The impact of household health shocks on female time allocation and agricultural labor participation in rural Pakistan[1]

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Abstract

There have been few empirical studies, in particular for the developing world and the agricultural sector, on the impact of negative health shocks on household well-being. This research paper main objective is to measure the effect of household health shocks on female time allocation and agricultural labor participation in rural Pakistan. To deal with both the joint determination and the measurement error problem present in this study I use a wide range of covariates found in the 2012 and 2013 Pakistan Rural Household Surveys, individual, year and district fixed effects. This paper improves on previous evidence by understanding the role of changes in female labor supply as an insurance mechanism and shedding light on adverse health shocks' non-monetary consequences. Increases in paid workload for women reduce time spent on household chores directly related to child quality. I show how these changes in time allocation affect the households' overall well-being.

Keywords: Division of Labor, Health shocks, Development, Agricultural Productivity
JEL classification: D13, I15, 013, 015

I. INTRODUCTION

There have been a small number of empirical studies, in particular for the developing world, on the return to investments in health. Furthermore most of these studies have not provided controls for the endogeneity of health variables and have not found significant effects for these variables (Picard and Mills 1992, Pitt and Rosenzweig 1986, Weisbrod and Helminiak 1977, Baldwin and Weisbrod 1974). The few studies that have found evidence of the economic costs of morbidity have analyzed salaried workers (Croppenstedt and Muller 2000, Schultz and Tansel 1997). The agricultural sector, characterized more often than not by a non-wage labor market, has very seldom been analyzed, despite the importance of good health on agricultural productivity. By its nature, agricultural activities are strenuous; hence individuals in poor health will be unable to

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sustain long hours of work or to participate at all in this activity. Moreover, agriculture is still a very important economic activity in most of the word. This is particularly the case for Pakistan where it is still to this day one of the main economic activities accounting for around 21% of GDP and affecting the livelihood of 45% of the country's population, in particular of rural areas where two thirds of population resides[2].

In the agricultural context, a sick worker can often rely on family to help him carry out his job and maintain productivity levels (Audibert and Etard 2003). If the loss of labor due to morbidity is compensated by other family members no effect will be found on agricultural output. Audibert and Etard (2003) studied the productivity of non-wage-earning workers that benefited from a parasite-control program taking into account time allocation changes induced by the improvements of health. Given this flexible framework they were able to find positive impacts, which would have been gone unrecorded if only a particular outcome such as main crop productivity would have been measured. Hence, researchers studying the effects of health shocks in the agricultural family unit need to take into account time allocation changes to truly understand the impact of investments in health in the agricultural context. In the past the literature has shown how households deal with idiosyncratic shocks through mechanisms such as asset sales or informal insurance systems (Morduch 1995, Skoufias 2003). However these options are not always available for poorer households and hence they might need to resort to their most abundant asset: labor (Bhalotra and Umana-Aponte, 2012). Understanding changes in time allocation will more accurately help understand copying mechanisms.

The main objective of this research paper is to measure the effect of household level health shocks on female time allocation and agricultural labor participation in rural Pakistan. This approach enables me to look into the intra-household dynamics behind time allocation changes. In addition, I examine the indirect consequences of household health shocks on the well-being of the family unit brought about by these time allocation variations. When looking at impacts of household level health shocks on female labor force participation it is important to account for time dedicated to household chores since these activities are of outmost importance in the rural context. Especially in the case of rural Pakistan, where women are dedicated to an assortment of household chores that augment household well-being and that are closer in nature to labor activities rather than to leisure (Alderman and Chishti 1991). In this context, where traditional family structures are the norm and women exhibit low levels of education and skill, women will tend to act as secondary workers (Bhalotra and Umana-Aponte, 2012). This paper contributes to the literature by understanding the role of changes female labor supply as an insurance mechanism. Authors such as Jacoby and Skoufias (1997) and Skoufias (2003) have looked into the role of child labor as an insurance mechanisms for households in developing countries, but

[2] FAO. "Pakistan and FAO Achievements and success stories"

seldom has this literature researched the impact of variations in the labor supply of women (Kochar, 1995; Frankenberg et al., 2003; Halliday, 2006; Bhalotra and Umana-Aponte, 2012). Furthermore, this paper improves on previous evidence by using as its output measure not only agricultural labor participation but in addition, changes in time use for other non-agricultural activities such as child care, housework etc., which could affect households' overall well-being.

In order to do so I use both data from Round 1 (March - April 2012) and Round 2 (April - May 2013) of IFPRI's Pakistan Rural Household Panel Survey (RHPS) (IFPRI/IDS 2012). These surveys contain separate female and male modules that allow me to capture the specific decisions and constraints that female rural dwellers face. In addition, it contains detailed information on time allocated to farm and non-farm activities by women. Furthermore, these surveys comprise a health module designed to inform this particular study. It contains information on health shocks affecting the household, the cost of those shocks in monetary terms, and detailed agricultural labor participation for the whole family unit, data not usually available alongside in surveys. Hence it provides a unique opportunity to explore the impact of morbidity on agricultural labor participation including individual and households characteristics as well as individual, year and district fixed effects. Consequently taking care of many of the concerns that could lead to spurious relationships between these variables. Hence this paper contributes to the literature by providing controls for potential confounders and by analyzing the mechanisms behind the impacts of household level health shocks on household well-being.

This paper is divided into five sections. The introduction is followed by a description of the situation in rural Pakistan in terms of health shocks suffered by households and female time allocation. Section three discusses the methods used, while section four presents the results. Section five concludes with a discussion of the findings

II. HEALTH SHOCKS AND TIME ALLOCATION IN PAKISTAN

2.1 Health Shocks

Given the extreme importance of household level health shocks[3] in most developing country contexts, I use the presence of these shocks across years in rural Pakistan in order to look into the economic costs of morbidity. According to the 2012 Pakistan Rural Household Survey (RHPS - Round 1), the most common negative shock experience by rural households by a large was medical expenses due to illness or injury, with almost 58 percent of households having experienced this shock. The monetary value of the loss incurred by this shock was very

[3] A health shock in the family unit is recorded when medical expenses due to illness or injury are incurred during the calendar year.

significant, with an average of 44,422 rupees per episode (around US$491). The RHPS-2012 found that monthly household expenditure in rural Pakistan was about 18,930 rupees[4] (around US$209). Hence we are talking about a shock equivalent to 19.6% of annual expenses. Furthermore, according to the 2003 National Human Development for Pakistan, illness is the major force that pushes households below the poverty line. The data collected by this 2003 study showed that the poor mainly use the services of private allopathic medical practitioners who are not equipped to correctly diagnose illness (Hussain 2003). As a consequence, the effect of a health shock is long lived with high medical bills that eat up assets and push households further into destitution. In addition, Hussain's 2003 report highlights how the poor are more susceptible to illness due to a combination of a poor diet and unhygienic living conditions, both which contribute to a lowered immunity. These statements are true for the data employed in this study. According to Round 1 and 2 of the RHPS, when looking at the incidence of illness[5] in the last two weeks for children 5 years of age or younger[6] there is a striking difference between children belonging to the bottom 25 percentile of wealth and the ones from better of families. Over 30 percent of children belonging to the poorer households suffered an illness in the last two weeks while only 23 percent of the better off children did.

2.2 Female time allocation in Rural Pakistan

The role of women in agriculture in Pakistan is essential. By 2012 women constituted over 31% of the agricultural labor force in the country[7]. According to the Demographic and Health Survey (2006-2007) 54 percent of women in rural areas work in agriculture compared with only 6 percent in urban areas. According to RHPS data, on average 43 percent of women between 14 and 74 years old participated in either agricultural or livestock activities in their own farms. In addition, over 21 percent indicated that they worked in either paid agriculture or livestock activities in the past year. If we look only at married women in this age group[8], this numbers are even higher (48 percent participation in own farm activities and 23 percent in paid farm activities). In Pakistan the main system of farming is traditional with little mechanization making agricultural labor critical for its success. Hence it is of outmost importance to understand the constraints to female participation and productivity in agricultural activities. In addition, understanding how household health shocks affect women's time spent on different agricultural activities can shed light on important intra household decisions. In rural Pakistan, married women who contribute economically to their household are also responsible for all household chores. Hence decisions

[4] Source: Nazly, H. et al. 2012. Pakistan Rural Household Panel Survey 2012 (Round 1): Household Characteristics. PSSP Working Paper Series No. 008.
[5] The following conditions are considered: fever, cough/cold and diarrhea
[6] The most susceptible age group to disease.
[7] Source: FAOSTAT, FAO of the UN,
[8] Almost 64% of the women 14-74 years old were married.

affecting time allocation on agricultural activities also affect time allocation dedicated household chores. These shifts in time allocation are of particular importance for child well-being since many of these household chores are direct inputs in to the child quality production function, i.e. child care and daily hygiene practices such as washing and cleaning utensils.

Table 1 illustrates time allocation, in both agricultural and livestock activities, for married women between 14 and 74 years old in rural Pakistan. The first column presents the percentage of married women who are actively working in any of these activities. Column 2 gives the number of women who declared working a positive number of hours in each of these activities. Column 3 shows the average number of hours in the last 12 months that women in this age group worked on average in any of these activities (conditional on working at least a positive number of hours). Column 4 presents the standard deviation for this average. Finally, column 5 presents the average number of hours worked in a week by these women. As **Table 1** shows, married female labor is concentrated in livestock work for the homestead with over 44 percent of women working on this activity. This activity is followed by paid agricultural work with 22% of women dedicating time to it. Similarly, 20% of women work for their own farm in agricultural activities. In terms of the average number of hours allocated to each of these activities, again own livestock work seems to be the most prominent with women working at it almost 17 hours a week while 9 hours a week are dedicated to paid agricultural work. Own agricultural work, on the other hand only adds up to 6 hours a week. In terms of specific paid agricultural activities such as sowing, weeding, harvesting, etc. the harvest is the activity that requires most of the female work force (with an average of 20% of the total these women working on this activity). Furthermore, of the married women that participate in paid agricultural activities 93% work during the harvest. Finally, it is important to mention that according to the RHPS data there are practically no other jobs (paid or unpaid) for women apart from agriculture and livestock in rural Pakistan. Less than 2 percent of women in this age group declared doing any non –farm related work in the last 12 months.

Similarly, **Table 2** shows time allocation in household chores for married women between 14 and 74 years old in rural Pakistan. As before, the first column presents the percentage of women who actively work in any of these activities, while column 2 gives the number of women who declared working a positive number of hours in each of these activities. Column 3 shows the average number of hours (either in the last day or the last week) that women in this age group worked on average in any of these activities (conditional on working at least a positive number of hours). Column 4 presents the standard deviation for this average. Finally, column 5 presents the average number of hours spent in each activity in a week. From **Table 2** it is evident that child and elderly care is the number one daily activity for women followed by cooking at home. Most women (around 70%) participate in daily activities such as child care, washing and cleaning utensils, cleaning the house and cooking. Other weekly activities such as preparing dung cakes, collecting

water and firewood are only performed by around 30% of women. In contrast, washing and pressing clothes is a chore done my most women in rural Pakistan (72%) although it only takes a fraction of the time than other daily activities such as caring for others, cooking food and house cleaning. Caring for others takes over 17 hours a weeks on average, while cooking over 13 hours. The least time consuming activities seems to be collecting water and preparing dung cakes with an average of around 5 hours a week spent on each of these activities. If a woman was to perform all these activities in a single week she will spent almost 72 hours a week only in household chores. If to this time we add the average number of hours spent taking care of livestock for the homestead (the most common farm activity) we end up with women working over 88 hours a week, a very intense work week by any standard. If I look at all women (married and unmarried) the number of hours worked and the participation rates follow very similar patterns (see **Table A.1** in the Appendix). Finally, if particularly vulnerable groups such as women with no education are analyzed I find a much higher rate of participation in the labor market as well really high total number of hours worked a week (see **Tables A.2** in the Appendix).

2.3 The impact of health shocks on household level time allocation

When a household level health shocks affects a rural family in Pakistan the agricultural labor participation of the whole family unit[9] is negatively affected. **Table 3** shows the impact of a health shock on the time dedicated by adults at their prime working age (18 to 65 years of age) to agricultural activities in the last year. The estimation in **Table 3** illustrates the impact of the presence of a health shock in the household on the change in the supply of days worked by the whole family unit. I use household, district and year fixed effects as well as controls for household level characteristics[10] in the regression. The standard errors are clustered at the household level to account for any variation within household. The results indicate that a household level health shock will decrease the agricultural labor participation of the family unit by 59 days a year (statistically significant at 5%). This is substantial impact, equivalent to 37% of the total amount of days worked in agricultural activities by the whole family unit in a year. However this effect is disguising the intra-household dynamics that occur when a health shock affects a household. Even though the household as a whole decreases it agricultural labor supply this does not mean all members do it in equal terms. Furthermore, it is possible that even though own farm labor supply is decreased due to a medical shock, hours spent in paid agricultural work could increase to compensate the loss in income and to cover medical expenses. In this paper I analyze what

[9] Measured in terms of number of days worked in agricultural activities in the last 12 months by all family members
[10] These characteristics include: household size, the household wealth score, the level of crowding, the number of hours per day that the household has electricity, the distance from the household to the water source (in km), the presence in the household of a piped drainage system and the occurrence of a flood, earthquake or droughts.

happens in particular with married female labor supply as well as married female time allocation in household chores.

III. METHODS

3.1 Data Source

In order to achieve the objectives of this paper I use the 2012 and 2013 Pakistan Rural Household Surveys (Rounds 1 and 2) produced by the International Food Policy Research Institute and currently under restricted access. The Pakistan Rural Household Survey (RHPS) was conducted in 19 districts of three provinces in Pakistan: Punjab, Sindh, and Khyber Pakhtunkhwa (KPK). The fourth province, Balochistan was not included due to security reasons. The sample universe includes all households in the rural areas of these three provinces. The data collection process took place during the months of March and April of 2012 and 2013. During the first round 2,090 households were interviewed (1,340 in Punjab, 560 in Sindh, and 224 in KPK).

The survey contains separate female and male modules and collects information on a wide array of issues, such as income, employment, consumption, time use, assets and savings, loans and credit, education, migration, economic shocks, participation in social safety nets, and household aspirations (for further detail see Nazli and Haider 2012). In addition, a detailed health module was included. The health module contains questions regarding not only the nature of recent illness, but its duration as well as information on health shocks affecting the household and the cost of those shocks in monetary terms, data not usually available in surveys. This information combined with the data on time allocated to farm and non-farm activities by family member allows me to capture the specific decisions and constraints that female rural dwellers face.

The analysis of this data is in itself a contribution to the literature given the limited amount of information available regarding the health status of women in Rural Pakistan. In particular morbidity indicators and intensity of episodes are not currently available. The standard source of health information for developing countries, the Demographic Health Survey (DHS 2007 and DHS 2013) for Pakistan is lacking in terms of these indicators. Regardless the vast amount of information regarding prenatal care, delivery and postnatal care as well as detailed health records for deceased women there is a void related to basic health indicators. Both, the 2012 Pakistan Rural Household Survey (Round 1) and the 2013 Pakistan Rural Household Survey (Round 2), are able to fill this void. .

Round 1 of the survey contains information on agricultural time allocation and on health status for 2,565 married women aged 14 to 74 years old, while Round 2 provides information for 2,790.

For household chores time allocation the number of observations available is 2,548 and 2,759 for Round 1 and Round 2, respectively.

3.2 Identification Strategy

Agricultural labor increases the exposure to health risks due to the use of pesticides and fertilizers in the field and enhancements in agricultural productivity can also improve health through increases in income. Similarly, the presence of measurement error due to self-reporting of health status may bias the estimations (Schultz and Tansel 1997). To deal with both the joint determination and the measurement error problem I use individual, district and year fixed effects as well as a health outcome that does not depend on individual perceptions. The health outcome chosen in this paper is an objective measure. A health shock in the family unit is recorded only when medical expenses due to illness or injury are incurred during the calendar year. I use a wide array of covariates as well as panel of data which allows me to include individual fixed effects and control for time invariant unobserved individual characteristics that could be correlated with time use. As a consequence I am able to measure the causal impact of a household level health shock on female time allocation (both in productive activities and in household chores).

3.3 Specification

In all specifications I use the following model:

$$Y_{ihjt} = \theta_i + \delta_j + \phi_t + \rho_1 Z_{hjt} + \rho_2 X_{ihjt}^{F} + \rho_3 X_{hjt}^{H} + \varepsilon_{jt} \qquad (1)$$

Y_{ihjt} is the outcome variable of interest for individual i, belonging to household h, in year t and district j, Z_{hjt} is a dummy equal to one if a health shock affected household h, in district j at time t, θ_i are individual fixed effects, δ_j are district fixed effects and ϕ_t are year fixed effects that control for aggregate shocks. I control for female (X_{ihjt}^{F}) and household (X_{hjt}^{H}) characteristics that also vary over time. I use a fixed effect panel model and heteroskedasticity-robust standard errors.

The individual fixed effects will capture, for example, differences across women in frailty, fertility, skills related to agricultural work, health knowledge, preferences related to health practices and time allocation, as well as awareness of health-related technology and services. The district fixed effects control for initial geographic conditions (such as climate and agricultural land configuration) as well as for persistent elements of culture and public service delivery that could simultaneously affect female time allocation and the presence of health shocks. The year dummy controls for aggregate time-variation associated with, improvements in health technology and national level economic or political regime changes.

The individual controls used in the estimations include the highest education grade completed by the woman, pregnancy status, lactation status, presence and intensity of illness (illustrated by the number of days unable to perform their main activity), the number of children under 5 years old the woman has and both the number of sons and daughters who live with her in the household.

Following Alderman and Chishti (1991) I included in the estimations household level controls to replicate the intricacy of the intergeneration and extended family structure present in most rural households in Pakistan which could affect time allocation decisions i.e. number of women in the different age categories that resided in the household (8-15, 15-50 and 51-80 years of age)[11]. In addition, I included as household level controls: household size, a household wealth score, the level of crowding, the number of hours per day that the household has electricity, the distance from the household to the water source (in km) and the presence in the household of a piped drainage system. Household wealth was chosen for this study instead of individual income since income data is not reliable and consumption is a function of wealth, which can be seen as a net cumulative indicator of economic wellbeing. I constructed a wealth indicator based on a series of household characteristics (flooring, walls and ceiling materials, ownership of goods, toilet facilities, and type of cooking fuel, and such) which are summarized using a principal component analysis. The wealth index is included in X_{hjt}^{H} as part of the household characteristics. In addition, I control for the presence of floods, earthquakes and droughts in the village. These questions were asked at the household level and hence they are considered a household level control since they measure the awareness of the household to these natural disasters. It is important to control for the presence of natural disasters since they are an important determinant of agricultural labor supply requirements, disease environment and health outcomes.

The estimations only include information for married women aged 14 to 74 with no missing variables for a total of 5,136 observations for agricultural time allocation regressions and 5,088 observations for household chores time allocation regressions.

3.4 Descriptive statistics

Table 4 provides descriptive statistics for the variables used in the estimations. The first section illustrates the unconditional[12] average number of hours in the last 12 months that women between 14 and 74 years old worked in rural Pakistan in both agricultural and livestock activities. Female labor is concentrated in livestock work for the homestead, followed by paid agricultural work

[11] These variables are used to control for the possible support groups that the woman might have in the household.
[12] It includes both women that worked a positive number of hours and women that work zero hours.

and finally own farm work. In terms of the average number of hours allocated per week to each of these activities, livestock work adds up to over 7 hours a week for the average woman, while paid agricultural work has an average of 2 hours worked per week. Finally, own agricultural work, adds up to over 1 hour a week. The next section, in **Table 4** shows married women between 14 and 74 years old time allocation in rural Pakistan in household chores. As before, these averages include both women that worked a positive number of hours and women that work zero hours. Child and elderly care is the number one activity with almost 13 hours per week spent by the average woman in this chore. It is followed by cooking at home and cleaning your own house. Washing and pressing clothes is the non-daily chore done for more hours by the average woman in rural Pakistan. The average woman will spent around 42 hours a week performing only household chores. If to this time we add the average number of hours spent taking care of farm activities we end up with the average woman working almost 54 hours a week. However, as it was illustrated in section 2, this average conceals the actual number of hours that could potentially be worked by a woman (closer to 88 hours a week).

Table 4 also presents woman and household characteristics. From the sample, we can see that around 8% of the women interviewed were pregnant and 20% are still breastfeeding. On average, they have a very low level of education (with less than 2 years of completed education) and 44% of them have children younger than 5 years old[13]. According to this sample, 34% of the women lived in a household that suffered medical expenses due to illness or injury. The average household only has 7 hours a day of electricity and has to walk 0.1 km. to reach a water source. Similarly, only 57% have access to a piped drainage system. Finally, 22% of households suffered from a flood in previous years, while 6% and 5% suffered a drought and an earthquake, respectively.

IV. RESULTS

I perform separate estimations of the impact of a household level health shock on the different measurements of time allocation. The first set of estimations show the impact of this shock on farm activities (both own and for pay). The results are shown in **Table 5.** All specifications include individual, district and year fixed effects. I control for all the individual and household characteristics presented in the descriptive statistics.

[13] As calculated using the RHPS data.

5.1 Impact of health shocks on female time allocation for married women

The results show that for married women, the presence of medical expenses in the household have a statistically significant impact only on paid agricultural activities. When a health shock takes place during the year married women on average increase their labor participation on paid agricultural activities by 45 hours a year (significant at a 1% level) which is around 0.86 hours a week. For the average married woman 14 to 74 years old this is an increase equivalent to almost 43 percent of their total work hours in paid agricultural activities. As mentioned earlier, health shocks to the household are usually accompanied by significant expenses. It would seem that married women have to increase their paid labor in order to be able to help cover these additional expenses.

However, when we looked at the total time allocation for married women we calculated that some married women could be working already as much as 88 hours a week. If I assume that daily, women sleep around 8 hours and dedicate 3 hours total for all their other necessary activities (such as grooming, eating, etc.) it is safe to assume that these women have less than half an hour daily for any leisure activities. Given that extremely grueling schedule is to be expected that these additional hours allocated to paid agricultural activities would not come from an already almost inexistent leisure time allocation. Furthermore, given that agricultural activities are by their nature very physically demanding, women dedicating more time to this type of labor would probably need to rest longer. Hence these additional hours would have to be compensated by decreasing the woman's time dedicated to other activities such as household chores. In order to test this theory, I estimate the impact of a household level health shock on time allocated to household chores. The results are shown in **Table 6.** As before, all specifications include individual, district and year fixed effects as well as all individual and household level controls discussed in the descriptive statistics.

According to the results presented in **Table 6**, women whose household face a health shock during the calendar year will reduce the amount of time spent daily on helping and taking care of children and elders by 0.23 hours (significant at a 5% level). Similarly, the time dedicated every day to washing and cleaning utensils will fall by 0.13 hours (significant at a 1% level), while the time spend cooking will be reduced by 0.11 hours (significant at a 5% level). Finally, the only weekly activity that is decreased is the time spent collecting firewood and fodder which diminishes by 0.59 hours (significant at a 5% level). If I look at the percentage of time lost in each of these activities we see that the time dedicated to looking after children and the elderly is reduced by 14%, the time spent on washing and cleaning utensils is reduced by 18%, the time spend cooking decreases by 8% and the time collecting firewood shrinks by 26%.

On average married women are decreasing the time spent on household chores by 3.93 hours a week. If I compare this reduction to the increase in time dedicated to paid agricultural activities it can be estimated that even after increasing their physical level of activity women only get around 45 minutes extra per day to rest (and possibly to commute). This time allocation will probably result in a reduction in the woman's own health and well-being. Furthermore, most of the time lost (85%) belongs to activities dedicated to enhance child quality (such as child care, hygiene and feeding practices). These are the most flexible activities and hence suffer the greatest reductions. These reductions will certainly have consequences in the well-being of the children in the household and in the well-being of the household as a whole.

5.2 Pathways through which health shocks affects household wellbeing

This paper has established that when a household faces a health shock during the year, married women are forced to change their time allocation. They have to work more on paid agricultural activities in order to increase the household income. Yet this comes at the cost of less time invested in child quality enhancing activities such as child care, hygiene and feeding practices. The next question we should ask is what are the consequences of those time re-allocations? Children could fall ill more often if their mothers spend less time in hygiene practices or they could have a harder time at school if they receive less attention and support from them. Similarly, mothers that spend less time at feeding practices could cause children to be worse nourished. Worse nourished children will get sick more often and also probably do worse at school and be less motivated to go. In addition to having data on the previous year labor supply and time allocation, the RHPS contains information on the total number of school days missed by children during the previous year. Hence I could test if the children of mothers that face health shocks are indeed at a greater risk of missing more school days. In order to do so, I construct a variable equal to the total number of school days missed by all the woman's children aged 5 to 13 during the previous year. I estimate the impact of a household level health shock on the total number of school days missed by a woman's children aged 5 to 13 years old. The results are shown in column 1 of **Table 7.** As in all previous specifications I include individual, district and year fixed effects as well as individual and household level controls. The results show that younger children of women who had to deal with a household level health shock missed an additional 3.78 days of school (significant at a 5% level). This is an increase equivalent to 29% of the average number of total school days missed a year by a woman's younger children. Given these results it is valid to question whether the increase in children's missed days at school due to a health shock is actually just a consequence of a change in the time allocation of children themselves. It is possible that when a health shock hits the household younger children are forced to increase their labor supply (to help with the additional income needed) or to augment their efforts at home to compensate

for the reduction in the time their own mother dedicates to household chores. If this is the case, reductions in the time dedicated to child quality enhancing activities by women is not the main channel by which a health shock affects children's well-being. I test this hypothesis by estimating the impact of a household level health shock on the time allocated to farm activities (paid and unpaid) as well as household chores by children aged 5 to 13 years of age. All specifications include individual, district and year fixed effects as well as all household level controls. In addition, I control for the highest grade completed at school by the child and the presence and intensity of an illness episode in the last two weeks (see **Tables A.3** and **A.4** in the Appendix). The results show neither time dedicated by young children to farm activities, nor to household chores is affected by the presence of medical expenses in the household. Consequently, this impact pathway can be discarded.

I could directly test if a decrease in investments in child quality is the pathway thorough which the presence of a health shock is affecting the number of days children miss at school. To accomplish this goal I run a regression looking at the impact on missed school days not only of the presence of medical expenses, but in addition I control for household chores directly correlated to child quality. The results are found in **Table 7**, column 2. According to the estimation, the presence of a household level health shock is not affecting directly the number of school days that children miss. It is a reduction in the time the mother dedicates every day to washing and cleaning utensils that increases the amount of missed days. In other words, all the effect is coming through the reduction in time spent in hygiene practices. For every additional hour that a mother dedicates to such hygiene practices her younger children miss 3.64 days of school less (significant at a 1% level).

A possible explanation could be that as mothers have less time to dedicate to hygiene practices, their children are exposed to a worst environment and could become sick more often and hence miss more days at school.

5.3 Impact of health shocks on female time allocation for married women with no education

According to the RHPS almost 76% of all married women between 14 to 74 years of age have never enrolled in school. These women are probably less aware of the consequences on child health of neglecting hygiene practices and could decrease the time dedicated to them more than the average woman when a health shock forces them to increase their participation in the labor market. This behavior will generate worse consequences of a household health shock on household well-being, specifically on the number of school days missed by children. To test this hypothesis I estimate the impact of a household level health shock on the number of hours

worked in paid agriculture and the time spent washing and cleaning utensils, only for women that never enrolled in school. Similarly, I look at the impact of the presence of medical expenses in the household on the number of days children of uneducated women miss at school[14]. The results are shown in **Table 8.** When a health shock takes place, uneducated married women, on average, increase their labor participation in paid agricultural activities by 44.2 hours a year (significant at a 5% level). This number is very similar to the one for the population of married women as a whole (44.5). However the time they dedicate every day to washing and cleaning utensils falls by 0.16 hours (significant at a 1% level). This reduction is bigger than for the average married woman and it is equivalent to a reduction of over 22% of the time spent in this activity (compared to 18% for the population as a whole). Furthermore, younger children of uneducated women who had to deal with a household level health shock miss an additional 4.34 days of school (significant at a 5% level). This is an increase equivalent to 33% of the average number of total school days missed a year by these children. A number considerably bigger than for the population as a whole. Thus a household level health shock can generate worse consequences for children of already disadvantaged women who could end up in a poverty trap. In this context the lack of education of the mother can worsen the odds of her children getting more education.

V. DISCUSSION

There have been a small number of empirical studies, in particular for the developing world and the agricultural sector, on the impact of negative health shocks on household well-being. Likewise, very few authors have estimated the direct impact of household health shocks on female time allocation in the household. This research paper contributes to the literature by offering new evidence on the effect of household morbidity not only on female agricultural labor participation but also on time use for other non-agricultural activities such as child care, housework etc., which could affect households' overall well-being. In addition, very few authors have researched the impact of variations in the labor supply of women as an insurance mechanisms for households in developing countries (Kochar, 1995; Frankenberg et al., 2003; Halliday, 2006; Bhalotra and Umana-Aponte, 2012). Hence, this paper improves on previous evidence by understanding the role of changes in female labor supply as an insurance mechanism.

Furthermore, this paper looks into the indirect consequences of household health shocks on the well-being of the family unit brought about by these time allocation variations. As a consequence,

[14] In addition I estimated the impact of health shocks for uneducated women in all of the other time allocation variables analyzed in the previous sections and found very similar results to the general population in both magnitude and significance. Results are available upon request.

this study expands the literature by shedding some light on non-monetary consequences related to adverse health shocks. Previous literature, has shown that increases in mortality can be pro-cyclical (Ruhm, 2000; Dehejia and Lleras-Muney, 2004; Miller and Urdinola, 2010). According to this literature, during an economic boom the opportunity cost of time is high and hence women allocate less time to child quality enhancing activities (which are time consuming) and invest more time in the labor market. They conclude that despite the positive income effect, there is a negative net effect on child health since the substitution effect is larger. Bhalotra (2010) call this the behavioral explanation. This paper has shown that when a health shock affects the household, women in rural Pakistan are forced to allocate more time to the labor market (particularly paid agricultural activities). However in this instance the income effect is probably negligible or even negative since the additional earnings are being destined to cover medical expenses. On the other hand, the substitution effect is clearly present and negative. By providing new evidence related to the different channels through which the households' overall well-being is being affected, this paper attempts to provide support to the behavioral explanation. Similarly, it also builds on the literature that establishes a strong and negative correlation between maternal labor supply and child health outcomes (Bhalotra 2010) in contexts were women are used as secondary workers.

Finally, this paper analyzes further implications of household health shocks by differentiating their impact by levels of education. In doing so, it provides evidence surrounding the impact of these type of shocks on poverty traps. There exists a limited amount of evidence on the contribution of negative household health shocks to the poverty trap. In this context, a poverty trap arises when a disadvantaged household, due to the lack of education of the mother, is unable to cope with a negative shock without generating further negative consequences for the household. This lack of copying mechanisms hinders their development in other areas (e.g. worse health and hence school attendance, worse productivity and lower future income) in comparison to households with better initial conditions. Similarly to Bhalotra (2010), I find that that the effect of a negative shock is significantly larger for children with uneducated mothers.

The topic analyzed in this paper is of outmost importance for policymakers since it demonstrates that household level health shocks can have long-run effects which persists beyond the impact of the initial shock itself. If these health shocks indirectly affect long-run outcomes such as education attainment then the long-run well-being of the household will be affected. Policy makers should then devise policies that mitigate the impact of these kinds of shocks and internalize their true cost for the household. A limitation of this paper is that the estimation technique employed cannot assure that the estimates provided are unbiased. The paper deals with the joint determination problem present in this study by using a wide range of covariates, individual, year and district fixed effects. However, future research should focus on finding exogenous sources of variation for the occurrence of health shocks at the household level to ensure causal estimates.

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Tables

Table 1: Total amount of hours worked by married women in different agricultural and livestock activities in rural Pakistan

Farm activity	Percentage of women working in activity	Number of women working in activity	Average number of hours worked (last 12 months)	Std. Dev. (Hours)	Average number of hours worked weekly
Agricultural work in own farm	20%	1076	331	327	6.4
Paid agricultural work	22%	1157	479	450	9.2
Livestock work	44%	2355	878	694	16.9
Paid livestock work	2%	128	799	605	15.4

Source: RHPS 2012 and 2013,

Notes: Observations for women between 14 and 74 years old.

Table 2: Total amount of hours worked by married women in different household chores in rural Pakistan

Household chore	Percentage of women working in activity	Number of women working in activity	Average number of hours spent	Std. Dev. (Hours)	Average number of hours spent weekly
Helping and caring for children and elders (yesterday)	70%	3690	2.5	1.7	17.4
Washing and cleaning utensils (yesterday)	65%	3476	1.1	0.7	7.9
Cleaning own house (yesterday)	65%	3465	1.4	0.8	9.9
Cooking food for home (yesterday)	73%	3885	1.9	1.1	13.1
Preparing dung cakes (during last 7 days)	27%	1443	5.2	4.3	5.2
Collecting water (during last 7 days)	29%	1516	5.2	4.5	5.2
Collecting firewood and fodder (during last 7 days)	30%	1610	7.5	5.9	7.5
Washing and pressing clothes (during last 7 days)	72%	3814	5.5	3.9	5.5

Source: RHPS 2012 and 2013,

Notes: Observations for women between 14 and 74 years old.

Table 3: Impact of a household level health shock on the total amount of hours worked in agricultural activities by the whole family unit in rural Pakistan

Dependent variable:	Hours worked in agricultural activities by the whole family unit
Health shock	-59.492
	(24.422)**
Other Controls	YES
Observations	9,972
Adjusted R^2	0.39

Source: RHPS 2012 and 2013,

Notes: The estimation includes household, year and district fixed effects. Controls include: household size, household wealth score, crowding, hours per day that the household has electricity, distance to the water source (in km), presence in the household of a piped drainage system, occurrence of a flood, earthquake or droughts. Robust standard errors clustered at the household level appear below coefficients, in parentheses. * = significant at 10%; ** = significant at 5%; *** = significant at 1%.

Table 4: Descriptive Statistics for married women 14-74 years old in rural Pakistan

Variable	N	Mean	Std. Dev.
Farm activity (average number of hours worked in the last 12 months)			
Agricultural work in own farm	5355	66	198
Paid agricultural work	5355	103	287
Livestock work	5355	386	634
Paid livestock work	5355	19	154
Household chores (average number of hours worked in the last 7 days)			
Helping and caring for children and elders	5307	12.1	12.8
Washing and cleaning utensils	5307	5.2	5.5
Cleaning own house	5307	6.4	6.7
Cooking food for home	5307	9.6	8.8
Preparing dung cakes	5306	1.4	3.2
Collecting water	5307	1.5	3.4
Collecting firewood and fodder	5306	2.3	4.7
Washing and pressing clothes	5306	3.9	4.1
Woman characteristics			
Highest grade completed in school	5355	1.8	3.7
Days unable to perform main activity due to illness or injury	5355	0.7	2.8
Currently pregnant	5355	0.08	0.28
Currently lactating	5355	0.20	0.40
Number of children under 5 years old	5355	0.7	1.0
Number of sons who live at home	5355	1.2	1.4
Number of daughters who live at home	5355	1.0	1.3
Household characteristics			
Suffered medical expenses due to illness or injury	5355	0.34	0.47
Women 8-15 years of age in the household	5355	0.7	0.9
Women 15-50 years of age in the household	5355	1.1	1.3
Women 51-80 years of age in the household	5355	0.2	0.4
Household Wealth score	5277	0.1	2.2
Household size	5355	7.0	3.8
Crowding	5277	3.5	2.3
Hours per day of electricity	5354	7.0	4.9
Distance to water source (km)	5140	0.1	0.5
Piped drainage system	5274	0.57	0.49
Flood in village in previous years	5355	0.22	0.41
Suffered a drought	5355	0.06	0.25
Suffered an earthquake	5355	0.05	0.22

Source: RHPS 2012 and 2013,

Table 5: Impact of a household level health shock on the total amount of hours worked in farm activities by married women in rural Pakistan

Dependent variable:	Agricultural work in own farm (hours)	Paid agricultural work (hours)	Livestock work (hours)	Paid Livestock work (hours)
Health shock	7.02	44.53	-22.91	2.70
	(10.13)	(15.91)***	(36.27)	(9.43)
Observations	5,136	5,136	5,136	5,136
Adjusted R^2	0.09	0.07	0.10	0.02

Source: RHPS 2012 and 2013.

Notes: Observations for married women between 14 and 74 years old. The estimation includes household, year and district fixed effects. Controls include: the highest education grade completed, pregnancy status, lactation status, presence and intensity of illness, number of children under 5 years old the woman has, number of sons and daughters who live in the household, number of women in the different age categories that resided in the household (8-15, 15-50 and 51-80 years of age), household size, household wealth score, crowding, hours per day that the household has electricity, distance to the water source (in km), presence in the household of a piped drainage system, occurrence of a flood, earthquake or droughts. Heteroskedasticity-robust standard errors appear below coefficients, in parentheses. * = significant at 10%; ** = significant at 5%; *** = significant at 1%.

Table 6: Impact of a household level health shock on the total amount of hours worked in household chores by married women in rural Pakistan

Dependent variable: Hours spent on …	Helping/ caring for children and elders yesterday	Washing and cleaning utensils yesterday	Cleaning own house yesterday	Cooking food for home yesterday	Preparing dunk cakes during last 7 days	Collecting water during last 7 days	Collecting firewood/ fodder last 7 days	Washing and pressing clothes last 7 days
Health shock	-0.234	-0.130	-0.053	-0.113	-0.094	-0.009	-0.591	-0.003
	(0.095)**	(0.043)***	(0.048)	(0.067)*	(0.185)	(0.152)	(0.284)**	(0.224)
Observations	5,088	5,088	5,088	5,088	5,088	5,088	5,088	5,088
Adjusted R^2	0.16	0.11	0.08	0.14	0.06	0.11	0.10	0.12

Source: RHPS 2012 and 2013.

Notes: Observations for married women between 14 and 74 years old. The estimation includes household, year and district fixed effects. All controls previously stated are included Heteroskedasticity-robust standard errors appear below coefficients, in parentheses. * = significant at 10%; ** = significant at 5%; *** = significant at 1%.

Table 7: Impact a household level health shock on the total amount of school days missed by all the woman's younger children

Dependent variable:	School days missed by younger children	School days missed by younger children
Health shock	3.782	2.501
	(1.702)**	(1.688)
Hours spent on helping/ caring for children		0.302
and elders yesterday		(0.499)
Hours spent on washing and cleaning utensils		-3.635
yesterday		(1.195)***
Hours spent on cooking food for home		0.616
yesterday		(0.836)
Observations	5,136	5,088
Adjusted R^2	0.09	0.09

Source: RHPS 2012 and 2013.

Notes: Observations for married women between 14 and 74 years old. Total amount of school days missed calculated using information of children 5 to 13 years old. The estimation includes household, year and district fixed effects. All controls previously stated are included Heteroskedasticity-robust standard errors appear below coefficients, in parentheses. * = significant at 10%; ** = significant at 5%; *** = significant at 1%.

Table 8: Impact of a household level health shock on time allocation and total amount of school days missed all the woman's younger children for uneducated women in rural Pakistan

Dependent variable:	Paid agricultural work (hours)	Hours spent on washing and cleaning utensils yesterday	School days missed by younger children
Health shock	44.23	-0.164	4.343
	(20.32)**	(0.049)***	(1.952)
Observations	3,836	3,796	3,836
Adjusted R^2	0.09	0.10	0.10

Source: RHPS 2012 and 2013.

Notes: Observations for married women between 14 and 74 years old that never enrolled in school. The estimation includes household, year and district fixed effects. All controls previously stated are included Heteroskedasticity-robust standard errors appear below coefficients, in parentheses. * = significant at 10%; ** = significant at 5%; *** = significant at 1%.

Appendix

Table A.1: Time allocation in rural Pakistan for all women

Activities	Percentage of women working in activity	Average number of hours spent weekly
Farm activity		
Agricultural work in own farm	19%	6.2
Paid agricultural work	20%	9.3
Livestock work	39%	15.7
Paid livestock work	2%	14.3
Household chore		
Helping and caring for children and elders	58%	16.3
Washing and cleaning utensils	62%	7.7
Cleaning own house	63%	9.8
Cooking food for home	67%	12.4
Preparing dung cakes	23%	5.1
Collecting water	26%	4.9
Collecting firewood and fodder	26%	7.2
Washing and pressing clothes	68%	5.2

Source: RHPS 2012 and 2013,

Notes: Observations for women between 14 and 74 years old.

Table A.2: Time allocation in rural Pakistan for women never enrolled in school

Activities	Percentage of women working in activity	Average number of hours spent weekly
Farm activity		
Agricultural work in own farm	22%	6.4
Paid agricultural work	25%	9.5
Livestock work	46%	16.6
Paid livestock work	3%	14.8
Household chore		
Helping and caring for children and elders	63%	16.5
Washing and cleaning utensils	63%	7.9
Cleaning own house	62%	9.6
Cooking food for home	69%	12.8
Preparing dung cakes	28%	5.3
Collecting water	30%	5.2
Collecting firewood and fodder	31%	7.6
Washing and pressing clothes	68%	5.3

Source: RHPS 2012 and 2013,

Notes: Observations for women between 14 and 74 years old.

Table A.3: Impact of a household level health shock on the total amount of hours worked in farm activities by younger children in rural Pakistan

Dependent variable:	Agricultural work in own farm (hours)	Paid agricultural work (hours)	Livestock work (hours)	Paid Livestock work (hours)
Health shock	-2.976	-4.559	-7.488	0.782
	(3.770)	(6.198)	(13.141)	(2.884)
Observations	6,163	6,163	6,163	6,163
Adjusted R^2	0.01	0.02	0.03	0.01

Source: RHPS 2012 and 2013.

Notes: Observations for children 5 to 13 years old. The estimation includes household, year and district fixed effects. Controls include: the highest education grade completed, presence and intensity of illness, household size, household wealth score, crowding, hours per day that the household has electricity, distance to the water source (in km), presence in the household of a piped drainage system, occurrence of a flood, earthquake or droughts. Heteroskedasticity-robust standard errors appear below coefficients, in parentheses. * = significant at 10%; ** = significant at 5%; *** = significant at 1%.

Table A4: Impact of a household level health shock on the total amount of hours worked in household chores by younger children in rural Pakistan

Dependent variable: Hours spent on …	Helping/ caring for children and elders yesterday	Washing and cleaning utensils yesterday	Cleaning own house yesterday	Cooking food for home yesterday	Preparing dunk cakes during last 7 days	Collecting water during last 7 days	Collecting firewood/ fodder last 7 days	Washing and pressing clothes last 7 days
Health shock	0.007	-0.013	-0.022	-0.002	-0.067	0.093	0.051	-0.003
	(0.038)	(0.020)	(0.022)	(0.017)	(0.044)	(0.086)	(0.136)	(0.078)
Observations	5,898	5,898	5,898	5,898	5,898	5,898	5,898	5,898
Adjusted R^2	0.04	0.02	0.03	0.02	0.02	0.04	0.04	0.01

Source: RHPS 2012 and 2013.

Notes: Observations for children 5 to 13 years old. The estimation includes household, year and district fixed effects. All controls previously stated are included Heteroskedasticity-robust standard errors appear below coefficients, in parentheses. * = significant at 10%; ** = significant at 5%; *** = significant at 1%.