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Security, Trust, and Child Health in Kyrgyzstan, 2010-2012.

The effects of distrust and household shocks on health outcomes of children in Kyrgyzstan.

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Introduction

The Kyrgyz Republic is an impoverished, largely rural nation in Central Asia. A former Soviet Republic, Kyrgyzstan experienced a challenging reform from a controlled to a market-based economy following the fall of the USSR in 1991. The first President of Kyrgyzstan, Askar Akayev, was President of the country for 15 years, from 1990 to 2005 until political controversy and corruption surrounded his 2005 election. He and his administration were overthrown in the Tulip Revolution and replaced by the opposition figure, Kurmanbek Bakiyev, and his supporters. Bakiyev's regime was accused of corruption during his tenure which was stained by assassinations of high profile figures including members of parliament (BBC News, 2006).

Kyrgyzstan's energy supply disruptions and severe price hikes after 2005 ultimately turned the public against Bakiyev. Russian support for his administration waned, and the Russian state media vilified the leader with accusations that he and his family stole millions of soms from the Kyrgyz people (Pan 2010). Civil unrest ensued; clashes between pro-Bakiyev and opposition forces resulted in the deaths of hundreds of protestors; several thousand were injured, and hundreds of thousands were displaced (UNDP 2016). The instability is one reason we expect to see differences in child health outcomes in the country following the revolution. I expect that children were in worse health if they lived in the more violent regions of Kyrgyzstan (Bishkek and Batken) or if they were Uzbek because that ethnicity was targeted by the titular ethnic group, Kyrgyz, in some areas of the country. The country is still recovering from the resulting political and economic instability. The continuing lack of trust in public institutions likely affects the level of trust in social institutions as well, which in the long run can affect the well-being of children. A study of Tajikistan's civil war showed that children, especially girls, achieved a lower level of education on average if they were directly exposed to the violence of war (Shemyakina 2011).

Kyrgyzstan is a relatively well-studied Central Asian nation; the government allowed international observers to monitor recent elections and collect survey data at the household and community levels. The Kyrgyz Republic has a growing economy that lags behind some of the other countries in the region, but the country improved on many measures of health, equity, and human development since independence (UNDP 2016). The World Bank reports that one of the areas of concern in the Kyrgyz Republic is early childhood development (World Bank 2013). The stunting rate for children below 5 was 18% in 2010, and I measure an even higher rate for the 2010-2012 period (Tables 5-7). Reports on the progress of the Kyrgyz Republic towards the Millennium Development Goals emphasize the importance of vaccinations for child health. These reports also explain that a lack of specialized staff for pre-natal and post-natal services is related to high levels of under-five child mortality (UNDP 2010). In 2010 under-five mortality

was 31 per 1,000 live births, which lowered to 27 in 2012 (UNICEF 2012). This puts Kyrgyzstan in the same category as North Korea, the Philippines, and Mongolia; the United States experienced 7 deaths per 1,000 live births in those same years (UNDP 2013). One study compared diphtheria, pertussis, and tetanus (DPT) and meningococcal (MPV) vaccination rates in Kyrgyzstan in 1997 and 2012; they found that there was a slight increase in vaccination coverage, but rates were already over 90% in 1997 (Schweitzer et al. 2015).

The Kyrgyz Republic's health system evolved since its independence from the USSR; disruptions in the supply of drugs and transformation from a state-run to a mixed public and private system drastically changed the provision of quality healthcare (Rechel et al. 2011). Health expenditures accounted for 6.6% of state GDP in 2008, which is one percentage point higher than the Commonwealth of Independent State (CIS) average but over three percentage points lower than the EU15 countries (Rechel et al. 2011). The revolution of 2010 caused severe disruptions in access to health services, which included late-admissions to hospitals and pre-term deliveries (Rechel et al. 2011). The co-payment system evolved and now includes exemptions based on income-level. However, the proportion of people providing informal payments or gifts to doctors and staff ranges from 5% to 18% depending on medical specialty (Falkingham, Akkazieva, and Baschieri 2010). The increased informal costs for health services could affect a hospital's reputation and force lower income families to forego healthcare.

My research explores the determinants of child health, malnutrition, and receipt of vaccinations in the Kyrgyz Republic after the 2010 revolution. My goal is to better understand which community and family variables impact health outcomes of children following the serious political and ethnic disruptions in 2010. I focus my study on the health of young children in two-parent households and compare the health of boys and girls during this period. Genetic characteristics are primary determinants (up to 90%) of a child's height, weight, and arm circumference; I cannot measure directly the impact of genetics on health, but I look at how family and community environmental differences affect child health and vaccinations (Chatterjee, Das, and Chatterjee 1999).

Previous Empirical Literature

Social capital and social organization can facilitate community cooperation such as "interpersonal trust between citizens, norms of reciprocity, and density of civic associations…" (Page 1187, Kawachi et al., 1999). Trust is essential for a functioning society. At the individual level, social capital can be approximated by consolidating opinions of how individuals view the rest of their community and how much they trust each other (Kawachi, Subramanian, and Kim

2008). An individual's trust in healthcare providers is connected with receiving good care that results in enhanced health outcomes (H. J. Chen and Boothroyd 2006). Effective healthcare providers are critical to the maintenance of and improvement in health. Healthcare providers must have good relationships with their patients in order to provide effective care. Lack of patient trust in health care institutions can emerge because of inadequate healthcare facilities, lack of qualified healthcare workers, or feelings of mistreatment due to socioeconomic status or ethnicity (Sheppard, Zambrana, and O'Malley 2004). A lack of social trust increases the perceived risks and reduces the perceived benefits from health services (Siegrist et al. 2002). This could manifest in parents choosing not to find health services for children for certain illnesses or diseases.

Individual, family, household, and community characteristics shape child health outcomes; social capital and organization constitute the foundation of society and promote either social cohesion or division (Chen 2004). Early childhood is a critical time for the development of personality and behavior. This development is largely influenced by the stability of the household and community. A more recent area of inquiry focuses on the impact of stress, psychological distress, and personality on health behaviors and outcomes (Chen and Tsu 2004). Given a child's complex health needs, parents must rely on healthcare providers to enhance child health (Chen and Boothroyd 2006). Without societal networks to support psychological and physical wellbeing, children are especially vulnerable. Physical and psychological health problems early in life are associated with long-term health concerns (Currie 2010).

Socioeconomic status (SES) is an important determinant of health outcomes; SES is affected by education, financial resources, social rank, ethnicity, and diversity. The relationship between SES and health is documented in considerable research on child and adult health (Cutler, Lleras-Muney, and Vogl 2008). The relationship between income and child health outcomes can also be explained by differences in the home environment (Berger, Paxson, and Waldfogel 2009). Children in wealthier households tend to have better health. The choices that parents make for income and home environment can lead to differences in child health, and parental choices for a good home environment affect child health significantly. In fact, all the factors that parents consider when providing health services to their children and reinforcing positive or negative health behaviors can affect a child's ultimate health outcome.

Aladysheva and Brück (2015) conducted a similar study on child health outcomes in Kyrgyzstan for 2010-2013. The focus of the study was to look at the association of women's power and child health. They expected that females would fare worse than males due to nutritional differences. Due to the differences in expected income for boys and girls, there can be a nutritional

distribution by gender, thus leading to lower outcomes for girls (Rosenzweig and Schultz 1982). The sample for the Aladysheva and Brück study differs from mine because they use parental height and employment data. Their results showed that older children do better in Weight-for-Height but that Height-for-Age gets worse for older children. Only the mother's age mattered for girls, while no parent characteristic significantly affected Weight-for-Height or Height-for-Age for boys. Their women's empowerment index was significant at a 10% level for Height-for-Age for girls, but it had no effect on Height-for-Age for boys or on Weight-for-Height.

Given this previous work in the field, my goal is to better understand how characteristics of the child's home environment and availability of healthcare influenced child health in Krygyzstan following the 2010 revolution. The role of health services depends greatly on the household's ability to pay, as shown by Falkingham et al. (2013). The revolution and resulting shocks to society provide a unique opportunity to see how violence affects child health outcomes in a lower middle-income country in Central Asia.

Model

The determinants of an individual's health are examined through Grossman's model of the demand for health (Grossman 1972). An individual invests in health; the health commodity depreciates over time for all investors, and at some point in time the depreciation leads to death. The individual investor chooses inputs into the production of own health such as nutrition, housing, and healthcare. As one ages, the costs of health maintenance increase. Health is jointly determined by these inputs, and previous health and is constrained by heredity, education, and environmental conditions.

This investment approach to health can be used to evaluate the determinants of child health (Grossman 1999). In this case, parents make decisions on how many health inputs to purchase for each child given household income, market prices, and information and technology. Parents consider their child's health as both investment and consumption goods. Child health enters into parents' utility; an increase in SES and a decrease in the price of health care are predicted to increase the parents' demand for their child's health. Child health is a major determinant of the child's future income and also influences the ability of the child to work at home or in the labor market. The higher the income of the child today and in the future, the higher will be the return on the parents' investment in child health. The child health decisions of parents are also constrained by the education of parents, heredity, and community characteristics which include social cohesion, social capital, and access to health services.

A strong indicator of child health outcomes in developing countries is immunization strategy. Vaccinations are not effective against all childhood illnesses, but millions of lives are saved each year because children are vaccinated against diseases such as measles, polio, smallpox, and various bacterial infections. The demand for children's vaccinations is derived from the Grossman model of health because vaccines improve a child's health. High demand for vaccinations is not only a function of access; the choice to vaccinate a child is made by parents who evaluate the benefits relative to the costs of vaccinating their children. The benefits of preventing or reducing the severity of a disease for a child are weighed against the opportunity cost and material cost of traveling to the vaccination center and any associated fees for the vaccinations. The perceived benefits from vaccinations depend on trust in health institutions (Chen 2015). Parents' trust in healthcare providers and the community to facilitate healthcare access plays a role in their choice to vaccinate their children (Holte, Mæstad, and Jani 2012).

The empirical model of child health, based on the consumption and investment models of health, is given in (1) below:

$$y_{it} = \alpha + \beta x_{i,t} + \gamma x_{i,parents,t} + \delta x_{i,household,t} + \zeta x_{i,community,t} + \varepsilon_{i,t} \quad (1)$$

where:
i = child 1, … , n
t = 2010, 2011, 2012.

$x_{i,t}$ is child demographic characteristics; $x_{i,parents}$ are parental demographic and trust level characteristics; $x_{i,household}$ is household shocks and ethnicity; and $x_{i,community}$ is a set of community characteristics including access to health care and community shocks.

Data

The data for this project are from the Life in Kyrgyzstan Surveys (LIK). Data at the individual, household, and community levels were collected from random samples of households in 2010 through 2013. Table 1 summarizes the number of observations by survey type and year. The resurvey rate was high, 86.1% of households surveyed in 2010 also have data in 2013.

Table 1. Observations for each type of survey.

Number of Observations in the LIK			
	Individual	Household	Community
2010	8160	3000	120
2011	8089	2863	120
2012	8177	2816	120
2013	7675	2584	111

Basic household information includes income from all sources, expenditures by category, migration and remittances, proximity of healthcare services, and background information on children in the household. Individual demographic, work, health, education, and family data are available; a work history back to 1989 is a unique component of the labor market survey. Community data include information on community level shocks (weather or political unrest, for example), socioeconomic status (SES), migration, and availability of a wide variety of services and institutions. A unique feature of the LIK is that it is the only survey data for a Central Asian country that includes detailed information on personality characteristics (2012, 2013), shocks experienced by the household (economic, personal, weather/energy, political), household involvement with community institutions, individual trust towards others, and attitudes about the roles of women (2012, 2013). Many of these questions are important for my study of how social capital, community shocks, and parental trust impact child health outcomes. This dataset is a panel survey; households and individuals were resurveyed if they could be matched, and new household members were added over time. My measures of the child health and explanatory variables are defined in Tables 2 and 3.

Table 2. Child health outcome variables.

Measures of Child Health	Description
Stunting (0 or 1 variable)	This is a long-term issue worldwide issue affecting approximately 165 million children under five (Black et al. 2013). Stunting is defined to be a Height-for-Age two standard deviations below the WHO Median Growth Standards median (WHO 2010). Long-term nutritional deficiencies lead to stunting which has significant effects for the rest of the individual's lifetime.
Wasting (0 or 1 variable)	Wasting is a sign of acute undernutrition which could be the result of an infectious disease. Wasting can lead to a depressed immune system and increased risk of death. Anyone with a Weight-for-Height z-score less than two standard deviations below the WHO Median Growth Standards median is considered wasted (World Health Organization 2010).

Underweight (0 or 1 variable)	Underweight is defined to be two standard deviations below the WHO Median Growth Standards. Childhood mortality rates increase for mildly underweight children, and the risk increases for more severe underweight cases (World Health Organization 2010).
Vaccinations (0 or 1 variable) 1= Received all recommended vaccines, 0= otherwise	Vaccinations proxy for child health services because participation in the vitamin A dose, TB vaccine, and Polio vaccine all result in improved child health outcomes. A recent study on the BCG vaccine against tuberculosis finds that there are non-specific effects that benefit the child in addition to the protective effects against the disease (Berendsen et al. 2016).
Z-scores based on height, weight, and arm circumference: Weight-for-Height, BMI-for-Age, Weight-for-Age, Height-for-Age, and Arm-Circumference-for-Age.	Deviations from Weight-for-Age are likely due to a short-term shock in food supply, which potentially has long-term consequences on child health. Deviations from Height-for-Age could be due to malnutrition, which has a negative long-term impact on health. While genetics plays a primary role in the outcome of these measures, environmental factors have 5-10% effect on weight and height of children (Dubois et al. 2012).

Table 3: Explanatory Variables.

Explanatory Variables	Definition of Variable	Expected Effect on Child Health Outcomes
Child Age	Child's age in months at the time of survey.	Younger children in 2010 are more likely to be affected negatively by the recent revolution than older children. The probability of vaccination increases with age for all children.
Gender	Dummy variable where male=1.	Gender could play a role in a child's access to education and other social services.
Ethnicity	There are 4 ethnicity categories: Kyrgyz, Russian, Uzbek, and other. The "other" category encompasses any other ethnicity in the data.	There could be inequality in health outcomes based on ethnicity.
Personal Shocks	Dummy variable =1 if the household experienced a personal shock including death or illness of HH member or close relative, or a divorce over the last year.	Personal shocks in the family could affect the cost-benefit analysis of the use of health inputs for children. A negative shock lowers household welfare and may reduce child health and vaccinations.
Economic Shocks	Dummy variable = 1 if the household experienced an economic shock over the last year.	Decreased income from an economic shock could reduce the use of health services due to high informal payments required in Kyrgyzstan.
Proximity to Hospital	Distance from the household to the nearest hospital in kilometers.	Hospitals in a community improve health outcomes due to increased access to services.
Region	Regions considered were urban/rural Mountain (Talas, Naryn, Issuk-kul oblasts), South (Batken, Jalal-Abad, Osh oblasts), and Chui oblast and Bishkek (capital city) in the North. Osh City and Bishkek are urban. Residence is defined with dummy variables =1 if an individual lives in this region.	Regions with a greater percentage of people in poverty may have less access to healthcare services. Regions with the most frequent ethnic disruption and violence experience higher stress and distrust; both outcomes can negatively affect health. I expect health to be higher in Bishkek than in the other regions and urban health to exceed rural health in all regions.

Mother's Education	Dummy variable =1 if the mother achieved secondary education or higher.	Better educated mothers are more likely to take advantage of health services to improve the health of their children; education also proxies for income.
Father's Education	Dummy variable = 1 if the father achieved secondary education or higher.	The dummy for better educated fathers is a proxy for income of the household as better educated fathers are likely to earn more. Higher father's education indicates better knowledge of how to take care of the child.
Mother's Age	Mother's age in years at the time of survey.	Mothers who are young might not have full information to get the best health inputs for children.
Parents' Trust in Doctors	Summed survey response (1 to 5) for both parents, where 5 is most trusting and 1 is least trusting.	Trust in health providers is necessary to provide proper health services and vaccinations for children.

The index of household shocks is a count of the number of all shocks reported by the household head.

$$Household\ Index_{it} = \sum_{i,t}[personal_{i,t} + political_{i,t} + disaster_{i,t} + health_{i,t} + other_{i,t}] \quad (2)$$

The shocks are further broken down by category of shock: personal, political, natural disaster, health, and other. Figure 1 presents a histogram of the composite index of household shocks for 2010. Most of the households experienced few or no shocks during 2010 as the highest density is less than three shocks. The weighting of the shock by its severity could not be reliably performed. Every household will respond differently to a death in the family or an economic hardship. There is little specific data on the severity of the shock -- only the dummy variable of whether that specific shock occurred. The final multivariate models include a dummy for whether the household experienced any type of personal shock or any type of economic shock.

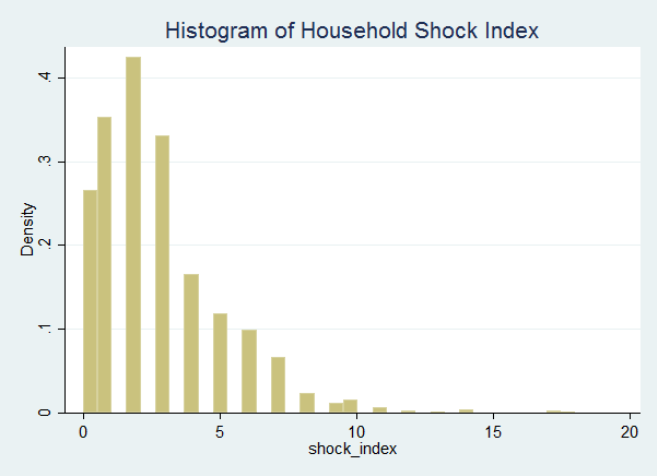

Figure 1: Histogram of the Household Shock Index.

Community shocks can affect the health services infrastructure and might influence child health. The frequency distribution for the index of community shocks in 2010 is given in Table 4. There is slightly more spread in the data than for the household shocks. Many communities experienced at least one shock. Survey year 2011 did not include the community shock questionnaire. The community shocks variables were dropped from the final model because of the missing data for 2011.

Table 4: Frequency Distribution of the Community Shock Index.

Community Shock Index	Frequency	Percent
0	188	6.62
1	704	24.79
2	566	19.93
3	593	20.88
4	293	10.32
5	118	4.15
6	283	9.96
7	30	1.06
8	34	1.2
9	31	1.09
Total	2,840	100

Sample and Methods

Data from 2010-2012 were analyzed using STATA 14.2. Data for 2013 were not included in my study because the interviews occurred in winter (late December and early January 2014) while the interviews for 2010-2012 were in October. Weather differentially affects the health of household members in the fall and the winter. In addition, fewer adults were working in the winter months than in October. The dates of the 2011 interviews were in early October, two weeks before the interview dates for 2010 and 2012. Interviews occurred early in 2011 to avoid data collection during the week of or shortly after the national elections. October is also the month of the harvest. Household income is highest, on average, after the harvest and declines throughout the winter.

The 2010 household data did not have parental identifiers for the children. Parent identifiers were required in order to link parent characteristics including trust in doctors, education level, and mother's age to child outcomes. Parental identifiers were assigned by considering adult household composition characteristics: adult age, child age, adult sex, and relationship to the head of household. Potential parents were cross-referenced against parental identifiers from other years in the data (2011, 2012, 2013), and identifiers for 2010 were assigned based on a plurality decision. If there was a conflict, the adult who was listed in the plurality of years was assigned to be a parent. Out of 3,415 children in the original 2010 dataset, 2,840 children were assigned parents and were used for the next step of the analysis. Data for 2011 and 2012 had parent identifiers. These identifiers were cross-checked against the other survey years to ensure accuracy. When conflict arose, a majority decision was used. The identifiers for the given year were taken as given, and only when the other two years disagreed was a change made.

Health outcomes were based on the anthropometric measurements of children who remained in the dataset. These measurements of height, weight, and arm circumference were evaluated against reference standards from the WHO Multicentre Growth Reference Study Group (2006). Five z-scores were produced to describe a child's health outcomes in units of standard deviations from the mean reference population. Reference data are specific to the age and gender of the child. The WHO offers two sets of reference data, one for children ages 0-5 years and another for ages 5-19. Height-for-age and BMI-for-age were calculated for all children ages 12 and below. Weight-for-age and weight-for-height were calculated for children ages 10 and below. Arm-circumference-for-age was calculated for children ages 5 and below. Since I am interested in multiple anthropometric outcome variables, I include only children ages five and below in my working sample. I use the same age criterion for sample selection as Aladysheva and Brück (2015).

Summary Statistics for Dataset

Tables 5-7 are the summary statistics for the dependent and independent variables for 2010, 2011, and 2012, respectively. There was no major change in the outcome variables from year to year. Changes in vaccination rates were similar across years as well. Despite the violence that occurred in 2010, there was little change in shocks and trust in doctors over the three-year survey period. The most striking feature of the summary statistics was that the outcomes for males and females were not equivalent for Weight-for-Age and Height-for-Age. Males fared worse than females in these outcomes for 2010 and 2011 and for Height-for-Age in 2012.

Table 5: Summary statistics for dependent and independent variables in 2010 dataset.

	Asterisks denote a significant difference in means for males and females.	Male	Female	Total
Dependent Variables:				
Z-score Weight-for-Height	Statistically Equal	0.497 (2.099)	0.493 (2.059)	0.495 (2.079)
< -2 Z-scores		0.073	0.086	0.079
> +2 Z-scores		0.300	0.319	0.309
Z-score Weight-for-Age	$\mu_{Males} < \mu_{Females}$ at $p < 0.10$	-0.280 (1.362)	-0.152 (1.303)	-0.217 (1.334)
< -2 Z-scores		0.080	0.066	0.073
> +2 Z-scores		0.056	0.059	0.057
Z-score BMI-for-Age	Statistically Equal	0.573 (2.201)	0.478 (2.112)	0.527 (2.158)
< -2 Z-scores		0.054	0.065	0.059
> +2 Z-scores		0.238	0.230	0.234
Z-score Height-for-Age	$\mu_{Males} < \mu_{Females}$ at $p < 0.05$	-1.084 (2.103)	-0.806 (2.070)	-0.948 (2.091)
< -2 Z-scores		0.240	0.218	0.229
> +2 Z-scores		0.101	0.107	0.104
Z-score Arm-Circumference-for-Age	Statistically Equal	-0.723 (1.907)	-0.554 (1.639)	-0.642 (1.785)
< -2 Z-scores		0.095	0.086	0.091
> +2 Z-scores		0.249	0.256	0.252
All Vaccinations Completed (TB, Polio, Vitamin A)	Statistically Equal	0.933	0.911	0.922
Independent Variables				
Children				
Age in Months		32.977 (20.916)	33.690 (19.907)	33.328 (20.405)
Gender		0.492	0.508	1
Ethnicity				
Kyrgyz		0.711	0.757	0.735
Russian		0.039	0.031	0.035
Uzbek		0.122	0.114	0.118
Other		0.127	0.098	0.112

Household Shocks			
Personal Shocks? (Yes=1)	0.192	0.169	0.180
Economic Shocks? (Yes=1)	0.202	0.188	0.195
Community Info			
Distance to Hospital (in km)	5.178 (8.341)	4.752 (7.754)	4.961 (8.048)
Region Information			
Bishkek	0.135	0.098	0.117
Rural Mountain	0.156	0.152	0.154
Rural South	0.418	0.428	0.423
Rural Chui	0.153	0.123	0.137
Urban Chui	0.018	0.012	0.015
Urban South	0.076	0.080	0.078
Urban Mountain	0.039	0.029	0.034
Osh City (all urban)	0.042	0.041	0.042
Parent Information			
Mother with Secondary Education or Greater	0.855	0.859	0.857
Father with Secondary Education or Greater	0.785	0.804	0.795
Mother's Age (in Years)	34.097 (6.910)	34.242 (6.992)	34.171 (6.949)
Mother's Trust in Doctors (1 to 5 survey response)	3.281 (0.699)	3.190 (0.773)	3.235 (0.738)
Father's Trust in Doctors (1 to 5 survey response)	3.231 (0.98)	3.199 (0.773)	3.215 (0.736)

Table 6: Summary statistics for dependent and independent variables in 2011 dataset.

	Asterisks denote a significant difference in means for males and females.	Male	Female	Total
Dependent Variables:				
Z-score Weight-for-Height	Statistically Equal	0.522 (1.760)	0.580 (1.702)	0.550 (1.732)
< -2 Z-scores		0.071	0.061	0.066
> +2 Z-scores		0.306	0.294	0.300
Z-score Weight-for-Age	$\mu_{Males} < \mu_{Females}$ at $p < 0.10$	-0.164 (1.217)	-0.056 (1.137)	-0.112 (1.180)
< -2 Z-scores		0.050	0.026	0.038
> +2 Z-scores		0.060	0.060	0.060
Z-score BMI-for-Age	Statistically Equal	0.638 (1.862)	0.543 (1.761)	0.592 (1.813)
< -2 Z-scores		0.062	0.061	0.061
> +2 Z-scores		0.217	0.183	0.201
Z-score Height-for-Age	$\mu_{Males} < \mu_{Females}$ at $p < 0.05$	-1.009 (1.996)	-0.790 (1.754)	-0.903 (1.886)
< -2 Z-scores		0.238	0.198	0.218
> +2 Z-scores		0.102	0.094	0.098
Z-score Arm-Circumference-for-Age	Statistically Equal	-0.846 (1.872)	-0.729 (1.649)	-0.790 (1.768)
< -2 Z-scores		0.179	0.168	0.174
> +2 Z-scores		0.199	0.201	0.200
All Vaccinations Completed (TB, Polio, Vitamin A)	Statistically Equal	0.955	0.948	0.952
Independent Variables				
Children				
Age in Months		34.853 (19.794)	35.474 (20.120)	35.154 (19.948)
Gender		0.516	0.484	1
Ethnicity				
Kyrgyz		0.736	0.692	0.714
Russian		0.042	0.042	0.042
Uzbek		0.112	0.140	0.126
Other		0.110	0.127	0.118
Household Shocks				
Personal Shocks? (Yes=1)		0.164	0.150	0.157
Economic Shocks? (Yes=1)		0.234	0.213	0.224
Community Info				
Distance to Hospital (in km)		4.179 (7.598)	4.626 (8.859)	4.395 (8.232)

Region Information			
Bishkek	0.126	0.101	0.114
Rural Mountain	0.161	0.168	0.165
Rural South	0.376	0.365	0.371
Rural Chui	0.147	0.176	0.161
Urban Chui	0.014	0.022	0.018
Urban South	0.077	0.072	0.074
Urban Mountain	0.038	0.036	0.037
Osh City (all urban)	0.062	0.060	0.061
Parent Information			
Mother with Secondary Education or Greater	0.848	0.848	0.848
Father with Secondary Education or Greater	0.835	0.823	0.829
Mother's Age (in Years)	34.416 (6.980)	34.067 (6.778)	34.248 (6.883)
Mother's Trust in Doctors (1 to 5 survey response)	3.122 (0.769)	3.172 (0.740)	3.147 (0.756)
Father's Trust in Doctors (1 to 5 survey response)	3.021 (0.763)	3.053 (0.773)	3.037 (0.768)

Table 7: Summary statistics for dependent and independent variables in 2012 dataset.

	Asterisks denote a significant difference in means for males and females.	Male	Female	Total
Dependent Variables:				
Z-score Weight-for-Height	Statistically Equal	1.022 (2.024)	0.940 (1.944)	0.983 (1.985)
< -2 Z-scores		0.052	0.064	0.058
> +2 Z-scores		0.343	0.339	0.341
Z-score Weight-for-Age	Statistically Equal	-0.137 (1.250)	-0.075 (1.190)	-0.107 (1.221)
< -2 Z-scores		0.052	0.051	0.051
> +2 Z-scores		0.073	0.051	0.062
Z-score BMI-for-Age	Statistically Equal	1.084 (2.237)	0.942 (2.132)	1.015 (2.188)
< -2 Z-scores		0.046	0.064	0.054
> +2 Z-scores0		0.272	0.248	0.260
Z-score Height-for-Age	$\mu_{Males} < \mu_{Females}$ at $p < 0.10$	-1.443 (2.224)	-1.248 (2.052)	-1.349 (2.144)
< -2 Z-scores		0.323	0.286	0.305
> +2 Z-scores		0.097	0.087	0.092
Z-score Arm-Circumference-for-Age	Statistically Equal	-0.690 (2.061)	-0.746 (1.836)	-0.717 (1.957)
< -2 Z-scores		0.150	0.166	0.158
> +2 Z-scores		0.236	0.229	0.232
All Vaccinations Completed (TB, Polio, Vitamin A)	Statistically Equal	0.931	0.930	0.931

Independent Variables			
Children			
Age in Months	36.264 (19.344)	35.694 (19.915)	35.990 (19.616)
Gender	0.519	0.481	1
Ethnicity			
Kyrgyz	0.696	0.697	0.696
Russian	0.043	0.045	0.044
Uzbek	0.146	0.139	0.142
Other	0.116	0.118	0.117
Household Shocks			
Personal Shocks? (Yes=1)	0.167	0.162	0.165
Economic Shocks? (Yes=1)	0.239	0.209	0.225
Community Info			
Distance to Hospital (in km)	3.686 (6.256)	3.828 (7.671)	3.755 (6.970)
Region Information			
Bishkek	0.108	0.097	0.103
Rural Mountain	0.144	0.139	0.142
Rural South	0.409	0.405	0.407
Rural Chui	0.130	0.171	0.150
Urban Chui	0.016	0.025	0.020
Urban South	0.078	0.069	0.074
Urban Mountain	0.043	0.035	0.039
Osh City (all urban)	0.071	0.058	0.065
Parent Information			
Mother with Secondary Education or Greater	0.844	0.848	0.846
Father with Secondary Education or Greater	0.831	0.833	0.832
Mother's Age (in Years)	33.879 (6.996)	33.438 (6.705)	33.667 (6.859)
Mother's Trust in Doctors (1 to 5 survey response)	3.146 (0.740)	3.139 (0.784)	3.142 (0.761)
Father's Trust in Doctors (1 to 5 survey response)	3.012 (0.795)	3.032 (0.808)	3.022 (0.801)

Restricting the Dataset

I expected that children who have both parents present in the household likely have different outcomes than children with only one parent in the household. In most cases, the absent parent is the father; many of these men are migrant workers, usually in Russia, Kazakhstan, Bishkek, or Osh City. I excluded from my study children with only one parent present in the household. Without parental education, the analysis would not be able to effectively control for

socioeconomic status. Education of the mother and father is positively correlated with income (Anderson et al. 2016) Parental education is one proxy for household well-being in my model. I dropped observations without parental education from the dataset.

Assuming a normal distribution of anthropometric measurements, the probability that a child's z-score is greater than 3 on any of the anthropometric measures is 0.002. The observations that were far outside of the typical range raised concerns about the reliability of the data. To validate the observations, a Grubbs test was performed to remove outliers (Grubbs 1969; Stefansky 1972). A Grubbs test has a null hypothesis that there are no outliers in the data and an alternative hypothesis that there is at least one. The test statistic used is $G = \frac{\max(|X_i - \bar{x}|)}{\sigma}$, where $\bar{x}$ is the sample mean and σ is the standard deviation, which is the largest absolute standard deviation in units of sample standard deviation. The potential outlier is dropped if:

$$G > \frac{N-1}{\sqrt{N}} \sqrt{\frac{t^2_{\alpha/(2N),N-2}}{N-2+t^2_{\alpha/(2N),N-2}}}$$

where t is the t-statistic for the sample. The standard α is 95% to minimize both type 1 and type 2 errors. The G statistic was recalculated each time an outlier was identified and removed. The test was performed on every x_i remaining in the dataset to confirm that no outliers were included. Table 8 shows the total observations for each anthropometric measure and the number of outliers that were dropped from the final dataset. Up to 2.22% of the z-score statistic was dropped from a given year. Only Arm-Circumference-for-Age in 2011 did not have any outliers.

Table 8: Anthropometric measurements and number of Grubbs outliers

Year	Description	Weight-for-Height	Height-for-Age	BMI-for-Age	Weight-for-Age	ArmC-for-Age
2010	Number of observations	1245	1419	1415	1440	1188
2010	Number of outliers	10	13	11	15	3
2010	Percentage of Total	0.803%	0.916%	0.777%	1.04%	0.253%
2011	Number of observations	1170	1366	1366	1386	1142
2011	Number of outliers	26	16	29	23	0
2011	Percentage of Total	2.22%	1.17%	2.12%	1.66%	0%
2012	Number of observations	1369	1597	1597	1601	1329
2012	Number of outliers	12	21	16	22	2
2012	Percentage of Total	0.877%	1.31%	1.00%	1.37%	0.150%

The standard deviations for some of the health measures were still higher than the recommended values as defined by the WHO 2006 standards (Mei and Grummer-Strawn 2007). Levels of standard deviation that are too high mean that there is likely some measurement or reporting

error. Mei and Grummer-Strawn (2007) determined a range of standard deviations from the Demographic and Health Surveys (DHS) for countries across the world. Table 9 shows the recommended standard deviation range from the WHO, the 5th and 95th percentiles of standard deviations from Mei and Grummer-Strawn (2007), and the actual standard deviation for each year of the data. The quality of the data can be inferred from the "spread" of the data. Length-for-Age has a slightly larger standard deviation than the 95th percentile, so the statistical analysis could be affected by reporting error. Weight-for-Height has a higher standard deviation than the 95th percentile. The results for Weight-for-Height were carefully scrutinized in my study because of the high standard deviation of the sample and potential problems with data quality. I chose to keep this health measure so the results of my analysis can be compared to the Weight-for-Height regressions from Aladysheva and Brück (2015).The standard deviation for Height-for-Age is higher than the recommended standard deviation but is close to the 95th percentile; therefore this measure was kept in the dataset. BMI-for-Age also suffered from a higher than usual standard deviation and is 0.3-0.5 above the 95th percentile. For this reason, I dropped BMI-for-Age as a dependent variable in the regression analysis. Weight-for-Age falls within the recommended standard deviation. Arm-Circumference-for-Age has a higher standard deviation than the model would predict. The underlying transformation into z-scores means that $\mu_{pop} = 0 \; and \; \sigma_{pop} = 1$. However, there is no recommendation on the standard deviation range or a range from Mei and Grummer-Strawn (2007) for this anthropometric measure, so I included arm circumference for age as one of my health outcomes.

Table 9: Anthropometric measurement standard deviations by year and overall compared to WHO and other studies.

	Weight-for-Height	Height-for-Age	BMI-for-Age	Weight-for-Age	ArmC-for-Age
Recommended by WHO (1995)	0.85 - 1.10	1.10 - 1.30	-	1.00 - 1.30	-
5th to 95th percentile (Mei and Grummer-Strawn, 2007)	1.08 - 1.50	1.35 - 1.95	1.08 - 1.55	1.17 - 1.46	-
2010	2.079	2.091	2.158	1.334	1.785
2011	1.732	1.886	1.813	1.180	1.768
2012	1.985	2.144	2.188	1.221	1.957
Panel[1]	1.953	2.058	2.078	1.246	1.846

Appendix Figures A.1, A.2, A.3, and A.4 are graphs of the kernel distributions for Weight-for-Height, Weight-for-Age, Height-for-Age, and Arm-Circumference-for-Age, respectively. The distributions for Weight-for-Age, Height-for-Age, and Arm-Circumference-for-Age have a right-

[1] Panel includes all observations where some children are represented in more than one year.

hand skew, while Weight-for-Height has a slight left-hand skew. As a population, children ages 0 to 5 in the Kyrgyz Republic generally do worse than the mean child in the reference population. They are slightly shorter and lighter on average. From 2010 to 2012, children do slightly better overall in the four z-score metrics, and the distributions exhibit sharper mean peaks.

Regressions

Z-score metrics of Weight-for-Height, Weight-for-Age, Height-for-Age, and Arm-Circumference-for-Age and the bivariate dependent variables stunting, underweight, wasting, and vaccine compliance were regressed on the explanatory variables described in Table 3.

There are significant differences in healthcare needs for males and females due to fundamental differences in biology and behavior. The susceptibility of males and females to health problems is not always equivalent. Differential allocation of nutritional resources to boys and girls could partially explain differences in health outcomes by sex of the child. Appendix Figures 1 - 4 graph the distribution of the z-scores metrics used in my study. Males are more likely to be in the left tail in all of the health outcome distributions.

I estimated models for all children and include a dummy variable for the sex of the child to see if boys on average have worse health outcomes than girls; these models for all children assume that the marginal effects of the other variables on health outcomes do not vary for boys and girls. I then estimate separate models for all outcomes for boys and girls and see whether trust, shocks, and the other explanatory variables differentially affect the health of boys and girls.

Cross-Sectional Regressions

I estimated regression models for each outcome and by sex of the child separately for 2010, 2011, and 2012. This approach provided a degree of robustness to complement the results of the random effects panel regression. Robust standard errors with clustering at the Rayon level were calculated. The observations were defined to be independent across Rayons but not necessarily within Rayons[2].

[2] Krygyzstan is divided into Rayons, which are administered by government-appointed officials. This is essentially the equivalent to counties in the United States.

Panel Regressions

Panel regressions were estimated using a random-effects model for the combined data for 2010, 2011, and 2012. Out of the 2,308 unique individuals in the dataset, 709 were surveyed in all three years, 607 were surveyed in two of the three years, and 992 were surveyed in only one year. Regressions were performed with year effects included and without year effects. Dummy variables for 2011 and 2012 show the effect of being surveyed after 2010 had on the health outcomes of children. The 709 individuals ages 0-5 in all three survey years were separately used for a regression to see the results of a subset panel model. This allowed for greater within individual characteristic changes to have an effect in the child health regressions.

Results

Continuous Variable Analysis: Cross-sectional and Panel Models

Cross-Sectional Regression Models

Regression results for Weight-for-Height are found in Appendix Tables A.1, A.2, A.3 for all children, males, and females, respectively. Regression results for Weight-for-Age are found in Appendix Tables A.4, A.5, A.6 for all children, males, and females, respectively. Regression results for Height-for-Age are found in Appendix Tables A.7, A.8, A.9 for all children, males, and females, respectively. Regression results for Arm-Circumference-for-Age are found in Appendix Tables A.10, A.11, A.12 for all children, males, and females, respectively.

The R^2 values for all cross-sectional models are low; the strongest model based on R^2 is Arm-Circumference. The R^2 increases after 2010 for Arm-Circumference for all children and for boys and girls; R^2 falls over time for the other measures for all children and, in most cases, for boys and girls as well. The biggest change overall is between 2010 (year of the revolution) and the later years.

Older children usually had worse outcomes but that result was not seen for every continuous health measure. Males fared worse in Weight-for-Age and Height-for-Age. Ethnic differences were significant only for Weight-for-Height and Arm-Circumference-for-Age. Other ethnic groups and Uzbeks fared worse relative to Kyrgyz. Shocks to the household played no role in most of the models for the continuous health measures. One major exception was economic shocks in 2011 which lowered Height-for-Age, especially for females. Farther distance to a hospital did not consistently lead to worse outcomes. Regional differences showed minor variation in child health for the most part.

Panel Models

None of the regression models for the continuous dependent variables have a high R^2 overall, between, or within. The best R^2 model in within, between, and overall effects is Arm-

Circumference-for-Age. Weight-for-Height and Height-for-Age had low R^2 throughout. Weight-for-Age did a better job for the R^2 for between effects and the overall model. Table 10 shows the result for the random effects model including year effects. Table 11 shows the result of the random effect model without year effects. Table 12 presents the result from estimation of panel models that only include children who were present in all three survey years. This subset panel model allows for greater within effects than the other panel methods used.

Table 10: Random Effects Model of Child Health with Year Effects for Children Ages 0-5 for 2010-2012.

All Children, Age <= 5	Weight-for-Height	Weight-for-Age	Height-for-Age	ArmC-for-Age	Stunting Model	Wasting Model	Underweight Model	Vaccine Model
Child Characteristics								
Child Age (months)	-0.013***	-0.019***	-0.009*	0.046***	-0.002	0.000	0.000	0.002***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Male (=1)	-0.220*	-0.182**	-0.112	-0.103	0.050*	0.031*	0.029**	0.011
	(0.12)	(0.07)	(0.13)	(0.10)	(0.03)	(0.02)	(0.01)	(0.01)
Ethnicity (relative to Kyrgyz)								
Russian	0.166	0.278	0.275	0.632**	-0.056	-0.040	-0.005	0.035
	(0.36)	(0.22)	(0.38)	(0.29)	(0.07)	(0.05)	(0.04)	(0.03)
Uzbek	-0.083	0.150	0.409*	-0.066	-0.095**	-0.044	-0.033	-0.002
	(0.23)	(0.14)	(0.24)	(0.19)	(0.05)	(0.03)	(0.02)	(0.02)
Other	-0.176	0.258*	0.614**	-0.123	-0.109**	-0.010	-0.021	0.033*
	(0.24)	(0.15)	(0.26)	(0.20)	(0.05)	(0.03)	(0.03)	(0.02)
Household Shocks								
Personal Shock (=1)	0.033	-0.123*	-0.142	-0.087	-0.014	-0.022	0.005	-0.014
	(0.12)	(0.07)	(0.12)	(0.10)	(0.03)	(0.02)	(0.01)	(0.01)
Economic Shock (=1)	0.006	-0.047	-0.047	-0.201**	0.038	-0.002	0.032**	-0.002
	(0.11)	(0.07)	(0.11)	(0.09)	(0.03)	(0.02)	(0.01)	(0.01)
Community								
Distance to Hospital (km)	0.006	0.007*	0.003	-0.002	-0.001	-0.003***	-0.001	-0.002**
	(0.01)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
Region (relative to Bishkek)								
Rural Mountain	-0.246	-0.131	0.061	-0.064	0.061	0.094***	0.049**	0.014
	(0.23)	(0.14)	(0.25)	(0.19)	(0.05)	(0.03)	(0.02)	(0.02)
Rural South	-0.051	0.143	0.244	0.054	-0.011	0.075***	0.053**	-0.032*
	(0.21)	(0.12)	(0.22)	(0.17)	(0.04)	(0.03)	(0.02)	(0.02)
Rural Chui	-0.038	0.163	0.228	0.588***	-0.019	0.038	0.019	-0.054***
	(0.26)	(0.15)	(0.27)	(0.21)	(0.05)	(0.03)	(0.03)	(0.02)
Urban Chui	0.412	0.304	0.232	0.206	-0.161	-0.024	0.007	-0.179***
	(0.57)	(0.34)	(0.60)	(0.46)	(0.12)	(0.08)	(0.06)	(0.05)
Urban South	0.037	0.002	-0.120	-0.038	0.036	0.063	0.039	-0.048**
	(0.29)	(0.17)	(0.30)	(0.23)	(0.06)	(0.04)	(0.03)	(0.02)
Urban Mountain	-0.251	-0.018	0.131	-0.004	-0.008	0.053	0.063*	-0.023
	(0.36)	(0.22)	(0.38)	(0.29)	(0.07)	(0.05)	(0.04)	(0.03)
Osh City	-0.116	-0.176	-0.286	-0.003	0.080	0.055	0.098***	0.013
	(0.36)	(0.21)	(0.38)	(0.29)	(0.07)	(0.05)	(0.04)	(0.03)
Parent Characteristics								
Mother Education	-0.124	-0.062	0.019	-0.101	-0.092**	-0.052**	0.010	0.009
	(0.19)	(0.11)	(0.20)	(0.15)	(0.04)	(0.03)	(0.02)	(0.02)
Father Education	-0.163	0.094	0.400**	-0.022	-0.035	0.032	-0.050***	0.011
	(0.16)	(0.10)	(0.17)	(0.13)	(0.03)	(0.02)	(0.02)	(0.01)
Mother Age (years)	0.009	0.017***	0.012	-0.005	-0.003	-0.001	-0.001	0.000
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
Mother's Trust in Doctors	-0.192***	-0.118***	0.012	0.022	-0.003	0.006	0.007	0.014*
	(0.06)	(0.04)	(0.06)	(0.05)	(0.01)	(0.01)	(0.01)	(0.01)
Father's Trust in Doctors	0.002	0.035	0.023	0.015	-0.008	0.000	0.003	-0.002
	(0.06)	(0.04)	(0.06)	(0.05)	(0.01)	(0.01)	(0.01)	(0.01)
Year Effects (relative to 2010)								
Year 2011	0.199**	0.157**	-0.109	-0.089	0.028	-0.014	-0.040***	0.034***
	(0.10)	(0.06)	(0.10)	(0.08)	(0.02)	(0.01)	(0.01)	(0.01)
Year 2012	0.554***	0.287***	-0.162	-0.353***	0.066**	-0.026	-0.045***	-0.004
	(0.14)	(0.09)	(0.15)	(0.11)	(0.03)	(0.02)	(0.02)	(0.01)
Constant	1.533***	0.019	-1.616***	-1.674***	0.505***	0.072	0.067	0.843***
	(0.47)	(0.28)	(0.49)	(0.38)	(0.10)	(0.06)	(0.05)	(0.04)
R2 for Within Effects	0.020	0.018	0.025	0.097	0.003	0.030	0.027	0.018
R2 for Between Effects	0.039	0.105	0.023	0.169	0.049	0.021	0.049	0.091
R2 for Overall Model	0.020	0.079	0.024	0.174	0.027	0.023	0.036	0.049
			* p<0.1	** p<0.05	*** p<0.01			

Table 11: Random Effects Model of Child Health without Year Effects for Children Ages 0-5 for 2010-2012.

All Children, Age <= 5	Weight-for-Height	Weight-for-Age	Height-for-Age	ArmC-for-Age	Stunting Model	Wasting Model	Underweight Model	Vaccine Model
Child Characteristics								
Child Age (months)	0.002	-0.010***	-0.008***	0.041***	-0.001***	-0.001***	-0.001***	0.002***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Male (=1)	0.028	-0.099*	-0.263***	-0.100	0.044***	-0.004	0.013	0.010
	(0.09)	(0.05)	(0.09)	(0.08)	(0.02)	(0.01)	(0.01)	(0.01)
Ethnicity (relative to Kyrgyz)								
Russian	0.047	-0.044	-0.060	0.315	0.014	-0.020	0.026	0.014
	(0.26)	(0.15)	(0.26)	(0.22)	(0.05)	(0.03)	(0.03)	(0.03)
Uzbek	-0.026	-0.040	0.015	-0.386***	-0.050*	-0.038*	-0.026	-0.035**
	(0.15)	(0.09)	(0.15)	(0.13)	(0.03)	(0.02)	(0.02)	(0.02)
Other	-0.265	-0.049	0.176	-0.329**	-0.036	0.002	-0.025	0.020
	(0.16)	(0.10)	(0.16)	(0.14)	(0.03)	(0.02)	(0.02)	(0.02)
Household Shocks								
Personal Shock (=1)	-0.030	-0.080	-0.022	-0.026	-0.016	-0.017	0.003	-0.009
	(0.10)	(0.06)	(0.10)	(0.09)	(0.02)	(0.01)	(0.01)	(0.01)
Economic Shock (=1)	0.051	-0.002	-0.067	-0.117	0.040**	0.001	0.025**	-0.001
	(0.09)	(0.05)	(0.09)	(0.08)	(0.02)	(0.01)	(0.01)	(0.01)
Community								
Distance to Hospital (km)	0.000	0.010***	0.005	-0.009**	-0.001	-0.001	-0.001*	-0.003***
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Region (relative to Bishkek)								
Rural Mountain	-0.381**	-0.267**	-0.090	-0.314**	0.051	0.076***	0.047**	0.001
	(0.18)	(0.11)	(0.18)	(0.16)	(0.03)	(0.02)	(0.02)	(0.02)
Rural South	-0.026	-0.045	-0.081	-0.041	0.034	0.050**	0.039**	-0.023
	(0.16)	(0.09)	(0.16)	(0.14)	(0.03)	(0.02)	(0.02)	(0.02)
Rural Chui	-0.051	0.124	0.221	0.269	-0.019	0.023	0.018	-0.036*
	(0.19)	(0.11)	(0.19)	(0.17)	(0.04)	(0.03)	(0.02)	(0.02)
Urban Chui	0.173	0.231	0.188	-0.142	-0.071	-0.005	-0.017	-0.098**
	(0.37)	(0.22)	(0.37)	(0.33)	(0.07)	(0.05)	(0.04)	(0.04)
Urban South	-0.051	-0.048	-0.216	0.119	0.062	0.065**	0.032	-0.051**
	(0.22)	(0.13)	(0.22)	(0.19)	(0.04)	(0.03)	(0.02)	(0.02)
Urban Mountain	-0.172	-0.041	0.040	0.070	-0.017	0.017	0.031	-0.026
	(0.27)	(0.16)	(0.27)	(0.23)	(0.05)	(0.04)	(0.03)	(0.03)
Osh City	-0.391	0.040	0.337	0.664***	0.018	0.091***	0.045	0.018
	(0.26)	(0.15)	(0.26)	(0.22)	(0.05)	(0.03)	(0.03)	(0.03)
Parent Characteristics								
Mother Education	-0.237*	-0.101	0.050	-0.201*	-0.087***	-0.020	-0.002	-0.002
	(0.13)	(0.08)	(0.13)	(0.12)	(0.03)	(0.02)	(0.01)	(0.02)
Father Education	-0.084	0.166**	0.385***	0.054	-0.051**	-0.006	-0.052***	0.008
	(0.12)	(0.07)	(0.12)	(0.10)	(0.02)	(0.02)	(0.01)	(0.01)
Mother Age (years)	0.011	0.012***	0.010	0.000	-0.002	-0.001	-0.001	0.001
	(0.01)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
Mother's Trust in Doctors	-0.144***	-0.083***	0.042	-0.032	0.008	0.008	0.008	0.003
	(0.05)	(0.03)	(0.05)	(0.04)	(0.01)	(0.01)	(0.01)	(0.01)
Father's Trust in Doctors	-0.075	-0.007	0.082*	0.007	-0.017*	0.003	0.005	-0.007
	(0.05)	(0.03)	(0.05)	(0.04)	(0.01)	(0.01)	(0.01)	(0.01)
Constant	1.321***	0.146	-1.739***	-1.736***	0.475***	0.108**	0.090**	0.856***
	(0.34)	(0.20)	(0.34)	(0.30)	(0.07)	(0.05)	(0.04)	(0.04)
R2 for Within Effects	0.018	0.014	0.032	0.105	0.000	0.018	0.018	0.012
R2 for Between Effects	0.015	0.053	0.014	0.169	0.032	0.017	0.017	0.063
R2 for Overall Model	0.009	0.046	0.014	0.173	0.023	0.014	0.019	0.041
			* p<0.1	** p<0.05	*** p<0.01			

Table 12: Random Effects Model of Child Health without Year Effects for Children Ages 0-5 in 2010 and Present in Survey Years 2010-2012.

All Children, Age <= 5	Weight-for-Height	Weight-for-Age	Height-for-Age	ArmC-for-Age	Stunting Model	Wasting Model	Underweight Model	Vaccine Model
Child Characteristics								
Child Age (months)	0.002	-0.012***	-0.014***	0.036***	0.000	-0.001*	-0.001**	0.002***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Male (=1)	-0.248**	-0.197***	-0.102	-0.082	0.047*	0.032*	0.031**	0.011
	(0.12)	(0.07)	(0.13)	(0.10)	(0.03)	(0.02)	(0.01)	(0.01)
Ethnicity (relative to Kyrgyz)								
Russian	0.154	0.267	0.283	0.642**	-0.058	-0.039	-0.003	0.033
	(0.36)	(0.22)	(0.39)	(0.29)	(0.07)	(0.05)	(0.04)	(0.03)
Uzbek	-0.065	0.160	0.404	-0.075	-0.093*	-0.045	-0.035	-0.001
	(0.23)	(0.14)	(0.25)	(0.19)	(0.05)	(0.03)	(0.02)	(0.02)
Other	-0.170	0.262*	0.614**	-0.124	-0.109**	-0.010	-0.021	0.032*
	(0.24)	(0.15)	(0.26)	(0.20)	(0.05)	(0.03)	(0.03)	(0.02)
Household Shocks								
Personal Shock (=1)	0.032	-0.125*	-0.143	-0.086	-0.014	-0.022	0.005	-0.014
	(0.12)	(0.07)	(0.12)	(0.10)	(0.03)	(0.02)	(0.01)	(0.01)
Economic Shock (=1)	0.016	-0.037	-0.051	-0.205**	0.040	-0.003	0.029**	-0.001
	(0.11)	(0.07)	(0.11)	(0.09)	(0.03)	(0.02)	(0.01)	(0.01)
Community								
Distance to Hospital (km)	0.009	0.010***	0.001	-0.003	-0.001	-0.003***	-0.002**	-0.001*
	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Region (relative to Bishkek)								
Rural Mountain	-0.249	-0.138	0.067	-0.066	0.059	0.094***	0.051**	0.012
	(0.23)	(0.14)	(0.25)	(0.19)	(0.05)	(0.03)	(0.02)	(0.02)
Rural South	-0.054	0.140	0.245	0.056	-0.011	0.075***	0.054**	-0.032**
	(0.21)	(0.12)	(0.22)	(0.17)	(0.04)	(0.03)	(0.02)	(0.02)
Rural Chui	0.001	0.183	0.215	0.562***	-0.015	0.036	0.016	-0.053**
	(0.26)	(0.16)	(0.28)	(0.21)	(0.05)	(0.03)	(0.03)	(0.02)
Urban Chui	0.423	0.307	0.231	0.196	-0.160	-0.024	0.008	-0.181***
	(0.57)	(0.34)	(0.61)	(0.46)	(0.12)	(0.08)	(0.06)	(0.05)
Urban South	0.089	0.026	-0.136	-0.071	0.041	0.061	0.036	-0.049**
	(0.29)	(0.17)	(0.31)	(0.23)	(0.06)	(0.04)	(0.03)	(0.02)
Urban Mountain	-0.214	0.002	0.117	-0.027	-0.004	0.051	0.060	-0.023
	(0.36)	(0.22)	(0.39)	(0.30)	(0.07)	(0.05)	(0.04)	(0.03)
Osh City	-0.086	-0.160	-0.296	-0.024	0.083	0.053	0.097***	0.012
	(0.36)	(0.21)	(0.38)	(0.29)	(0.07)	(0.05)	(0.04)	(0.03)
Parent Characteristics								
Mother Education	-0.114	-0.054	0.014	-0.107	-0.091**	-0.053**	0.008	0.010
	(0.19)	(0.11)	(0.20)	(0.16)	(0.04)	(0.03)	(0.02)	(0.02)
Father Education	-0.131	0.111	0.390**	-0.037	-0.032	0.030	-0.053***	0.010
	(0.16)	(0.10)	(0.17)	(0.13)	(0.03)	(0.02)	(0.02)	(0.01)
Mother Age (years)	0.008	0.017***	0.013	-0.005	-0.003	-0.001	-0.001	0.000
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
Mother's Trust in Doctors	-0.182***	-0.114***	0.011	0.013	-0.001	0.005	0.006	0.013*
	(0.06)	(0.04)	(0.06)	(0.05)	(0.01)	(0.01)	(0.01)	(0.01)
Father's Trust in Doctors	-0.004	0.029	0.027	0.019	-0.009	0.000	0.005	-0.003
	(0.06)	(0.04)	(0.06)	(0.05)	(0.01)	(0.01)	(0.01)	(0.01)
Constant	1.245***	-0.094	-1.566***	-1.462***	0.482***	0.082	0.071	0.862***
	(0.46)	(0.28)	(0.49)	(0.38)	(0.10)	(0.06)	(0.05)	(0.04)
R2 for Within Effects	0.015	0.018	0.024	0.094	0.001	0.032	0.026	0.010
R2 for Between Effects	0.019	0.094	0.024	0.172	0.046	0.019	0.038	0.090
R2 for Overall Model	0.009	0.070	0.024	0.168	0.025	0.022	0.030	0.043
			* p<0.1	** p<0.05	*** p<0.01			

Overview of Continuous Regression Results

Household shocks were not significant in any of the survey years for the model for all children or the male model. Shocks were significant in the female models for everything but Arm-Circumference-for-Age. The coefficient for this effect varied between positive and negative depending on whether the measure had a more long term or short term variability. Ultimately there was almost no significance for household shocks in the cross-sectional models for the continuous health outcome variables. There was only one instance of shocks negatively affecting Height-for-Age.

Parental trust did not have much of an effect on child health in the models for the continuous health variables. Mother's trust in doctors led to a lower health outcome for Weight-for-Height and Weight-for-Age, which is not easily explained. This result was consistent for the subset panel, the year effects panel, and the without year effects panel. Father's trust in doctors was important for improved male Height-for-Age in 2010. Females also had lower health from increased trust in doctors for Weight-for-Age, Height-for-Age, and Arm-Circumference-for-Age.

Farther distance to a hospital did not play a significant role in the continuous health measures. Weight-for-Age was greater for children farther away from a hospital.

Weight-for-Height and Weight-for-Age were lower on average for males than females when year effects were taken into account. The subset panel model in Table 13 agrees with this result. I found no gender differences in the other health outcomes. The largest difference was for Height-for-Age in 2010. Ethnicity differences did not have large effects on the continuous health variables. There is no evidence that the health of children in one ethnicity was consistently better than the health of children in other ethnic groups. The panel models show an instance of ethnic groups besides Kyrgyz doing better in one continuous health measure. The location of the household was important in some cases. Children in Osh City and the Rural Mountain regions had lower Weight-for-Height and Height-for-Age than children in other regions for some of the cross-sectional models. Three of the four models show that children in the rural mountain region (Talas, Naryn, Issuk-kul oblasts) had worse health outcomes relative to children in the capital city, Bishkek using the random effects panel model. Including year effects or only sampling from the children in all three datasets eliminated the significance of rural mountain region having lower outcomes. The only location still significant in these regressions is rural Chui which improves Arm-Circumference-for-Age.

Parental education, especially the father's education, was positively associated with Height-for-Age and less so for Weight-for-Age. The education effects for Weight-for-Age were lost after including year effects or when examining the subset panel. Father's education remained a positive force for Height-for-Age. In individual years, there are instances of father's education being significant in regressions for both males and females. There does not appear to be a differential effect of parental education on one gender. Older mothers led to improvements in Weight-for-Age but were not significant in any other continuous health measure.

The year effects panel model confirms the distribution graphs in the Appendix. Weight-for-Height and Weight-for-Age measures are higher in 2011 and 2012 relative to 2010. Arm-Circumference-for-Age is lower for 2012 relative to 2010.

Bivariate Variable Analysis: Cross-sectional and Panel Models.

Cross-Sectional Models

The nutrition variables – stunting, wasting, and underweight -- and receipt of recommended vaccinations are dummy variables. I estimated models for these outcomes using regression with robust standard errors. Coefficients from the regression models are consistent, and the coefficients are easy to interpret as marginal effects of the independent variables on the probability of each outcome.

Regression results for stunting are found in Appendix Tables A.13, A.14, A.15 for all children, males, and females, respectively. Regression results for wasting are found in Appendix Tables A.16, A.17, A.18 for all children, males, and females, respectively. Regression results for underweight are found in Appendix Tables A.19, A.20, A.21 for all children, males, and females, respectively. Regression results for vaccinations are found in Appendix Tables A.22, A.23, A.24 for all children, males, and females, respectively.

Panel Models

Panel models were estimated over the full sample of children, with and without fixed effects for year and over the subset of children who were 0-5 in all three years. Tables 10, 11, and 12 include the regression results for the bivariate health outcomes. The panel model regressions also had very low R^2 values. These values were approximately the same for both males and females.

Nutrition

Household shocks were only significant for economic shocks which led to a greater likelihood that the child would be underweight. Economic shocks increased the odds of stunting and underweight, but the effects varied by gender; if the household experienced an economic shock, males were more likely to be underweight and females were more likely to be stunted.

Trust in doctors did not have much effect on nutrition, and often mother's trust and father's trust coefficients were opposite of each other for cross-sectional regressions. The panel models smoothed over this inconsistency; parent trust in doctors was not significant in any of the nutritional outcomes.

Farther distance to a hospital usually lowered the odds of having a nutritional deficiency. This effect was not consistent with the subset panel model and the year effects panel model.

Older children were slightly worse off for nutrition outcomes than younger children for some cross-sectional regressions. This effect was lost after taking year effects into account. Males were significantly more likely to be stunted, wasted, and underweight than females. This effect was clearly shown in the subset panel and the year effects panel. Ethnicity played a role because Uzbeks were less likely to be stunted than Kyrgyz. Females were less likely to be wasted if they were Uzbeks. Russians in Kyrgyzstan showed improvement in certain cross-sectional regressions. Russians are more often in cities and have different diets than Kyrgyz. This could factor into the differences in outcomes. Other measures were inconsistent on the role of ethnicity.

Regional differences were not evident for stunting. Females had consistent outcomes for all nutritional outcomes throughout the country in the cross-sectional models, while males who lived outside of Bishkek were more likely to be wasted than males in Bishkek. The panel models showed that children in the rural mountain and rural southern regions were more likely to have a nutritional issue than children in Bishkek.

Parental education played a major role in reducing the prevalence of stunting, wasting, and underweight. Male nutrition was more likely to be improved by better parental education than female nutrition. However, both males and females experienced better nutrition if their parents were more educated. The panel models show that mother's education resulted in lower stunting and wasting while father's education was important for lowering the likelihood of being underweight. Mother's age was not a factor in nutritional outcomes in the panel models.

The year effects model indicated that stunting was more likely in 2012 than in 2010. However, 2011 and 2012 children were less likely to be underweight than children in 2010.

Vaccines

Increased vaccination in general proxies for better health services and lower incidence of serious childhood illness in the future. There was not a major difference in the vaccination rate by gender. Personal household shocks negatively affected females in 2010, and economic household shocks negatively affected males in 2011. Shocks had no significant effects on nutrition in the panel models.

Parental trust in doctors was not a significant determinant of vaccinations for any of the cross-sectional models; however, the subset panel and the year effects panel show that greater mother's trust in doctors leads to an increase in the vaccination rate.

Farther distance to a hospital led to lower rates of vaccination. This effect was consistent for both males and females.

Older children were slightly more likely to have complete vaccinations than younger children across all years. A child one month older tended to have a 0.2% greater likelihood of complete vaccinations than a child one month younger. Gender did not play a role in vaccination rates. Uzbek children were less likely to have complete vaccinations than other children. Russians and other ethnicities (Dungan, Uighur, Tajik, Kazakh, and others) had higher rates of vaccination than Kyrgyz, particularly in 2012. These effects are not seen in the panel models.

Regional differences in vaccination varied, sometimes switching signs from year to year. Children in the Chui oblast were less likely to be vaccinated than children in neighboring Bishkek.[3] The brunt of this effect fell on females in the population. Panel models showed that the southern region and the Chui oblast experienced lower vaccination rates.

[3] Bishkek is in the Chui oblast. It is the capital city and the largest urban area in the country. Most residents of Chui outside of Bishkek live in small rural communities.

Parental education did not play a role in vaccination rates. The children of older mothers had improved vaccination rates for 2012 for both males and females, but this outcome was an isolated occurrence. Mother's age was insignificant in every other vaccine regression.

The year effects model showed that 2011 had higher vaccination rates than in 2010.

Discussion

The models presented in this study helped illuminate the determinants of child health outcomes in Kyrgyzstan. While many factors were initially considered when building the model for social determinants of child health outcomes in Kyrgyzstan, the factors ultimately chosen were meant to control for exogenous causes of variability in child anthropometric measurements.

I found weak effects of household shocks on health outcomes. Economic shocks lowered health outcomes in four cases. In a few models, mother's trust in doctors was associated with worse outcomes, and father's trust had a positive influence in only two cases. Access to health services (distance to a hospital) was important in a number of models; in general, the farther the household was from a hospital the lower in the child's nutrition and health. Increased distance from a hospital led to a lower rate of complete vaccinations.

Males consistently fared worse than females in both types of regressions, an observation also noted from Figures A.1, A.2, A.3, and A.4. Males had lower nutritional outcomes than females, which does not agree with the results of Aladaysheva and Brück (2015). Ethnicity is important to child health and relevant given the recent ethnic conflicts in Kyrgyzstan. Relative to Kyrgyz, the nutrition outcomes of children in other ethnic groups were higher in general. Vaccination outcomes relative to Kyrgyz were generally the same, with exceptions occurring for the "other ethnic" group and Russians for 2010 and 2012. The "other ethnic" group is not easily understood. The ethnic differences are weaker for the anthropometric health outcomes but tend to work in favor of the Kyrgyz. Despite the political conflict between Uzbeks and Kyrgyz, there was not a pattern of significant differences between these ethnic groups.

The region of the household was important in most models. Regional differences in outcomes show the need for greater health services in areas outside of Bishkek. Health outcomes were lower in all regions in comparison to the capital city in the North. Residence in the more remote Mountain oblasts and in the southern region was also frequently associated with worse health

outcomes than in other regions. Parent education, particularly the father's education, increased child health, with a few exceptions. Mother's and child's age matter and were associated with better outcomes. Other variables that might affect child health outcomes that were not included in the survey included parental anthropometric measurements, quality of health services, and the prevalence of other health problems such as famine or disease.

The results of the cross-sectional analysis do not yield any major differences across the survey years. This is likely because the measures available for study do not vary greatly in the short run so year-by-year differences in independent variables do not cause a large change in anthropometric measurements over a short period of time. The level of variability in the independent variables was also low. Children who might have experienced shocks during the 2010 revolution would not necessarily experience changes in anthropometric measurements immediately. One instance where this might have occurred is the higher levels of stunting in 2012 than in 2010. Stunting is a long-term measure and is not realized immediately in anthropometric measurements. Children were more likely to be underweight in 2010 than in 2011 and 2012. As the revolution was the major disruptive event in Kyrgyzstan in 2010, I would theorize that the difference in underweight prevalence is due to the violence and displacement that occurred.

I was interested in this work because the unique events of 2010 provided a natural experiment to test how child health outcomes could be affected by revolution, trust in institutions, and social services. Ultimately, the social trust and shock variables did not consistently affect the health outcomes that I focused on in the study. An analysis of these children five to ten years later would be one way to elucidate the effect of the 2010 revolution on children's anthropometric measurements.

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Appendix

Distribution of Z-Scores by Gender and Year

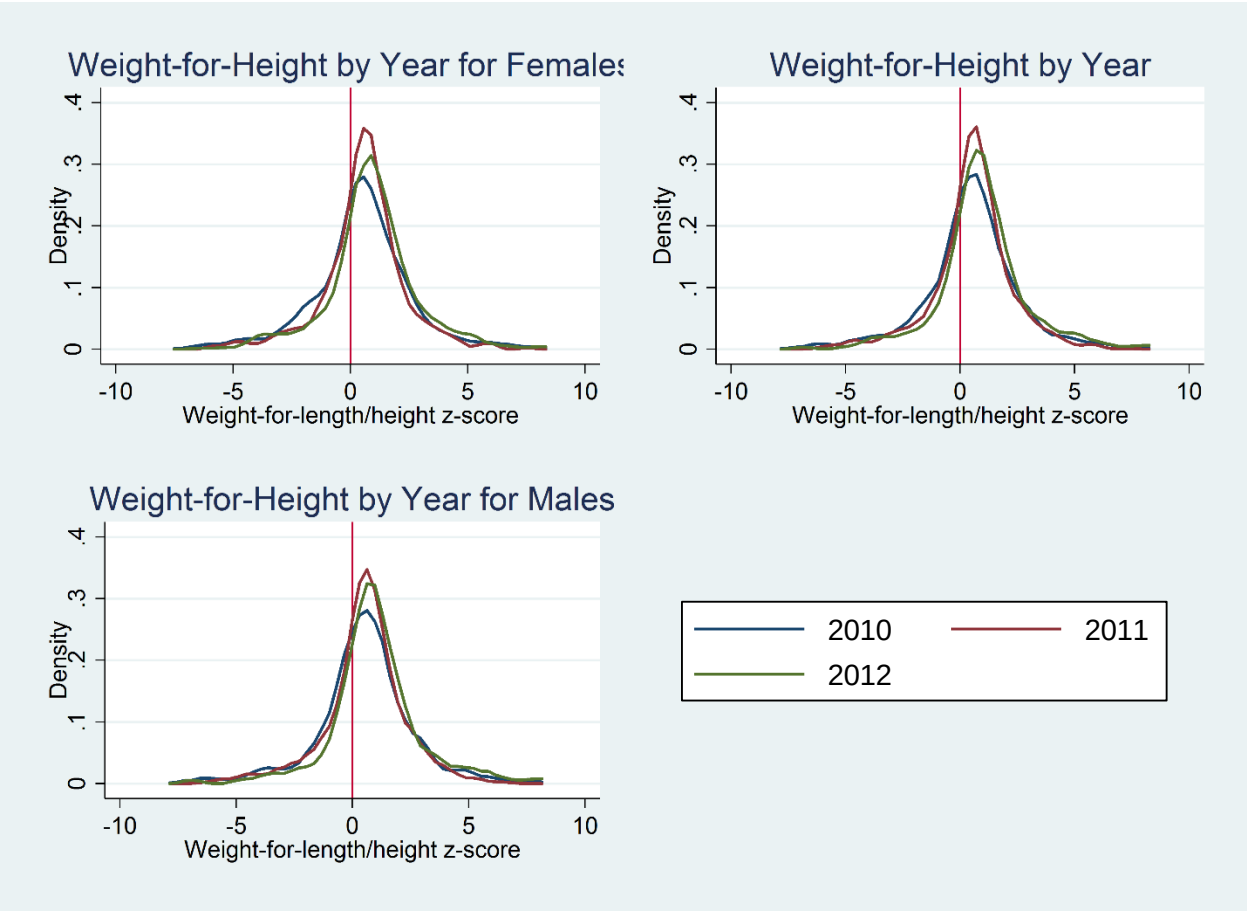

Figure A.1. Weight-for-Height Z-score Distributions for 2010, 2011, 2012.

Notes: Bottom left and top left are the distributions for males and females, respectively. Each successive year corresponds to a denser mean of the distribution.

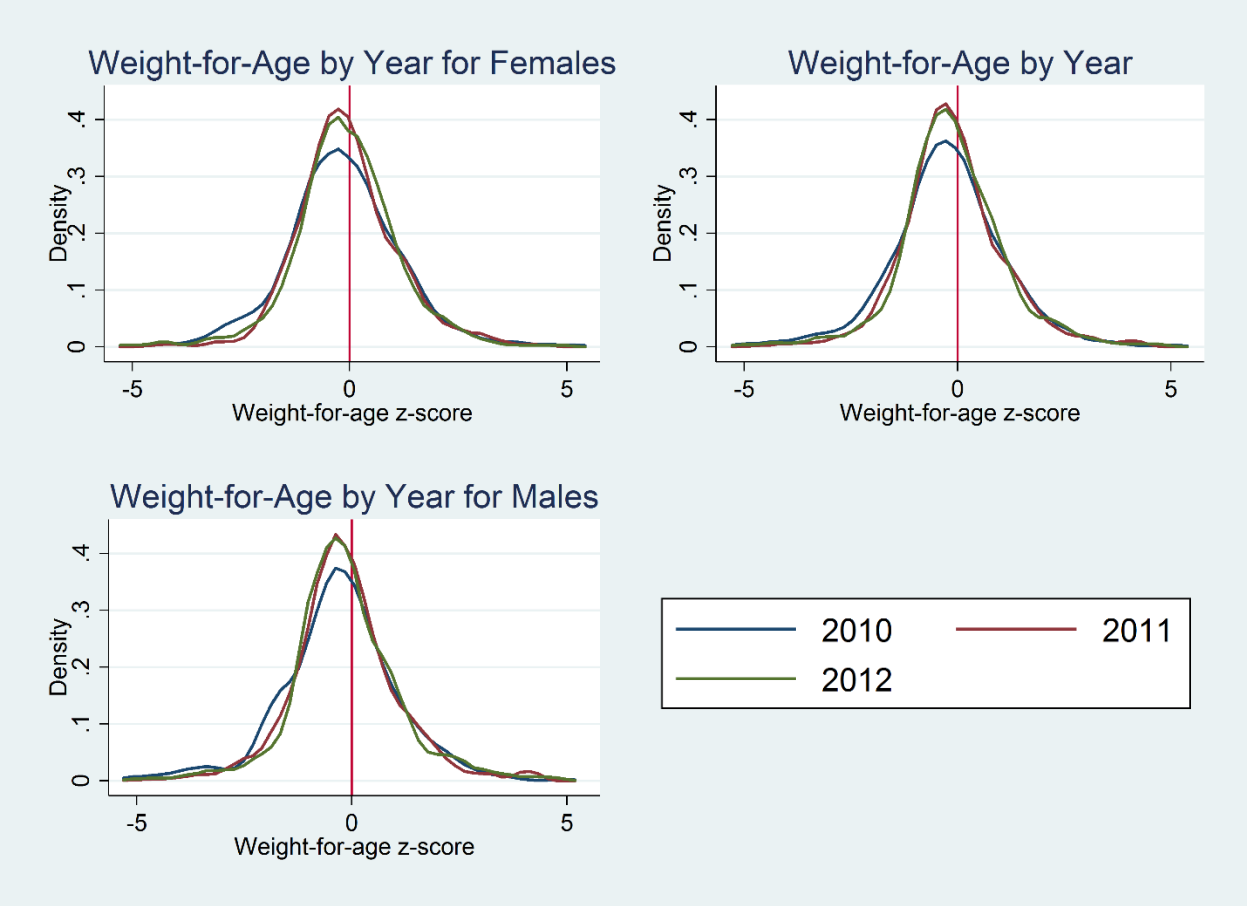

Figure A.2. Weight-for-Age Z-score Distributions for 2010, 2011, 2012.

Notes: Bottom left and top left are the distributions for males and females, respectively. Notice that the 2010 peak is lower than the peak for the other two years in all graphs; more density is situated in the left tail of the distribution.

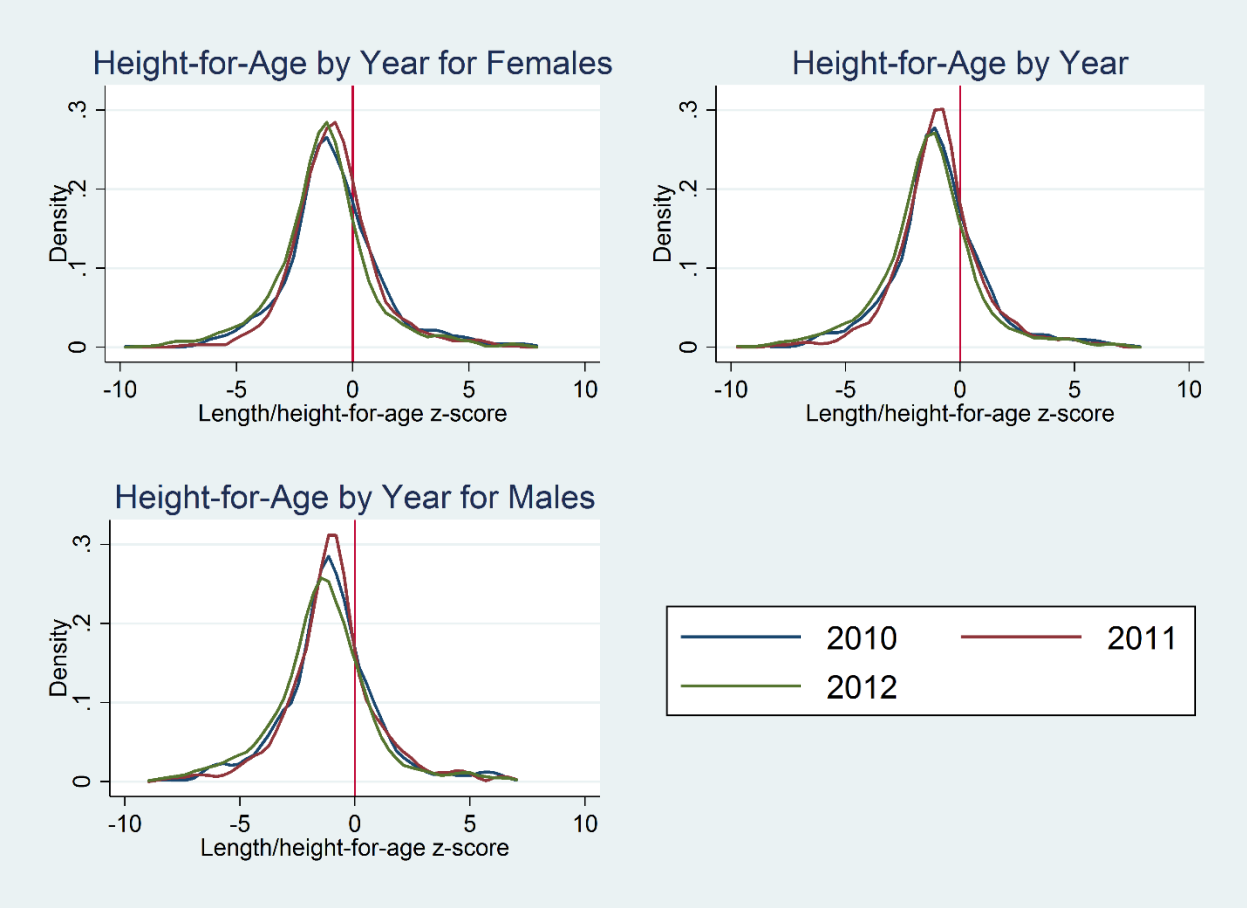

Figure A.3. Height-for-Age Z-score Distributions for 2010, 2011, 2012.

Notes: Bottom left and top left are the distributions for males and females, respectively. The 2012 distribution has the most observations close to the mean. Males have gotten progressively better off; more males have become better off based on the rightward and upward shift of their distribution.

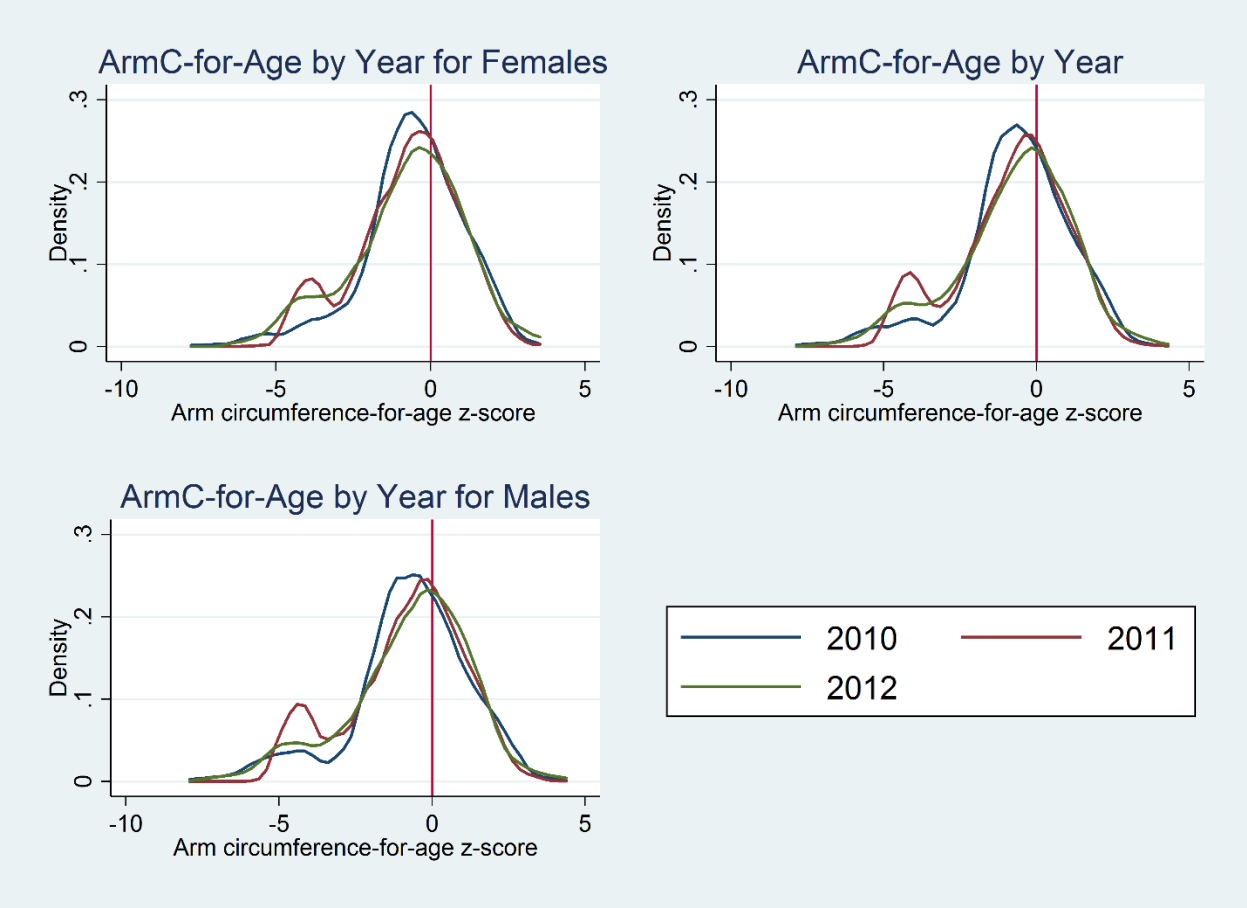

Figure A.4: Arm-Circumference-for-Age Z-score Distributions for 2010, 2011, 2012.

Notes: Bottom left and top left are the distributions for males and females, respectively.

Table A.1. Weight-for-Height Results for All Children.

All Children, Age <= 5	2010	2011	2012
Child Characteristics			
Child Age (months)	-0.005	0	-0.005
	0	0	0
Male (=1)	-0.016	-0.102	0.055
	-0.12	-0.11	-0.09
Ethnicity (relative to Kyrgyz)			
Russian	-0.360*	0.300*	0.251
	-0.21	-0.16	-0.3
Uzbek	-0.212	-0.215	0.115
	-0.27	-0.21	-0.27
Other	-0.412*	-0.177	-0.14
	-0.23	-0.2	-0.32
Household Shocks			
Personal Shock (=1)	-0.041	-0.003	-0.065
	-0.21	-0.16	-0.11
Economic Shock (=1)	0.002	0.021	0.075
	-0.25	-0.17	-0.2
Community			
Distance to Hospital (km)	-0.01	-0.01	-0.016*
	-0.01	-0.01	-0.01
Region (relative to Bishkek)			
Rural Mountain	-0.476**	-0.155	-0.145
	-0.19	-0.19	-0.13
Rural South	-0.152	-0.029	0.014
	-0.18	-0.13	-0.14
Rural Chui	-0.038	-0.381***	0.1
	-0.18	-0.13	-0.12
Urban Chui	0.38	0.003	-0.071
	-0.58	-0.38	-0.12
Urban South	-0.162	0.013	-0.093
	-0.18	-0.2	-0.3
Urban Mountain	-0.26	-0.374	-0.149
	-0.35	-0.4	-0.23
Osh City	-0.715***	0.018	-0.097
	-0.2	-0.16	-0.18
Parent Characteristics			
Mother Education	-0.238	-0.078	-0.251
	-0.45	-0.24	-0.2
Father Education	-0.152	-0.08	0.031
	-0.26	-0.22	-0.18
Mother Age	0.017*	0.012	0.009
	-0.01	-0.01	-0.01
Mother's Trust in Doctors	-0.106	-0.004	-0.199*
	-0.21	-0.11	-0.12
Father's Trust in Doctors	-0.089	0.066	-0.007
	-0.17	-0.13	-0.11
Constant	1.313	0.34	1.646***
	-1.01	-0.55	-0.55
R2 for the Model	0.025	0.015	0.017
Degrees of Freedom	36	35	35
	* p<0.1	** p<0.05	*** p<0.01

Table A.2. Weight-for-Height Results for Males Only.

Male Children, Age <= 5	2010	2011	2012
Child Characteristics			
Child Age (months)	0.001	-0.003	-0.006
	-0.01	0	-0.01
Ethnicity (relative to Kyrgyz)			
Russian	-0.319	0.088	0.032
	-0.21	-0.11	-0.36
Uzbek	-0.15	-0.175	0.066
	-0.22	-0.43	-0.35
Other	-0.538	-0.608	-0.821**
	-0.42	-0.42	-0.33
Household Shocks			
Personal Shock (=1)	-0.149	0.178	0.116
	-0.24	-0.24	-0.15
Economic Shock (=1)	-0.164	-0.36	-0.174
	-0.23	-0.24	-0.29
Community			
Distance to Hospital (km)	-0.004	-0.015*	-0.023**
	-0.01	-0.01	-0.01
Region (relative to Bishkek)			
Rural Mountain	-0.484***	-0.162	-0.452**
	-0.17	-0.27	-0.19
Rural South	-0.117	-0.035	-0.14
	-0.23	-0.19	-0.18
Rural Chui	-0.085	-0.082	0.443**
	-0.23	-0.29	-0.17
Urban Chui	1.144	0.934**	-0.244
	-1.13	-0.36	-0.25
Urban South	-0.108	-0.096	-0.171
	-0.4	-0.28	-0.44
Urban Mountain	-0.248	-0.522	-0.439
	-0.61	-0.53	-0.34
Osh City	-1.027***	0.097	-0.405
	-0.2	-0.29	-0.24
Parent Characteristics			
Mother Education	-0.362	0.024	0.024
	-0.51	-0.27	-0.29
Father Education	-0.255	0.274	-0.213
	-0.36	-0.3	-0.31
Mother Age	0.025*	0.007	0.009
	-0.01	-0.02	-0.02
Mother's Trust in Doctors	-0.014	-0.004	-0.235*
	-0.2	-0.13	-0.13
Father's Trust in Doctors	-0.214	0.083	0.081
	-0.17	-0.16	-0.15
Constant	1.207	0.169	1.826**
	-1.25	-0.7	-0.68
R2 for the Model	0.05	0.034	0.036
Degrees of Freedom	35	34	34
	* p<0.1	** p<0.05	*** p<0.01

Table A.3. Weight-for-Height Results for Females Only.

Female Children, Age <= 5	2010	2011	2012
Child Characteristics			
Child Age (months)	-0.01	0	-0.005
	-0.01	-0.01	0
Ethnicity (relative to Kyrgyz)			
Russian	-0.365	0.560*	0.49
	-0.28	-0.29	-0.37
Uzbek	-0.233	-0.305*	0.153
	-0.42	-0.16	-0.31
Other	-0.275	0.331*	0.780*
	-0.19	-0.17	-0.43
Household Shocks			
Personal Shock (=1)	0.102	-0.207	-0.297*
	-0.28	-0.2	-0.16
Economic Shock (=1)	0.168	0.463**	0.276
	-0.34	-0.22	-0.21
Community			
Distance to Hospital (km)	-0.015	-0.008	-0.013
	-0.02	-0.01	-0.01
Region (relative to Bishkek)			
Rural Mountain	-0.455	-0.141	0.215
	-0.29	-0.25	-0.17
Rural South	-0.244	0.02	0.154
	-0.17	-0.14	-0.19
Rural Chui	-0.024	-0.715***	-0.336***
	-0.28	-0.21	-0.11
Urban Chui	-0.038	-1.038***	0.144
	-0.18	-0.17	-0.21
Urban South	-0.212	0.28	-0.005
	-0.3	-0.29	-0.33
Urban Mountain	-0.294	-0.117	0.076
	-0.24	-0.35	-0.21
Osh City	-0.444	-0.009	0.238
	-0.32	-0.15	-0.22
Parent Characteristics			
Mother Education	-0.159	-0.141	-0.559**
	-0.44	-0.38	-0.27
Father Education	-0.007	-0.404	0.326
	-0.3	-0.26	-0.3
Mother Age	0.01	0.019*	0.013
	-0.02	-0.01	-0.02
Mother's Trust in Doctors	-0.152	-0.065	-0.161
	-0.23	-0.16	-0.14
Father's Trust in Doctors	0.043	0.069	-0.092
	-0.22	-0.15	-0.12
Constant	1.228	0.476	1.460**
	-1.08	-0.79	-0.69
R2 for the Model	0.022	0.056	0.04
Degrees of Freedom	36	35	35
	* p<0.1	** p<0.05	*** p<0.01

Table A.4. Weight-for-Age Results for All Children.

All Children, Age <= 5	2010	2011	2012
Child Characteristics			
Child Age (months)	-0.018***	-0.008***	-0.008***
	0	0	0
Male (=1)	-0.170**	-0.149**	-0.057
	-0.07	-0.07	-0.07
Ethnicity (relative to Kyrgyz)			
Russian	-0.095	0.023	0.091
	-0.1	-0.11	-0.19
Uzbek	-0.184	-0.093	0.119
	-0.24	-0.22	-0.11
Other	0.054	0.116	-0.079
	-0.18	-0.12	-0.15
Household Shocks			
Personal Shock (=1)	-0.034	0.104	-0.087
	-0.13	-0.12	-0.08
Economic Shock (=1)	0.041	-0.184	0.017
	-0.1	-0.13	-0.14
Community			
Distance to Hospital (km)	-0.003	-0.002	0.009
	0	0	-0.01
Region (relative to Bishkek)			
Rural Mountain	-0.287***	-0.224**	-0.116
	-0.08	-0.09	-0.13
Rural South	-0.013	0.075	0.028
	-0.09	-0.09	-0.08
Rural Chui	0.048	-0.013	0.392***
	-0.2	-0.09	-0.14
Urban Chui	0.136	-0.074	0.274
	-0.21	-0.29	-0.2
Urban South	-0.053	0.007	-0.022
	-0.13	-0.14	-0.13
Urban Mountain	-0.175	-0.167	0.174
	-0.19	-0.21	-0.19
Osh City	-0.921***	0.380**	0.385***
	-0.17	-0.16	-0.1
Parent Characteristics			
Mother Education	-0.006	-0.243	-0.135
	-0.17	-0.16	-0.09
Father Education	0.179	0.095	0.203*
	-0.13	-0.12	-0.11
Mother Age	0.013**	0.016**	0.009
	-0.01	-0.01	-0.01
Mother's Trust in Doctors	-0.102	-0.063	-0.173***
	-0.1	-0.06	-0.05
Father's Trust in Doctors	-0.016	-0.018	0.084
	-0.09	-0.07	-0.07
Constant	0.377	0.129	0.038
	-0.3	-0.4	-0.3
R2 for the Model	0.105	0.05	0.049
Degrees of Freedom	36	35	35
	* p<0.1	** p<0.05	*** p<0.01

Table A.5. Weight-for-Age Results for Males Only.

Male Children, Age <= 5	2010	2011	2012
Child Characteristics			
Child Age (months)	-0.012***	-0.005	-0.006**
	0	0	0
Ethnicity (relative to Kyrgyz)			
Russian	-0.196	-0.198**	-0.053
	-0.24	-0.08	-0.23
Uzbek	-0.315	-0.033	0.279*
	-0.26	-0.33	-0.15
Other	0.353	0.003	-0.211
	-0.3	-0.21	-0.2
Household Shocks			
Personal Shock (=1)	-0.089	0.141	0.078
	-0.16	-0.16	-0.11
Economic Shock (=1)	-0.187	-0.2	-0.07
	-0.13	-0.14	-0.13
Community			
Distance to Hospital (km)	-0.010*	-0.003	-0.007
	-0.01	-0.01	-0.01
Region (relative to Bishkek)			
Rural Mountain	-0.188**	-0.253**	-0.152
	-0.09	-0.12	-0.13
Rural South	-0.004	0.074	0.153
	-0.1	-0.13	-0.11
Rural Chui	-0.087	0.265	0.620***
	-0.34	-0.22	-0.12
Urban Chui	-0.025	0.335	0.193
	-0.18	-0.49	-0.31
Urban South	0.025	0.068	0.139
	-0.22	-0.15	-0.21
Urban Mountain	-0.198	0.097	0.35
	-0.39	-0.31	-0.29
Osh City	-1.070***	0.292	0.477***
	-0.2	-0.2	-0.13
Parent Characteristics			
Mother Education	0.04	-0.193	-0.03
	-0.21	-0.22	-0.13
Father Education	0.12	0.108	0.273
	-0.16	-0.15	-0.17
Mother Age	0.019**	0.017	0.016**
	-0.01	-0.01	-0.01
Mother's Trust in Doctors	-0.113	-0.07	-0.094
	-0.13	-0.08	-0.08
Father's Trust in Doctors	0.011	-0.02	0.064
	-0.09	-0.09	-0.1
Constant	-0.171	-0.204	-0.713*
	-0.36	-0.44	-0.35
R2 for the Model	0.098	0.047	0.057
Degrees of Freedom	35	34	34
	* p<0.1	** p<0.05	*** p<0.01

Table A.6. Weight-for-Age Results for Females Only.

Female Children, Age <= 5	2010	2011	2012
Child Characteristics			
Child Age (months)	-0.023***	-0.011***	-0.010***
	0	0	0
Ethnicity (relative to Kyrgyz)			
Russian	-0.083	0.334	0.239
	-0.21	-0.24	-0.25
Uzbek	-0.028	-0.143	0.012
	-0.23	-0.19	-0.2
Other	-0.168	0.303	0.147
	-0.18	-0.25	-0.27
Household Shocks			
Personal Shock (=1)	0.027	0.085	-0.267**
	-0.17	-0.18	-0.11
Economic Shock (=1)	0.252*	-0.171	0.096
	-0.14	-0.18	-0.18
Community			
Distance to Hospital (km)	0.004	-0.001	0.018***
	-0.01	-0.01	-0.01
Region (relative to Bishkek)			
Rural Mountain	-0.420***	-0.208	0.018
	-0.14	-0.14	-0.21
Rural South	-0.103	0.081	-0.09
	-0.1	-0.12	-0.11
Rural Chui	0.159	-0.335**	0.141
	-0.13	-0.13	-0.21
Urban Chui	0.284	-0.354**	0.349**
	-0.32	-0.17	-0.14
Urban South	-0.191*	-0.059	-0.201
	-0.1	-0.19	-0.15
Urban Mountain	-0.122	-0.434*	0.01
	-0.11	-0.24	-0.1
Osh City	-0.771***	0.477***	0.264*
	-0.16	-0.17	-0.15
Parent Characteristics			
Mother Education	-0.008	-0.287	-0.223**
	-0.22	-0.19	-0.11
Father Education	0.268	0.103	0.131
	-0.16	-0.16	-0.13
Mother Age	0.006	0.014*	0.002
	-0.01	-0.01	-0.01
Mother's Trust in Doctors	-0.05	-0.036	-0.227***
	-0.1	-0.1	-0.06
Father's Trust in Doctors	-0.05	-0.038	0.104
	-0.12	-0.07	-0.07
Constant	0.630*	0.322	0.636
	-0.33	-0.53	-0.41
R2 for the Model	0.157	0.074	0.089
Degrees of Freedom	36	35	35
	* p<0.1	** p<0.05	*** p<0.01

Table A.7. Height-for-Age Results for All Children.

All Children, Age <= 5	2010	2011	2012
Child Characteristics			
Child Age (months)	-0.013***	0	0.003
	0	0	0
Male (=1)	-0.341***	-0.226*	-0.204*
	-0.11	-0.13	-0.11
Ethnicity (relative to Kyrgyz)			
Russian	0.299	-0.121	-0.115
	-0.22	-0.12	-0.19
Uzbek	0.113	0.086	0.043
	-0.35	-0.28	-0.31
Other	0.571*	0.283	0.041
	-0.29	-0.19	-0.27
Household Shocks			
Personal Shock (=1)	0.205	0.017	-0.009
	-0.17	-0.21	-0.16
Economic Shock (=1)	0.096	-0.378**	0.007
	-0.19	-0.15	-0.22
Community			
Distance to Hospital (km)	0	0.003	0.016
	-0.01	-0.01	-0.02
Region (relative to Bishkek)			
Rural Mountain	-0.006	-0.117	-0.074
	-0.17	-0.18	-0.16
Rural South	-0.027	0.063	0.083
	-0.21	-0.15	-0.19
Rural Chui	-0.243	0.489***	0.569**
	-0.27	-0.12	-0.22
Urban Chui	0.052	0.173	0.513
	-0.21	-0.27	-0.47
Urban South	-0.124	-0.288	0.02
	-0.16	-0.39	-0.32
Urban Mountain	0.052	-0.175	0.382**
	-0.2	-0.12	-0.17
Osh City	-0.859***	0.653***	0.665***
	-0.23	-0.18	-0.17
Parent Characteristics			
Mother Education	0.146	-0.1	-0.064
	-0.41	-0.3	-0.3
Father Education	0.517**	0.354*	0.288**
	-0.21	-0.19	-0.13
Mother Age	0.004	0.001	0.012
	-0.01	-0.01	-0.01
Mother's Trust in Doctors	-0.007	-0.043	0.01
	-0.12	-0.09	-0.09
Father's Trust in Doctors	0.083	-0.039	0.127
	-0.09	-0.12	-0.12
Constant	-1.262	-0.808	-2.559***
	-0.79	-0.51	-0.38
R2 for the Model	0.05	0.037	0.019
Degrees of Freedom	36	35	35
	* p<0.1	** p<0.05	*** p<0.01

Table A.8. Height-for-Age Results for Males Only.

Male Children, Age <= 5	2010	2011	2012
Child Characteristics			
Child Age (months)	-0.010**	0.002	0.01
	0	-0.01	-0.01
Ethnicity (relative to Kyrgyz)			
Russian	0.33	-0.352**	-0.139
	-0.3	-0.17	-0.3
Uzbek	-0.036	0.142	0.195
	-0.36	-0.47	-0.42
Other	1.247***	0.564	0.527
	-0.28	-0.37	-0.46
Household Shocks			
Personal Shock (=1)	0.055	-0.155	0.116
	-0.24	-0.29	-0.17
Economic Shock (=1)	-0.042	0.001	0.104
	-0.28	-0.23	-0.31
Community			
Distance to Hospital (km)	-0.018	0	0.005
	-0.01	-0.01	-0.03
Region (relative to Bishkek)			
Rural Mountain	0.243	0.048	-0.206
	-0.19	-0.29	-0.29
Rural South	-0.038	0.172	0.186
	-0.22	-0.22	-0.21
Rural Chui	-0.299	0.649***	0.355
	-0.35	-0.22	-0.29
Urban Chui	-0.038	-0.438	0.026
	-0.18	-0.58	-0.61
Urban South	0.043	-0.22	0.071
	-0.19	-0.44	-0.4
Urban Mountain	-0.169	0.346	0.713***
	-0.36	-0.4	-0.26
Osh City	-0.953***	0.731**	0.830***
	-0.28	-0.28	-0.25
Parent Characteristics			
Mother Education	0.442	0.114	-0.293
	-0.46	-0.47	-0.4
Father Education	0.514*	0.188	0.417*
	-0.28	-0.21	-0.22
Mother Age	0.004	0.004	0.016
	-0.01	-0.02	-0.01
Mother's Trust in Doctors	-0.151	-0.093	0.018
	-0.15	-0.1	-0.13
Father's Trust in Doctors	0.312**	0.072	0.111
	-0.15	-0.16	-0.18
Constant	-2.217**	-1.663**	-3.146***
	-0.84	-0.79	-0.61
R2 for the Model	0.076	0.033	0.032
Degrees of Freedom	35	34	34
	* p<0.1	** p<0.05	*** p<0.01

Table A.9. Height-for-Age Results for Females Only.

Female Children, Age <= 5	2010	2011	2012
Child Characteristics			
Child Age (months)	-0.016***	-0.003	-0.002
	0	0	0
Ethnicity (relative to Kyrgyz)			
Russian	0.169	0.14	-0.183
	-0.33	-0.22	-0.28
Uzbek	0.243	0.009	-0.003
	-0.38	-0.28	-0.31
Other	0.058	0.052	-0.460**
	-0.46	-0.3	-0.19
Household Shocks			
Personal Shock (=1)	0.296	0.238	-0.159
	-0.29	-0.18	-0.23
Economic Shock (=1)	0.24	-0.845***	-0.093
	-0.26	-0.25	-0.23
Community			
Distance to Hospital (km)	0.018**	0.007	0.027**
	-0.01	-0.01	-0.01
Region (relative to Bishkek)			
Rural Mountain	-0.29	-0.336	0.124
	-0.23	-0.28	-0.23
Rural South	-0.068	-0.112	-0.037
	-0.23	-0.17	-0.23
Rural Chui	-0.212	0.208	0.823***
	-0.26	-0.17	-0.27
Urban Chui	0.029	0.659***	0.948***
	-0.41	-0.2	-0.33
Urban South	-0.402	-0.467	-0.055
	-0.3	-0.46	-0.36
Urban Mountain	0.286*	-0.854***	0.171
	-0.15	-0.19	-0.26
Osh City	-0.694**	0.495***	0.396**
	-0.33	-0.16	-0.19
Parent Characteristics			
Mother Education	-0.065	-0.296	0.139
	-0.42	-0.2	-0.33
Father Education	0.525***	0.563**	0.153
	-0.18	-0.25	-0.19
Mother Age	0.001	-0.007	0.004
	-0.01	-0.01	-0.01
Mother's Trust in Doctors	0.2	0.066	0.045
	-0.12	-0.17	-0.14
Father's Trust in Doctors	-0.204*	-0.172	0.14
	-0.12	-0.18	-0.14
Constant	-0.681	-0.124	-2.266***
	-0.9	-0.66	-0.43
R2 for the Model	0.061	0.075	0.029
Degrees of Freedom	36	35	35
	* p<0.1	** p<0.05	*** p<0.01

Table A.10. Arm-Circumference-for-Age Results for All Children.

All Children, Age <= 5	2010	2011	2012
Child Characteristics			
Child Age (months)	0.031***	0.057***	0.050***
	0	0	0
Male (=1)	-0.177	-0.109	-0.086
	-0.11	-0.09	-0.11
Ethnicity (relative to Kyrgyz)			
Russian	0.604	0.735**	-0.029
	-0.5	-0.31	-0.37
Uzbek	-0.16	0.013	-0.567
	-0.17	-0.19	-0.35
Other	-0.291	-0.114	-0.352**
	-0.25	-0.28	-0.17
Household Shocks			
Personal Shock (=1)	-0.04	0.088	-0.048
	-0.09	-0.12	-0.13
Economic Shock (=1)	-0.09	-0.144	-0.063
	-0.14	-0.16	-0.2
Community			
Distance to Hospital (km)	-0.003	-0.010**	-0.006
	-0.01	0	-0.02
Region (relative to Bishkek)			
Rural Mountain	0.021	-0.267	-0.289
	-0.17	-0.16	-0.21
Rural South	0.009	-0.185*	0.284
	-0.13	-0.1	-0.34
Rural Chui	0.183	0.349***	0.752***
	-0.16	-0.09	-0.25
Urban Chui	-0.662	0.264	0.697
	-0.45	-0.63	-0.7
Urban South	-0.079	-0.419	0.725*
	-0.2	-0.28	-0.41
Urban Mountain	-0.738***	0.145	0.827*
	-0.24	-0.4	-0.44
Osh City	0.121	-0.288**	1.451***
	-0.17	-0.13	-0.25
Parent Characteristics			
Mother Education	-0.138	-0.135	-0.237
	-0.18	-0.18	-0.19
Father Education	-0.093	0.126	0.01
	-0.15	-0.17	-0.12
Mother Age	-0.014**	0.004	0.011
	-0.01	-0.01	-0.01
Mother's Trust in Doctors	-0.013	-0.005	-0.102
	-0.13	-0.07	-0.14
Father's Trust in Doctors	-0.084	-0.064	0.041
	-0.11	-0.07	-0.08
Constant	-0.453	-2.321***	-2.567***
	-0.37	-0.47	-0.47
R2 for the Model	0.101	0.298	0.223
Degrees of Freedom	36	35	35
	* p<0.1	** p<0.05	*** p<0.01

Table A.11. Arm-Circumference-for-Age Results for Males Only.

Male Children, Age <= 5	2010	2011	2012
Child Characteristics			
Child Age (months)	0.040***	0.067***	0.056***
	-0.01	-0.01	-0.01
Ethnicity (relative to Kyrgyz)			
Russian	1.285***	1.191***	-0.032
	-0.23	-0.21	-0.52
Uzbek	-0.22	0.107	-0.481
	-0.3	-0.28	-0.36
Other	-0.600*	-0.002	-0.455*
	-0.31	-0.26	-0.26
Household Shocks			
Personal Shock (=1)	-0.078	0.09	-0.134
	-0.15	-0.15	-0.23
Economic Shock (=1)	-0.137	-0.159	-0.157
	-0.2	-0.19	-0.23
Community			
Distance to Hospital (km)	-0.008	-0.004	-0.022
	-0.01	-0.01	-0.02
Region (relative to Bishkek)			
Rural Mountain	0.076	-0.187	-0.252
	-0.24	-0.26	-0.28
Rural South	0.164	-0.092	0.245
	-0.16	-0.14	-0.41
Rural Chui	0.206	0.231**	0.914**
	-0.13	-0.09	-0.34
Urban Chui	-0.295	0.869*	0.847
	-0.64	-0.48	-0.68
Urban South	-0.009	-0.343	0.546
	-0.27	-0.3	-0.44
Urban Mountain	-0.698	0.508	0.929**
	-0.46	-0.6	-0.44
Osh City	-0.055	-0.418**	1.380***
	-0.26	-0.19	-0.28
Parent Characteristics			
Mother Education	-0.435	-0.593**	-0.301
	-0.35	-0.22	-0.26
Father Education	-0.195	0.347	0.207
	-0.23	-0.24	-0.2
Mother Age	-0.013	0.007	0.004
	-0.01	-0.01	-0.01
Mother's Trust in Doctors	0.014	0.002	-0.135
	-0.21	-0.13	-0.18
Father's Trust in Doctors	0.095	0.082	-0.004
	-0.16	-0.12	-0.09
Constant	-1.261**	-3.192***	-2.354***
	-0.57	-0.6	-0.68
R2 for the Model	0.158	0.361	0.245
Degrees of Freedom	35	34	34
	* p<0.1	** p<0.05	*** p<0.01

Table A.12. Arm-Circumference-for-Age Results for Females Only.

Female Children, Age <= 5	2010	2011	2012
Child Characteristics			
Child Age (months)	0.021***	0.047***	0.044***
	-0.01	0	-0.01
Ethnicity (relative to Kyrgyz)			
Russian	-0.081	0.338	-0.018
	-0.74	-0.31	-0.32
Uzbek	-0.075	-0.14	-0.618
	-0.17	-0.22	-0.38
Other	0.074	-0.156	-0.163
	-0.26	-0.38	-0.22
Household Shocks			
Personal Shock (=1)	0.042	0.2	0.102
	-0.18	-0.19	-0.16
Economic Shock (=1)	0.123	-0.096	0.003
	-0.18	-0.23	-0.25
Community			
Distance to Hospital (km)	0.002	-0.013**	0.008
	-0.01	-0.01	-0.01
Region (relative to Bishkek)			
Rural Mountain	-0.078	-0.345*	-0.273
	-0.22	-0.19	-0.19
Rural South	-0.261	-0.261*	0.312
	-0.16	-0.15	-0.27
Rural Chui	-0.012	0.418**	0.560***
	-0.28	-0.19	-0.2
Urban Chui	-0.791	-0.056	0.521
	-0.55	-0.73	-0.83
Urban South	-0.148	-0.474	0.997**
	-0.31	-0.3	-0.44
Urban Mountain	-0.761***	-0.176	0.741
	-0.13	-0.25	-0.5
Osh City	0.337*	-0.075	1.514***
	-0.18	-0.12	-0.29
Parent Characteristics			
Mother Education	0.053	0.259	-0.114
	-0.22	-0.29	-0.28
Father Education	0.027	-0.137	-0.227
	-0.2	-0.24	-0.2
Mother Age	-0.017*	0	0.022**
	-0.01	-0.01	-0.01
Mother's Trust in Doctors	0.017	-0.007	-0.095
	-0.09	-0.09	-0.14
Father's Trust in Doctors	-0.313***	-0.237***	0.137
	-0.11	-0.09	-0.11
Constant	0.385	-1.373**	-3.020***
	-0.51	-0.66	-0.52
R2 for the Model	0.079	0.267	0.218
Degrees of Freedom	35	35	34
	* p<0.1	** p<0.05	*** p<0.01

Table A.13. Stunting Model Results for All Children

All Children, Age <= 5	2010	2011	2012
Child Characteristics			
Child Age (months)	0	-0.003***	-0.002***
	0	0	0
Male (=1)	0.037*	0.046*	0.055**
	-0.02	-0.03	-0.02
Ethnicity (relative to Kyrgyz)			
Russian	-0.064	0.066***	0.03
	-0.06	-0.02	-0.06
Uzbek	-0.067	-0.069	-0.043
	-0.06	-0.05	-0.08
Other	-0.129***	-0.087*	0.033
	-0.03	-0.05	-0.07
Household Shocks			
Personal Shock (=1)	-0.011	-0.039	-0.04
	-0.03	-0.04	-0.04
Economic Shock (=1)	0.002	0.086**	0.03
	-0.03	-0.03	-0.04
Community			
Distance to Hospital (km)	0.001	-0.001	-0.003
	0	0	0
Region (relative to Bishkek)			
Rural Mountain	0.049	0.075	0.032
	-0.03	-0.05	-0.04
Rural South	0.032	0.049	-0.026
	-0.04	-0.03	-0.05
Rural Chui	0.116*	-0.089**	-0.111**
	-0.07	-0.04	-0.05
Urban Chui	-0.031	-0.014	-0.181
	-0.04	-0.08	-0.12
Urban South	0.031	0.133*	0.008
	-0.05	-0.07	-0.05
Urban Mountain	-0.042	0.078	-0.096**
	-0.03	-0.06	-0.04
Osh City	0.232***	-0.049	-0.079*
	-0.03	-0.03	-0.05
Parent Characteristics			
Mother Education	-0.106	-0.097*	-0.042
	-0.07	-0.05	-0.05
Father Education	-0.087**	-0.039	-0.02
	-0.04	-0.04	-0.04
Mother Age	-0.001	-0.002	-0.002
	0	0	0
Mother's Trust in Doctors	0.011	0.03	0.003
	-0.02	-0.02	-0.02
Father's Trust in Doctors	-0.011	-0.011	-0.024
	-0.02	-0.02	-0.03
Constant	0.371**	0.390***	0.607***
	-0.15	-0.13	-0.08
R2 for the Model	0.042	0.068	0.03
Degrees of Freedom	36	35	35
	* p<0.1	** p<0.05	*** p<0.01

Table A.14. Stunting Model Results for Males Only.

Male Children, Age <= 5	2010	2011	2012
Child Characteristics			
Child Age (months)	-0.001	-0.003**	-0.004***
	0	0	0
Ethnicity (relative to Kyrgyz)			
Russian	0.012	0.129*	-0.002
	-0.08	-0.07	-0.06
Uzbek	-0.055	-0.046	-0.093
	-0.04	-0.07	-0.1
Other	-0.299***	-0.1	-0.038
	-0.06	-0.07	-0.08
Household Shocks			
Personal Shock (=1)	0.006	-0.017	0
	-0.04	-0.06	-0.06
Economic Shock (=1)	0.041	-0.006	0.013
	-0.06	-0.05	-0.06
Community			
Distance to Hospital (km)	0.003	0	0.002
	0	0	0
Region (relative to Bishkek)			
Rural Mountain	0.011	0.057	0
	-0.05	-0.07	-0.07
Rural South	-0.007	0.048	-0.072
	-0.05	-0.05	-0.06
Rural Chui	0.15	-0.136**	-0.111**
	-0.1	-0.06	-0.05
Urban Chui	-0.006	0.126	-0.076
	-0.08	-0.2	-0.18
Urban South	0.047	0.137*	-0.005
	-0.04	-0.08	-0.09
Urban Mountain	-0.013	0.076	-0.126**
	-0.05	-0.07	-0.05
Osh City	0.252***	-0.04	-0.114*
	-0.04	-0.05	-0.06
Parent Characteristics			
Mother Education	-0.148	-0.157**	-0.072
	-0.11	-0.07	-0.08
Father Education	-0.102*	0.029	-0.07
	-0.05	-0.04	-0.06
Mother Age	-0.001	-0.002	-0.003
	0	0	0
Mother's Trust in Doctors	0.049*	0.037	-0.002
	-0.03	-0.03	-0.03
Father's Trust in Doctors	-0.057**	-0.016	-0.024
	-0.03	-0.03	-0.03
Constant	0.527***	0.483**	0.834***
	-0.16	-0.19	-0.11
R2 for the Model	0.082	0.074	0.044
Degrees of Freedom	35	34	34
	* p<0.1	** p<0.05	*** p<0.01

Table A.15. Stunting Model Results for Females Only.

Female Children, Age <= 5	2010	2011	2012
Child Characteristics			
Child Age (months)	0	-0.003***	-0.001
	0	0	0
Ethnicity (relative to Kyrgyz)			
Russian	-0.088**	-0.003	0.102
	-0.04	-0.08	-0.08
Uzbek	-0.078	-0.087	-0.006
	-0.07	-0.07	-0.07
Other	0.013	-0.09	0.116
	-0.07	-0.1	-0.09
Household Shocks			
Personal Shock (=1)	-0.017	-0.065*	-0.079*
	-0.04	-0.04	-0.05
Economic Shock (=1)	-0.039	0.201***	0.052
	-0.04	-0.06	-0.04
Community			
Distance to Hospital (km)	-0.001	-0.002	-0.007***
	0	0	0
Region (relative to Bishkek)			
Rural Mountain	0.117**	0.076	0.045
	-0.05	-0.06	-0.03
Rural South	0.096***	0.046	0.028
	-0.03	-0.03	-0.05
Rural Chui	0.103**	-0.029	-0.115
	-0.04	-0.06	-0.07
Urban Chui	-0.003	-0.141***	-0.278***
	-0.07	-0.04	-0.06
Urban South	0.054	0.137	0.038
	-0.07	-0.1	-0.08
Urban Mountain	-0.058	0.103	-0.072
	-0.04	-0.11	-0.07
Osh City	0.226***	-0.066*	-0.025
	-0.04	-0.04	-0.05
Parent Characteristics			
Mother Education	-0.083	-0.035	-0.004
	-0.08	-0.06	-0.05
Father Education	-0.066	-0.114**	0.043
	-0.05	-0.04	-0.05
Mother Age	0	-0.001	-0.001
	0	0	0
Mother's Trust in Doctors	-0.037	0.011	-0.008
	-0.02	-0.03	-0.02
Father's Trust in Doctors	0.046	-0.002	-0.021
	-0.03	-0.03	-0.04
Constant	0.233	0.371***	0.456***
	-0.14	-0.12	-0.12
R2 for the Model	0.044	0.093	0.036
Degrees of Freedom	36	35	35
	* p<0.1	** p<0.05	*** p<0.01

Table A.16. Wasting Model Results for All Children

All Children, Age <= 5	2010	2011	2012
Child Characteristics			
Child Age (months)	-0.001*	-0.001	0
	0	0	0
Male (=1)	-0.002	0.026**	-0.013
	-0.01	-0.01	-0.01
Ethnicity (relative to Kyrgyz)			
Russian	-0.031	-0.060**	-0.003
	-0.03	-0.03	-0.03
Uzbek	0.003	-0.024	-0.064**
	-0.04	-0.02	-0.03
Other	0.009	-0.035	0.023
	-0.03	-0.05	-0.05
Household Shocks			
Personal Shock (=1)	-0.017	0.002	-0.029
	-0.03	-0.02	-0.02
Economic Shock (=1)	-0.026	0.025	0.007
	-0.03	-0.04	-0.03
Community			
Distance to Hospital (km)	0.005**	0.002	0.001
	0	0	0
Region (relative to Bishkek)			
Rural Mountain	0.078*	0.058	0.061*
	-0.04	-0.04	-0.03
Rural South	0.050**	0.045	0.053**
	-0.02	-0.03	-0.02
Rural Chui	0.036	0.076***	0.003
	-0.02	-0.02	-0.02
Urban Chui	0.049	-0.028	-0.023
	-0.05	-0.03	-0.02
Urban South	0.056	0.018	0.119***
	-0.03	-0.03	-0.04
Urban Mountain	0.017	0.036	0.043*
	-0.03	-0.03	-0.02
Osh City	0.144***	0.002	0.073***
	-0.04	-0.02	-0.02
Parent Characteristics			
Mother Education	-0.009	mal	-0.003
	-0.04	-0.03	-0.02
Father Education	-0.008	0.004	-0.021
	-0.03	-0.03	-0.02
Mother Age	-0.002	0	-0.002
	0	0	0
Mother's Trust in Doctors	-0.007	-0.003	0.029**
	-0.02	-0.02	-0.01
Father's Trust in Doctors	0.01	0.002	-0.032***
	-0.02	-0.02	-0.01
Constant	0.141	0.091	0.122*
	-0.1	-0.07	-0.07
R2 for the Model	0.044	0.031	0.036
Degrees of Freedom	36	35	35
	* p<0.1	** p<0.05	*** p<0.01

Table A.17. Wasting Model Results for Males Only.

Male Children, Age <= 5	2010	2011	2012
Child Characteristics			
Child Age (months)	-0.001*	-0.001	0
	0	0	0
Ethnicity (relative to Kyrgyz)			
Russian	0.003	-0.070**	0.036
	-0.03	-0.03	-0.06
Uzbek	-0.029	0.023	-0.043
	-0.04	-0.04	-0.03
Other	0.037	-0.008	0.078
	-0.04	-0.08	-0.05
Household Shocks			
Personal Shock (=1)	-0.032	-0.015	-0.017
	-0.03	-0.03	-0.03
Economic Shock (=1)	-0.011	0.052	0.029
	-0.04	-0.06	-0.03
Community			
Distance to Hospital (km)	0.004*	0.002	0.004*
	0	0	0
Region (relative to Bishkek)			
Rural Mountain	0.057	0.056	0.072*
	-0.04	-0.04	-0.04
Rural South	0.058**	0.032	0.047**
	-0.02	-0.04	-0.02
Rural Chui	0.033	0.063*	-0.009
	-0.03	-0.03	-0.02
Urban Chui	-0.039*	-0.042	-0.009
	-0.02	-0.04	-0.02
Urban South	0.06	0.026	0.137***
	-0.05	-0.04	-0.05
Urban Mountain	0.080*	0.065	0.118***
	-0.05	-0.07	-0.04
Osh City	0.241***	-0.059	0.082***
	-0.04	-0.04	-0.03
Parent Characteristics			
Mother Education	-0.001	-0.037	-0.025
	-0.04	-0.06	-0.03
Father Education	0.005	-0.047	0.022
	-0.04	-0.04	-0.03
Mother Age	-0.001	0.002	-0.002*
	0	0	0
Mother's Trust in Doctors	-0.017	0.006	0.028*
	-0.02	-0.02	-0.01
Father's Trust in Doctors	0.023	0.007	-0.033**
	-0.02	-0.02	-0.02
Constant	0.082	0.029	0.083
	-0.14	-0.09	-0.07
R2 for the Model	0.046	0.041	0.058
Degrees of Freedom	35	34	34
	* p<0.1	** p<0.05	*** p<0.01

Table A.18. Wasting Model Results for Females Only.

Female Children, Age <= 5	2010	2011	2012
Child Characteristics			
Child Age (months)	-0.001	0	-0.001
	0	0	0
Ethnicity (relative to Kyrgyz)			
Russian	-0.073**	-0.04	-0.046**
	-0.03	-0.03	-0.02
Uzbek	0.028	-0.058*	-0.087**
	-0.05	-0.03	-0.04
Other	-0.016	-0.073*	-0.045
	-0.05	-0.04	-0.06
Household Shocks			
Personal Shock (=1)	-0.002	0.01	-0.033
	-0.03	-0.03	-0.03
Economic Shock (=1)	-0.036	-0.012	-0.014
	-0.04	-0.03	-0.03
Community			
Distance to Hospital (km)	0.007*	0.001	0
	0	0	0
Region (relative to Bishkek)			
Rural Mountain	0.096*	0.059	0.053*
	-0.05	-0.04	-0.03
Rural South	0.044	0.060**	0.070**
	-0.03	-0.03	-0.03
Rural Chui	0.042	0.097***	0.029
	-0.03	-0.03	-0.02
Urban Chui	0.132*	-0.027	-0.021*
	-0.08	-0.02	-0.01
Urban South	0.045	-0.006	0.104*
	-0.04	-0.03	-0.05
Urban Mountain	-0.043**	-0.015	-0.034**
	-0.02	-0.02	-0.02
Osh City	0.055	0.051**	0.075***
	-0.05	-0.02	-0.03
Parent Characteristics			
Mother Education	-0.012	-0.095**	0.013
	-0.06	-0.03	-0.03
Father Education	-0.014	0.049	-0.072
	-0.04	-0.03	-0.05
Mother Age	-0.004	-0.002	-0.002
	0	0	0
Mother's Trust in Doctors	0	-0.007	0.029**
	-0.03	-0.02	-0.01
Father's Trust in Doctors	0.001	-0.005	-0.031*
	-0.03	-0.02	-0.02
Constant	0.196*	0.176*	0.171
	-0.1	-0.1	-0.11
R2 for the Model	0.066	0.052	0.047
Degrees of Freedom	36	35	35
	* p<0.1	** p<0.05	*** p<0.01

Table A.19. Underweight Model Results for All Children

All Children, Age <= 5	2010	2011	2012
Child Characteristics			
Child Age (months)	0.001	-0.001***	-0.001**
	0	0	0
Male (=1)	0.019	0.022	0.007
	-0.02	-0.01	-0.02
Ethnicity (relative to Kyrgyz)			
Russian	0.029	-0.041***	0.03
	-0.05	-0.01	-0.02
Uzbek	0.025	-0.039**	-0.054**
	-0.05	-0.02	-0.02
Other	-0.047	-0.044**	0.006
	-0.03	-0.02	-0.03
Household Shocks			
Personal Shock (=1)	0.014	-0.002	-0.018
	-0.03	-0.02	-0.02
Economic Shock (=1)	0.015	0.036	0.023
	-0.03	-0.02	-0.03
Community			
Distance to Hospital (km)	0.001	0	0.001
	0	0	0
Region (relative to Bishkek)			
Rural Mountain	0.029	0.035	0.050*
	-0.02	-0.02	-0.03
Rural South	0.026	0.029*	0.043*
	-0.02	-0.02	-0.02
Rural Chui	0.034*	0.012	-0.004
	-0.02	-0.02	-0.02
Urban Chui	0.021	-0.005	-0.041*
	-0.03	-0.01	-0.02
Urban South	0.021	-0.002	0.057**
	-0.04	-0.02	-0.03
Urban Mountain	0.052	0.032	0.019
	-0.04	-0.05	-0.04
Osh City	0.190***	0.013	-0.01
	-0.04	-0.01	-0.02
Parent Characteristics			
Mother Education	-0.016	-0.019	0.009
	-0.04	-0.02	-0.02
Father Education	-0.064**	-0.037*	-0.042*
	-0.03	-0.02	-0.02
Mother Age	-0.001	0	-0.002
	0	0	0
Mother's Trust in Doctors	-0.002	0.008	0.025**
	-0.01	-0.01	-0.01
Father's Trust in Doctors	0.001	0	-0.011
	-0.01	-0.01	-0.01
Constant	0.122	0.070*	0.101**
	-0.09	-0.04	-0.04
R2 for the Model	0.041	0.045	0.037
Degrees of Freedom	36	35	35
	* p<0.1	** p<0.05	*** p<0.01

Table A.20. Underweight Model Results for Males Only.

Male Children, Age <= 5	2010	2011	2012
Child Characteristics			
Child Age (months)	0	-0.001**	-0.001
	0	0	0
Ethnicity (relative to Kyrgyz)			
Russian	0.026	-0.045***	0.072
	-0.03	-0.01	-0.05
Uzbek	0.014	-0.049	-0.070***
	-0.06	-0.04	-0.02
Other	-0.085	-0.051**	0.059
	-0.06	-0.02	-0.04
Household Shocks			
Personal Shock (=1)	0.001	-0.002	-0.038
	-0.03	-0.03	-0.03
Economic Shock (=1)	0.044	0.052	0.034
	-0.03	-0.04	-0.04
Community			
Distance to Hospital (km)	0.001	0	0.003
	0	0	0
Region (relative to Bishkek)			
Rural Mountain	0.039	0.049	0.067
	-0.03	-0.04	-0.05
Rural South	0.045	0.032	0.052*
	-0.03	-0.03	-0.03
Rural Chui	0.104***	-0.029	-0.057*
	-0.02	-0.02	-0.03
Urban Chui	-0.02	-0.033	-0.041
	-0.02	-0.03	-0.04
Urban South	0.051	-0.003	0.075*
	-0.05	-0.03	-0.04
Urban Mountain	0.076	0.06	0.077
	-0.09	-0.1	-0.07
Osh City	0.350***	0.025	0.008
	-0.05	-0.02	-0.02
Parent Characteristics			
Mother Education	0.008	-0.029	-0.031
	-0.05	-0.04	-0.03
Father Education	-0.081**	-0.055*	-0.053
	-0.04	-0.03	-0.04
Mother Age	0	0.002	-0.002
	0	0	0
Mother's Trust in Doctors	-0.027	0.017	0.024
	-0.02	-0.01	-0.02
Father's Trust in Doctors	0.008	0.007	-0.007
	-0.02	-0.02	-0.02
Constant	0.152	0.005	0.119
	-0.12	-0.08	-0.09
R2 for the Model	0.088	0.065	0.074
Degrees of Freedom	35	34	34
	* p<0.1	** p<0.05	*** p<0.01

Table A.21. Underweight Model Results for Females Only.

Female Children, Age <= 5	2010	2011	2012
Child Characteristics			
Child Age (months)	0.001**	-0.001***	-0.001
	0	0	0
Ethnicity (relative to Kyrgyz)			
Russian	0.025	-0.037**	-0.009
	-0.08	-0.02	-0.03
Uzbek	0.023	-0.032***	-0.04
	-0.05	-0.01	-0.02
Other	-0.025	-0.051	-0.067
	-0.02	-0.04	-0.05
Household Shocks			
Personal Shock (=1)	0.029	-0.012	0.007
	-0.03	-0.02	-0.03
Economic Shock (=1)	-0.011	0.023	0.019
	-0.03	-0.02	-0.03
Community			
Distance to Hospital (km)	0	0	-0.001
	0	0	0
Region (relative to Bishkek)			
Rural Mountain	0.013	0.02	0.013
	-0.03	-0.01	-0.02
Rural South	0.005	0.022**	0.03
	-0.02	-0.01	-0.02
Rural Chui	-0.026	0.054	0.049*
	-0.02	-0.03	-0.03
Urban Chui	0.027	0.019	-0.046*
	-0.05	-0.02	-0.02
Urban South	-0.018	-0.009	0.034
	-0.04	-0.01	-0.04
Urban Mountain	0.027	-0.002	-0.051***
	-0.03	-0.01	-0.01
Osh City	0.039	-0.004	-0.033**
	-0.05	-0.01	-0.01
Parent Characteristics			
Mother Education	-0.038	-0.009	0.045*
	-0.04	-0.02	-0.02
Father Education	-0.051	-0.021	-0.031
	-0.04	-0.03	-0.03
Mother Age	-0.002	-0.002**	-0.002*
	0	0	0
Mother's Trust in Doctors	0.021	0.001	0.024*
	-0.01	-0.01	-0.01
Father's Trust in Doctors	-0.005	-0.006	-0.017
	-0.02	-0.01	-0.01
Constant	0.137*	0.166***	0.107**
	-0.07	-0.05	-0.04
R2 for the Model	0.029	0.056	0.037
Degrees of Freedom	36	35	35
	* p<0.1	** p<0.05	*** p<0.01

Table A.22. Vaccine Model Results for All Children

All Children, Age <= 5	2010	2011	2012
Child Characteristics			
Child Age (months)	0.002**	0.001**	0.003***
	0	0	0
Male (=1)	0.024	0.005	-0.003
	-0.02	-0.01	-0.01
Ethnicity (relative to Kyrgyz)			
Russian	0.009	-0.002	0.049**
	-0.05	-0.04	-0.02
Uzbek	-0.102	0.004	0.004
	-0.09	-0.03	-0.07
Other	0.076***	0	0.003
	-0.03	-0.02	-0.03
Household Shocks			
Personal Shock (=1)	-0.041	0.009	-0.005
	-0.03	-0.02	-0.02
Economic Shock (=1)	-0.01	0.006	-0.011
	-0.03	-0.01	-0.02
Community			
Distance to Hospital (km)	0.001	0.001	-0.008**
	0	0	0
Region (relative to Bishkek)			
Rural Mountain	0.003	-0.026	0.047
	-0.03	-0.02	-0.03
Rural South	-0.044*	-0.027	0.022
	-0.03	-0.03	-0.02
Rural Chui	-0.096***	-0.025	0.017
	-0.02	-0.03	-0.03
Urban Chui	-0.305*	0.025**	-0.03
	-0.16	-0.01	-0.09
Urban South	-0.025	0.006	-0.098
	-0.04	-0.03	-0.09
Urban Mountain	-0.032	-0.063	0.018
	-0.06	-0.05	-0.03
Osh City	0.074	-0.02	0.023
	-0.07	-0.02	-0.04
Parent Characteristics			
Mother Education	0.02	-0.013	0.005
	-0.04	-0.02	-0.03
Father Education	0.009	0.019	-0.008
	-0.03	-0.03	-0.02
Mother Age	-0.001	0	0.003***
	0	0	0
Mother's Trust in Doctors	0.003	-0.005	0.007
	-0.02	-0.01	-0.01
Father's Trust in Doctors	-0.003	-0.008	-0.012
	-0.01	-0.01	-0.01
Constant	0.915***	0.956***	0.772***
	-0.15	-0.05	-0.06
R2 for the Model	0.069	0.023	0.117
Degrees of Freedom	36	35	35
	* p<0.1	** p<0.05	*** p<0.01

Table A.23. Vaccine Model Results for Males Only.

Male Children, Age <= 5	2010	2011	2012
Child Characteristics			
Child Age (months)	0.001	0.001**	0.003***
	0	0	0
Ethnicity (relative to Kyrgyz)			
Russian	-0.001	0.019	0.046**
	-0.08	-0.01	-0.02
Uzbek	-0.103	-0.007	-0.017
	-0.08	-0.03	-0.09
Other	0.069	-0.021	-0.039
	-0.04	-0.04	-0.05
Household Shocks			
Personal Shock (=1)	0.002	0.014	0.019
	-0.03	-0.02	-0.02
Economic Shock (=1)	0.012	0.035**	-0.017
	-0.03	-0.02	-0.03
Community			
Distance to Hospital (km)	0.001	0	-0.007**
	0	0	0
Region (relative to Bishkek)			
Rural Mountain	-0.009	0	0.011
	-0.03	-0.02	-0.03
Rural South	-0.039*	-0.001	0.007
	-0.02	-0.02	-0.02
Rural Chui	-0.052*	0.024	0.005
	-0.03	-0.03	-0.05
Urban Chui	-0.265	0.072***	-0.054
	-0.19	-0.02	-0.11
Urban South	-0.003	0.034	-0.186*
	-0.04	-0.02	-0.11
Urban Mountain	0.036**	-0.043	-0.014
	-0.01	-0.03	-0.04
Osh City	0.057	-0.005	0.024
	-0.06	-0.02	-0.06
Parent Characteristics			
Mother Education	0.041	0.013	0.005
	-0.04	-0.04	-0.05
Father Education	0.03	0.011	-0.033
	-0.03	-0.03	-0.03
Mother Age	-0.001	0	0.003**
	0	0	0
Mother's Trust in Doctors	-0.019	-0.011	0.006
	-0.01	-0.01	-0.02
Father's Trust in Doctors	0.013	-0.016	-0.014
	-0.02	-0.01	-0.02
Constant	0.912***	0.941***	0.814***
	-0.12	-0.07	-0.09
R2 for the Model	0.056	0.038	0.127
Degrees of Freedom	35	34	34
	* p<0.1	** p<0.05	*** p<0.01

Table A.24. Vaccine Model Results for Females Only.

Female Children, Age <= 5	2010	2011	2012
Child Characteristics			
Child Age (months)	0.002***	0.001*	0.003***
	0	0	0
Ethnicity (relative to Kyrgyz)			
Russian	0.024	-0.019	0.056*
	-0.06	-0.07	-0.03
Uzbek	-0.108	0.015	0.022
	-0.11	-0.04	-0.05
Other	0.079**	0.017	0.064**
	-0.03	-0.02	-0.03
Household Shocks			
Personal Shock (=1)	-0.086*	0.006	-0.038
	-0.05	-0.04	-0.03
Economic Shock (=1)	-0.023	-0.033	-0.004
	-0.04	-0.03	-0.02
Community			
Distance to Hospital (km)	0.001	0.001	-0.009***
	0	0	0
Region (relative to Bishkek)			
Rural Mountain	0.007	-0.042*	0.092***
	-0.03	-0.02	-0.02
Rural South	-0.041	-0.049	0.047*
	-0.03	-0.04	-0.02
Rural Chui	-0.132***	-0.071**	0.031
	-0.03	-0.03	-0.03
Urban Chui	-0.360**	0.001	0.01
	-0.17	-0.02	-0.09
Urban South	-0.049	-0.025	0.02
	-0.07	-0.04	-0.08
Urban Mountain	-0.091	-0.087	0.065**
	-0.09	-0.08	-0.02
Osh City	0.09	-0.029	0.029
	-0.08	-0.03	-0.03
Parent Characteristics			
Mother Education	0.003	-0.042	0.01
	-0.06	-0.03	-0.03
Father Education	-0.018	0.026	0.023
	-0.03	-0.06	-0.03
Mother Age	-0.002	-0.001	0.003***
	0	0	0
Mother's Trust in Doctors	0.024	0.005	0.001
	-0.04	-0.01	-0.01
Father's Trust in Doctors	-0.027	-0.001	-0.007
	-0.02	-0.01	-0.01
Constant	0.979***	0.966***	0.713***
	-0.2	-0.09	-0.09
R2 for the Model	0.102	0.03	0.135
Degrees of Freedom	36	35	35
	* p<0.1	** p<0.05	*** p<0.01