

# EARLY CHILDHOOD DEVELOPMENT

Analysis of Incentives and Improved Quality of Pre-school Education at Anganwadi Centers in Andhra Pradesh



Cost-Benefit Analysis

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# Cost-Benefit Analysis of Incentives and Improved Quality of Pre-school Education at Anganwadi Centers in Andhra Pradesh

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## Andhra Pradesh Priorities An India Consensus Prioritization Project

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<b>ACADEMIC ABSTRACT .....</b>	<b>1</b>
<b>POLICY ABSTRACT .....</b>	<b>2</b>
BACKGROUND AND CONTEXT.....	2
INTERVENTION 1: CASH INCENTIVES TO INDUCE UPTAKE OF PSE AT AWCS .....	3
<i>Description and Considerations</i> .....	3
<i>Costs</i> .....	3
<i>Benefits</i> .....	3
INTERVENTION 2: IMPROVING QUALITY OF PSE IN AWCS BY PARTNERING WITH ACCREDITED PRIVATE ORGANIZATIONS .....	4
<i>Description and Considerations</i> .....	4
<i>Costs</i> .....	4
<i>Benefits</i> .....	4
<b>INTRODUCTION .....</b>	<b>6</b>
<b>EARLY CHILDHOOD CARE AND EDUCATION IN INDIA .....</b>	<b>7</b>
<b>INCENTIVIZING PSE ENROLMENT AND IMPROVING QUALITY OF EDUCATION AT AWCS IN ANDHRA PRADESH .....</b>	<b>10</b>
<b>INTERVENTION 1: CASH INCENTIVES TO INDUCE UPTAKE OF PSE SERVICES AT AWCS .....</b>	<b>10</b>
DESCRIPTION .....	10
CALCULATION OF COSTS .....	10
BENEFITS.....	11
<b>INTERVENTION 2: IMPROVING QUALITY OF PSE IN AWCS BY PARTNERING WITH ACCREDITED PRIVATE ORGANIZATIONS.....</b>	<b>13</b>
DESCRIPTION .....	13
CALCULATION OF COSTS .....	14
BENEFITS.....	15
<b>QUALITY OF EVIDENCE.....</b>	<b>16</b>
<b>CONCLUSION .....</b>	<b>16</b>
<b>WORKS CITED .....</b>	<b>19</b>

## Academic Abstract

This paper aims to address the issues of quality of education and enrolment ratios in pre-school education offered by Anganwadi Centers (AWCs) or 'courtyard centers' in Andhra Pradesh. About 70% of all rural children aged 3-6 years in Andhra Pradesh have the benefit of enrolment and are possibly going to AWCs for pre-school education. However, the quality of pre-school education (PSE) at AWCs is quite poor; this is reflected in the fact that children spend only about 99 minutes per day on PSE in Andhra Pradesh's AWCs, on average, going by data from 2009. Further, just about one-half of all AWCs in India are found to have basic facilities such as proper books, drawing materials, puzzles, etc. (Government of India, 2011). It is realistic to assume that no drastic changes have come about in the past seven years that significantly improved the quality of pre-schooling in the country.

For the purpose of this paper, the authors undertake a cost-benefit analysis of two interventions: i) a conditional cash incentive to induce uptake of PSE services for 4 year olds at AWCs and, ii) improving quality of pre-school education at AWCs by hiring external teaching inputs from localized organizations specializing in early childhood development. The results show positive benefit-cost ratios (BCRs) for both interventions.

## Policy Abstract

### Background and context

Pre-school education in India is primarily provided through AWCs running under the Integrated Child Development Scheme (ICDS), and private-run pre-schools. In the Indian context, it has been demonstrated that participation in the pre-school component of ICDS is correlated to improved cognitive outcomes, school readiness, and health, in relation to non-users (Pandey, 1991; Kaul, Bhattacharjea, Chaudhary, Ramanujan, Banerji, & Nanda, 2017).

The India Early Childhood Education Impact (IECEI) longitudinal study undertaken in Rajasthan, Telangana and Assam shows pre-school education provided to children at the age of 4 improves their school readiness scores (SRS). SRS has a positive correlation with early grade learning outcomes (Kaul. et al., 2017). However, the same paper also suggests 30% of 4-year-olds are not enrolled in any pre-school program, whether in government or private-run schools. This presents a missed opportunity to substantively boost the population's human capital.

Another challenge is the quality of pre-school education in AWCs. Majority of anganwadi workers (AWWs) face problems in organizing pre-school education activities. About 63.33% of them receive no help from supervisors to plan or execute PSE activities, notes Kular (2014). Moreover, AWWs do not take enough interest in their job-related responsibilities due to lack of skills and formal training in early childhood development. The absence of fixed service conditions for AWWs aggravate the situation.

In India, half the population aged 5-29 is still educated only up to the primary school level (Government of India, 2014a). This is indicative of a significantly high proportion of children dropping out of the education system at an early age. There is an urgent need to address this issue. Exposure to early childhood education programs can improve student retention rates during the primary education period. Though ICDS is one of the largest universal service delivery programs of its kind in the world, the coverage and quality of PSE have left much to be desired.

The solution to this lies in interventions aimed at: 1) incentivizing pre-school enrolment to induce uptake of the services at AWCs, and 2) improving the quality of PSE in AWCs by

partnering with accredited localized organizations specializing in early childhood development. Cash incentives and improved teaching quality at AWCs (at par with private pre-schools) may attract children hailing from economically well-off families as well, thereby improving overall levels of education in government and private-run PSE programs.

This paper looks into the impact of these interventions through a technical analysis. The BCR procedures presented below indicate positive and healthy levels of BCRs for the interventions.

## **Intervention 1: Cash incentives to induce uptake of PSE at AWCs**

### **Description and Considerations**

Cash incentives of about Rs 6,000 each to all 4-year-olds attending PSE programs at AWCs in Andhra Pradesh, irrespective of the levels of income of the mother or household.

The incentives would initially be given to all 4 lakh children aged 4 currently enrolled in AWCs for PSE, and would result in the coverage of 1.4 lakh more children in the same age group.

### **Costs**

The experience of impact of cash voucher incentives on pre-school attendance in rural China forms the basis for calculation of this intervention's costs (Wong, Luo, Zhang and Rozelle, 2013). Based on this, the authors' estimations have yielded that the total annual cost of the intervention in Andhra Pradesh would be Rs. 333 crore.

### **Benefits**

The conditional cash incentives are expected to result in a 35% increase in pre-school enrolment, taking the percentage of 4-year-olds enrolled in AWCs for PSE from 49% to 66% in the short term (Wong et al., 2013). This will lead to an addition of 1.4 lakh new 4-year-olds to the AWC PSE program in Andhra Pradesh. Further, these children will see an increase of 23% to their average wages as they reach the labor and employment market. The wage benefits of the intervention are thus estimated at Rs. 3,146 crore for the state at 5% discounting. The transfer (Rs. 333 crore) is also considered a benefit in the calculation leading to a positive BCR of 10.

## **Intervention 2: Improving quality of PSE in AWCs by partnering with accredited private organizations**

### **Description and Considerations**

An amount of about Rs. 7,000 per year is spent on each child in the 3-6 years age group currently enrolled at AWCs. This sum is spent on improving the quality of PSE offered by partnering with accredited localized organizations that focus on early childhood education and development. The Hippocampus Learning Centers (HLCs) in Karnataka are an example of such an organization.

The amount is spent towards the cost of hiring one teacher per center, improving the curriculum, training of existing AWC staff, and uniforms and books for the students. One teacher comes to the AWC every day for one year.

The effect for this intervention is based on the demonstrated effectiveness from private school pre-school programs, which while not perfect, are generally regarded as providing a more appropriate environment and curriculum for children (Kaul et al., 2017).

### **Costs**

The cost of improving the quality of PSE at AWCs is calculated based on a model already in place in rural Karnataka (Dean and Jayachandran, 2016). An annual sum of about Rs. 7,000 is spent on each 3-6 year-old currently enrolled in AWCs to bring the quality of PSE provided through ICDS at par with private pre-schools. This amount will go towards hiring an external teacher trained in early childhood development for each AWC, curriculum improvement, uniforms, books and training of existing staff. The author's calculations have yielded a total cost for this intervention amounting to Rs. 1,183 crore per year for all 3-6 year-olds currently enrolled at AWCs in the state.

### **Benefits**

Estimations in this paper conclude that this intervention will lead to a 13% increase in average wages for one year of quality pre-school education. Thus, the total benefits for Andhra Pradesh are estimated at Rs. 21,815 crore at 5% discounting, yielding a BCR of 18. Even at higher discounting, the BCRs are positive.

**Table 1: Summary of BCR calculations for Andhra Pradesh**

Intervention	Benefit (Rs. crore)	Cost (Rs. crore)	BCR	Quality of Evidence
Conditional payments for 4-year-olds to attend PSE classes at AWCs	3,479	333	10	Limited
Improving quality of PSE by partnering with localized organizations	21,815	1,183	18	Medium

*Note: All figures assume a 5% discount rate; Source: Author's calculations*

## Introduction

Human capital has emerged as a crucial factor in explaining differences in productivity and inequality. With adequate investments in human capital, a country's demographic dividend can play a critical role in accelerating economic growth and reducing poverty. Given an opportunity, the presence of a larger share of working age population (15-64) as compared to a non-working population has potential for greater economic achievement. Having a favorable demographic age structure does not necessarily guarantee economic growth. History shows there are possibilities of missing this chance as the opportunity to reap this benefit has a finite period, making it crucial to act at the right time (UNFPA, 2016).

With 64.4% of its population between 15-59 years of age, as per the *Sample Registration System Statistical Report – 2015*, India is set to have the world's largest youth population by 2020. According to the *Economic Survey 2016-17*, the country is likely to experience a peak in its demographic dividend in the early 2020's. Economists believe India's demographic dividend could add up to 2% to its current GDP growth rate (Aiyar and Mody, 2011). As the rest of the world greys and the number of young Indians rise, a pertinent question that arises is if India is ready to realize the demographic dividend. Is India's young population equipped with the required skills, health and employment to tap this potential?

Only by investing in education and health for the future generation can India develop a labor force that realizes this demographic dividend. Realization of the demographic dividend requires strategic decision-making from policy makers for different age-groups of the population. A 'dividend' is lost if a country's young population is not educated, skilled and healthy, or if policy makers fail to provide employment opportunities for the country's youth. The demographic dividend doesn't realize itself; it requires well-planned investment aimed at tapping the potential of the youth.

The first six years of a child's life are marked by rapid physical, cognitive, and psychosocial development. Early childhood care and education (ECCE) lays the foundation for sustained cognitive, psychosocial, behavioural, health and schooling benefits. It has a direct influence on economic, health and social outcomes for individuals, and society. Besides, early childhood education can greatly improve the development and future success of at-risk children.

A growing body of literature points to a range of benefits accrued from ECCE for achievement of social, economic and health-related well-being. Young (2002) says these include better physical, psychosocial and cognitive development for lifelong learning, more equitable outcomes and reduction of poverty, and increased inter-generational social mobility. Nobel laureate James Heckman has demonstrated ECCE is a cost-effective strategy for promoting economic growth. Research in neurosciences by Karoly et al. has suggested that 90% of the brain's growth takes place at a rapid pace by the time a child is 6 years old (as cited in Kaul et al., 2017).

Besides, ECCE is as a specific target mentioned in the context of Goal 4 of the Sustainable Development Goals for 2030, which aims to “ensure inclusive and equitable quality education and promote lifelong learning opportunities for all”.

## **Early Childhood Care and Education in India**

On average, children's school readiness levels at the age of 5 are far below expected levels in India, indicating they enter school unequipped with the cognitive, pre-literacy and pre-numeracy skills necessary to meet the demands of the primary school curriculum (Kaul et al., 2017). Half of the population aged 5-29 is still educated only up to the primary school level (Government of India, 2014a). This is suggestive of a high proportion of children dropping out of the education system at an early age. This can be addressed by exposure to early childhood education programs that can improve student retention rates during the primary education period.

While Article 45 of the Constitution of India has been amended to include “early childhood care and education for all children until they complete the age of six years”, ECCE is still not a justiciable right. A National Law Commission report to the government has recommended the need for legislation to make early childhood development a fundamental right for every Indian child below 6 years of age. It has also recommended that the Right to Education Act, 2009, be amended to include pre-school education (Kaul. et al., 2017).

In more recent times, the government has focused on improving enrolment ratios and quality of education at the pre-school level. The National Early Childhood Care and Education Policy and the National Curriculum Framework and Quality Standards that were released in 2013

provide a comprehensive framework for promoting access, equity and quality in ECCE. State governments design their own programs using this national framework.

Pre-school education in India is primarily provided through AWCs running under the Integrated Child Development Scheme (ICDS), and private-run pre-schools. The ICDS, initiated in 1975 on a pilot basis, has now grown to include 1.3 million Anganwadi Centers (AWCs) across the country (Kaul. et al., 2017). It is one of the largest initiatives of its kind in the world for children below 6 years. PSE programs under ICDS aim to cover all children in the 0-6 age group. This group is further divided into two - 0-2 years and 3-6 years. The program's delivery structure chooses either an anganwadi or a child's home to dispense a service. ICDS has specific allocations to target children in the 0 – 2 years group along with their mothers; followed by 3-6 year-olds. The scheme targets children, pregnant and lactating mothers, and adolescent girls from the life cycle perspective.

A major challenge facing ECCE in India is the quality of pre-school education offered through AWCs. Most AWCs currently operate primarily as nutrition or day-care centers staffed by individuals with no formal training in child development (Dean and Jayachandran, 2016). AWWs do not take enough interest in their job-related responsibilities due to lack of skills. The absence of fixed service conditions for AWWs aggravate the situation. Moreover, a majority of anganwadi workers (AWWs) face problems in organizing pre-school education activities. About 63.33% of them receive no help from supervisors to plan or execute PSE activities, notes Kular (2014). On the other hand, private pre-schools seem to be a downward extension of primary schools that fail to meet the needs of early childhood development.

ECCE is an essential ingredient to achieve India's demographic dividend. Improved enrolment rates, combined with better quality of education, will help boost GDP through higher wages earned by the beneficiaries as they grow and enter the labor force. In this context, PSE can operate through and trigger the following social and economic processes:

Bridge gaps in knowledge and ability: As Heckman has demonstrated, strategic approach to cognitive and social skill development through investments in quality early childhood programs is more effective in bridging gaps in knowledge and ability between children from disadvantaged backgrounds and their peers at an early age than trying to fix the problem

later. Further, investments in early childhood education can reduce social costs involved for at-risk children.

**Reduce primary school drop-outs and increase school readiness:** Through early childhood schooling, children become accustomed to school hours and the classroom environment in a manner that helps bring down school dropouts at the early primary levels. School readiness, too, increases and is preparatory for primary and subsequent higher level of schooling achievements.

While the primary objective of early childhood education is to enable children to acquire a sound foundation for life, a more immediate and tangible objective is to help better prepare them for school. A growing body of research demonstrates that children who come to school prepared with certain cognitive and socio-emotional competencies have better chances of success in the primary grades. For example, a study conducted with 38,000 children from across eight Indian states demonstrated that participation in pre-school programs can make a positive difference of 8-20% on retention or continuation rates of children in primary grades (Kaul, Ramachandran, and Upadhyay, 1993). More recently, an NGO initiative carried out an impact evaluation covering AWCs across the south Indian city of Bengaluru in Karnataka. While the renewed focus on the PSE component of ICDS by means of short trainings and supply of play materials seem to lead to a positive shift in the overall environment of the AWC, specific curricular inputs may be required to improve children's school readiness levels (Kaul, Chaudhary, and Sharma, 2013).

Despite being home to the ICDS scheme, the largest public initiative in the world for integrated development of children below six years of age, India suffers from a significant dearth of large-scale research evidence on ECCE in India. The present study is a step towards filling this gap.

**Improve pedagogy and school achievement levels:** Early childhood schooling does improve pedagogic understanding and grades at the primary school level. This is evident from marks scored in subjects such as mathematics and English.

**Relatively Higher Wage and Income over Lifetime:** Further, as has been found in this study, those who participate in the early childhood educational system are able to maximize their

wage incomes as they grow older and enter the labor force, even at lower levels of education.

## **Incentivizing PSE enrolment and Improving Quality of Education at AWCs in Andhra Pradesh**

About 70% of all rural children aged 3-6 years in Andhra Pradesh have the benefit of enrolment and are possibly going to AWCs for pre-school education. However, the quality of pre-school education at AWCs is poor; this is reflected in the fact that children spend only about 99 minutes per day on PSE in Andhra Pradesh's AWCs, on average, going by data from 2009 (Government of India, 2011). This paper looks into the impact of two separate interventions aimed at incentivizing PSE enrolment and improving quality of education at AWCs in Andhra Pradesh.

### **Intervention 1: Cash Incentives to Induce Uptake of PSE Services at AWCs**

#### **Description**

Since children seem to lack the motivation to attend pre-school classes at AWCs, it would be essential to incentivize them to join the PSE program to effect an increase in the time spent at the centers to 200 minutes, and possibly more. This intervention proposes to provide cash incentives of Rs. 6,176 (5% of GSDP) each to all 4 lakh children (Government of India, 2014b) in the age group of 4 years in Andhra Pradesh, who are currently participating in the PSE program, irrespective of the levels of income of the mother or household. This will encourage and motivate other non-participants from the same age group to join this program, resulting in a coverage of 5.4 lakh children in total.

#### **Calculation of costs**

The experience of impact of cash voucher incentives on pre-school attendance in China forms the basis for these calculations. Wong, Luo, Zhang and Rozelle have shown in a 2013 study that an incentive amounting to 5% of per capita GDP in China boosted pre-school attendance by 35% in the short term. Other studies have investigated the impact of cash transfers for

early childhood development but these were not conditional on pre-school enrolment (Macours et al 2012; Paxson and Schady, 2010). These studies indicate that cash transfers can improve child cognitive, physical and social-emotional outcomes in pre-school aged children.

The cost of the current intervention is calculated by assuming that every 4-year-old enrolled at AWCs in Andhra Pradesh for PSE gets the incentive. If one were to look at the statistics for 5/6-year-olds, it becomes apparent that most of them are already in some form of school – private or otherwise (Kaul et al, 2017). However, there is still ample room for enrolment in PSE among 4-year-olds. For the purpose of this analysis, the authors have used the all-India findings from the IECEI study report to calculate the number of 4-year-olds currently not enrolled in any PSE program in Andhra Pradesh. The number of PSE beneficiaries (aged 4 years) in the state post the intervention stood at 5.4 lakh. It is expected that the stock of beneficiaries will be the same for 2013 and 2017. The incentive per child is Rs. 6,176 (5% of GSDP), which translates to an annual cost of Rs. 333 crore per year for all 4-year-olds enrolled in AWCs in Andhra Pradesh.

## **Benefits**

The cash transfers are expected to result in a 35% increase in pre-school enrolment (Wong et al., 2013), taking the percentage of 4-year-olds enrolled in AWCs from 49% to 66% in the short term. This will lead to an addition of 1.4 lakh new 4-year-olds to the PSE program in Andhra Pradesh's AWCs. It is assumed most of this shift will come from incentivizing parents of those children not attending any school to enrol in AWCs, while some of the shift will come from 4-year old child who are currently attending age-inappropriate primary school. Due to the size of the transfer it is also assumed that children attending private pre-school will not shift.

The findings from the IECEI study (Kaul et al., 2017) form the basis of these calculations. Data was collected through a longitudinal study that followed a cohort of 14,000 four-year-olds from ages 4 to 8 from two districts each in the states of Assam, Rajasthan and Telangana. It examines young children's participation in pre-schools, the quality of institutions they attend, and the short- and medium-term outcomes of this participation.

The findings indicate that the SRS of a child increases by 21.67 due to ‘one exposure of pre-schooling’. The average number of exposures for one year of pre-school in the state is 3.8. Therefore, the SRS increases by 82.35 in one year’s attendance, in comparison with another child who has no exposure to pre-school. It also suggests the Standard Deviation (SD) for early age assessment at age 6 is observed to be 21.9. Another key takeaway from the same report is that SRS has a correlation coefficient of 0.346 with higher test scores in primary schools.

A study by Aslam, Kingdon and Kumar (2010) provides insights on the effects of education on labor market outcomes in India and Pakistan. The papers establish that 1 SD increase in mathematics score leads to 16% higher wages in the labor market while 1 SD increase in literacy results in 20% higher wages in India. Taking an average of the two (18%) and applying the impact of pre-school attendance on SRS (82.35), SD at early age assessment (21.9) and correlation of SRS with higher test scores (0.346) presents the impact of pre-school attendance on wages in the following formula:

$$\text{One year pre – schooling} \equiv \frac{(82.35) \times (0.346)}{(21.9)} \times (18\%) \equiv 23\% \text{ increase in wages}$$

The results and coefficients estimated in IECEI study and the paper by Aslam et al. (2010) provide us with an interesting insight that one year’s exposure to pre-schooling boosts the beneficiary’s wages by 23%. The estimates suggest that each child exposed to pre-school education at an AWC for one year will have 23% higher wages for his/her lifetime, as compared to another child who did not have this exposure. It is important to note that the benefits in this paper are estimated in terms of lifetime difference of wages of only lowly literate (below primary) persons. The author’s calculations estimate that the intervention to incentivize PSE enrolment will add wage benefits amounting to Rs. 3,146 crore at 5% discounting in Andhra Pradesh. Additionally, the transfer value of Rs. 333 crore is a benefit leading to total benefits of Rs. 3,479 crore at the 5% level.

**Table 2: Summary of BCR calculations of Intervention 1**

Discount Rate	Benefit (Rs. crore)	Cost (Rs. Crore)	BCR
3%	6,442	333	19
5%	3,479	333	10
8%	1,644	333	5

*Source: Authors' estimations*

## **Intervention 2: Improving quality of PSE in AWCs by partnering with accredited private organizations**

### **Description**

This intervention proposes to improve the quality of PSE offered through ICDS by spending a sum of Rs 7, 232 on each child in the 3-6 years age group currently enrolled at AWCs. This amount will be spent towards the cost of hiring one teacher per center, improving curriculum, training of existing AWC staff, and provision of uniforms and books for the students through accredited and localized organizations such as Hippocampus Learning Centers (HLCs) that specialize in early childhood development. While doing so, care must be taken to ensure that a) the partnered organizations have previous experience in teaching and are well-versed with modern teaching techniques, and (b) the selected teachers spend all their time in teaching activities at the AWCs.

It is to be noted that the AWW and ICDS helper at a center are generally barely educated and lack the required formal training in early childhood education. Besides, there are no benchmarks to assess the capacity to teach and manage AWCs, and to measure the achievement levels of the children who visit AWCs. AWWs are often mandated to engage in multiple tasks; including work in community surveys and attendance at village, taluk and district level bureaucratic events that take away from their capacity to concentrate work on child development.

Researchers from J-PAL and MIT have partnered with HLCs to assess the impact of attending kindergarten on children's cognitive and socioemotional development, and on their performance in the first year of primary school (Dean and Jayachandran, 2016). As mentioned by them, HLC teachers are local women from the community who have completed at least 12 years of schooling and have passed examinations of their math and language abilities administered by HLC. Some of them are retired teachers who have prior experience. They are provided with 20 days of intensive training, in-service training throughout the year, as well as ongoing technical support.

Although the curriculum developed by HLC-like organizations usually has detailed daily lesson plans and necessary materials in a ready-made kit that makes it easy for teachers in rural areas to deliver quality lessons, the authors assume there is scope of further improvement in the curriculum part. Therefore, costs have been assigned that may be used to hire experts to design, localize and upgrade the curriculum. This gains importance with the increasing adoption of technology and internet-based learning solutions in education.

### **Calculation of costs**

To enhance the quality of teaching at AWCs, it is proposed that Rs. 7,232 be spent per year on all 3 - 6-year-old children attending AWCs by partnering with accredited localized organizations like HLCs. One dedicated teacher will visit the AWC on each working day and teach the children. For estimating the cost of improving quality of PSE, the cost for one AWC student is taken from the J-PAL study. According to Dean and Jayachandran (2016), the cost for improved quality of PSE education per student per year varies from \$85 to \$140, depending on factors such as wealth of the village where AWC is located and grades being taught. This paper takes into consideration the average of \$85 and \$140, which amounts to about Rs. 7,232 spent per child per year. Total cost of the intervention is estimated by multiplying this with the number of 3-6 year-olds attending AWCs in Andhra Pradesh, which is 16.4 lakh (as on 31 December, 2015) according to the government's official website. The total annual cost for the intervention is estimated to be Rs. 1,183 crore for all children in the 3-6 age group attending PSE classes in Andhra Pradesh's AWCs.

## Benefits

The findings from the IECEI study indicate that the SRS of a child increases by 12.32 after one exposure to quality pre-school education. Considering that the average number of exposures for one year of pre-schooling in the state is 3.8, the SRS of a child increases by 46.82 after one year's attendance in comparison with another child who only has exposure to pre-school via AWCs. The SD for each early grade assessment distribution at age 6 is 21.9. SRS has a correlation coefficient of 0.364 with higher test scores in primary schools (Kaul et al., 2017). The study by Aslam et al. (2010) establishes that 1 SD increase in mathematics score leads to 16% higher wages in the labor market while 1 SD increase in literacy results in 20% higher wages in India. Taking an average of the two (18%) and applying the impact of pre-school attendance on SRS (46.82), SD at early age assessment (21.9) and correlation of SRS with higher test scores (0.346) presents the impact of pre-school attendance on wages in the following formula:

$$\text{One year pre - schooling} \equiv \frac{(46.82) \times (0.346)}{(21.9)} \times (18\%) \equiv 13\% \text{ increase in wages}$$

These calculations estimated that one year's exposure to improved quality of PSE at AWCs boosts the beneficiary's wages by 13%, as compared to another child who did not have this exposure. It is important to note that the benefits are estimated in terms of lifetime difference of wages of lowly literate persons. The benefits realized from facilitating one year of quality teaching in AWCs for 3-6 year-olds would amount to Rs. 21,815 crore for Andhra Pradesh at 5% discounting.

**Table 3: Summary of BCR calculations of Intervention 2**

Discount Rate	Benefit (Rs. crore)	Cost (Rs. Crore)	BCR
3%	41,603	1,183	35
5%	21,815	1,183	18
8%	9,366	1,183	8

Source: Authors' estimations

## Quality of Evidence

The authors rate the quality of evidence for the cash transfer as 'limited', and 'medium' for the quality improvement intervention. The basis for each intervention comes from a high-quality published research work based on India (Kaul et al., 2017; Aslam, 2010). The only reference which is taken out of the Indian context is the experience from China by Wong et al. (2013). A cash transfer at the pre-school level has not been tried in India. While China is a reasonable comparator, all Chinese pre-schools are private, which is different from the case in India. Additionally, the conditional cash-transfer in China did not lead to improved school readiness. We discount that finding as being specific to China, given that Kaul et al (2017) demonstrate improved school readiness from AWC exposure in India.

It is important to note that while all interventions do generate great benefits, they may produce many externalities not accounted for in this analysis and estimation of benefit-cost ratios. For example, enhanced investments in AWC PSE may also increase chances of younger siblings of the beneficiaries attending PSE and wage benefits realized by incrementally (highly) educated persons. Even associated programs such as maternal nutrition and adolescent girl's health schemes will get benefitted indirectly from implementing an enhanced AWC program.

## Conclusion

The benefits realized from both these interventions for Andhra Pradesh are significant. However, benefits calculated in this paper are limited only to the extent that in the future, children with a year of pre-school education will earn more than the children who remain illiterate. The estimation of benefits of early childhood education realized by incrementally-educated persons at the metric, pre-university and college levels could be phenomenal; but such estimations are complex and out of scope of this work. Further, for example, estimating the wage difference between a doctor with one-year of pre-schooling and another doctor without one year of pre-schooling is not easy. Such estimations are complex and out of scope of this work. In other words, a significant proportion of benefits is not carried out and hence the benefits and BCRs presented in this paper are rather under-estimates; yet important. Actual benefits and BCRs will be higher than the values presented in this paper.

For the sake of policy-related decision-making, it suffices to find out what benefits PSE generate when children move over from remaining illiterate to attending school for one year.

The author’s empirical estimations suggest ECCE interventions in Andhra Pradesh yield good lifetime benefits. For example, at 3% discounting, the intervention to incentivize pre-school enrolment produces a value 19 times the cost of intervention. Even at higher rates of discounting, the BCRs are positive: 10 at 5% discounting and BCR of 5 even at 8%. On the other hand, the quality improvement intervention produces a value 35 times the intervention’s cost at 3% discounting. At 5% and 8% discounting, the intervention yields healthy BCRs of 18, and 8 respectively.

The following tables present a summary of the cost and benefit estimates carried out, and the underlying BCRs realized for the interventions. The results indicate positive benefits for investment in these interventions.

**Table 4: BCR Estimations of Intervention 1**

Benefit-Cost estimations of intervention in Andhra Pradesh to incentivize PSE enrolment at AWCs		
<b>Costs</b>		
Annual incentive to be given to each 4-year-old child for PSE enrolment at AWCs		Rs. 6,176
Number of 4-year-olds covered by intervention		5.4 lakh
Annual cost of intervention		Rs. 333 crore
<b>Benefits</b>	<b>Discount rate</b>	<b>(Rs. Crore)</b>
Total lifelong wage benefits accrued from intervention	3%	6,089
	5%	3,146
	8%	1,310
<b>BCR</b>	<b>Discount rate</b>	<b>Value</b>
Benefit-Cost Ratio (including incentive payment of Rs. 333 crore)	3%	19
	5%	10
	8%	5

*Source: Authors’ estimations*

**Table 5: BCR Estimations of Intervention 2**

Benefit-Cost estimations of intervention in Andhra Pradesh to improve quality of PSE at AWCs by partnering with private organizations		
<b>Costs</b>		
Amount spent per child in the 3-6 year age group per year to improve quality of pre-school education in AWCs		Rs. 7,232
Number of 3-6 year-olds benefitting from PSE at AWCs		16.4 lakh
Annual cost of intervention		Rs. 1,183 crore
<b>Benefits</b>	<b>Discount rate</b>	<b>(Rs. Crore)</b>
Total lifelong wage benefits accrued from intervention	3%	41,603
	5%	21,815
	8%	9,366
<b>BCR</b>	<b>Discount rate</b>	<b>Value</b>
Benefit-Cost Ratio	3%	35
	5%	18
	8%	8

*Source: Authors' estimations*

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