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### Impacts of child health on caregiver labor supply

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**Report on UGP 2016: Impacts of child health on caregiver labor supply**  
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**1. Study objectives**

Health problems in childhood can have lasting negative consequences (Case et al., 2005; Currie et al., 2010). This may be due to a direct physical relationship between early-years health and subsequent health, or it may be the result of indirect impacts of a child's health on their education or their parents' financial status. There are clear correlations between child health and household income, but the direction of causation is ambiguous. For example, there is substantial evidence that household income affects child health (Case et al., 2002; Currie and Stabile, 2003; Duflo, 2000; Gertler, 2004), but child illness may also affect household income through impacts on work hours or choices about type of employment by caregivers, or on healthcare expenditures. The overall objective of the UGP-supported project was to determine how lower respiratory tract infections (LRTI) in young children affect the economic circumstances of their household. This is challenging because of the bi-directional causal pathways described above.

Within this overall objective, there were two specific aims. First, we addressed the identification challenge associated with estimating impacts of child health on caregiver labor supply by using data from the Montana KidsAIR Study, a randomized experiment aimed at reducing LRTI among children under the age of 5 through interventions to improve indoor air quality in homes heated with woodstoves. Any health improvements resulting from the randomized intervention are, by design, uncorrelated with other household or child characteristics. This provides a source of exogenous variation in child health, allowing for estimation of the impacts on caregiver labor supply. The second aim was to collect pilot data on the economic situation of the households involved in the Montana KidsAIR study to better understand the most important ways in which they are affected by LRTI in young children.

The KidsAIR Study compares the effectiveness of alternative approaches for reducing PM<sub>2.5</sub> exposure in rural homes and the corresponding incidence of LRTI among children under five. Eligible households are those that use a woodstove as a primary heat source and have at least one child under the age of five. These households are randomly assigned to one of three treatment arms: 1) households receive a comprehensive in-home training session on best woodstove practices and also receive low cost tools such as woodstove thermometers and moisture meters; 2) a 20" x 18" Filtrete air filtration unit with a high efficiency filter is placed in the same room as the woodstove; 3) a 20" x 18" Filtrete air filtration unit with a placebo filter is placed in the same room as the woodstove. Pre-intervention data are collected on child, caregiver and house characteristics; and observation of indoor air quality and incidence of LRTI in children under five is carried out during two winters following the intervention.

The first stage of the UGP-supported Economic Outcomes project was an in-depth review of the literature on the relationship between child health, caregiver labor supply and the economic circumstances of the household more generally. This informed the design of an

online survey of caregivers from the Montana arm of the KidsAIR Study, eliciting information on employment, wages, health insurance, medical costs and personal characteristics. The data from this survey were linked to other data from the KidsAIR Study to estimate regression models of the impacts of child health on caregiver labor supply and analyze descriptive relationships between child health and household economic variables. One undergraduate RA and one graduate RA worked on the project, reviewing literature, developing the online survey in Qualtrics, and analyzing the data collected. The outcomes of these activities are described below.

## **2. Prior literature on child health and household economic outcomes**

### ***Child health and caregiver labor supply:***

A large standing body of research has observed the effects of children on primary caregiver (PCG) labor supply (Korenman and Neumark, 1992; Nakamura and Nakamura, 1992; Lundberg, 1988). A recent body of research looks at the effects of child health on PCG labor supply, particularly children with severe chronic conditions and or disabilities (Currie and Stabile, 2003; Smith, 1998; Case, Lubotsky and Paxon, 2002; Pitt and Rozenweig, 1990; Breslau, Salkever and Staruch, 1982; Corman, Noonan and Reichman, 2005; Gould, 2004; Powers, 2001; Meyers, Lukemeyer and Smeeding, 1998; Wolfe and Hill, 1995; Salkever, 1982). Like childhood illness, a child with a disability incurs greater medical and treatment costs to cope with the disability and additional personal care. Almost no research has been conducted in the effects of short term child illness on PCG labor supply. Most studies that involve 'sick' children use data pertaining to chronically ill or disabled children, as the majority have studied the effects of disabled children on public policy, parental labor supply or specifically maternal employment (Breslau, Salkever and Staruch, 1982; Gould, 2003; Powers, 2001; Meyers, Lukemeyer and Smeeding, 1998; Salkever, 1982; Wolfe and Hill, 1995).

The presence of children, child health and income are endogenously related (Nakamura and Nakamura, 1992; Korenman and Neumark, 1992; Lundberg, 1988; Lundberg and Rose, 2002). A 1992 study suggests that regardless of tenure and previous work experience the presence of children has a direct and negative effect on wages (Korenman and Neumark, 1992). The number of dependents in a household puts additional strain on the financial resources available to a family, and the presence of a sick or disabled child exacerbates these conditions. Depending on the severity and care needed for a child's illness families may opt to work more or fewer hours, delegating child care to an individual, or primary care giver (PCG). Child care plays a critical role in determining family income and ability to cope with additional medical expenses. A parent, guardian, or sibling may take partial or full responsibility in caring for a sick or disabled child when external child care is not available or too costly (Pitt and Rozenweig, 1990). The tradeoff between work and child care is closely tied to the cost of alternative child and medical care. The cost of care may exceed the additional income earned by PCG in the labor market, in this event the PCG will often choose to remain at home or decrease work hours to care for a child. A body of work documents the work decisions between cohabiting couples versus single mothers (Korenman and Neumark, 1992; Breslau, Salkever and Staruch, 1982; Corman, Noonan and Reichman, 2005; Gould, 2003; Powers, 2001; Wolfe and Hill, 1995). Couples will delegate labor force participation

and home work based on a variety of financial constraints, income and skill sets. Couples with children often see an increase in the hours of work for one parent and a sharp decrease in hours for the other (Lundberg, 1988; Lundberg and Rose, 2002; Breslau, Salkever and Staruch, 1982). The additional time required to care for an ill child and medical costs can cause one parent to increase work hours to pay for additional care costs while the other remains at home to care for the child.

Due to the higher earnings of men, the availability of jobs, and the overall financial needs of the family based on the income of the parent(s), women are most likely to act as a primary caregivers. Even in adolescence, girls are expected to help with household chores and childrearing at a much higher rate than that of boys of the same age (Pitt and Rozenweig, 1990). The disproportional amount of women involved in child care can have negative effects on education and career development (Nakamura and Nakamura, 1992). Caregivers in general often experience additional barriers to reentering the work force after raising or caring for a child. The time away from the work force is believed to degrade work capital, as a result many care takers will reenter the work force in a part time job to regain lost capital (Nakamura and Nakamura, 1992; Korenman and Neumark, 1992).

#### ***Socioeconomic status and child health:***

It is difficult to estimate the effects of child health on socioeconomic status (SES) or income of a family because SES and income also effect child health. Children born into families with low socioeconomic standings are more likely to have a disability or chronic illness (Smith, 1998; Currie and Stabile, 2003; Case, Lubotsky and Paxon, 2002). This occurs most likely due to lack of early detection in low income families and the high cost of medical treatment for chronic conditions and disabilities. In addition to medical intervention, children raised in low income families are more susceptible to long lasting effects from health shocks (e.g. accidents, medical emergencies, sicknesses). The most common health shocks recorded for children at all SES levels are respiratory diseases (Currie and Stabile, 2003). Children with chronic or long lasting illness obtain lower levels of educated than their healthy peers, causing them to enter into adulthood with a lower economic status and lower health levels (Currie and Stabile, 2003; Smith, 1998, Case, Lubotsky and Paxon, 2002). A lower SES and poor personal health can have repercussions on the family of the child later in life.

Families at all SES levels experience a higher rate of unemployment for the PCG when a sick or disabled child is present. Families at higher levels of income are better able to cope with additional medical and care costs associated with an ill child and therefore experience a lower rate of PCG unemployment. Often PCGs at high income levels will retain some form of partial employment in comparison to their low income counterparts (Salkever, 1982; Powers, 2001). Low income families have a higher rate of unemployment and decreased work hours when a disabled or ill child is present (Salkever, 1982; Powers, 2001; Meyers, Lukemeyer and Smeeding, 1998). One component of high unemployment for low SES families is that supplemental income aid programs are found to be a work disincentive for low income mothers (Wolfe and Hill, 1995). Conversely, employer provided health care plans that cover all children are a large work incentive to single mothers and that health care policies that incentivize employment are most effective for single mothers with non-disabled children (Wolfe and Hill, 1995). On average single mothers of disabled children work less

than those without (55% and 62%, respectively) and married mothers with disabled children work less than those without disabled children (60% and 70%, respectively) (Powers, 2001).

Many studies documenting the effects of child illness look at the presence of insurance and financial aid programs that cover medical expenses (Powers, 2001; Meyers, Lukemeyer and Smeeding, 1998; Wolfe and Hill, 1995). As previously stated, there is an incentive to work when jobs that provide insurance coverage (Wolfe and Hill, 1995). Middle and high SES working mothers are more likely to have private insurance and poor child health increases the demand for insurance. However for women that rely on public insurance that there is an issue of endogeneity with regards to work hours and benefits received (Gould, 2004). Medicare and supplemental income help to offset the cost of care, but out of pocket medical costs can be a determining factor in workforce participation. Additional income may help alleviate additional expenses, however more proactive childcare could help decrease child care costs.

Both demographic information and time taken off work to care for an ill child have effects on the employment status of the PCG. A racial difference has been observed in the employment trends of families with ill children. Cohabiting black women in low income situations are more likely to leave the work force to care for a disabled child rather than work fewer hours, as opposed to high income white women (Breslau, Salkever and Staruch, 1982). Explanations for the racial differences are that black women are most likely to work 'blue collar' jobs and due to inflexible hours and hourly wages versus the costs of child care, will opt out of the labor market to care for their child (Breslau, Salkever and Staruch, 1982). In general non-white women have limited access to jobs that provide time off. Time taken off work to care for a sick child negatively affects income. A 1998 study finds that the time taken off work to care for a child accounts for \$1000 to about \$5000 in forgone earnings, approximately 10 to 15% of household income at the time (Meyers, Lukemeyer and Smeeding, 1998). Time taken off work to care for a child is dependent on the severity of the illness and the intensity of care needed to care for said child. Approximately 74% of mothers with healthy children work as opposed to 57% of mothers with a child with a time intensive, severe or unpredictable illness (Gould, 2003).

### **3. Data collection**

The core component of this project was an online survey of caregivers from the Montana arm of the KidsAIR study. Based on review of the literature on economic consequences of child health, mapping of data already available through the study, and discussion with the KidsAIR field team, we developed survey questions covering 1) household composition, 2) employment status, work characteristics and earnings of the primary caregiver, 3) health insurance status of household members and out-of-pocket medical costs, 4) childcare arrangements when children are healthy and when they are sick, 5) changes in employment, insurance or childcare in past two years, and 6) personal characteristics of the respondent.

The survey was implemented using Qualtrics software. All 81 primary caregivers in the Montana KidsAIR sample were contacted by email or text message, depending on their

previously stated preferences. The KidsAIR field manager sent advance notice explaining the project, and this was followed by a message with a link to the survey, with an incentive of a \$15 gift card to the respondents' choice of Amazon.com or Target. Two reminder messages were sent. In total, 72 responses were received, a response rate of 89%.

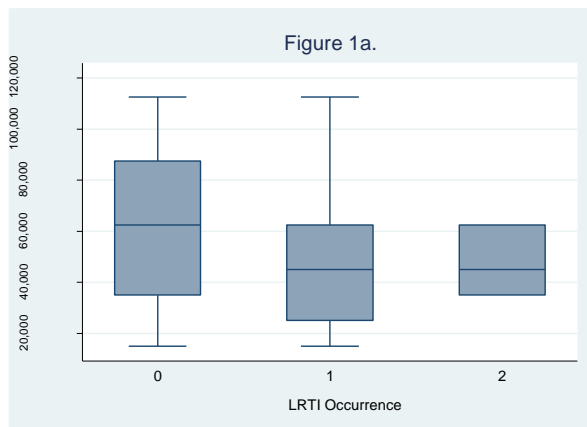
The survey data were linked by household ID to other KidsAIR data on household and house characteristics, air quality measures, child health and reports of LRTI occurrence, and treatment group in the randomized air quality intervention.

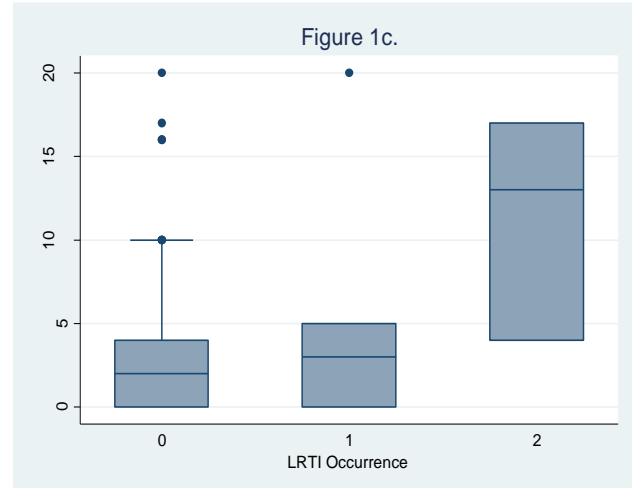
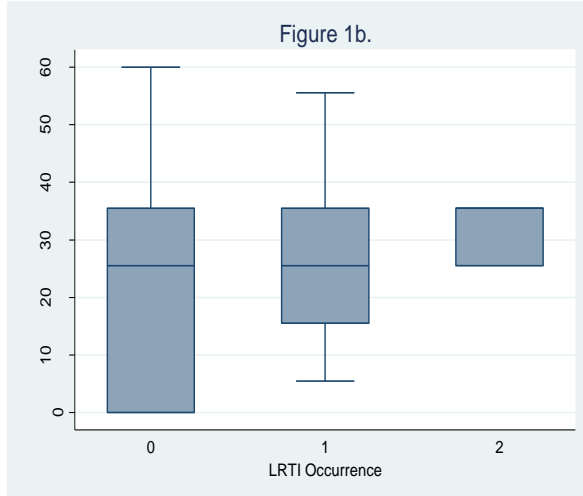
#### 4. Findings

##### ***Impacts of child health on caregiver labor supply:***

The first aim of the project was to use variation in child health resulting from the randomized air quality intervention to estimate the causal relationship between child health and caregiver work hours. Descriptive results show that households experiencing one or more occurrences of LRTI in children under 5 during the winter preceding the survey have slightly, although not significantly, lower income than households that did not experience any LRTI incidences (Fig 1a), although the primary caregivers work similar numbers of hours (Fig 1b). Caregivers in households experiencing one occurrence of LRTI took about the same number of days off for care of sick children overall during the winter, while caregivers in households experiencing two occurrences took more days off on average (Fig 1c).

**Figure 1: Household income, caregiver weekly hours, and caregiver days off to care for sick children by number of occurrences of LRTI (0, 1 or 2)**





These results show that there is likely to be a multi-directional relationship between risk of LRTI, caregiver work hours and household income. We therefore proposed to estimate the causal impact of LRTI in children on days taken off work by the primary caregiver using a two-stage least squares approach, in which frequency of LRTI is estimated as a function of study treatment arm (Eq. 1b), and this estimate is used to instrument for actual LRTI in the main labor supply equation (Eq. 1a):

$$\text{Labor supply} = \beta_0 + \beta_1 LTRI + \beta_j X + u \quad (\text{Eq. 1a})$$

$$LTRI = \alpha_0 + \alpha_1 \text{Treatment} + \alpha_j X + v \quad (\text{Eq. 1b})$$

In addition to absence from work, additional control variables ( $X$ ) were included, namely whether the primary caregiver works full time, their health insurance status, and their level of education.

The first two columns in Table 1 show the results from OLS models of the effects of LRTI incidence on days taken off work by the caregiver, for care of a sick child and in total. These results show that in households where there were one or more occurrences of LRTI in children under 7, the caregiver took an average of 2 additional days off work. However, child illness may not be exogenously determined with respect to caregiver work patterns. For this reason, we estimated two-stage least squares models of days off for child illness and total days off for the primary caregiver, using the woodstove intervention as an instrumental variable for child LRTI incidence. Columns (3) and (5) show the first stage results of the effects of treatment on LRTI incidence. They do not show a significant effect of either the air filter or behavioral treatment on incidence of LRTI in children under 5. Due to this, the woodstove interventions are not a valid instrument, and we do not see an effect of LRTI on caregiver time off work.

**Table 1: Regression results on impacts of LRTI in children under 7 on caregiver days off work**

	OLS (1)	OLS (2)	Eq. (1b) (3)	Eq. (1a) (4)	Eq. (1b) (5)	Eq. (1a) (6)
	Days Taken off to Care for Sick Child	Total Days Taken off for Sickness in Household	Household LRTI Occurrence	Days Taken off to Care for Sick Child	Household LRTI Occurrence	Total Days Taken off for Sickness in Household
Part-time	1.610 (1.200)	5.917** (1.972)	0.302 (0.217)	6.548 (13.691)	0.302 (0.217)	-5.675 (34.774)
Full-time	3.406** (1.087)	8.356*** (2.221)	0.365 (0.243)	9.229 (16.369)	0.365 (0.243)	-5.664 (41.577)
Other	4.736* (1.966)	10.437** (3.865)	-0.196 (0.405)	0.996 (12.081)	-0.196 (0.405)	19.663 (30.684)
Medicaid	2.971 (1.588)	5.686* (2.782)	0.181 (0.371)	4.984 (8.678)	0.181 (0.371)	-0.589 (22.042)
Family insurance	5.549* (2.504)	9.956** (3.669)	0.103 (0.413)	6.418 (6.980)	0.103 (0.413)	6.931 (17.728)
Own insurance	3.475 (1.853)	9.081* (3.941)	-0.036 (0.427)	2.153 (7.164)	-0.036 (0.427)	11.399 (18.196)
Some college	-2.418 (1.853)	-0.435 (3.816)	-0.257 (0.284)	-5.680 (11.766)	-0.257 (0.284)	9.893 (29.884)
College degree	-2.559 (1.584)	-6.128 (3.560)	-0.330 (0.272)	-7.033 (14.929)	-0.330 (0.272)	7.210 (37.918)
tx=10			-0.062 (0.184)		-0.062 (0.184)	
tx=15			-0.021 (0.184)		-0.021 (0.184)	
LRTI Occurrence	2.140* (1.005)	0.711 (1.647)		-13.476 (45.172)		41.326 (114.733)
Observations	69	69	68	68	68	68
Adjusted R <sup>2</sup>	0.149	0.091	-0.007	.	-0.007	.

***Economic status of caregivers in KidsAIR sample:***

The online survey also provided information on the economic status of caregivers in the KidsAIR study. Although the woodstove intervention has not yet demonstrated effects on child health, this is thought to be due to the size of the partial sample. As the interventions are rolled out to additional households, the precision of the treatment effects will increase. The online survey results provide information on the economic context of the study participants, which will aid in the interpretation of any health impacts that are observed in the full sample.

The results in Table 2a show that the majority of primary caregivers work at least part time, with over 40% stating that they work full time. Two-thirds of respondents are the main caregiver for their children in a typical week, but this increases to 80% when the child is sick (Tables 2b and 2c). This accords with the increase in days off work for respondents in households with an occurrence of LRTI in a child under 7. When the primary caregiver does not care for the sick child, it is typically the other parent who does so, which would increase the labor supply effects for the household as a whole.



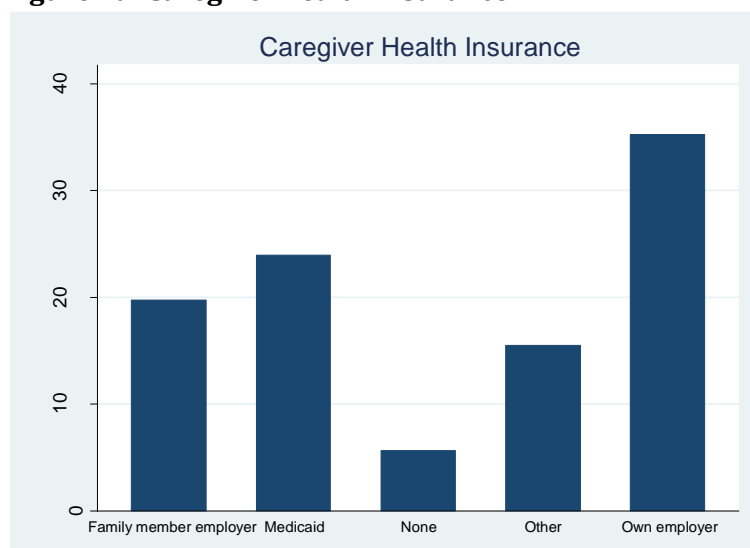
Table 2a: Work patterns of primary caregivers		
	Frequency	Percent
Full-time	30	42.25
Part-time	24	33.8
Not Working	17	23.94
Total	71	100

Table 2b: Primary Caregiver on regular basis		
	Frequency	Percent
Daycare	11	15.49
Grandparent	2	2.82
Other Parent	11	15.49
You	47	66.2
Total	71	100

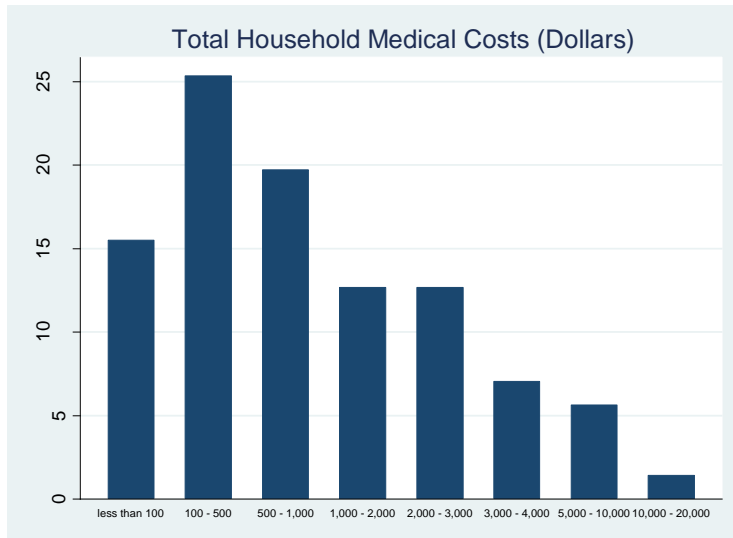
Table 2c: Primary Caregiver when Child is Sick		
	Frequency	Percent
Grandparent	1	1.41
Other Parent	13	18.31
You	57	80.28
Total	71	100

We also asked about health insurance and health costs. Most respondents stated that they had health insurance, both for themselves and their children. In about ¼ of cases, this was in the form of Medicaid coverage, and in most other cases the insurance was through the caregiver’s own employer or the employer of a family member. Out of pocket medical costs, for households as a whole and for young children vary widely from less than \$100 over the past year to many thousands of dollars. In most cases, annual out of pocket medical costs were a few hundred dollars.

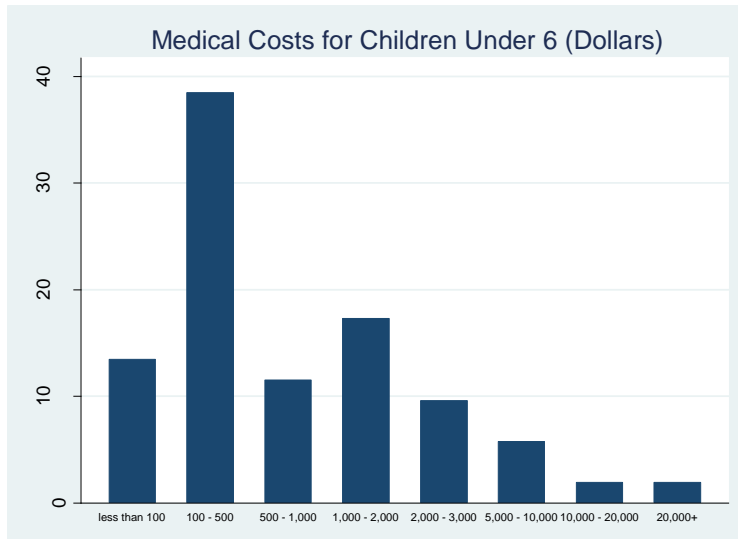
**Figure 2a: Caregiver health insurance**



**Figure 2b: Total Household Medical Costs**

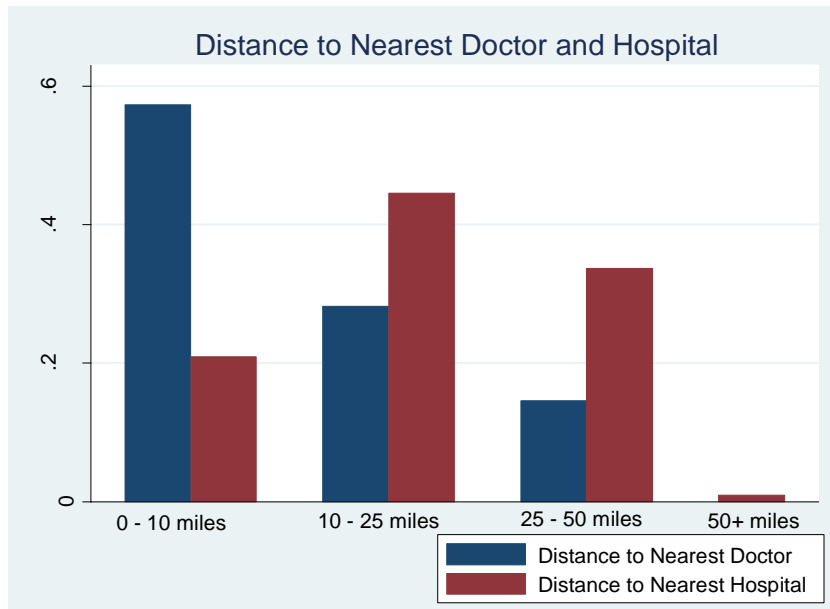


**Figure 2c: Medical costs for young children**



In addition to out of pocket expenditures, the other main cost of the health consequences of poor air quality is the time and cost to travel to the doctor or hospital. Many of the households in this study live in rural areas, which is reflected by the distance they must travel to receive healthcare. Almost half of the respondents live more than 10 miles from a doctor and over a third live more than 25 miles from the nearest hospital.

**Figure 3: Distance to health providers**



## 5. Next steps

This study explored the potential economic consequences of improving child health through air quality interventions. We did not find direct evidence of impacts of LRTI in children on caregiver labor supply, although there was positive correlation between incidences of LRTI and days taken off work to care for sick children.

As the sample size for the KidsAIR intervention increases, the data from the economic survey will help to inform interpretations of the impacts of observed changes in indoor air quality and any changes in child health. They provide an overall picture of who is most likely to be affected in addition to the child themselves. Data on insurance coverage and typical out of pocket medical costs, as well as on distance to doctors and hospitals, will provide context for discussion of the implications of changes in child health for household costs.

One objective of this study was to develop a pilot survey to inform future work on economic impacts of health interventions. The results have been used in a recent grant proposal for an NIH Center of Biomedical Research Excellence at the University of Montana. The funding for the proposed Center would support multiple research projects on preventative health interventions for children in rural Montana, along with an economic component which will involve working with the individual project Leads in interpreting the broader economic consequences of changes in child health, and in analyzing the behavioral responses to health interventions.

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