

# Economic Costs of Preprimary Program Reductions due to COVID-19 Pandemic

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## Abstract

Longitudinal studies of people conceived, in utero or in early childhood during previous pandemics and famines show that children can suffer lifelong negative consequences. Hundreds of millions of children are losing learning opportunities resulting in potentially large losses in their lifetime education, health, income, and productivity. Losses in long-term incomes from preprimary program closures due to COVID-19 can be unprecedented. Acute effects are plausible for such disruptions early in life when the brain is rapidly developing and is more sensitive to environmental changes. This study is the first to simulate losses due to preprimary program closures because of the COVID-19 pandemic on the discounted values of future earnings when current preschool-age children become adults for 140 countries. These losses are considerable in comparison with governmental expenditures on all levels of education in the same countries. Policies need to mitigate the effects of preprimary program closures to avoid these enormous losses.

**Keywords:** human capital, COVID-19, early childhood, preschool, learning losses, earning losses

**JEL codes:** I2, I24, J13, I26, I28

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## Abbreviations and acronyms

ECD	Early childhood development
GDP	Gross Domestic Product
GER	Preprimary Gross Enrollment Rates (GER)

# Economic Costs of Preprimary Program Reductions due to COVID-19 Pandemic

## 1. Introduction

COVID-19's potential risks for children are discussed in a recent paper.(1) Other studies have examined the substantial negative impact of the coronavirus pandemic on primary and secondary school-age children(2, 3) and earnings losses due to school closures.(4) However, these studies make no mention of preprimary programs, which are key for Sustainable Development Goals Target 4.2 'By 2030, ensure that all girls and boys have access to quality early childhood development, care, and preprimary education so that they are ready for primary education', and which have been shown to be important for children's intellectual development, later educational progress, and lifetime earnings.(5-9) We address this gap by simulating long-run economic costs of preprimary program participation reductions due to the pandemic.

### 1.1. *Risks faced by children as consequence of COVID-19*

The COVID-19 pandemic may have devastating impacts on young children's physical, mental, and emotional development, both immediately, and in the long run. Studies tracking individuals conceived, in utero, infancy and early childhood during pandemics, natural disasters, and famines (e.g., the 1918/19 influenza pandemic, the 1959-61 Chinese famine) demonstrate that those exposed can suffer life-long negative consequences.(10) These possibilities have received little attention with regard to the COVID-19 pandemic, possibly because of the low rates of COVID-19 observed among very young children (though there is evidence of the disease in exceptional cases being associated with hyperinflammatory shock syndrome or Kawasaki-like disease). However, child mortality, morbidity(11), and poverty(11) are estimated to rise as consequences of the pandemic and measures to contain the pandemic. Limited access to basic services, disparities in parenting skills, and unequal access to technology probably magnify the impacts of this crisis for the most vulnerable children. Also very importantly, in the early years when developing brains are more sensitive to the lack of responsive environments, the pandemic effects probably further amplify the already-wide socioeconomic-status gradient in early childhood development(13-15) and lead to more pronounced inequalities later on.

## 1.2. *Preprimary program participation and the impact of COVID-19*

The pandemic is precluding millions of children from attending preprimary programs. On April 1, 2020, only four months after the outbreak was first identified, country-wide mandated preschool program closures were affecting more than 160 million children in the 140 countries we analyze while local closures were affecting almost 15 million more children.<sup>(16)</sup> At that time, only 800 thousand children were enrolled in preprimary programs in countries where governments had not closed educational institutions. Figure 1 presents the percentages of children in those countries affected by national or local closures in the 4.5 months from mid-March until 1 August. Despite program efforts to stay in contact with the children and their families and to continue offering some services remotely,<sup>(17)</sup> this situation is expected to undermine seriously children's development, learning, and physical and mental health, resulting in potentially dramatic losses in their lifetime education, income, and productivity. Children have many fewer learning exposures and opportunities due to their disrupted routines and confinement in their homes.

Before the pandemic, preprimary enrollment rates varied considerably across countries (Figure 2), with a strong positive income gradient: a median of 92.9% for high-income, 73.8% for upper-middle-income, 42.2% for lower-middle-income, and 14.9% for low-income countries (see Table 1, column 1).

## **2. Economic losses of reducing preprimary program participation**

We simulate for 140 countries with combined populations of 6.4 billion people the present discounted value of losses in future income (net of preprimary program costs) if preprimary programs are closed for 3, 6, or 12 months due to national and local strategies to contain the pandemic. Box 1 presents our methodology. Our simulations size the effects and inform timely mitigation policies and practices for children, their families and societies.

Table 1 presents our results: future earnings foregone when the children become adults as percentages of GDP due to declines in preprimary participation net of preprimary program costs for individual countries are categorized in World Bank income groups for the 323 million preprimary-age children in these countries.<sup>(18)</sup> For each country three estimates are presented, respectively, for interruptions of 3, 6, or 12 months. To provide perspective, the first column gives



the pre-pandemic 2018 preprimary enrollment rates and the last column gives 2018 governmental expenditures on all education as percentages of GDP.

Estimated losses as percentages of GDP due to reducing preschool participation vary considerably by country, depending in important part on what was the pre-pandemic preprimary program participation (i.e., if participation was very low, then cutting implied relatively small losses due to small absolute cuts). Figure 3 gives the median losses of a 6-month cut in participation for the country groups: high-income (2.94% of GDP), upper-middle income (3.38% of GDP), lower-middle income (2.66% of GDP), and low-income countries (0.89% of GDP). The losses are smaller but still substantial for 3-months closures, and much larger for 12-months closures.

### Box 1: Simulation methodology

Our model follows a common approach to monetize the benefits of social programs through their impact on earnings and productivity. In Equation (1) the additional income as a consequence of attending preprimary is discounted and summed over the relevant years in which income is expected to be affected to compare with the per child program cost for the  $N$  children covered by the preprimary school.

$$COI = \left( \sum_{j=a}^{t+a} \frac{PCI_j \times i}{(1+d)^j} - c \right) \times N \quad (1)$$

Preprimary schools are associated with other short- and long-term benefits that are not included in this simple model. For example, they may positively impact a child's nutrition (via school meals and/or a less sedentary day) or mothers' mental health or reduce the cost of crime in a society. The omission of benefits that are hard to monetize, such as family and health benefits, means that our estimates are conservative.

In our estimations we considered a discount rate ( $d$ ) of 3 percent, an impact on earnings ( $i$ ) of 8 percent, a starting age for work of 18, a time horizon ( $t$ ) of 45 years, and a per child-cost ( $c$ ) that varies across income groups according to the price level ratio of purchasing-power-parity (PPP) conversion factors: \$1,300 for high-income countries, \$912 for upper-middle-income countries, \$696 for lower-middle-income countries, and \$654 for low-income countries. A relatively low discount rate of 3 percent is widely used in ex-ante economic evaluations of social programs to discount benefits that accrue in the long term back to the present. The assumption on the impact of preprimary school on adult earnings ( $i$ ) is based on the empirical literature that investigates long-term effects of ECD programs, adjusted downwards to address concerns about the external validity of those evaluations for scaled-up programs on average of lower quality.(19, 20) The assumptions for the starting age for work ( $a$ ) and time horizon for work ( $t=45$  years) reflect observed labor market participation behaviors.

To explore the uncertainty of the simulations, we undertook sensitivity analyses. Estimates for the losses do not change substantially if the assumed impact of preprimary on earnings is reduced to 6%, the years in the labor market are reduced to 25, or the costs are increased by ~15%. When we apply higher discount rates, patterns are similar but with smaller losses.

### **3. Discussion**

Our estimates quantify some important lifetime economic losses for most preprimary-school-age children globally. They imply that hundreds of millions of children of current preprimary-program ages are likely to suffer considerable earnings losses over their lifetimes due to preprimary-program closures. As percentages of GDP, the aggregated losses are relatively small for low-income countries in which prior to the pandemic preprimary enrollments were relatively low. But they are still considerable for these countries, and much larger on average for the other country groups. It is also important to note that because we do not include effects other than on earnings and we assume that there are no other effects on children's education beyond preprimary program closures, our estimates probably are lower bounds.

### **4. Limitations**

Our study has important limitations. We assumed critical parameter values, in some cases based on few studies. We applied similar assumptions to 140 countries regarding discount rates and labor-force participation. We address but one important dimension – preprimary program participation – that may be affected by the pandemic. We note that, of course, this is not the only possible effect of the pandemic on early childhood outcomes. Younger children may be affected. The quality of preschool and other programs may suffer. Families might shift from private schooling to public schooling and overwhelm the public sector, causing quality to decline. Increased stress, domestic abuse, and violence for children and their caregivers may make families and homes less hospitable environments for early childhood education. Malnutrition may increase due to increased household poverty and loss of nutrition provided by preprimary programs. The pandemic is also affecting the mental health of caregivers due to changes in household dynamics, unequal division of chores and caregiving work, stress from having to juggle childcare and work, job and income losses, and health-related anxieties. On the other hand, families and other institutions may compensate some with, for example, virtual programs or other forms of learning. Therefore, our simulations do not capture the total effects of the pandemic on preschool-age children. But estimates of the effects on children's life-long earnings due to reductions in preschool participation undoubtedly address an important component of early-life education, and it is valuable to know the extent of these effects. Our simulations suggest that these losses are considerable.

**Table 1: Estimates of the % GDP lost if 2018 enrollment rates in preprimary programs are reduced due to the pandemic**

Group	Country	Gross Enrollment Rates in 2018 (%) <sup>1</sup>	Number of months lost			Expenditure on education (% of GDP) <sup>2</sup>
			3	6	12	
High income	Antigua and Barbuda	70.3	1.2	2.3	4.7	n/a
	Australia	164.6	2.9	5.7	11.4	5.3
	Austria	104.4	1.5	2.9	5.9	5.5
	Bahamas	34.5	0.7	1.3	2.6	n/a
	Bahrain	53.7	1.1	2.2	4.5	2.3
	Barbados	86.8	1.4	2.8	5.5	4.7
	Belgium	115.1	1.8	3.7	7.4	6.5
	Brunei Darussalam	64.8	1.3	2.6	5.1	4.4
	Chile	81.8	1.7	3.3	6.6	5.4
	Hong Kong	106.4	1.3	2.6	5.2	3.3
	Macao	95.6	1.3	2.6	5.2	2.7
	Croatia	70.0	1.1	2.2	4.4	n/a
	Cyprus	83.7	1.9	3.8	7.6	6.3
	Czechia	106.4	1.8	3.6	7.1	5.6
	Denmark	95.9	1.4	2.9	5.7	n/a
	Estonia	92.4	1.7	3.5	6.9	5.2
	Finland	83.6	1.4	2.8	5.5	6.9
	France	106.0	1.8	3.7	7.4	n/a
	Germany	109.1	1.5	3.0	6.0	4.8
	Greece	74.4	1.0	1.9	3.8	n/a
	Hungary	82.3	1.3	2.7	5.3	4.7
	Iceland	94.1	1.4	2.8	5.7	7.5
	Ireland	163.4	3.7	7.4	14.7	3.7
	Israel	110.8	3.3	6.6	13.2	5.8
	Italy	94.0	1.1	2.2	4.5	3.8
	Kuwait	62.5	1.1	2.1	4.2	n/a
	Latvia	95.6	1.6	3.2	6.4	4.7
	Lithuania	88.2	1.7	3.4	6.8	4.0
	Luxembourg	91.9	1.5	3.0	5.9	n/a
	Malta	107.7	1.5	3.0	5.9	n/a
	Netherlands	94.3	1.5	2.9	5.9	5.5
	New Zealand	91.5	1.7	3.4	6.9	6.4
	Norway	95.4	1.5	3.0	5.9	8.0
Oman	52.2	1.2	2.4	4.7	n/a	
Panama	62.2	2.0	3.9	7.9	n/a	
Poland	81.1	1.3	2.6	5.2	4.6	
Portugal	93.9	1.2	2.4	4.7	n/a	

Group	Country	Gross Enrollment Rates in 2018 (%) <sup>1</sup>	Number of months lost			Expenditure on education (% of GDP) <sup>2</sup>
			3	6	12	
	Qatar	60.3	0.9	1.8	3.6	2.9
	Republic of Korea	95.0	1.2	2.4	4.7	4.6
	Saudi Arabia	21.2	0.5	1.0	2.0	n/a
	Seychelles	95.4	3.1	6.2	12.4	4.4
	Slovakia	95.2	1.6	3.2	6.4	3.9
	Slovenia	91.7	1.6	3.2	6.3	4.8
	Spain	92.5	1.3	2.5	5.0	4.2
	Sweden	96.3	1.6	3.3	6.5	7.7
	Switzerland	103.6	1.6	3.2	6.5	5.1
	United Arab Emirates	78.0	0.9	1.9	3.8	n/a
	United Kingdom	106.4	1.8	3.6	7.2	5.5
	United States of America	72.9	1.4	2.7	5.5	n/a
	Uruguay	93.4	2.0	4.0	7.9	4.8
	<b>High income (N=50)</b>	<b>92.9</b>	<b>1.5</b>	<b>2.9</b>	<b>5.9</b>	<b>4.8</b>
<b>Upper middle income</b>	Albania	80.5	1.8	3.6	7.1	2.5
	Argentina	76.1	1.7	3.3	6.6	5.5
	Armenia	38.0	0.9	1.9	3.8	2.7
	Azerbaijan	39.7	0.9	1.9	3.8	2.5
	Belarus	98.9	1.7	3.5	7.0	4.8
	Belize	47.4	1.2	2.4	4.8	7.4
	Brazil	96.3	2.0	3.9	7.8	n/a
	Bulgaria	77.0	1.3	2.5	5.0	n/a
	China	88.1	2.1	4.1	8.2	n/a
	Costa Rica	97.9	2.2	4.4	8.7	7.0
	Dominican Republic	51.4	1.8	3.5	7.0	n/a
	Ecuador	66.1	1.6	3.3	6.5	n/a
	Grenada	100.5	3.1	6.1	12.2	3.2
	Guatemala	50.7	1.9	3.9	7.7	2.9
	Jamaica	73.3	1.8	3.5	7.0	5.4
	Jordan	27.1	1.0	1.9	3.8	3.6
	Kazakhstan	59.7	2.1	4.3	8.6	2.8
	Malaysia	99.2	2.5	5.1	10.2	4.5
	Maldives	91.5	3.5	7.0	14.1	4.1
	Mauritius	98.1	1.7	3.5	6.9	4.8
Mexico	73.7	2.0	4.1	8.1	4.9	
Montenegro	69.3	1.2	2.5	4.9	n/a	
Namibia	34.2	1.4	2.7	5.4	n/a	
	North Macedonia	41.0	0.8	1.5	3.0	n/a

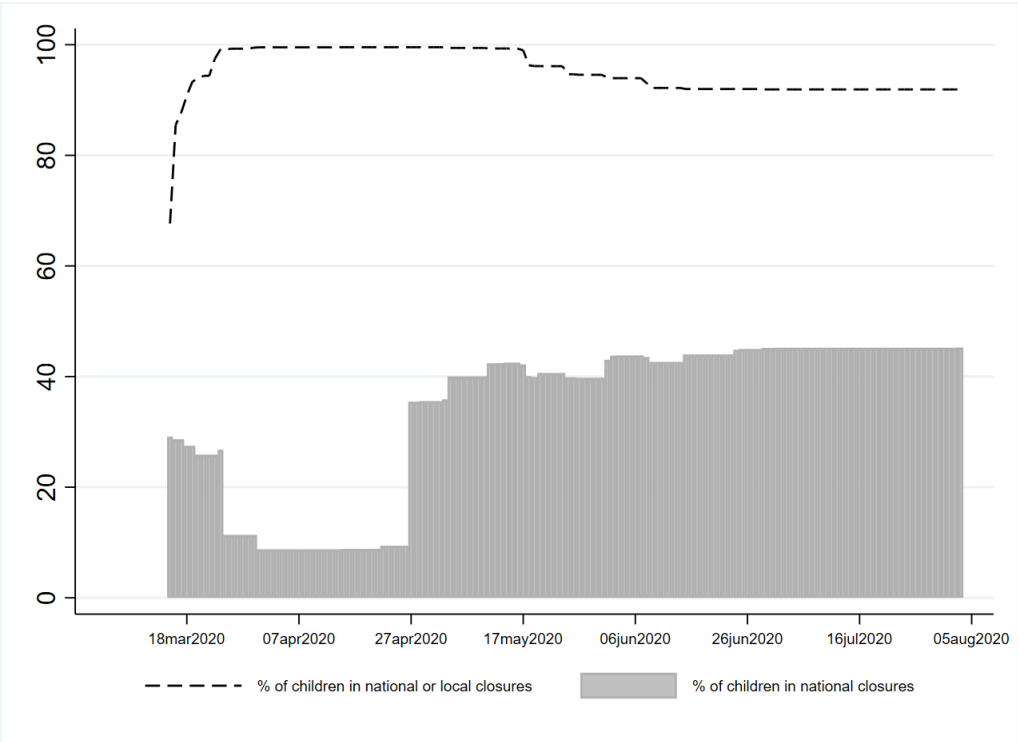
Group	Country	Gross Enrollment Rates in 2018 (%) <sup>1</sup>	Number of months lost			Expenditure on education (% of GDP) <sup>2</sup>
			3	6	12	
	Paraguay	43.8	1.3	2.6	5.2	3.4
	Peru	103.5	2.6	5.3	10.5	3.7
	Romania	84.0	1.5	2.9	5.8	3.0
	Russian Federation	86.8	1.6	3.3	6.6	3.7
	Saint Lucia	73.9	1.2	2.4	4.8	3.7
	Saint Vincent and the Grenadines	76.1	2.2	4.4	8.8	5.7
	Samoa	48.8	1.9	3.7	7.4	4.1
	Serbia	62.3	1.4	2.8	5.6	3.7
	South Africa	24.6	0.6	1.3	2.6	6.2
	Suriname	86.2	2.7	5.4	10.9	n/a
	Thailand	79.0	1.5	3.0	6.0	n/a
	Turkey	32.7	0.9	1.8	3.6	n/a
	<b>Upper middle income (N=36)</b>	<b>73.8</b>	<b>1.7</b>	<b>3.4</b>	<b>6.8</b>	<b>3.7</b>
	Angola	39.6	1.5	2.9	5.8	n/a
	Bangladesh	40.8	1.4	2.8	5.5	2.0
	Bhutan	34.4	0.9	1.8	3.7	6.6
	Bolivia (Plurinational State of)	74.5	2.6	5.2	10.5	n/a
	Cabo Verde	73.2	2.4	4.7	9.5	5.2
	Cambodia	23.8	0.8	1.7	3.3	2.2
	Cameroon	34.5	1.3	2.6	5.3	3.1
	Comoros	21.8	0.7	1.4	2.7	n/a
	Côte d'Ivoire	8.2	0.3	0.5	1.0	4.4
	Djibouti	7.8	0.2	0.5	0.9	5.6
	Egypt	28.7	1.4	2.8	5.6	n/a
	El Salvador	66.7	1.6	3.3	6.5	3.6
<b>Lower middle income</b>	Ghana	114.5	4.1	8.3	16.5	4.0
	Honduras	41.1	1.1	2.2	4.4	6.1
	India	13.7	0.4	0.9	1.7	n/a
	Indonesia	62.3	2.0	4.0	8.1	n/a
	Kenya	75.8	3.8	7.6	15.1	5.3
	Kyrgyzstan	39.8	1.1	2.3	4.6	6.0
	Lao People's Democratic Republic	46.7	1.8	3.6	7.2	n/a
	Lesotho	38.9	1.1	2.2	4.5	6.5
	Mongolia	86.7	3.2	6.3	12.6	4.1
	Morocco	50.9	1.5	3.1	6.1	n/a
	Myanmar	8.5	0.2	0.4	0.8	2.0
	Pakistan	83.1	<0.1	<0.1	<0.1	2.9
	Papua New Guinea	43.2	1.2	2.5	4.9	1.9
	Philippines	80.7	3.0	5.9	11.9	n/a

Group	Country	Gross Enrollment Rates in 2018 (%) <sup>1</sup>	Number of months lost			Expenditure on education (% of GDP) <sup>2</sup>
			3	6	12	
	Republic of Moldova	86.7	1.7	3.4	6.8	5.5
	Sao Tome and Principe	50.3	2.0	4.0	8.0	5.1
	Senegal	16.5	0.8	1.5	3.0	4.7
	Solomon Islands	84.1	3.6	7.3	14.5	n/a
	Sudan	46.6	0.9	1.8	3.5	n/a
	Timor-Leste	22.8	1.2	2.5	5.0	4.1
	Tunisia	44.6	1.0	2.0	3.9	n/a
	Uzbekistan	27.9	1.3	2.7	5.4	5.3
	Viet Nam	100.2	2.9	5.8	11.6	4.2
	Zambia	7.6	0.2	0.3	0.6	4.7
	<b>Lower middle income (N=36)</b>	<b>42.2</b>	<b>1.3</b>	<b>2.7</b>	<b>5.4</b>	<b>4.5</b>
<b>Low income</b>	Benin	25.5	1.0	2.1	4.2	4.0
	Burkina Faso	4.4	0.1	0.3	0.5	6.0
	Burundi	15.4	<0.1	<0.1	<0.1	5.0
	Central African Republic	2.9	<0.1	0.1	0.2	n/a
	Chad	1.0	<0.1	<0.1	0.2	2.2
	Gambia	41.7	1.3	2.6	5.3	2.4
	Liberia	125.2	2.4	4.8	9.5	2.6
	Madagascar	39.6	0.6	1.2	2.5	3.2
	Mali	7.0	0.3	0.5	1.1	3.8
	Nepal	88.3	2.6	5.2	10.4	5.2
	Niger	8.0	0.1	0.2	0.5	4.9
	Rwanda	22.5	0.8	1.6	3.2	3.1
	Sierra Leone	13.9	0.3	0.5	1.0	7.1
	Tajikistan	9.9	0.3	0.6	1.2	n/a
	Togo	22.8	0.7	1.4	2.8	5.4
	Uganda	14.4	0.6	1.2	2.4	2.5
	United Republic of Tanzania	41.4	1.7	3.4	6.8	3.7
	Yemen	1.6	<0.1	<0.1	0.1	n/a
	<b>Low income (N=18)</b>	<b>14.9</b>	<b>0.7</b>	<b>1.2</b>	<b>2.4</b>	<b>3.8</b>

<sup>1</sup> Preprimary Gross Enrollment Rates in 2018 (2017 if 2018 not available). GER = total enrollments of all ages relative to number of children of preprimary program age, so it may exceed 100%. Source: UNESCO Institute for Statistics (UIS). <http://data-uis.unesco.org/>

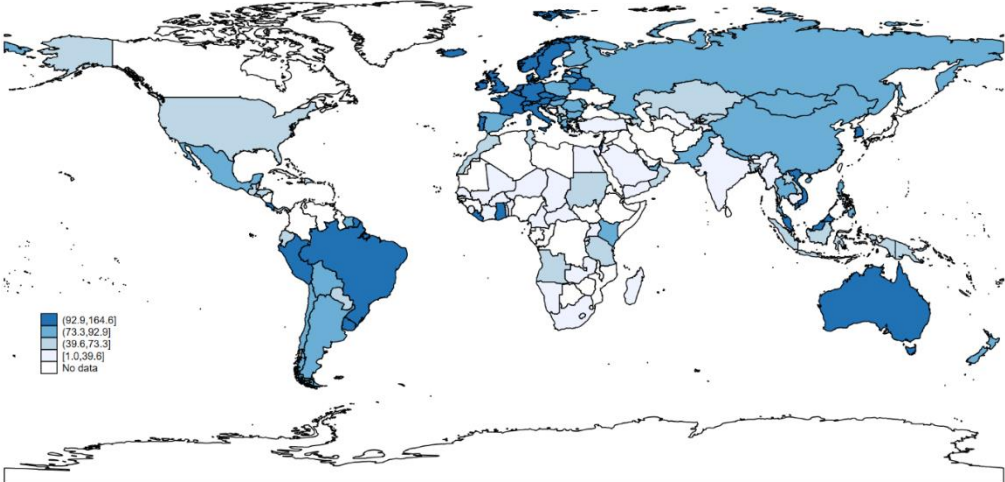
<sup>2</sup> Governmental expenditure on education, total (% of GDP) in 2018 (2017 if 2018 not available). Source: World Development Indicators. <https://databank.worldbank.org/>

**Figure 1: School closures caused by COVID-19 and % of preprimary children affected in selected countries.**



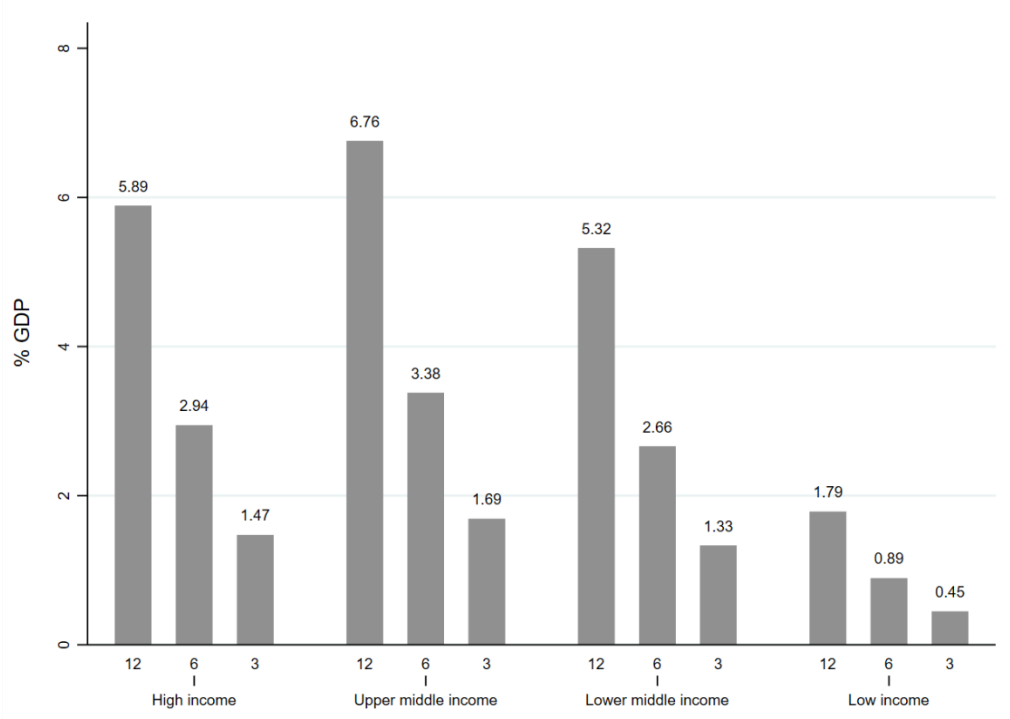
Note: 140 countries. Source: UNESCO Institute for Statistics (UIS). <http://data.uis.unesco.org/>

**Figure 2: Preprimary Gross Enrollment Rates (GER) in 2018 in selected countries**



Note: Data correspond to 2017 if 2018 was not available. GER = total enrollments of all ages relative to number of children of preprimary-program age, so it may exceed 100%. Source: UNESCO Institute for Statistics (UIS). <http://data.uis.unesco.org/>

**Figure 3: Percentage GDP lost if 2018 participation rates in preprimary programs are reduced 3, 6 or 12 months. Medians by income groups**



Note: children are assumed to enter the labor market at age 18 with benefits of 8% per year that persist for 45 years.



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