not due to an increase in the incidence of VL in these households, but an unusual, three-fold increase in outpatient expenditures which derives from a 10 percent increase in the percentage of households with non-zero expenditures in

the month prior to the survey interview.[23] While this is less than half the 12 percent increase due to VL in the baseline survey it is associated with the same readjustment in household expenditures: expenditures on food, education, and (other) non-food items declined, in the baseline survey for VL households and in the second follow-up survey for nonVL households. These changes are not just in terms of expenditure shares but also in actual expenditures (data not shown). Indeed, as we shall see other coping mechanisms also show similarities between VL households in the baseline survey period, and nonVL households in the second follow up survey period, thus suggesting that the observed pattern is not a data artifact but indicative of how households cope with a health shock.

The observed changes in household expenditures, in absolute terms and in terms of expenditure shares, in two time periods, and in different sets of households, highlight an important aspect of coping - readjustment of household expenditures - that has received relatively less attention in the literature on health shocks and consumption smoothing. That households would make some adjustments in their expenditures seems obvious, but it has been largely ignored, perhaps because the standard approach to measuring well-being and poverty excludes health expenditures (Deaton and Zaidi 2002). The rationale is that expenditures on healthcare are not directly welfare enhancing, and are largely financed out of savings. Our results suggest that while households do finance treatment expenses by using savings, borrowing, and asset sales, they also make adjustments to expenditures on other items, and so some part of the increase in healthcare expenditure is financed by a substitution away from welfare-contributing items. To the extent that these expenditures contribute to restoring health, which is a normal good, it is not clear why they should be excluded on welfare grounds.[24]

Households can also adjust their composition to cope with a health shock, with temporary in or out-migration for increasing income, and temporary or permanent relocation of dependent members to reduce expenditures. The surveys show that a substantial proportion of households, as much as two-thirds, change composition between surveys. Differences between VL and nonVL households are

[23] As with several similar household surveys data on expenditures on different items were obtained with different recall periods, and then standardized to a common reference period. In the case of health, outpatient and medication expenses were obtained for the month prior to the interview, and the less-frequent inpatient expenditures obtained for the previous 12 months (baseline survey) or the previous six months (the two follow-up surveys).

[24] These results also highlight the need to view cross-sectional data on expenditure shares with some caution. The expected inverse relationship between food share and income (Engel's law), one of the more consistent empirical regularities in economics, might be violated when households face a health shock, and have to readjust their expenditures to accommodate the unexpected increase in health expenditures. In these cases it is not reasonable to interpret a lower food share as indicative of higher well-being. In our case we observe a lower food share for VL households in the baseline survey and for nonVL households in the second follow up survey. In both cases these are reflective of lower, not higher, well-being, and this is evident only by looking at the panel dimension.

relatively small, and even though there is some indication that VL households coped with the disease by having adults leave the household for work, a similar change is observed for nonVL households and so it is not reasonable to assert a causal relationship between VL and these changes. Indeed not only do the regressions show no statistically significant differences for numbers leaving the household, they show statistically significant coefficients for numbers joining the household for nonVL households.

There is some indication that households suffering a health shock withdraw older children from school, which is consistent with literature which indicates risk management strategies that compromise human capital formation (Jacoby and Skoufias 1997). Table 4 shows that in VL households nine percent of children 11 to 14 years, and 21 percent of children 15 to 18 years who were in school at the start of the baseline survey's reference period had dropped out prior to the survey. These dropout percentages are higher than those in follow up surveys and in nonVL households. One exception is the second follow up survey which shows a similar pattern, but for nonVL households, the same ones with a five percent increase in health expenditures. These are all based on very small samples but they are consistent with differences in hours worked by children of these years which show higher hours of work by children of these ages in the baseline survey for VL households, and in the second follow up survey for nonVL households.

On the income-generation side Table 5 shows that there are changes in the percentages of households receiving income from agricultural production and wages, but these are relatively small and some are also observed for nonVL households so it unlikely that they are related to VL incidence. There is a large increase in the proportion of households receiving some income from collection/foraging of food and wood (for cooking fuel) from the forest, but this is likely to contribute relatively little to household income and is also observed for nonVL households. There is also an increase in the proportion receiving remittances, and even though this too is observed for nonVL households it is noteworthy because it is linked to the demographic coping strategies noted earlier. In VL households, in comparison with the baseline survey, twice as many households report this to be the top income source for the household. Temporary migration and the resulting remittances from such migration might thus be one of the coping strategies employed by households.

The primary coping strategy for poor households with relatively few resources is ultimately determined by their labour resources, and we examine household labour supply response to VL in some detail. For starters there is little doubt that the disease results in a substantial loss of labour earnings: on average 45 days of work are lost, which is almost twice the amount lost in other survey periods and in nonVL households. This is, of course, an average and as we noted earlier only 36 percent of individuals

affected by the disease reported losing income, so amongst households that do lose work days, the actual number of days lost is substantially greater. Households cope with the loss of these work days by making adjustments in the labour supply of individuals not affected by the disease, and on average, they are able to this quite well. Table 5 shows that over the 16-month study period there is relatively little change in the total hours worked by a VL household which, given the lost work days due to VL in the baseline survey period,[25] has to have been accomplished by an increase in the work effort of individuals not affected by the disease. Much of this increase in work effort in the baseline survey period probably comes from an increase in hours worked by females and those between the ages of 11 and 18 years because there is little change in the work effort of males and 19 to 64 year olds between the three surveys. Since we do not have pre-disease data our inference is necessarily indirect, and based on comparing labour supply over the three surveys and with the comparison group of households. Table 5 shows that the (increased) work effort by females and 11 to 18 year olds continues to increase in the first follow-up survey, which is also consistent with the need to pay off debts incurred for treatment expenses (Table 2). A perverse aspect of this pattern is that the increase in female labour appears to be a sustained increase with only a 2 percent drop in the second follow up survey, but that of younger workers drops is of a more temporary nature because it declines by 12 percent. NonVL households also experience a similar pattern of changes in labour supply, but the magnitude of change is smaller suggesting that changes observed in VL households might indeed be due to the disease.

Next we estimate a set of reduced form household fixed effects models to obtain difference-in-difference estimates of the relevance of various coping strategies. These are of the following form.

$$Y_{it} = \alpha_i + \beta D_t + \delta D_t * VL_i + \gamma X_{it} + \varepsilon_{it}$$

In each of these models the dependent variable (Y_{it}) consists of different measures of household coping strategies, D_t are dummy variables for survey periods, VL_i is a dummy variable for (VL) disease-affected households, $\delta D_t * VL_i$ are interaction terms, X_{it} are a set of time-varying control variables which include demographic variables (number of children 0-5 years, and number of children 6-10 years), a dummy variable for landless households, and a variable for the acres of agricultural land

[25] This can also be seen in the large (21 percent) increase in hours of work of VL cases between the baseline survey and the first follow up survey. A further five percent increase occurs between the first and second follow up surveys, and this is consistent with the fact that 20 percent of the baseline survey's VL cases had treatment and therefore continued to experience the disease's effects in the first follow up survey's reference period.

owned by a household, and ε_{it} is the error term. The δ coefficients capture the difference-in-difference effects, one for each of the two follow-up periods.

The household fixed-effects specification sweeps out household-specific time-invariant characteristics, including VL status at baseline (all included in the household-specific intercept term α_i), and so we cannot recover baseline differences between VL and nonVL households. Since the baseline survey is also a post-disease, and in some cases contemporaneous, measurement and thus represents a shorter term coping response to the disease we are also interested in VL-nonVL differences during the baseline reference period; these represent the shorter term response. We, therefore, estimate separate cross-sectional regressions for the baseline survey period for each of the Y_i, including as regressors the dummy variable for VL households, and the same control variables. Together these two sets of models capture household coping strategies over the entire duration of the study. All models are estimated in linear form, the exception being the disaggregated labour supply models which, due to extensive corner solutions (0 work hours) are estimated with random effects Tobit.

Tables 6 and 7 present the results of these regressions. Standard errors of coefficients are presented in parentheses, and the asterisks reflect significance levels with * for p-value<0.05, ** for p-value<0.01, and *** for p-value<0.001. In the case of the household fixed effects models we show only the coefficients for the survey period dummies, the difference in difference estimates (interaction terms), and the coefficient for the dummy variable for landless households.[26] At baseline, which measures coping strategies soon after, or contemporaneous with, disease experience there are no significant differences between VL and non-VL households in terms of household income sources, the ranking of these sources, or household labour supply. VL households do appear to readjust household expenditures to accommodate treatment expenses in such a way that share of food declines, but this difference is only significant at 10 percent. VL households are also more likely to have (past) household members leaving the household for reasons other than death (during the 12-month reference period of the baseline survey),[27] but this is not for work, and this being a cross-sectional regression this might reflect unobserved differences in other factors unrelated to disease experience. VL households are also more likely to withdraw from school children 11 to 18 years who were attending at the start of the reference period, but this result should be viewed cautiously because it is based on a small sample (89

[26] In most models the other three control variables are not significant.

[27] The survey questionnaires included questions on individuals who were (past) household members but no longer part of the household at the time of the interview. This variable is based on reasons given for the departure of these household members.

households). Moreover, the Tobit regression for hours of work of 11 to 18 year olds does not exhibit a significant difference between VL and nonVL households during the baseline survey.

On the whole these results suggest that there is little difference in the coping strategies used by households soon after disease experience, but this conclusion is tempered by the fact that these regressions only control for a limited set of observed factors, and do not control for unobserved heterogeneity; we address the later in the panel models. We do control for land ownership and the results of these baseline regressions show that landlessness has a very clear relationship with household income sources, livestock ownership, and household labour supply. Landless households are less likely to derive income from farm production and less likely to own livestock, more likely to rank wage income, and remittances as their top income source, and work fewer hours than those with land. They are also more likely to withdraw 11 to 18 year olds from school. We do not pursue this any further, other than to note that interacting the landlessness dummy variable with that for VL households shows that it is the landless VL households that make the adjustments in expenditures that leads to a lower food share; those with land do not have a significantly lower food share.[28]

The panel regression models provide a longer period for observing household coping strategies and also a mechanism for controlling for unobserved time-invariant heterogeneity. The first regression for food share shows that the patterns discussed earlier (Table 4) are statistically significant and households do cope with a health shock by temporarily readjusting expenditures. The decline in food share in VL households during the baseline survey period is rectified over time as expenditure shares revert to a household mean, and in the first follow up survey are not statistically different from those of nonVL households. The decline in food shares of nonVL households in the second follow up survey, on account of a large increase in healthcare expenses, is also significant. In the case of VL households the recovery of the food share in the two follow-up surveys occurs in the context of declining consumption, and a similar pattern can be expected for nonVL households after the second follow up survey.

The regressions show that coping strategies based on increasing income are largely reliant on wage labour, especially in the period immediately following the disease. VL households are more likely to generate income from wage labour, and Table 7 shows that this comes about primarily from the employment of females and younger (11 to 18 year old) workers whose work effort in the two follow up surveys is more than double that during the baseline survey period. The work effort of females and younger workers also increases amongst nonVL households, but a significantly smaller magnitude. The

[28] The coefficient for the interaction term (landless x VL household) is significant at 5 percent, while that for VL households is no longer significant (results not shown in Table 6 but available on request).

one exception to this, again, is the second follow-up period when females in nonVL households work significantly longer hours than in the baseline survey period. Given that both groups of households are resource constrained, and there is a need to pay back the unsecured loans used to finance treatment expenses, a labour supply response is one of the few options available, and households employ it when needed. These results provide clear evidence of this response, but the fact that households are still unable to smooth consumption shows that the earnings generated by this coping strategy are insufficient.

The regression for school dropout continues to suggest the possibility that a health shock, VL or more general, is associated with an increase in school dropout. The baseline regression showed shows that VL households had drop out during the baseline survey's reference period when they experienced the disease; the panel regressions show that nonVL households have a similar response during the second follow-up survey when their healthcare expenditures go up unexpectedly. Small sample size remains a concern, but the pattern of higher school dropout and an increase in work hours amongst 11 to 18 year olds, together, indicates that this household coping strategy has the potential for lowering human capital formation in the next generation.

Finally, household sale of livestock is another coping strategy highlighted by Table 6. VL households are more likely to sell livestock in the first follow-up period, presumably to help service the unsecured loan taken for treatment expenses in the baseline survey period, and nonVL households do the same in the second follow-up survey. These results are consistent with other findings in the literature which show that households accumulate durable assets as a means to smooth consumption (Rosenzweig and Wolpin 1993; Islam and Maitra forthcoming).

VI. Conclusion and policy implications

This paper uses panel data to examine the coping strategies used by households affected by an infectious disease in one district of Bihar, India. We use household responses to treatment financing mechanisms to understand how households deal with the unexpected increase in healthcare expenses and find that while several use savings, and asset sales, almost all rely on the credit market, in particular on unsecured loans. Next we use panel data on households affected by the disease and those not affected by the disease to examine the coping strategies used by households over a 16-month period. We find that households rely on the labour market and livestock sales for meeting the increase in debt servicing induced by a health shock. An increase in hours worked by females and younger workers (11

to 18 years) is able to offset the loss in hours worked by those who are affected by the disease. As a result the total work effort of disease-affected households is no different from households not affected by the disease. However, this increase in hours worked by females and younger workers, who most likely earn lower wages, is associated with lower earnings because households are not able to smooth consumption, and experience a 13 to 15 percent decline in well-being over a 16-month period. Another consequence of the increased labor market participation of younger workers is an increase in school dropout of 11 to 18 year olds, which is bound to constrain future income.

These findings have important implications for health and welfare policy in India. One reason for the high economic burden imposed by visceral leishmaniasis is late diagnosis, and ineffective treatment of the disease. This results in unnecessary variation in treatment pathways which undoubtedly increases the expense burden for households. Since the study period new initiatives have been launched to combat this disease, so this can be expected to reduce the size of the economic shock imposed by the disease. Household reliance on labour markets for coping with a health shock highlights the importance of employment programs as social safety nets. In India there is much debate on the value and effectiveness of large public works programs like the Mahatma Gandhi National Rural Employment Guarantee scheme. Our results show that while households are able to generate sufficient employment to compensate for the loss of work hours of those affected by the disease, they clearly are unable to generate earnings to weather the economic impact of the disease.

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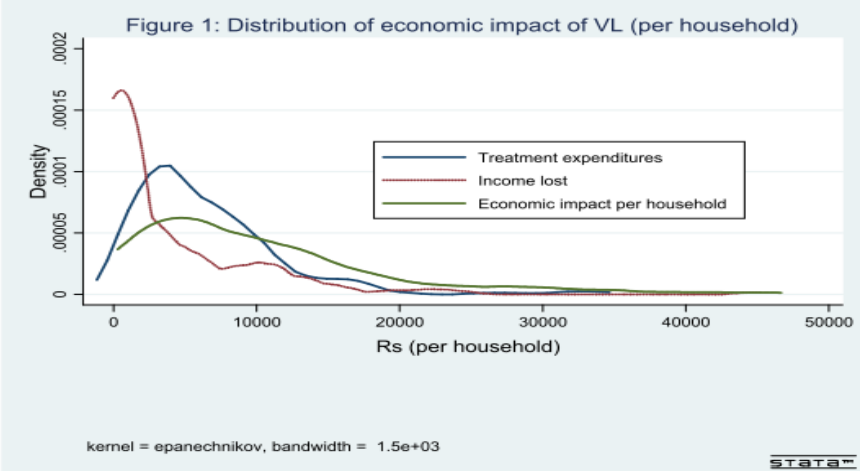
Figure 1: Distribution of economic impact of VL (per household)
Density
.0002
.00015
.0001
.00005
0
Treatment expenditures
Income lost
Economic impact per household
0
10000
20000
30000
40000
50000
Rs (per household)
kernel = epanechnikov, bandwidth = 1.5e+03
Stata

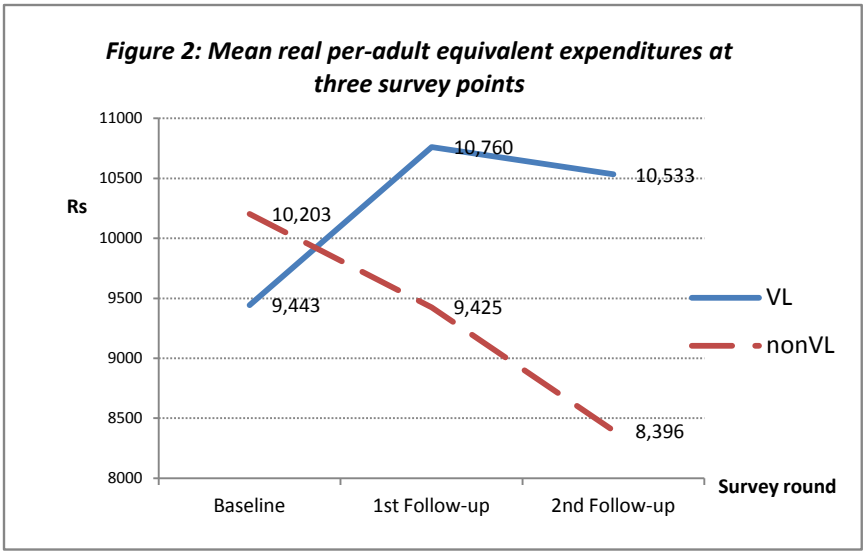
Figure 2: Mean real per-adult equivalent expenditures at three survey points
Rs
11000
10500
10000
9500
9000
8500
8000
10,760
10,533
10,203
9,443
9,425
8,396
VL
nonVL
Baseline
1st Follow-up
2nd Follow-up
Survey round

Appendix

Districts of Bihar state in India (with study site circled)

Table 1: Characteristics of individuals who had visceral leishmaniasis during baseline survey reference period, and their households

	Mean	*S.D.*
Individuals who had visceral leishmaniasis during baseline survey period		
Mean age in years	23.9	17.7
Proportion adult (>18 years)	0.51	0.5
Proportion male	0.57	0.49
Proportion head of household	0.25	0.43
No of individuals	209	
Household characeristics		
Household size	6.81	2.65
No. of household members 15 years old and younger	3.24	1.93
No. of household members older than 15 years	2.46	1.39
Proportion scheduled castes or other backward castes (OBCs)	0.89	0.31
Proportion of households with at least 1 person older than 15 years with some schooling	0.38	0.49
Proportion who own watches	0.33	0.47
Proportion who own radio, cassete player	0.08	0.28
Proportion who own bicycle	0.60	0.49
Proportion who live in a solid or semi-solid dwelling	0.75	0.43
Proportion whose main source of drinking water is a Tubewell	0.96	0.19
Household's sources of income (proportion who income from…..)		
Own farm activities	0.58	0.49
Casual labour (farm and non-farm)	0.73	0.45
Collection/foraging (of food, wood)	0.20	0.40
Remittances	0.35	0.48
Proportion of households who own land	0.47	0.50
Proportion of households who cultivated land	0.61	0.49
Proportion of households who own livestock	0.53	0.50
Mean acres owned per household (n=83)	1.22	2.11
Mean acres cultivated (n=108)	1.40	1.55
Mean value of land owned by a household (Rs)	78,910	157,684
Mean value of livestock owned by a household (Rs)	3,573	4,995
Per-capita expenditures (6 months)	5,134	3716.41
Per-adult equivalent expenditures (6 months)	10,203	6083.66
Share of food in total household expenditures	0.58	0.15
Share of cereals in total food expenditures	0.51	0.14
No. of households	178	

Table 2: Sources of financing for kala azar treatment expenses (Proportion of households who cited each source, n=178) and Instrumental variable regression results

	Savings	*Sale of various assets*	*Unsecured loan*	*Mortgaged assets or land*	*Other sources*
Descriptive statistics (Source cited 0/1)					
Mean	0.3539	0.1292	0.8820	0.1236	0.0618
SD	0.4795	0.3364	0.3235	0.3300	0.2415
Instrumental variable regression results (Dependent variable: Household cited source (0/1)					
Treatment expenses ('000 Rs)	0.0061	0.0417**	0.009	-0.0185	0.0085
	[0.0174]	[0.0127]	[0.0121]	[0.0123]	[0.0093]
Dummy: Landless household	-0.0697	-0.0192	0.0821	-0.2372***	0.015
	[0.0778]	[0.0568]	[0.0541]	[0.0550]	[0.0414]
Land owned in acres	0.0023	0.0011	-0.0118	0.014	-0.0102
	[0.0260]	[0.0190]	[0.0181]	[0.0184]	[0.0138]
Dummy: Received remittances	0.2826***	-0.0532	0.0404	-0.009	-0.0166
	[0.0758]	[0.0554]	[0.0527]	[0.0536]	[0.0403]
No. of adult males (19-64) in the household	-0.0334	0.0529	0.0488	0.0108	-0.0123
	[0.0521]	[0.0381]	[0.0362]	[0.0368]	[0.0277]
No. of adult females (19-64) in the household	0.0369	-0.0412	-0.0161	-0.0645	-0.0194
	[0.0572]	[0.0418]	[0.0398]	[0.0404]	[0.0304]
No. of children (0-10) in the household	0.0219	0.0067	0.004	0.0172	0.0036
	[0.0196]	[0.0143]	[0.0136]	[0.0138]	[0.0104]
Dummy: female-headed household	-0.1778	0.062	0.094	0.0142	0.0135
	[0.1122]	[0.0819]	[0.0780]	[0.0793]	[0.0597]
Intercept	0.2032	-0.1446	0.7120***	0.3907***	0.0401
	[0.1467]	[0.1072]	[0.1020]	[0.1037]	[0.0781]

Notes: Standard errors of coefficients in parentheses. First-stage regressions for treatment expenses include number of VL cases in the household, months since first high fever in the household and its squared term as identifying variables; all are significant at 1%

Table 3: Means, standard deviations and normalized differences of potentially pre-disease household characteristics in VL and nonVL households

	VL households		*NonVL households*		*Normalized Difference*
	Mean	*SD*	*Mean*	*SD*	
No. of household members 15 and younger	**3.2360**	**1.9282**	**2.2472**	**1.7404**	**0.3807**
No. of household members over 15	2.4551	1.3903	2.5393	1.4227	-0.0424
some schooling	0.6292	1.0127	0.7753	1.1751	-0.0942
No. of non-nuclear household members	1.3146	2.0890	1.0787	1.5756	0.0902
No. of household members (total)	**5.6910**	**2.4333**	**4.7865**	**2.3907**	**0.2652**
Dummy: Muslim	0.1517	0.3597	0.1798	0.3862	-0.0532
Dummy: Caste general	0.1067	0.3097	0.1461	0.3552	-0.0835
Dummy: Scheduled caste	0.4775	0.5009	0.3596	0.4826	0.1696
Dummy: Other backward caste (OBC)	0.4157	0.4942	0.4944	0.5028	-0.1116
Dummy: Head female	0.0955	0.2947	0.1124	0.3176	-0.0389
Age of household head (years)	43.7416	11.7353	43.5506	14.0430	0.0104
Dummy: Head currently married	0.8820	0.3235	0.9438	0.2316	-0.1553
Dummy: House of durable materials	0.7528	0.4326	0.6966	0.4623	0.0887
Dummy: House floor material - mud	0.9607	0.1949	0.8876	0.3176	0.1960
Dummy: Drinking water source - tubewell	0.9607	0.1949	0.9438	0.2316	0.0557
Dummy: Toilet - no latrine	0.9663	0.1810	0.9438	0.2316	0.0765
Dummy: Household gets income from own farm activities	0.5843	0.4942	0.6292	0.4858	-0.0649
Dummy: Household gets wage income	0.7303	0.4450	0.6404	0.4826	0.1369
Dummy: Household owns land	0.4663	0.5003	0.5506	0.5003	-0.1191
Acres of agricultural land owned	0.5671	1.5618	0.8655	1.6071	-0.1331
Dummy: Household raises livestock	0.8034	0.3986	0.7865	0.4121	0.0294
Dummy: Pre-illness loan for production	0.0449	0.2078	0.1124	0.3176	-0.1776
Dummy: Pre-illness loan for consumption	**0.1685**	**0.3754**	**0.5955**	**0.4936**	**-0.6885**
Dummy: Pre-illness loan for treatment	0.2360	0.4258	0.3146	0.4670	-0.1245
Resource index (principal components based)	-0.068	0.913	0.135	0.889	0.1590
Number of households	178		89		

Table 4: Household expenditures, well-being, demographic coping, and school drop outs at three survey points

	VL households (n=178)			*Non-VL households (n=89)*		
	Baseline	*1st Follow-Up*	*2nd Follow-Up*	*Baseline*	*1st Follow-Up*	*2nd Follow-Up*
Expenditure-based well-being measures (6 months)						
Per-capita expenditures	5,007	4,655	4,234	5,104	5,842	5,682
Per-adult equivalent expenditures	9,929	9,396	8,425	9,443	10,760	10,533
Per-adult equivalent non-health expenditures	7,617	7,766	7,178	7,600	8,918	8,237
Per-adult equivalent food expenditures	5,848	5,634	5,096	5,411	6,535	5,641
Mean expenditure shares (%)						
Food	59.6	64.5	62.7	63.0	63.5	56.9
Non-food	12.6	15.1	14.2	15.5	14.4	13.9
Education	1.7	2.2	2.7	1.7	1.8	1.8
Housing (rent)	3.9	4.9	7.1	5.3	6.1	8.4
Health (excluding VL expenses)	10.8	11.7	12.7	14.4	14.1	18.8
VL - test, treatment	11.5	1.6	0.7	0.0	0.0	0.1
Total	100.0	100.0	100.0	100.0	100.0	100.0
Total household expenditures - 6 months (Rs)	30,772	30,150	26,410	27,192	30,586	29,600
Demographic coping						
Percent with members who left						
Any reason	23.6	44.4	33.1	7.9	32.6	33.7
Reasons other than death	6.7	24.2	12.4	2.2	18.0	15.7
Death	13.5	6.7	5.6	3.4	4.5	3.4
For work	0.6	15.2	6.7	0.0	11.2	6.7
Percent with members who joined the household		35.4	53.4		57.3	68.5
Percent headed by a female	15.2	23.0	23.6	16.9	18.0	21.3
School drop out during survey reference period (Percent who dropped out)						
11-14 years	9.1	4.3	0.0	0.0	3.4	5.6
No. in school before survey reference period	55	69	75	27	29	36
15-18 years	20.7	11.1	3.4	6.7	0.0	25.0
No. in school before survey reference period	29	27	29	15	18	16

Table 5: Household income sources, and labour supply at three survey points

	VL households (n=178)			*Non-VL households (n=79)*		
	Baseline	*1st Follow-Up*	*2nd Follow-Up*	*Baseline*	*1st Follow-Up*	*2nd Follow-Up*
Household's sources of income (% of all households)						
Own farm activities	58.4	64.6	55.6	62.9	68.5	64.0
Casual labour (farm and non-farm)	73.0	79.8	74.7	64.0	57.3	59.6
Collection/foraging (of food, wood)	19.7	52.2	61.2	12.4	37.1	58.4
Remittances	35.4	42.1	44.9	33.7	41.6	42.7
No. of household income sources (mean)	2.1	2.7	2.6	1.9	2.3	2.5
Top-ranked income source of household						
Own farm production	35.4	24.7	21.9	36.0	38.2	31.5
Agricultural wage labour	43.8	42.7	46.1	36.0	33.7	38.2
Remittances	10.1	22.5	20.2	18.0	21.4	21.4
Agricultural production						
Percent who own agricultural land	46.6	43.8	41.0	55.1	56.2	53.9
Percent who cultivated land	60.7	62.9	57.3	67.4	68.5	66.3
Percent who own livestock	53.4	41.0	49.4	60.7	57.3	56.2
Percent who sold livestock	8.4	12.4	7.9	12.4	2.2	20.2
Labour supply (household)-6months						
Mean days lost to work	45	25	23	24	22	24
Mean hours worked	1622	1649	1684	1498	1474	1403
Mean hours worked by VL cases	287	346	363	21	0	5
Mean hours worked by nonVL cases	1335	1303	1320	1477	1474	1398
Mean no. of workers	2.2	2.6	2.6	2.0	2.2	2.3
Mean no. of VL cases who worked	0.5	0.5	0.5			
Mean no. of nonVL cases who worked	1.7	2.1	2.1	2.0	2.2	2.3
Mean hours worked by females	473	591	579	314	375	358
Mean hours worked by males	1148	1058	1105	1184	1100	1045
Mean hours worked: 11-18 year olds	170	251	221	119	131	149
Mean hours worked: 19-64 year olds	1353	1320	1365	1250	1231	1155
Mean hours worked: 65 plus years	98	77	98	129	112	98

Table 6: Baseline village-fixed effects regression results, and difference-in-difference estimates from householdfixed effects regressions of household coping variables

	Baseline-Cross-sectional (n=267)			*All surveys-Panel (n=801)*							
Dependent variable	*Dummy: VL household=1* δ_1	*Dummy: Landless=1* γ_1	*F(5, 41) p-value*	*Dummy: 1st Followup Survey* β_1	*Dummy: 2nd Followup survey* β_2	*Interaction: VL=1 x 1st Followup* δ_1	*Interaction: VL=1 x 2nd Followup* δ_2	*Dummy: Landless=1* γ_1	σ_v	σ_ε	*F(8,266) p-value*
Food share	-0.0414	0.0025	0.1818	0.0035	-0.0614**	0.046	0.0950***	-0.0277	0.111	0.139	0.0005
	[0.0235]	[0.0237]		[0.0223]	[0.0223]	[0.0265]	[0.0266]	[0.0206]			
No. of household income sources	0.1482	-0.5112***	0.0026	0.3302**	0.5185***	0.2604	-0.0206	-0.3695**	0.691	0.729	0.0000
	[0.1210]	[0.1324]		[0.1094]	[0.1048]	[0.1343]	[0.1281]	[0.1174]			
Households sources of income (Y=0/1)											
Farm production	-0.0119	-0.5699***	0.0000	0.0475	0.0161	0.0278	-0.0229	-0.4387***	0.314	0.303	0.0000
	[0.0584]	[0.0641]		[0.0402]	[0.0501]	[0.0531]	[0.0603]	[0.0545]			
Wage labour	0.0444	0.0378	0.0000	-0.0686	-0.0505	0.1358*	0.0673	0.0475	0.385	0.308	0.3068
	[0.0651]	[0.0655]		[0.0478]	[0.0497]	[0.0571]	[0.0603]	[0.0438]			
Remittances	0.053	0.0016	0.4454	0.0788	0.0885	-0.0113	0.0088	-0.0016	0.373	0.388	0.4220
	[0.0714]	[0.0676]		[0.0592]	[0.0618]	[0.0723]	[0.0758]	[0.0601]			
Top-ranked income source of household (Y=0/1)											
Own farm production	0.053	-0.3094***	0.0000	0.0194	-0.0452	-0.122	-0.087	-0.0974	0.320	0.353	0.0029
	[0.0675]	[0.0619]		[0.0555]	[0.0507]	[0.0683]	[0.0636]	[0.0568]			
Agricultural wage labour	0.0124	0.2063*	0.0000	-0.0238	0.0165	0.0146	0.0064	0.1538**	0.362	0.388	0.2540
	[0.0846]	[0.0773]		[0.0547]	[0.0576]	[0.0697]	[0.0731]	[0.0559]			
Remittances	-0.0771	0.1002*	0.0082	0.0404	0.0400	0.0819	0.0608	-0.0266	0.286	0.322	0.0140
	[0.0478]	[0.0459]		[0.0504]	[0.0564]	[0.0604]	[0.0658]	[0.0503]			
Percent who own livestock (Y=0/1)	-0.0708	-0.1435*	0.0000	-0.0262	-0.0459	-0.0942	0.0167	-0.0777	0.380	0.351	0.0035
	[0.0641]	[0.0690]		[0.0410]	[0.0542]	[0.0582]	[0.0676]	[0.0614]			
Percent who sold livestock (Y=0/1)	-0.0593	-0.009	0.1312	-0.1037*	0.0757	0.1440**	-0.1291*	-0.0185	0.182	0.290	0.0074
	[0.0467]	[0.0431]		[0.0403]	[0.0537]	[0.0516]	[0.0522]	[0.0380]			

Table 6: Baseline village-fixed effects regression results, and difference-in-difference estimates from householdfixed effects regressions of household coping variables

	Baseline-Cross-sectional (n=267)			*All surveys-Panel (n=801)*							
Dependent variable	*Dummy: VL household=1* δ_1	*Dummy: Landless=1* γ_1	*F(5, 41) p-value*	*Dummy: 1st Followup Survey* β_1	*Dummy: 2nd Followup survey* β_2	*Interaction: VL=1 x 1st Followup* δ_1	*Interaction: VL=1 x 2nd Followup* δ_2	*Dummy: Landless=1* γ_1	σ_v	σ_ε	*F(8,266) p-value*
Household labour supply (6 months)											
Household hours worked	143.4723	-3.1e+02*	0.1860	-59.1177	-1.20E+02	92.9263	202.1488	-5.8533	905.9	867.1	0.4734
	[196.6677]	[144.8388]		[134.3853]	[131.6845]	[169.5497]	[159.3610]	[119.1830]			
No. of workers	0.2114	-0.5091*	0.0079	0.209	0.3211*	0.2153	0.1608	-0.2815	1.039	0.995	0.0000
	[0.2224]	[0.1887]		[0.1370]	[0.1492]	[0.1797]	[0.1811]	[0.1492]			
Demographic coping (Y=0/1)											
Members left for reasons other than death	0.0554*	-0.0022	0.1466	0.1588***	0.1329***	0.0166	-0.0732	-0.0353	0.221	0.316	0.0000
	[0.0221]	[0.0263]		[0.0446]	[0.0393]	[0.0579]	[0.0484]	[0.0426]			
Members left for work	0.01	-0.0079	0.9429	0.1325**	0.0609*	0.0313	0.0179	-0.0025	0.191	0.273	0.0000
	[0.0103]	[0.0081]		[0.0429]	[0.0261]	[0.0535]	[0.0346]	[0.0385]			
*Children dropped out of school**	0.1848*	-0.1840**	0.12	-0.0276	0.1479	-0.0864	-0.2630**	-0.1451*	0.237	0.251	0.1560
	[0.0766]	[0.0631]		[0.0456]	[0.0755]	[0.0750]	[0.0969]	[0.0706]			

* Sample size for the baseline cross-sectional regression is 89, and for the panel regression 295

Table 7: Random effects Tobit regression results for total hours worked by females, males, and 11-18 year olds

	Hours worked by females	*Hours worked by males*	*Hours worked by 11-18 year olds*
	Coeff. (s.e)	*Coeff. (s.e)*	*Coeff. (s.e)*
Intercept	-21.9326	986.7884***	-7.2e+02***
	[95.9137]	[171.6888]	[204.2065]
Dummy: Survey=Baseline & VL household=1	191.2331	-4.91E+01	158.0324
	[101.8507]	[169.7158]	[197.6607]
Dummy: Survey=1st Followup & VL household=0	107.1369	-9.92E+01	192.8506
	[57.2964]	[118.6432]	[192.3481]
Dummy: Survey=1st Followup & VL household=1	434.3890***	-1.70E+02	478.5069**
	[95.8277]	[159.0606]	[156.2811]
Dummy: Survey=2nd Followup & VL household=0	153.5713*	-1.30E+02	376.7192
	[65.2843]	[151.2026]	[198.1930]
Dummy: Survey=2nd Followup & VL household=1	424.5438***	-1.00E+02	429.6026*
	[95.7186]	[160.9559]	[189.5359]
No. of children 0-5 years	42.6479	49.4502	-11.2182
	[34.7245]	[52.9639]	[34.3353]
No. of children 6-10 years	71.7651	43.2265	109.1494*
	[37.9637]	[54.0323]	[47.5062]
Dummy: Landless household	-66.8996	-88.4704	-1.8e+02*
	[63.1182]	[82.5556]	[86.7161]
Land (acres) owned by household	-60.8877*	73.7841*	-60.1673
	[29.2528]	[36.7899]	[35.3164]
N	801	801	801
Wald χ^2 statistic (p-value)	0.000	0.215	0.0022
σ_v	496.0862***	769.2090***	514.1907***
	[36.7834]	[77.5446]	[47.1259]
σ_ε	563.9608***	786.2334***	732.6835***
	[34.4247]	[36.6930]	[61.7039]