How do Households Respond to Health Information? Evidence from a Randomised Experiment in Malawi[1]

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Abstract

This paper investigates how households respond to the relaxation of one barrier constraining adoption of health practices – information - in a resource constrained setting. We do so by examining the effects of a randomised intervention in rural Malawi which provided mothers of very young infants with information on infant nutrition. We find that the intervention results in important increases in household food consumption, and in particular in the consumption of protein-rich foods by children which yields substantial increases in children's height. The increased household consumption appears to be funded by significant increments in adult labour supply, particularly for males.

Keywords: Infant Health, Health Information, Cluster Randomised Control Trial

JEL Codes: D10, I15, I18, O12, O15

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1. Introduction

Health outcomes in developing countries are generally very poor: life expectancy at birth is much lower in African countries than in Western Europe[6], and a substantial majority of the over 10 million children under the age of 5 that die every year live in developing countries. A majority of these deaths are a result of diseases and health complications which could be easily prevented and treated, including diarrhoea (which can be prevented by better infant feeding practices and treated using oral rehydration solution), and malaria (which can be prevented by sleeping under an insecticide treated net, ITN). Yet, adoption of these simple preventative and curative health practices and products has been relatively slow: for instance, in the context we study, Malawi, only 28% infants aged 4-5 months were exclusively breastfed[7] in 2004, while only 20% of all children under 5 slept under an ITN[8]. A number of factors have been identified to constrain the adoption of these behaviours including information, credit and liquidity constraints. Relaxing these constraints is hypothesised to improve adoption of these and thereby health outcomes, but may also affect other margins of household behaviour beyond health outcomes and practices. Social experiments have begun to shed light on the effects of the former, but as yet, not much evidence exists on the latter.

The objective of this paper is to understand how households respond to the relaxation of one constraint – information. In particular, we examine the effects of providing mothers with information on infant nutrition on different stages of households' optimisation problems. We do so by exploiting a randomised experiment in rural Malawi, which supplied nutrition related information to mothers of children aged less than 6 months. In selected randomly chosen clusters, local volunteers carried out home visits to provide advice on exclusive breastfeeding and post-breastfeeding nutrition to mothers. We consider the effects of this intervention on infant feeding practices, child health outcomes, household consumption and adult labour supply. The randomised experiment allows us to overcome problems of endogeneity in identifying the effects of health information on outcomes such as health and health behaviours, as unobserved factors (such as unobserved preferences) may drive an individual to obtain information and also take care of his health.

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[6] See the WHO Life Tables, accessible at
http://www.who.int/healthinfo/statistics/mortality_life_tables/en/index.html

[7] Exclusive breastfeeding means feeding the infant breast milk only.

[8] Source: Demographic and Health Survey 2004.

Our results suggest that households respond to the improved infant nutrition information by altering their infant feeding practices, including increasing the mix of foods given to children aged under 48 months. In particular, children were more likely to eat protein-rich foods, and children aged less than 6 months were less likely to be given water. Concurrently, we find an increase in household consumption, including increased consumption of protein-rich foods, and of fruits and vegetables. These changes in practices results in large improvements in child health: we detect drops in the incidence of diarrhoea and vomiting among children under 6 months, and an increase of 0.4 standard deviations of the WHO reference population in child height, among children aged 6-24 months. Further, we find that adult labour supply increases as a response to this information, probably funding the increased consumption.

Taken together, our results indicate that households act on improved nutrition related knowledge. The effect goes beyond households simply changing the input mix while keeping budget constant since overall food consumption also increased. This is consistent, for instance, with having learnt that certain expensive foods are more nutritious than households thought.

Our results are important for policy-makers: Malnutrition amongst children is very prevalent in developing countries. According to Onis *et al.* (2000) approximately one third of children below the age of five are stunted in growth. Moreover, not only does malnutrition and ill health in infanthood decrease welfare, but they are also associated with poor cognitive and educational performance (Behrman 1996, Strauss and Thomas 1998, Glewwe *et al.* 2001, Alderman *et al.* 2001, Maluccio *et al.* 2010) and low productivity later on in life (Strauss and Thomas 1998, Schultz 2005, Hoddinott *et al.* 2008).

This research contributes to the literature investigating barriers to the adoption of health products and practices. Jalan and Somanathan (2008) find that households respond to information that their drinking water is contaminated by adopting water purification services, Dupas (2011) shows that adolescent girls react to information on the relative risk of contracting HIV by type of partner by substituting to a relatively lower risk partner type. Kremer and Miguel (2007), conversely, find no effect on child behaviour of a health education campaign aimed at reducing intestinal worm infections. This research varies from this literature in two ways: first, we consider a relatively more complex behavioural change and second, we track the effects of the information at different stages of the household maximisation problem. We also contribute to the literature investigating the relationship between education and health (Thomas and Strauss (1997), Lleras-Muney 2005, McCrary and Royer 2011). After all, easier access of health related information by the more educated is one of the hypotheses through which education is said to affect health.

The rest of the paper is structured as follows. Section 2 provides some background on rural Malawi and describes the experimental design, section 3 describes our empirical model. Thereafter, we describe our data in section 4, before presenting the results in section 5. Section 6 concludes and describes some ongoing and future work.

2. Background and Intervention

2.1 The Setting

Malawi is one of the poorest countries in Sub-Saharan Africa and has very high rates of maternal mortality and infant mortality[9]. Exclusive breastfeeding is recommended for children under the age of 6 months, but is rarely practiced: according to the 2004 Malawi Demographic and Health survey, only 28% of infants aged 4-5 months are exclusively breastfed, and median exclusive breastfeeding duration stood at 2.5 months. Evidence from the medical literature suggests that the early introduction of complementary foods and feeding water (which is unlikely to be sterilised in rural environments) can lead to gastrointestinal infections and growth faltering (Haider et al 1996, Kalanda et al 2006). 11% of adults are estimated to be infected with HIV/AIDS[10]. 30-45% of children born to mothers with HIV will become infected with the virus either during gestation, during birth or through breast milk (Newell et al 2004). The Mai Mwana Project was set up as a research and development project in Mchinji District, in the Central region of Malawi in 2004 by paediatricians from Kamuzu Central Hospital and researchers from the Centre for International Health and Development, UCL, with the aim of designing effective and scalable interventions to improve health outcomes for mothers and infants. Mchinji District lies to the west of the capital, Lilongwe, and on the border with Zambia and Mozambique. Socio-economic conditions in Mchinji are comparable to or poorer than the average for Malawi (in parentheses in what follows), with literacy rates of just over 60% (64%), poor quality flooring materials used by 85% (78%) of households, piped water access for 10% (20%) of

[9] These stood at 984 per 100 000 and 76 per 1000 respectively in 2004 (Demographic and Health Survey 2004)
[10] Source: UNICEF. http://www.unicef.org/infobycountry/malawi_statistics.html

households, and electricity access for just 2% (7%) of households.[11] To achieve its aim, Mai Mwana has implemented an infant feeding counselling intervention in the district with the intention of assessing its effectiveness via a cluster randomised control trial.

2.2 The infant feeding counselling intervention

The goals of this intervention are to impart information related to infant feeding through training volunteers nominated by the local community. The trained volunteers identify pregnant women in their clusters and visit them 5 times in their homes – once before the birth of the child and 4 times after the birth. During the first visit, issues related to birth preparedness (including having ready sterilised equipment, and transport to a health centre) and HIV testing and counselling services are discussed. Women are also encouraged to give birth in a health facility, rather than at home. During subsequent visits after birth, the volunteer stresses the importance of exclusive breastfeeding (that is, feeding the infant breast-milk only) for the first 6 months of the infant's life and aids the woman in resolving any breast-feeding related issues. At the final visit, which takes place when the infant is 5 months old, advice is provided on post-breastfeeding nutrition for the infant, including suggestions on suitable nutritious locally available foods instructions on food preparation. There are 2 – 3 volunteer counsellors in each zone (which is a group of villages, described further below). The intervention is intensive: information is provided on a one-to-one basis, over a number of visits.

2.3 The Experimental Design

The experimental evaluation was designed as follows: Mchinji district was divided into 48 enumeration areas or zones, each containing a population of approximately 8,000 people. From this, a population of roughly 3000 people, living at the centre or close to the centre of each enumeration area, was selected from each zone to be part of the study area, leaving buffer regions between the study areas in adjacent zones. 12 of these zones were randomly selected to receive the infant feeding counselling intervention, while a further 12 serve as control zones[12][13]. Lewycka et al (2010) summarises the experimental design and provides more information on the intervention.

[11] Source: Malawi Population and Housing Census 2008.

[12] The rest of the 24 zones were randomly assigned to receive a participatory women's group intervention, in which reproductive age women were encouraged to form groups, which meet regularly to discuss issues related to pregnancy, child birth and neo-natal health, and strategies to overcome these problems. This intervention does not solely provide information: the groups are actively encouraged to think of strategies to overcome problems and to implement these. This may generate changes in economic outcomes through other channels, complicating

All women aged 10-49 years living in the study areas in 2004 were enrolled in the study. Women in this age range who later migrated into the study areas were also subsequently enrolled in the study. The intervention began in 2006. Further, as part of its research activities, Mai Mwana set up a demographic surveillance system, which identifies pregnant women, interviews them twice after they have given birth (when the child is 1 and 6 months old), and tracks any women and infants that died within a month of birth. This data is used for an impact evaluation of the interventions on maternal and infant mortality and morbidity outcomes. Further, this data can be linked with a large survey with detailed socio-economic information, generating a unique dataset with extensive information of health status at birth and socio-economic information.

3. Empirical Model

We now describe the empirical model we use to estimate household responses to improved health information. We exploit the randomised experiment described in section 2 to identify the effects of improved health information on various dimensions of household behaviour. Our basic model is as follows:

(1)

Where includes outcomes for individuals and households, i living in zone c at time t. Outcomes considered include measures of child health (including child anthropometrics and self-reported health measures), household consumption, labour supply and child nutrition; is a dummy variable which equals 1 if the individual/child's mother/household was living in 2005 in a zone that received the infant feeding intervention; are zone level control variables, such as whether there is a trading centre or tobacco estate in the zone. is a time dummy and is a Gaussian error term.

Note that the treatment indicators are defined based on location of residence of the sampled woman in 2005, before the start of the Mai Mwana interventions, meaning that the identified is an intent-to-treat parameter. It can be interpreted as the effect of information provided through the infant feeding intervention on the outcomes of interest. Equation (1) is

identification of how households respond to information. Further, the groups have a much broader focus than the infant feeding counselling intervention (Rosato et al (2006) and Rosato et al (2009) summarises some of the issues discussed in these groups). For these reasons, we focus solely on the infant feeding counselling intervention only in this paper.

[13] Mai Mwana Project also improved health facilities across the district and provided training to staff, which benefitted all zones.

estimated by OLS, and standard errors are clustered at the level of the zone, which corresponds to the geographic area at which the treatments were randomly allocated. However, some of our outcome measures are binary variables. For these variables, the model (1) is estimated using probit, with standard errors clustered at the level of the zone as above.

4. Data and Descriptive Statistics

The main source of data exploited in this paper is a 2-year survey conducted by the authors in collaboration with Mai Mwana. The surveys were conducted in 2008-09 and 2009-10, approximately 2.5 – 3.5 years after the start of the intervention. It was implemented on a random sample of women of child bearing age and their households across the treatment and control zones[14]. The sample was drawn from a census of women of childbearing age in the study areas, collected by Mai Mwana in 2004 (before the start of the intervention). The surveys collected a rich set of information on socio-economic outcomes including education, labour supply, self-reported health for all individuals residing in the household, and infant feeding practices for all infants; household consumption, assets, savings, transfers and loans; and health knowledge, information sources and family networks of the sampled woman for a sample of 1660 households in these zones[15]. We also measured the weights and heights of all children under the ages of 4 and 6 respectively and the heights of their mothers.

Data collection was conducted using Personal Digital Assistants (PDAs), which improved the accuracy of some of the data. The data is of good quality, and matches well with measures from the 2004 Demographic and Health Survey (DHS) for Malawi.

In addition to the household survey, we collected detailed information on market level food prices, with repeat visits to the same markets in different months to attenuate any seasonality effects. A further unique feature of our data is that it can be linked with data collected by Mai Mwana from its demographic surveillance system, providing us with information on the health status of mothers and their infants soon after birth and at 6 months after birth. This kind of information is usually not available for cross-sectional or panel surveys commonly used by economists to answer questions such as the ones we consider. Below, we first describe the households in our sample before the intervention was implemented, before considering the success of the randomisation, by assessing the sample balance of observed

[14] A woman is considered to be of child bearing age if she is of age 15 to 49 years.

[15] Data was also collected on a further 1600 households residing in zones with the women's group intervention.

variables. Finally, we discuss the outcome measures and describe the post-intervention socio-economic data.

4.1 Pre-Intervention Descriptive Statistics

In 2004, before the start of the interventions, Mai Mwana conducted a census of all women of child bearing age (defined as between 10-49 years of age) living in the study areas. Information on a small number of socio-economic characteristics such as education, asset holdings and housing conditions was collected. Table 1 describes some of the pre-intervention characteristics of the sample for whom follow up socio-economic data was collected in 2008-09.

Table 1: Baseline Descriptive Statistics

Variable	Mean	Std. Dev.
Woman's Characteristics		
Age (years)	25.281	8.65
Married (dv = 1)	0.644	0.479
Some Primary Schooling or Higher	0.702	0.458
Some Secondary Schooling or Higher	0.057	0.231
Chewa (dv=1)	0.933	0.25
Christian (dv=1)	0.983	0.131
Farmer (dv=1)	0.658	0.474
Student (dv=1)	0.215	0.411
Small Business/Rural Artisan (dv=1)	0.048	0.214
Household Characteristics		
Agricultural Household	0.996	0.06
Main Flooring Material: Dirt, sand or dung	0.903	0.296
Main roofing Material: Natural Material	0.855	0.352
HH Members Work on Own Agricultural Land	0.923	0.267
Piped water	0.025	0.157
Traditional pit toilet (dv = 1)	0.817	0.386
# of hh members	5.912	2.511
# of sleeping rooms	2.233	0.993
HH has electricity	0.004	0.065
HH has radio	0.648	0.478
HH has bicycle	0.516	0.5
HH has motorcycle	0.008	0.088
HH has car	0.005	0.073
HH has paraffin lamp	0.943	0.231
HH has oxcart	0.048	0.214
N	1660	

Notes to table: Source: 2004 Mai Mwana Census Data.

Households in the study area are mainly involved in agriculture, with 99% reporting having at least 1 household member involved in agriculture. Moreover, about 66% of women in our sample also report agricultural work to be their main activity. Women, who were chosen to be the main respondents in our survey were 25 years old on average (by construction), with 65% married. Over 70% had some primary schooling, but the proportion with any secondary schooling drops very sharply to 6%, demonstrating that this population is not very well educated. Households are very poor, as revealed by the poor housing materials and low household asset holdings, and have close to 6 household members on average.

4.2 Sample Balance

Next, we check for the success of the random allocation, by comparing the means of the available observable characteristics between the treatment and control zones. Table 2 below displays the mean for the control zones, the differences in means between the control and treatment zones and the p-value of the t-test of this difference for a number of socio-economic characteristics, including age, education and household characteristics of the woman. Reassuringly, the sample balance between the treatment and control zones is very good, with imbalance detected on only 1 variable.

Table 2: Sample Balance

	Control Group	Difference IF - Control	p-value
Woman's Characteristics			
Married (dv = 1)	0.661	-0.034	0.182
Some Primary Schooling or Higher	0.682	0.040	0.341
Some Secondary Schooling or Higher	0.060	-0.007	0.561
Age (years)	25.492	-0.429	0.367
Chewa	0.957	-0.050	0.239
Christian	0.979	0.008	0.287
Farmer	0.688	-0.060	0.138
Student	0.204	0.022	0.234
Small Business/Rural Artisan	0.037	0.024	0.224
Household Characteristics			
Agricultural household	0.995	0.002	0.539
Main Flooring Material: Dirt, sand or dung	0.916	-0.027	0.417
Main roofing Material: Natural Material	0.857	-0.004	0.919
HH Members Work on Own Agricultural Land	0.950	-0.056	0.087

Piped water	0.009	0.032	0.286
Traditional pit toilet (dv = 1)	0.791	0.054	0.194
# of hh members	5.848	0.132	0.698
# of sleeping rooms	2.152	0.166	0.114
HH has electricity	0.002	0.004	0.327
HH has radio	0.641	0.015	0.675
HH has bicycle	0.512	0.008	0.849
HH has motorcycle	0.007	0.002	0.770
HH has car	0.007	-0.003	0.310
HH has paraffin lamp	0.926	0.036	0.141
HH has oxcart	0.059	-0.022	0.068*
N	846	814	

Notes to Table: * indicates significant at the 10% level, ** indicates significant at the 5% level. Note that standard errors are clustered at the zone level when computing the p-values. The results of the t-tests are robust to the wild cluster bootstrap-t method recommended by Cameron et al (2007), which is shown to perform well when the number of clusters is less than 30.

4.3 Outcome Measures

Child Health

Our first measure of child health is child anthropometrics. Height and weight have been shown to be robust indicators of a child's growth and development. A child's height is correlated with outcomes later on in life, as shown by Maluccio et al (2011). Height for age is a measure of long term health status, while weight for age is an indicator of short term health.

The survey collected weight and height measurements for all children under the age of 4 and 6 respectively and of their mothers. From this data, we compute standardised z-scores using STATA macros supplied by the WHO. In addition to the z-scores, we obtain measures of height-for-age, weight-for-age and weight-for-height. In this paper, we focus on the health outcomes for children aged < 48 months, which is the cohort affected by the intervention.

The second measure of child health is a self-reported measure, elicited from the respondent in our survey (a woman of child bearing age). She was asked to report on the health of all children in the household over the 15 days prior to the survey. In particular, the survey asked whether the child had suffered from diarrhoea and vomiting over this period, among other questions. We investigate the effect of the interventions on these measures.

Consumption:

The survey contained an extensive consumption module, asking respondents to report at the household level the quantities consumed and purchased of, and the amount spent on over 25 different food items in the week preceding the survey. Information was also collected on expenditures on household items such as fuel and transport (over the past month) and clothing, health and education (over the past year). In addition to the household survey, data was collected on food prices, at multiple points during the survey period, from village markets and trading centres usually visited by the households in the study area. Collecting the information at multiple points helps alleviate concerns of seasonality. Further, in 2009-10, information was also collected on conversion units, which can be used to convert non-standard measurement units (such as a heap of tomatoes) into standard measurement units such as kilograms and litres.

The consumption aggregates were computed by aggregating the food expenditures and adding on the values of non-purchased food. We employed the following procedure to compute the value of food that was consumed but not purchased: First, the conversion units collected in 2009-10 were applied to convert quantities measured in non-standard units into standard units. Thereafter, we used median unitvalues (computed by dividing expenditure on a certain good by the quantity purchased, and taking the median at the zone and district levels) to value this non-purchased consumption[16]. All consumption values were converted into monthly values and aggregated to yield total household non-durable consumption. Finally, we divide total household non-durable consumption by family size to obtain per-capita consumption, the measure used in our analysis.

Child Nutrition

Detailed data was collected on foods and liquids consumed by children aged 4 years old and under during the 3 days prior to the survey for every child in the household. Information is available on the different types of foods consumed by each child, including meat, fish, eggs, beans, porridge (which is commonly made from maize flour), nsima (a thick paste made from maize flour which is a staple food in Malawi)[17], fruit and vegetables, milk and water.

Our measures of child nutrition are constructed as follows. For each food, we create a dummy variable that equals 1 if it is consumed by the child and is zero otherwise. Aggregation of foods is done by simply summing up the dummy variables for the different foods, for

[16] We also valued consumption using the market prices rather than the median unitvalues. This is not our preferred method, since most households rarely purchase the foods they commonly consume from the markets. Reassuringly, though, valuing consumption by either method yields a food consumption share of total non-durable consumption of 0.86.

[17] However, nsima does not contain all the nutrients required by infants and can also be difficult for them to digest. Mai Mwana, therefore recommends weaning infants with porridge rather than nsima.

example, we compute a measure for proteins consumed by summing up dummy variables indicating whether a child consumed meat, eggs, fish and beans. The measure for proteins therefore takes a value of 4 if all of the four foods are consumed, 3 if only 3 of them are consumed and so on.

Labour Supply

The survey also collected detailed information on the activities and labour supply of all household members aged 6 and above. Our measures of labour supply are computed from the responses to a series of questions on employment and household activities in our survey. We focus on three main measures: first, whether or not an individual works for pay; second, whether or not an individual has a secondary income-generating activity and third, total hours worked in a week. The latter is computed from responses on the number of days worked in the week preceding the survey, and the number of hours worked per day. For those not working, this measure is set to zero. The first two measures relate to the extensive margin, where the third measure relates to the intensive margin. Our focus in this paper is on understanding adjustments made by households on the adult labour supply margin. To this end, we report the adjustment of the labour supply of the head, spouse, mothers, fathers and male and female adults in general.

Table 3 below provides some descriptive statistics, pooled for both waves, for our outcome variables for the households in our data living in control zones in 2004.

The descriptive statistics for child height and weight z-scores suggest that children in these communities are indeed lagging behind in terms of their development. The average height-for-age z-score for this sample is -2.13 standard deviations less than the average for the WHO reference population. 93% of children aged less than 2 years are breastfed in the control communities, with 83% also fed water, suggesting that exclusive breastfeeding rates for children aged less than 6 months are likely very low.

Looking at the labour supply measures, we can see that over 80% of adults (defined to be those aged 15 and over) work, with little difference between male and females. However, the proportion with a secondary income generating activity drops substantially to around 10%, suggesting that this may be a relevant margin on which labour supply adjusts. Adults work on average 24 hours a week, though this is likely masking seasonal variations.

Table 3: Descriptive Statistics for the Outcome Variables

	N	Mean	Std Dev
Child Anthropometrics[a]			
Height for Age z-score	1898	-2.13	1.51
Weight for Age z-score	1799	-0.86	1.35
Weight for Height z-score	1501	0.62	1.33
Child Health[b]			
Diarrhoea (yes = 1)	4616	0.11	0.31
Vomit (yes = 1)	4617	0.16	0.37
Consumption			
Monthly Food Consumption (MK)	1623	9101.88	7078.54
Monthly Health Expenses (MK)	1595	85.65	143.51
Monthly Total Nondurable Consumption (MK)	1623	10937.19	8085.88
Monthly cereals consumption (MK)	1623	734.20	475.22
Monthly meat consumption (MK)	1623	343.30	616.25
Monthly vegetable consumption (MK)	1623	804.39	1224.86
Monthly Other Food Consumption (MK)	1623	174.70	249.25
Monthly Pulses Consumption (MK)	1622	67.08	126.56
Child Nutrition[b]			
Breastfed[c] (yes = 1)	665	0.93	0.25
Water [c](yes = 1)	637	0.83	0.37
Milk other than Maternal Milk[c,d] (yes = 1)	311	0.18	0.38
Number of foods[d] (yes = 1)	1168	4.89	2.07
Proteins[d] (out of 4)	1172	1.13	1.14
Fruit and Veg[d] (out of 2)	1171	1.60	0.63
Groundnuts[d]	1173	0.52	0.50
Nsima[d]	1177	0.89	0.31
Porridge[d]	1176	0.75	0.43
Labour Supply			
Work (Males, yes = 1)	2150	0.82	0.39
Work (Female, yes=1)	2344	0.84	0.37
Work in Secondary Job (Male; yes=1)	2149	0.12	0.32
Work in Secondary Job (Female; yes=1)	2344	0.10	0.30
Hours worked (Males, yes=1)	1952	24.621527	20.34555
Hours worked (Females, yes=1)	2142	23.59	17.59

Notes to Table: Data pooled for both rounds of collection, and is for households living in the control zones only. [a]For children aged < 48 months; [b]For children aged <48 months; [c]For children aged <24 months; [d]Asked in wave 2 only

5. Results

Child Health

Table 4 displays results for the effects of improved health information as provided through the intervention on some objective measures of child health and development: child anthropometrics. We estimate the effects of the intervention, by estimating equation (1) using OLS on height for age, weight for age and weight for height separately for children under the age of 6 months, children aged 6-24 months and those aged between 24-28 months. The infant feeding counselling intervention results in an increase of almost 0.4 standard deviations on average in the height-for-age for children aged 6-24 months. This increase is large and corresponds to 40% of a standard deviation of the WHO reference population. Though large, this is in line with estimates found across a range of studies as summarised by Bhutta et al (2008). The intervention also has a positive but insignificant increase in the height for age for children in the other age groups. We do not detect any significant changes in the weight-for-age, which can be considered to be a measure of short run health, for any of the age groups. Finally, we detect drops in weight-for-height, though these are not surprising given that child weight has been maintained, but height has increased as a result of the intervention.

In a separate evaluation, Mai Mwana detected a 25% drop in infant mortality as a result of the intervention[18]. This means that the results reported below are a lower bound on the actual effects of the intervention on child height and weight, if we assume that healthier children are more likely to survive.

Table 4: Effect on Child Anthropometrics

	Height For Age			**Weight for Age**			**Weight for Height**		
VARIABLES	**<6 months**	**6-24 months**	**24-48 months**	**<6 months**	**6-24 months**	**24-48 months**	**<6 months**	**6-24 months**	**24-48 months**
Infant Feeding (IF^c)	0.0905	0.390***	0.125	-0.168	-0.0252	-0.0059	-0.425	-0.333**	-0.069
	[0.272]	[0.137]	[0.125]	[0.177]	[0.0965]	[0.114]	[0.379]	[0.126]	[0.116]
Observations	290	909	1,166	290	909	1,166	290	909	1,166
N	0.066	0.106	0.031	0.053	0.054	0.042	0.082	0.049	0.014

Notes to Table: ** significant at the 1% level, * significant at the 5% level, + significant at the 10% level. All standard errors are clustered at the zone level. Additional controls include child age, age squared, child gender, dummies for year-month combinations, a dummy for Mchinji Social Cash

[18] See http://www.maimwana.malawi.net/MaiMwana/Infant_care.html

Transfer Programme, median distance at the cluster level to the nearest trading centre, education of main respondent and household wealth at baseline.

We next consider the effects of the intervention on self-reported measures of child morbidity. Indeed, one possible channel through which the improved health information generated by the infant feeding intervention increases child height could be by reducing child illnesses such as diarrhoea. We test whether this is the case by estimating equation (1) with binary measures of whether a child had suffered diarrhoea and vomiting as the dependent variable. Given that the measures are binary, we estimate equation (1) using a probit model, and report the marginal effects in Table 5 below

Table 5: Marginal Effects on Self-Reported Health Measures

	Diarrhoea			**Vomiting**		
VARIABLES	**< 6 months**	**6-24 months**	**24-48 months**	**< 6 months**	**6-24 months**	**24-48 months**
Infant Feeding (IF^c)	-0.0512*	0.0182	0.00038	-0.0646*	-0.00643	-0.018
	[0.0305]	[0.0434]	[0.0365]	[0.0369]	[0.0547]	[0.0384]
Observations	359	1,006	1,337	359	1,008	1,340

Notes to Table: *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. All standard errors are clustered at the zone level. Note that all regressions include month-year dummies, and controls for distance to the nearest trading centre, education of the main respondent and household wealth at baseline.

The results show a drop in the probability of diarrhoea and vomiting among children aged less than 6 months, which corresponds to the period of exclusive breastfeeding.

Household Consumption and Child Nutrition

We now turn to the results for consumption. We first test for the effects of improved information on household food consumption and total household non-durable consumption. Further, we check whether there is any change in the composition of the foods consumed by the household. The infant feeding volunteer counsellors encourage including foods such as vegetables, pulses and fish, which were usually not included before, in the meals fed to infants over 6 months of age. We therefore check whether the interventions result in changes in the amounts consumed of different types of foods, including cereals, meat and fish, pulses (which include beans), vegetables and fruits and other foods.

Table 7 displays the results for all these consumption measures. The panel on the left does so for food consumption, total consumption and health expenditures, while that on the right displays results for the various food categories. All results are for per-capita monthly values in Malawi Kwacha.

Table 7: Effects of the Interventions on Household Consumption

	Per Capita Monthly Food Consumption for:							
	Food	**Total Non-durable**	**Health**	**Cereals**	**Meat and Fish**	**Fruit and Vegetables**	**Pulses**	**Other Foods**
Infant Feeding (IF^c)	415.379***	509.846***	6.045*	0.978	16.480*	52.281**	9.410***	17.897***
	[145.344]	[166.636]	[2.959]	[10.990]	[9.505]	[22.965]	[2.885]	[6.260]
N	3208	3208	3199	3210	3210	3209.	3206	3210
R-squared	0.05	0.05	0.01	0.11	0.01	0.16	0.09	0.02

Notes to Table: *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. All standard errors are clustered at the zone level. All coefficient values are in Malawi Kwacha. Note that all regressions include dummies for month of interview and controls for the Mchinji Social Cash Transfer Programme, a conditional cash transfer programme which was being piloted in parts of the district from 2006 onwards, distance to the closest trading centre, baseline household wealth and education of the main respondent.

From the table, we can see that the infant feeding counselling intervention results in sizeable positive increases in per-capita monthly food consumption, non-durable consumption and modest positive increases in expenditures on health. When we disaggregate food consumption into food categories, we see that households increased their consumption on all foods other than cereals, which include the staple foods of maize and rice. These increases are statistically significant from zero, and remain so (other than for meat and fish) when we compute t-statistics using the wild cluster bootstrap-t procedure which has been shown to perform well in samples with less than 30 clusters. Overall, these results suggest that households react to the provided information by increasing consumption, particularly of non-staple foods.

We next test for the response of households to this new information on child feeding practices. The volunteer counsellors encouraged exclusive breastfeeding of infants under the age of 6 months. They further recommended the inclusion of protein-rich foods and of vegetables in the diet of infants aged 6 months and above. To investigate this, we first estimate the effects of the treatment on the probability of children less than 6 months and those aged 6 - 24 months being fed liquids other than breast milk[19]. Thereafter, we investigate the effects of the intervention on the intake of solid foods for children aged less than 48 months. The results are reported in Tables 8 and 9 respectively.

Table 8: Effects on Intake of Liquids for Children <24 months

	Water		**Milk other than maternal[a]**	
VARIABLES	**< 6 months**	**6-24 months**	**< 6 months**	**6-24 months**
Infant Feeding (IF[c])	-0.130**	0.0116	-0.0654	-0.0444
	[0.0653]	[0.0146]	[0.0447]	[0.0416]
Observations	346	919	150	510

Notes to Table: ** significant at the 1% level, * significant at the 5% level, + significant at the 10% level. All standard errors are clustered at the zone level. Note that all regressions include controls for month of interview, household wealth at baseline, education of main respondent, distance to nearest trading centre and controls for the Mchinji Social Cash Transfer Programme, a conditional cash transfer programme which was being piloted in parts of the district from 2006 onwards. Probit marginal effects reported.
[a] available only for wave 2.

Table 8 above reports the effects of the intervention on the consumption of other liquids by children under the age of 2 years. Consistent with the advice provided by the counsellors, we observe a drop of 13 percentage points in the probability that an infant aged less than 6 months is fed water. Further, there is a negative, but insignificant effect on the consumption of milk other than maternal milk among this cohort of children. For older children aged between 6-24 months, we do not detect any effects on their intake liquids, which is as expected from the advice provided.

Table 9 and 10 report the results for the intake of solid foods by children aged 48 months and under. Table 9 reports effects on the number of different types of foods consumed by children, while Table 10 reports probit marginal effects on the probability that these foods are consumed. We find a large increase in the number of foods consumed by children, and consistent with the results for consumption, we observe an increase in the number of protein foods consumed, and in the probability that they are consumed at all. We also observe an increase in the probability of consuming nsima (a maize paste which is a staple food) and porridge in these zones. Interestingly, the probability of consuming of porridge, which is

[19] Note that breastfeeding of children aged less than 2 years is almost universal in this environment, but exclusive breastfeeding of children under 6 months of age is much less widespread.

recommended as a food that children aged 6-24 months should be given, increases more than that of nsima, which is less nutritious and harder to digest for young children.

Table 9: Effects on Food Intake of Children Aged < 48 Months: Numbers

	Number of foods	**Meat, Fish, Egg, Beans**	**Fruit & Veg**	**Staples**
Infant Feeding (IF^c)	0.491**	0.292**	0.037	0.136**
	[0.215]	[0.137]	[0.0586]	[0.0512]
N	1,332	1,336	1,339	1,340
R-squared	0.454	0.157	0.516	0.417

Notes to Table: ** significant at the 1% level, * significant at the 5% level, + significant at the 10% level. All standard errors are clustered at the zone level. Note that all regressions include a time dummy and controls for the Mchinji Social Cash Transfer Programme, a conditional cash transfer programme which was being piloted in parts of the district from 2006 onwards.

Table 10: Effects on the probability that children aged <48 months take particular types of food

	Meat, Fish, Egg, Beans	**Fruit & Veg**	**Groundnuts**	**Nsima**	**Porridge**
Infant Feeding (IF^c)	0.113*	-0.00625	0.0267	0.0331**	0.0907*
	[0.0633]	[0.0165]	[0.0601]	[0.0160]	[0.0539]
N	1,336	1,342	1,339	1,343	1,340

Notes to Table: ** significant at the 1% level, * significant at the 5% level, + significant at the 10% level. All standard errors are clustered at the zone level. Note that all regressions include a time dummy and controls for the Mchinji Social Cash Transfer Programme, a conditional cash transfer programme which was being piloted in parts of the district from 2006 onwards.

Labour Supply

From above, we have seen that the intervention results in an improvement in child height, which is driven by households responding to this information by increasing household food consumption and the mix of foods fed to these children. Another margin on which households could be adjusting to this information is labour supply. On one hand, households may increase their total labour supply to fund the consumption of nutritious, but more expensive foods. At the same time, though, the intervention may result in mothers spending more time on food preparation, and thereby reduce their labour supply. We investigate the effects on adult labour supply, on both the intensive and extensive margins separately for males and females, and for mothers and fathers of children aged under 15. Table 11 below reports these results.

Table 11: Adult Labour Supply

	Works	Has at least 2 jobs	Weekly Hours Worked	Works	Has at least 2 jobs	Weekly Hours Worked
		Male Adults			**Female Adults**	
Infant Feeding (IF^c)	0.053	0.064**	3.56*	-0.027	0.033*	-0.68
	[0.037]	[0.026]	[1.90]	[0.042]	[0.019]	[2.10]
N	3,973	3,964	3,659	4,473	4,470	4,158
R-squared	0.34	0.089	0.22	0.32	0.077	0.19
		Fathers			**Mothers**	
Infant Feeding (IF^c)	0.055*	0.084***	4.88*	-0.042	0.04*	-0.94
	[0.03]	[0.03]	[2.51]	[0.03]	[0.02]	[2.36]
N	2,370	2,367	2,165	3,010	3,022	2,797
R-squared	0.44	0.0415	0.09	0.31	0.05	0.11

Notes to Table: *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. All standard errors are clustered at the zone level. Note that all regressions include a time dummy and controls for the Mchinji Social Cash Transfer Programme, a conditional cash transfer programme which was being piloted in parts of the district from 2006 onwards, for individual level education, marital status, age and a quadratic in age, and whether there is a trading centre or tobacco estate in the zone. Columns 1, 2, 5 and 6 report marginal effects from Probit regressions.

The results show that male adults and particularly fathers increase their labour supply, on both the intensive and extensive margins. They are 5 percentage points more likely to be working and over 6 percentage points more likely to have a second job. On the intensive margin, they work, on average, an additional 4 hours. Women are more likely to take on a second job, though the increase is much lower than that for men, but there is no change on the intensive margin.

6. Conclusion and Future Work

In this paper, we investigate how households respond to health information. To do this, we exploit a randomised experiment in rural Malawi, where households in randomly selected groups of villages (called zones in this paper) received information and advice on issues related to birth and infant feeding from volunteer counsellors trained by a Malawian NGO, Mai Mwana.

We find that the intervention improves child health. In particular, we detect an increase of 40% of a standard deviation of the WHO reference population in child height for age for children aged 6-24 months. This age corresponds with the period after the last visit of the volunteer counsellor to the child's household. We also detect reductions in morbidity as measured by diarrhoea and vomiting among children aged less than 6 months, who were targeted by the intervention. We attribute these health improvements to changes in infant feeding practices: children aged less than 6 months are less likely to be given water, and children under 48 months of age are more likely to be given protein-rich foods. Further, we find that households also increase consumption in response to the intervention, with these increases in consumption funded by an increase in labour supply on both the extensive and intensive margins for males and on the extensive margin for females.

Overall, our results show that households act on improved nutrition related information. The effect goes beyond changing the input mix while keeping budget constant, as overall food consumption also increased. This is consistent, for instance, with having learnt that certain expensive foods are more nutritious than households thought. Ongoing and future work will investigate for heterogeneities in responses to the information by, for instance, education of the head of the household, and household wealth.

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