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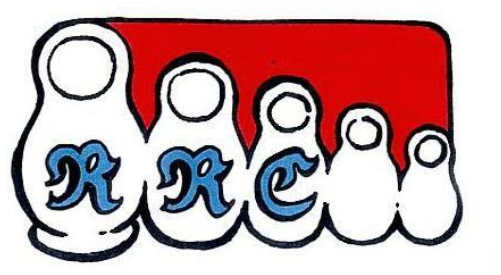

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Stunting in Kyrgyzstan: An Examination from a Social Epidemiological Perspective

Satoko OKABAYASHI
Kazuhiro KUMO

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RUSSIAN RESEARCH CENTER
THE INSTITUTE OF ECONOMIC RESEARCH
HITOTSUBASHI UNIVERSITY
Kunitachi, Tokyo, JAPAN

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An Examination from a Social Epidemiological Perspective

Satoko OKABAYASHI[*] and Kazuhiro KUMO[**]

1. Introduction

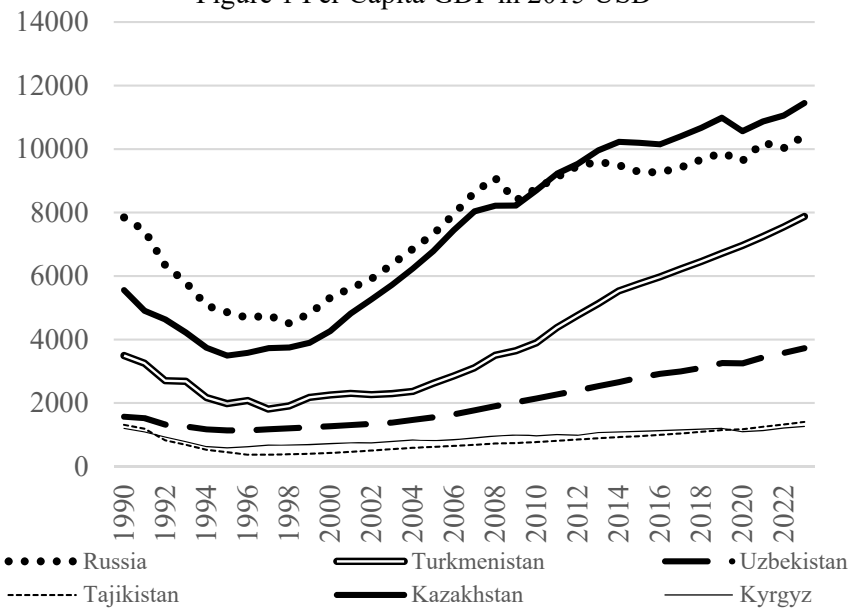
Over three decades have passed since the dissolution of the Soviet Union, and the Central Asian republics that once formed part of this former political entity have each embarked on divergent developmental trajectories. Despite these differing paths, with the notable exceptions of Kazakhstan and Turkmenistan, most countries in the region continue to be classified as low-income nations and grapple with a range of challenges associated with poverty and limited economic growth.

Kazakhstan, endowed with substantial natural resources, has experienced sustained economic development, and since 2013, it has surpassed Russia in terms of per capita gross domestic product (GDP). Turkmenistan has similarly demonstrated economic growth, primarily driven by its considerable reserves of natural gas (see Figure 1). Uzbekistan, though less resource-rich, follows this trend due to its demographic advantage as the most populous country in Central Asia.

In contrast, Kyrgyzstan and Tajikistan have experienced protracted stagnation in economic development. Kazakhstan exceeded its 1990 (pre-Soviet collapse) per capita GDP level by 2003, followed by Turkmenistan in 2008 and Uzbekistan in 2006. However, Kyrgyzstan and Tajikistan only returned to their pre-collapse GDP per capita levels in 2022. Their current absolute levels of economic development also remain significantly lower than their regional counterparts (Figure 1).

[*] Children and Family Support Centre, Kochi City Council.
[**] Institute of Economic Research, Hitotsubashi University. k.kumo@r.hit-u.ac.jp

Figure 1 Per Capita GDP in 2015 USD



Source: Compiled by the authors from World Development Indicators.

Accordingly, it can be reasonably inferred that income-related socioeconomic hardships are particularly acute in Kyrgyzstan and Tajikistan. It has been widely observed that, relative to their population sizes, both countries send disproportionately high numbers of labor migrants to Russia—a country facing demographic challenges such as low fertility and population decline. Remittances from these migrant workers serve as a vital source of economic support in both Kyrgyzstan and Tajikistan (Kumo, 2010; 2012; 2023). Even individuals possessing tertiary education frequently encounter difficulties securing employment within their domestic labor markets and are often compelled to seek manual labor positions—such as in road construction or professional driving—in Russia immediately following the completion of compulsory schooling (Ryazantsev & Horie, 2011).

Among the phenomena influenced by these socioeconomic conditions is childhood stunting. Chronic undernutrition, the underlying cause of stunting, has been demonstrated to exert long-term adverse effects on health and human capital formation. Although global trends indicate modest overall improvements, recent studies have pointed to stagnation or even reversals in some regions (Pirlea et al., 2023). While the prevalence of stunting is comparatively low in high-income settings such as North America, Europe, and Japan, it remains a pressing issue in regions plagued by persistent food insecurity, such as sub-Saharan Africa and South Asia.

In Central Asia, countries like Kazakhstan and Turkmenistan have leveraged economic growth to make meaningful strides in reducing stunting. However, in relatively lower-income contexts such as Kyrgyzstan and Tajikistan, stunting persists as a serious public health concern—albeit not at the same magnitude as observed in the most severely affected regions of the Global South. For instance, prior to 2020, it was estimated that approximately 27% of children in Kyrgyzstan suffered from stunting (World Bank, 2020). Despite various government-led interventions aimed at improving nutritional outcomes, these programs have largely failed to yield substantial results (Wigle et al., 2020). Similarly, in Tajikistan, stunting prevalence has been reported to reach as high as 30% (UNICEF, 2020). These challenges are not solely attributable to food scarcity but are also closely linked to pervasive poverty, low levels of parental—especially maternal—education, and limited maternal knowledge regarding nutrition and childcare practices (Smith et al., 2003; Prendergast & Humphrey, 2014).

This study aims to explore the determinants of child stunting in Kyrgyzstan—a country where improvements in nutritional outcomes have been limited in the decades following the economic downturn that accompanied the collapse of the Soviet Union. Particular attention is devoted to economic and educational variables, with the analysis grounded in nationally representative household survey data.

The remainder of this article is structured as follows. Section 2 provides a comprehensive review of the relevant literature, including general findings on stunting and specific studies pertaining to Kyrgyzstan and Tajikistan. Section 3 presents the data sources and descriptive statistics. Section 4 outlines the results of the empirical analysis. Finally, Section 5 discusses the implications of the findings and identifies areas for future research.

2. Literature Review

The relationship between socioeconomic status and stunting—defined as deficits in height-for-age—varies between developing and developed countries. Nonetheless, an extensive body of literature indicates that both economic conditions and social determinants exert profound influence on child development outcomes, particularly those related to stunting and underweight (McGovern et al., 2017; Handayani et al., 2023). This issue has predominantly been examined

through two analytical lenses: one emphasizing poverty and nutritional status, and the other focusing on education and social support structures.

It is well established that undernutrition and insufficient access to medical care are principal contributors to stunting. In low- and middle-income countries, children from economically disadvantaged households frequently suffer from inadequate nutrition and healthcare services, which adversely affect their physical growth trajectories (McGovern et al., 2017). Empirical studies conducted in various Caribbean and African contexts have confirmed the disproportionately high prevalence of stunting among children living in poverty (Victora et al., 2008). Moreover, chronic poverty and malnutrition during early childhood have been shown to have long-term effects, including reduced adult stature and associated health risks (Martorell, 1995).

Numerous studies have explored the mitigating role of economic interventions in addressing stunting. For instance, policy initiatives that provide targeted nutritional support—such as food subsidies or conditional cash transfers—have demonstrated potential in lowering stunting rates in developing regions (Gillespie et al., 2013). Access to affordable and nutritious food, along with financial aid for vulnerable families, is therefore recognized as a critical component in combating child stunting.

The influence of educational attainment, particularly among mothers, and the presence of social support mechanisms have also received considerable scholarly attention. Maternal education is consistently associated with improved child health and nutritional outcomes; mothers with higher levels of education are generally more knowledgeable about dietary practices and more likely to utilize healthcare services (Smith et al., 2003). In contrast, low maternal educational attainment has been linked to inadequate childcare practices and limited awareness of nutritional needs, thereby exacerbating the risk of stunting.

In parallel, the strength of a country's social support systems plays an important role. Nations with comprehensive social protection schemes and accessible healthcare infrastructures typically report lower levels of stunting (Mason et al., 2012). These systems are thought to buffer against the detrimental effects of poverty by ensuring at least a minimum standard of nutrition and medical care for disadvantaged populations.

In high-income countries, the relationship between socio-economic status and stunting

is conceptualized differently. While overt malnutrition is less prevalent, disparities in healthcare access and nutrition persist among lower-income families. In regions such as the United States and parts of Europe, children from socioeconomically marginalized households often experience suboptimal growth due to limited access to nutritious food and preventive healthcare services (St-Germain & Siddiqi, 2019). Additionally, children belonging to immigrant or ethnic minority groups may be disproportionately affected, underscoring the intersectionality of socioeconomic, cultural, and ethnic factors. Emerging research in developed contexts has begun to highlight the role of psychological and social determinants—including chronic stress and social isolation—in contributing to stunting (Barker, 2002). Persistent economic insecurity may trigger physiological stress responses in children, ultimately impairing growth and development.

In the context of Central Asia—particularly in Kyrgyzstan and Tajikistan—the issue of stunting has also garnered scholarly attention. As previously noted, both maternal nutritional knowledge and widespread poverty have been identified as critical determinants (World Bank, 2020). These nations continue to struggle with low levels of education and limited dissemination of health and nutrition information, which collectively pose formidable barriers to progress in child health outcomes (UNICEF, 2020).

In Kyrgyzstan, poverty remains a key driver of stunting, and its adverse effects on child growth have been well-documented. However, the majority of existing studies have been descriptive in nature, with relatively few employing rigorous quantitative methodologies. An important exception is the study by Wigle et al. (2020), which conducted a comprehensive quantitative analysis using household microdata spanning from 1997 to 2014. Their findings suggest that households facing persistent poverty struggle to provide nutritionally adequate meals, thereby contributing to food insecurity and stunting. Similar dynamics have been observed even in some high-income settings. In rural Kyrgyzstan, limited maternal knowledge regarding nutrition was also identified as a significant concern (Wigle et al., 2020). However, the study's reliance on a composite of three microdata sources and its temporal limitation to 2014 constrain its ability to reflect more recent developments in the region.

In summary, the existing literature underscores the complex interplay between socioeconomic status and stunting, encompassing poverty, undernutrition, educational disparities, social support mechanisms, and healthcare accessibility (McGovern et al., 2017; Yaya et al., 2020).

In developing countries, undernutrition remains the predominant cause, while in more affluent nations, the effects of socioeconomic inequality and cultural marginalization are increasingly salient.

3. Data and Descriptive Statistics

3.1 Data

This study draws upon microdata from the Multiple Indicator Cluster Survey (MICS), a survey conducted by the United Nations Children's Fund (UNICEF). MICS is a series of repeated cross-sectional micro-surveys targeting children and women, typically implemented in five-year intervals around 2000, 2005, 2010, 2015, and 2020. The principal aim of MICS is to gather comprehensive data on child health and women's reproductive health. The survey has been conducted across the five Central Asian republics of the former Soviet Union—Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan—as well as in other post-Soviet states such as Ukraine, Belarus, and Georgia.

However, the availability of analyzable MICS datasets—meaning the data that have undergone both collection and cleaning processes—differs substantially across countries. For instance, MICS was administered in Turkmenistan in 2006, 2015, and 2019; in Kazakhstan in 2006, 2010, and 2015; in Kyrgyzstan in 2006, 2014, 2018, and 2023; in Tajikistan in 1999 and 2005; and in Uzbekistan in 2006 and 2020. As of April 2025, data from these respective years are available for research use. Nevertheless, the non-uniformity of survey years across countries complicates direct, contemporaneous cross-country comparisons. In particular, data collection in Tajikistan—a country facing persistent developmental challenges—has not been conducted since 2005. Therefore, synchronized cross-national analysis using data from a single survey year is not feasible. Despite this limitation, MICS microdata maintain national representativeness and preserve subnational regional representativeness. These datasets are publicly accessible at the individual level and can be downloaded after a straightforward user registration process.[1]

[1] See https://mics.unicef.org/surveys for details.

3.2 Descriptive Analysis

This section presents a descriptive analysis of child anthropometric trends in four Central Asian countries—Kazakhstan, Kyrgyzstan, Turkmenistan, and Uzbekistan—excluding Tajikistan, for which data are outdated and therefore inadequate for evaluating recent developments. Two key nutritional indicators are employed: underweight (measured as weight-for-age) and stunting (measured as height-for-age). It is crucial to emphasize that these two indicators capture distinct dimensions of child malnutrition. Underweight status is typically sensitive to short-term fluctuations in food intake, while stunting reflects chronic deficiencies in nutrition and prolonged exposure to adverse living conditions.[2]

Table 1

Proportion of Underweight Children (Aged 0–4) Based on MICS(%)

		Turkmenistan			Kyrgyzstan				Kazakhstan			Uzbekistan	
		2006	2015	2019	2006	2014	2018	2023	2006	2010	2015	2006	2020
	Age vs. Height	Underweight (-2Standard deviation)											
Sex	Male	15.8	11.5	7.4	14	13.8	12.5	15	13.4	13.2	7.7	13.9	6
	Female	13.3	11.4	6.8	13.3	12	10.9	13.3	12.1	13	8.3	15.4	7.1
Residence	Urban	13.1	12.2	5.8	10.8	11.8	8.8	13	10.7	12.8	7.2	14	6.1
	Rural	15.4	11.1	7.9	15.7	13.4	13.1	14.6	14.9	13.4	8.9	14.9	6.9
Mother's	Junior High School or Lower	14.6	11.7	7.9	21.7	17.1	12	13.2	15.4	15.5	9.3	15	5.5
Education	High school/vocational school	14.8	10.6	6.5	14.2	11.8	12.2	12.2	14.8	11.7	9.2	13.3	6.8
	University and Higher	14.1	10.1	1.8	9.7	9.8	10	11.9	9.3	11.5	6.6	9.6	6.2
Wealth Index	Poorest	15.5	15.5	8.3	18.8	17.7	14	16.5	15.7	14.4	10.3	16.1	
Quantile	Runner-up poverty	15.2	9.7	7	14.9	14.2	13.8	15.6	13.7	14.5	8.1	16.7	
	Moderate	13.5	9.7	7.8	12.5	10.1	12	12.6	13.8	9.9	8.3	14.8	
	Next Rich	18.8	10.8	7.6	12.4	10.7	8.2	12.3	9.9	13.9	6.9	13.4	
	The wealthiest	9.5	11.4	4.4	10.2	10.7	9.2	12.4	8.4	12.1	6.2	11.6	
language	National language	14.3	11.1	6.9	15.6	12	11	13.8	14.5	13.6	7.7	14.6	6.5
	Uzbek	17	15.5	10.2	9.3	17.1	15.9	15.6	-	-	-	-	-
	Russian	3.9	8.8	6.2	4.6	11.7	5.4	7.1	7.9	11.9	6.9	9.9	4.7
	others	22.5	11.7	5.1	20.7	15.8	13.7	6.2	11.7	11.5	9.9	18.4	5.9
Total number of samples		2010	3713	3644	2884	4412	3422	2969	4190	4987	5277	4692	5519

Source: Author's calculation using MICS microdata.

Table 1 illustrates the association between selected socioeconomic variables and the prevalence of underweight children, defined as having a body weight more than two standard

[2] 'Failure to Thrive', MSD Manual Professional Version, https://www.msdmanuals.com/ja-jp/professional/ (accessed on April 30, 2025)

deviations below the average for age. A general improvement in nutritional status is observed across all countries when compared to the situation in 2006. Although the correlation between maternal educational attainment or household wealth and underweight prevalence is not consistently strong across countries, higher levels of maternal education and greater household asset ownership are, in general, associated with lower incidences of underweight children—an observation that is broadly consistent with findings in prior literature.

Table 2 presents a parallel analysis for stunting, defined as a height-for-age more than two standard deviations below the average for age. The data reveal significant improvements in stunting rates in Turkmenistan, Kazakhstan, and Uzbekistan between 2006 and approximately 2020.

Table 2

Proportion of Stunted Children (Aged 0–4) Based on MICS (%)

		Turkmenistan			Kyrgyzstan				Kazakhstan			Uzbekistan	
		2006	2015	2019	2006	2014	2018	2023	2006	2010	2015	2006	2020
	Age vs. Height	Stunting (-2Standard deviation)											
Sex	Male	11.9	3.2	3.5	3.9	2.9	2	2.7	4.3	3.7	1.9	4.8	1.9
	Female	10.2	3.2	2.6	2.9	2.6	1.6	3.2	3.6	3.6	2	5.4	1.7
Residence	Urban	9.4	4.1	2	3.4	1.9	1.4	3.4	3	4	1.5	4.7	1.8
	Rural	11.9	2.7	3.8	3.4	3.1	2	2.7	5.1	3.3	2.4	5.2	1.8
Mother's	Junior High School or Lower	11.4	3.7	3.4	6.4	4.6	4.6	3.2	5.1	4.6	2.1	5.5	2.7
Education	High school/vocational school	11.5	4	1.9	3.6	3.6	1	3.1	4.8	2.7	2.4	4.7	1.6
	University and Higher	3.4	4.3	1.1	1.9	1.8	1.5	2.1	2.4	3.4	1.3	2.6	0.9
Wealth Index	Poorest	12.3	4.4	4.7	3	3.5	0.9	5.4	4.7	4.1	3.2	5.6	
Quantile	Runner-up poverty	15	1.9	2.3	3.4	4	2.5	1.9	5	3.9	1.7	7	
	Moderate	10.4	2.1	3.5	4.2	2.1	2.9	2.2	4.5	2.8	1.7	5	
	Next Rich	11.7	3.1	3.5	4.1	2.4	1.7	1.9	4.1	4	2	4.2	
	The wealthiest	4.8	4.6	0.8	2.3	1.6	0.9	2.3	0.8	3.5	1.2	3.4	
language	National language	10.9	3.1	3	3.5	2.4	1.2	2.3	4.4	3.9	2.1	5.1	1.8
	Uzbek	9.1	3.4	3.2	3.7	4.7	5	4.5	-	-	-	-	-
	Russian	2.3	3.4	5	0.6	3.4	2.2	5.5	2.8	2.9	1.4	2.6	2.7
	others	27.5	4.8	3.9	6.3	3.1	0.9	7	4	3.2	1.6	5.3	1.6
Total number of samples		2010	3718	3653	2884	4441	3440	3008	4190	5015	5303	4692	5560

Source: Author's calculation using MICS microdata.

By contrast, the pattern in Kyrgyzstan diverges from this regional trend. While stunting prevalence declined between 2006 and 2018, the improvement appears to have plateaued thereafter. A particularly salient observation is that, although Kyrgyzstan does not exhibit unusually high underweight rates relative to its neighbors (as seen in Table 1), it performs notably

worse in terms of stunting (Table 2). Nevertheless, from a global perspective, Kyrgyzstan's stunting rates are not among the most severe. According to estimates from the World Health Organization (WHO), the global average stunting rate in 2010 was 26.7%, a threshold that all Central Asian countries remain well below.

The relatively favorable nutritional outcomes observed in Central Asia—despite generally modest levels of national income—are mirrored in other development metrics, such as the Human Development Index (HDI) and gender equality indices. These patterns may be attributed, at least in part, to the enduring legacy of Soviet-era investments in public education, healthcare, and infrastructure (UNDP Regional Bureau for Europe and the CIS, 2005). Nonetheless, when compared not only with Japan (see Table 3) but also with the other three Central Asian countries, Kyrgyzstan continues to exhibit lagging performance in stunting indicators. By 2019–2020, Turkmenistan and Uzbekistan had achieved stunting rates rather better than those in Japan, underscoring the relative stagnation in Kyrgyzstan's progress (Table 2).

Table 3

Proportion of Underweight and Stunted Children in Japan

1980	1990	2000	2010
Stunting (-2 Standard deviation)			
2	2.5	2.4	3.4
Underweight (-2 Standard deviation)			
5.8	5.1	5.7	7.1

Source: Author's calculation based on annual surveys of infant and child physical development.

3.3 Data for Analysis

In light of the foregoing observations, the present study focuses on child stunting in Kyrgyzstan, defined as height-for-age more than two standard deviations below the age-specific mean. The empirical analysis utilizes MICS microdata from surveys conducted in 2006, 2014, 2018, and 2023. Because MICS datasets are cross-sectional rather than longitudinal in nature, the analysis employs ordinary least squares (OLS) regression in an exploratory framework to identify salient correlates of stunting.

Table 4 Descriptive Statistics for Each Year

	2006					2014					
variable	Observations	Average	SD	Min	Max	Observations	Average	SD	Min	Max	Variable Description
HAZ Score	2987	-0.6035	2.187	-9.98	9.99	4577	-0.38	2.024	-8.72	9.99	Deviation from average height by age
HAP Score	2987	32.22	31.57	0	99.9	4577	35.22	29.48	0	99.9	Percentile for average height for age
Mother: High School or Higher	2984	0.227	0.419	0	1	4611	0.255	0.436	0	1	For those who have completed higher education 1, 0 for others
Mother: Secondary Education	2984	0.771	0.42	0	1	4611	0.737	0.44	0	1	For those who have completed secondary education 1, and o for lower ones
Household Wealth index: Quantile	2987	2.849	1.429	1	5	4611	2.737	1.388	1	5	Measured from owned assets, housing characteristics, water sources, sanitation facilities, etc.
Household Wealth Index	2987	0.092	1.008	-2.73	2.91	4611	-0.219	0.823	-1.186	2.83	Ibid.
Kyrgyz	2981	0.761	0.427	0	1	4608	0.798	0.402	0	1	Interview Language
Russian	2981	0.068	0.253	0	1	4608	0.026	0.161	0	1	Ibid.
Uzbek	2981	0.126	0.332	0	1	4608	0.144	0.351	0	1	Ibid.
Sex	2987	0.516	0.499	0	1	4611	0.513	0.499	0	1	Unity for Male, for Female
Breastfeeding	2987	0.98	0.141	0	1	2788	0.982	0.131	0	1	Breastfeeding experience 1, None 0
Vaccination experience	2865	0.957	0.203	0	1	2706	0.996	0.066	0	1	Vaccination experience 1, None 0

	2018					2023					
variable	Observations	Average	SD	Min	Max	Observations	Average	SD	Min	Max	Variable Description
HAZ Score	3546	-0.22	2.106	-8.72	9.99	3153	-0.125	2.431	-8.23	9.99	Deviation from average height by age
HAP Score	3546	38.72	30.71	0	99.9	3153	39.71	32.07	0	99.9	Percentile for average height for age
Mother: High School or Higher	3546	0.296	0.456	0	1	3194	0.281	0.45	0	1	For those who have completed higher education 1, 0 for others
Mother: Secondary Education	3546	0.702	0.457	0	1	3194	0.715	0.452	0	1	For those who have completed secondary education 1, and o for lower ones
Household Wealth index: Quantile	3552	2.939	1.403	1	5	3194	2.941	1.431	1	5	Measured from owned assets, housing characteristics, water sources, sanitation facilities, etc.
Household Wealth Index	3552	-0.242	0.828	-1.19	2.83	3194	0.229	0.898	-2.681	2.39	Ibid.
Kyrgyz	3552	0.791	0.407	0	1	3153	0.808	0.394	0	1	Interview Language
Russian	3552	0.027	0.162	0	1	3153	0.037	0.271	0	1	Ibid.
Uzbek	3552	0.148	0.355	0	1	3153	0.146	0.353	0	1	Ibid.
Sex	3552	0.511	0.499	0	1	3194	0.529	0.499	0	1	Unity for Male, for Female
Breastfeeding	2100	0.99	0.097	0	1	1761	0.979	0.143	0	1	Breastfeeding experience 1, None 0
Vaccination experience	1998	0.939	0.239	0	1	1244	0.781	0.413	0	1	Vaccination experience 1, None 0

Source: Prepared by Authors Based on Annual Data of MICS.

As noted earlier, Kyrgyzstan stands out among the Central Asian republics for its comparatively high prevalence of stunting. This makes it an appropriate case for investigating the determinants of severe growth retardation in the region. The descriptive patterns documented in Tables 1 and 2, when considered alongside findings from prior research, indicate that maternal education and household wealth are principal factors influencing the probability of child stunting. By contrast, these associations appear weaker with regard to underweight status. Moreover, there is little evidence that a child's gender or residential location has a substantial impact on stunting. However, the language spoken in the household may exert a meaningful influence. Notably, in the 2006 survey, children in Russian-speaking households exhibited lower stunting rates; this advantage, however, appears to have declined over time, as observed in both Turkmenistan and Kazakhstan.

Accordingly, the dependent variable in the regression analysis is an indicator of stunting, based on height-for-age measurements. The main explanatory variables include maternal educational attainment, a household asset index, and the language used during the interview. Control variables comprise the child's gender, experience of breastfeeding, and vaccination status. The analytical sample encompasses all children aged 0 to under 5 years. Descriptive statistics for the variables used in the regression analysis are presented in Table 4.

4. Results and Interpretation

The regression results are reported in Table 5. For reasons of conciseness, coefficients associated with control variables are not displayed. To ensure the robustness of the findings, four model specifications were employed: two with Height-for-Age Percentile (HAP) and two with Height-for-Age z-score (HAZ) as the dependent variable. In each case, household wealth was measured using either quintile-based summary indices or raw wealth data.

Across all specifications, the coefficient for household wealth remains consistently positive and statistically significant. This indicates that higher levels of household wealth are associated with a lower likelihood of stunting, as reflected in greater child height. These results are broadly consistent with existing literature and findings from other regional studies (Prendergast & Humphrey, 2014; McGovern et al., 2017; Siddiqui et al., 2020).

Table 5 Determinants of Stunting in Kyrgyzstan: Regression Results

Dependent variable	HAP		HAP		HAZ		HAZ	
2006	coefficient	SD	coefficient	SD	coefficient	SD	coefficient	SD
Mother: Tertiary or Higher Education	5.29	(1.44)**	5.13	(1.46)**	0.359	(0.099)**	0.364	(0.101)**
Household Wealth Index: Quantile	2.16	(0.43)**			0.083	(0.029)**		
Household Wealth Index			2.79	(0.62)**			0.091	(0.043)*
Russian	7.35	(2.34)**	7.55	(2.35)**	0.349	(0.163)*	0.372	(0.163)*
Observations	2865							
F-value	12.68**		11.84**		6.29**		5.76**	
2014								
Mother: Tertiary or Higher Education	4.78	(1.39)**	4.78	(1.39)**	0.222	(0.08)*	0.202	(0.088)*
Household Wealth Index: Quantile	2.06	(0.45)**			0.111	(0.028)**		
Household Wealth Index			3.18	(0.75)**			0.208	(0.048)**
Russian	-3.77	(3.88)	-4.29	(3.92)	-0.016	(0.246)	-0.086	(0.248)
Observations	2706							
F-value	8.41**		7.89**		5.79**		6.44**	
2018								
Mother: Tertiary or Higher Education	3.05	(1.61)+	2.96	(1.62)+	-0.059	(0.107)	-0.079	(0.108)
Household Wealth Index: Quantile	1.83	(0.535)**			0.085	(0.035)*		
Household Wealth Index			3.02	(0.93)**			0.17	(0.062)**
Russian	-0.575	(4.98)	-0.91	(5.01)	0.606	(0.331)+	0.57	(0.332)+
Observations	1998							
F-value	5.02**		4.81**		3.95**		4.19**	
2023								
Mother: Tertiary or Higher Education	3.26	(2.11)	2.49	(2.11)	0.03	(0.15)	-0.012	(0.153)
Household Wealth Index: Quantile	1.25	(0.70)+			0.12	(0.05)*		
Household Wealth Index			3.44	(1.12)**			0.272	(0.081)**
Russian	1.30	(3.28)	0.99	(3.27)	0.23	(0.24)	0.217	(0.081)
Observations	1244							
F-value	1.53		2.59*		1.58		2.52*	

**: Significant at 1% level; *: Significant at 5% level; +: Significant at 10% level.

Source: Prepared by the Authors.

By contrast, the impact of maternal education demonstrates temporal variability. While it exerts a statistically significant positive effect in earlier waves (2006 and 2014), this influence

dissipates in subsequent years, namely 2018 and 2023. A similar trajectory is observed for the dummy variable representing Russian-speaking households: the earlier statistically significant positive association between Russian language use and child growth outcomes becomes insignificant from 2014 onwards.

These findings prompt several interpretative considerations. The consistent effect of household wealth corresponds with established theoretical expectations and empirical evidence. However, the declining significance of maternal education merits closer scrutiny. One plausible explanation is an overall increase in maternal knowledge regarding child-rearing practices. In low-income Central Asian countries such as Kyrgyzstan and Tajikistan, numerous programs sponsored by international and foreign agencies have likely contributed to improved maternal and child health literacy. Japanese development assistance alone has encompassed projects such as the "Medical Equipment Improvement Project for Obstetric and Gynecological Hospitals in the Kyrgyz Republic" (JICA, 2002), the "Improvement of Pediatric Medical Services in Rural Areas" (JICA, 2004), and more recent initiatives including the "Development of Medical Equipment in Bishkek and Chuy Oblast" (JICA, 2022) and the "Promotion of Continuing Education and National Examination Development for Pharmacists in the Kyrgyz Republic" (JICA, 2024).

Moreover, Japan–UNICEF joint initiatives have included the "Peace Promotion Plan through Strengthening Maternal and Child Health in Conflict Areas" (2014) [3] and the "Maternal and Child Health Enhancement Plan" (2017) [4]. Concurrently, the World Health Organization and the European Union have co-sponsored the "Development of an Immunization Management System" (2022–2026) [5]. Collectively, these sustained efforts may have elevated maternal knowledge and practice irrespective of formal educational attainment.

Regarding Russian-speaking households, alternative interpretations warrant consideration. Data presented in Table 4 reveal a declining proportion of respondents identifying as Russian-speaking, a trend corroborated by macro-level population census data (Natsionalnyy statisticheskiy komitet Kyrgyzskoy Respubliki, various years). Since the early 2000s, Kyrgyzstan has witnessed multiple episodes of political and social instability, including the 2005 Tulip

[3] https://www.mofa.go.jp/mofaj/press/release/press4_001131.html （accessed on April 28, 2025）
[4] https://www.mofa.go.jp/mofaj/press/release/press11_000051.html （accessed on April 28, 2025）
[5] https://www.who.int/europe/news-room/feature-stories/item/digital-vaccination-records-how-one-kyrgyz-mother-stays-on-track-with-her-childrens-health （accessed on April 28, 2025）

Revolution (Juraev, 2008), the 2010 ethnic riots (Matveeva et al., 2012), and the 2020 anti-government protests (Doolotkeldieva, 2021). These events may have prompted emigration among Russian speakers, particularly among those with the financial and human capital necessary to relocate (Marat, 2006; Akiner, 2016). Consequently, the remaining Russian-speaking population may have undergone compositional changes. While Russian language use may once have been a proxy for better access to health information, this association may no longer hold in more recent periods.

In juxtaposition with factors such as maternal education and Russian language usage—which previously exerted positive effects but have since lost statistical significance—the consistently significant positive effect of household asset levels stands out. The robust finding that greater household wealth correlates with lower risk of stunting, and hence taller stature, is reaffirmed across model specifications and aligns with prior studies (McGovern et al., 2017; Siddiqui et al., 2020).

In contrast, the changing influence of maternal education level is a novel observation in the context of studies focusing on Kyrgyzstan. This may be attributed, at least in part, to the fact that even the most recent prior analyses, such as that by Wigle et al. (2020), were based on data only up to 2014, thereby failing to capture more recent developments. The observed decline in the explanatory power of maternal education—an objectively measurable variable—may reflect improvements in general maternal and child health knowledge among the surveyed population.

Furthermore, while the advantage of Russian language users—i.e., lower incidence of stunting—has been previously indicated through descriptive analyses (National Statistical Committee of the Kyrgyz Republic and UNICEF, 2007; 2014), this study is the first to quantitatively demonstrate this relationship. At the same time, the finding that this coefficient becomes statistically insignificant in the later period may suggest an overall improvement in maternal and child health awareness. However, considering the declining proportion of Russian speakers over time, this shift may also reflect a demographic change in the Russian-speaking population—namely, that those remaining in Kyrgyzstan may belong to subgroups with limited health knowledge.

Despite such dynamic shifts in the significance of maternal education and language, the effect of household wealth remains remarkably stable. The continued importance of economic

conditions, even as other sociodemographic variables lose their explanatory power, underscores a persistent and fundamental barrier to improved child health. This supports the enduring claim (Yaya et al., 2020) that addressing poverty remains central to any strategy aimed at eradicating stunting in Kyrgyzstan.

5. Conclusion

This study has investigated the determinants of child stunting in Kyrgyzstan by analyzing data from the Multiple Indicator Cluster Surveys (MICS), conducted by UNICEF. One of the traditionally emphasized variables—maternal education—was found to have lost its statistical significance in the latter half of the study period. Similarly, the positive association between Russian language usage and child growth outcomes also diminished over time. These findings represent novel contributions that have not been documented in previous literature.

In contrast, the variable most directly indicative of household economic status—household asset level—was consistently and significantly associated with a reduction in the likelihood of stunting. This suggests that while improvements in maternal and child health knowledge may have mitigated disparities linked to education or ethnicity, economic inequality remains a persistent and influential factor. Thus, the principal challenge for enhancing early childhood health in Kyrgyzstan continues to be economic development and the alleviation of poverty.

That said, the present analysis is not without its limitations and should be interpreted as exploratory in nature. While additional covariates were initially considered, few demonstrated statistical significance, leading to a more parsimonious final model. Moreover, even among the retained variables, many did not reach conventional levels of statistical significance, raising concerns regarding model specification and the need for further investigation.

A more fundamental limitation concerns the structure of the data itself. The MICS dataset consists of repeated cross-sectional data rather than longitudinal (panel) data, which precludes the establishment of causal inferences. To address this, future research would benefit from access to household panel datasets within Kyrgyzstan. Alternatively, small-scale, purpose-

built surveys designed to complement large-scale data collections may offer valuable insights, particularly in capturing nuanced behavioral and contextual factors related to child health.

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