

ADOLESCENTS

Cost-benefit analysis of adolescent health interventions in Andhra Pradesh

Cost-Benefit Analysis



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Cost-benefit Analysis of Adolescent Health Interventions for Andhra Pradesh

Andhra Pradesh Priorities
An India Consensus Prioritization Project

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Academic Abstract

With about nine million adolescents among its total population of 49 million, Andhra Pradesh has one fifth of its total population in the age group of 10-19 years, offering a potential demographic dividend to the state's economy. However, the full contribution of these adolescents can be utilized only if they are given the opportunity to develop their potential to the maximum possible extent. The unique health needs of this age group during their transition from childhood to adulthood are often neglected; this can have both immediate as well as long-term repercussions.

In this study, the authors have analyzed three key issues affecting the development of adolescents in Andhra Pradesh – high rate of child marriage, widespread anemia among adolescent girls and mental health disorders. The authors have reviewed the status and magnitude of these problems and have also analyzed prospective interventions for addressing these challenges using the cost-benefit analysis approach. They have found that interventions aimed at delaying child marriage through incentives in-kind, preventing anemia among adolescent girls through iron and folic acid supplementation, and protecting the mental health of all adolescents through screening and evidence-based care can yield higher benefit per unit of cost incurred. The analysis is based on sound secondary evidence in terms of data and other findings. The cost effectiveness will provide the rationale for policy makers to adopt these interventions to improve adolescent health in the state.

Policy Abstract

The Problem

Adolescence (10 to 19 years) is the transitional period of physical, physiological and psychological development from puberty to adulthood. More than 1.2 billion people worldwide are adolescents; this indicates that roughly one in every six people is an adolescent. Adolescents face challenges like poverty, lack of access to healthcare services, unsafe environments, etc., and have specific needs that vary with gender, life circumstances and socioeconomic conditions. Adolescence is a critical phase in a person's life as it is also a period of preparation for undertaking greater familial, social, cultural and economic responsibilities in adulthood (Sivagurunathan et al. 2015). About 21 percent (243 million) of India's total population is in the age group of 10 to 19 years (Census of India, 2011). This share is slightly lower at 19 percent (9 million) in Andhra Pradesh.

This study has looked into three critical problems that affect adolescents in the context of Andhra Pradesh. These problems are: prevalence of girl child marriage, prevalence of anemia among adolescent girls, and mental health problems among the adolescent population in schools.

Andhra Pradesh has one of the highest child marriage rates in the country. As per National Family Health Survey-4 (2015-16), 33 percent of women in the age group of 20-24 years in Andhra Pradesh are married before 18 years - the legal age of marriage. This study has analyzed both the social and economic costs of child marriage. The solution suggested for this problem is transfer of a consumable to the household on the condition that the girl child is not married before the age of 18 years. This is in contrast to the existing schemes under which cash incentive is provided to the household.

Another critical adolescent health issue is anemia. The District Level Household and Facility Survey 2012-13 has revealed that the prevalence of anemia among adolescent girls in Andhra Pradesh is 69 percent. The requirement for iron increases in adolescence due to nutritional needs for growth. This requirement further increases for girls due to the onset of menstruation, making them more vulnerable to anemia and posing a major threat to safe

motherhood in the future. Though there are existing programs that target adolescents, the larger focus for preventing anemia has been on pregnant and lactating mothers, and infants and young children. Hence, the needs of adolescent girls may remain unmet.

Adolescent mental illness is a growing area of public health concern and a leading cause of disability in young people around the globe. The National Mental Health Survey of India (2015-16) has reported that the prevalence of mental disorders is 7.3 percent among children aged 13 to 17 years in India, including depressive disorders (2.6 percent), disabilities affecting intellectual status (1.7 percent), agoraphobia (2.3 percent), autism (1.6 percent), psychotic disorders (1.3 percent) and phobic anxiety disorders (1.3 percent). The report suggests early recognition and intervention will help realize favorable outcomes in this area.

Though these select problems have been analyzed in the context of Andhra Pradesh, the findings are largely true for other states in India or any developing country facing similar problems.

Intervention 1: Delaying child marriage in Andhra Pradesh by providing incentives

Overview

Child marriage poses huge social as well as economic costs. All major states and the Union government in India have different schemes encouraging the protection and education of the girl child. Most of these schemes provide for cash incentives on the condition that the girl child is not married off before the legal age of marriage, which is 18 years in India. However, various studies have shown these schemes have not been able to yield the desired results. This is evident in the case of Andhra Pradesh, where the child marriage rate among girls is still above the national average (UNICEF, 2016).

The proposed intervention will provide incentives to households in rural areas in the form of a consumable on the condition that their girl children are not married before 18 years of age. The decision on the consumable can be taken by policy makers depending on local needs. A common consumable might not have the same utility in different parts, given the range of intra-state disparities. The dropout rate for girls increases dramatically between the upper primary and secondary levels, and the chances of a girl child's marriage are much higher once

she is taken out of school. Hence, this intervention aims to target around 6.9 lakh 14-year-old girls who are both in school and out of school, and follow this cohort for next the 4 years till they reach 18 years of age.

Implementation Considerations

The intervention will be implemented through the *panchayati raj* system by the department in charge of women and child development in the state. The *gram panchayat* will be given the authority to spread awareness about the intervention, identify beneficiaries, and revise the list at regular intervals to ensure only eligible households receive the benefits. The consumable can be distributed through the public distribution system network in the state through which food grains and other items are already being distributed. The data on enrollment, disbursement and monitoring of the intervention will be included in the Management Information Systems to minimize any discrepancy in the demand and/or supply side of the intervention.

Costs

The cost of providing the incentives for each beneficiary is based on the analysis of a similar successful program in Bangladesh. The direct cost of the incentive (household consumable) is the major component of the cost. This comes to around Rs. 2,900 per beneficiary, which is 2.4 percent of the state's per capita income¹, for a total cost of Rs. 398 crores over four years. Reduction in child marriage also results in higher enrolment in schools. The marginal cost of education due to increased schooling resulting from the intervention is estimated at Rs. 23 crores. And lastly, the implementation cost of the program that includes transport, staff and other program-related expenses is estimated at Rs. 1027 crores. Total cost of this proposed intervention is Rs. 1,449 crore over a period of four years, applying a discount rate of 5 percent.

Benefits

The major benefit of the intervention arises from averted child marriages and associated benefits. The intervention is expected to reduce the child marriage rate from the existing 33 percent to 25 percent. This translates to around 37,500 fewer child marriages in the state in

¹ This is equivalent to the cost of a similar intervention in Bangladesh where cooking oil was given to the household on the condition that the girl is not married off before a certain age.

four years due to the intervention². The averted social cost of child marriage that includes cost of higher fertility rate, domestic violence, stunting among the children and maternal mortality, are considered as potential benefits of this intervention. Incremental benefits in wages with increased years of schooling have also been included. Both these benefits are spread over the later years of lives of the beneficiaries. Finally, the amount of incentives provided to each beneficiary within the program, which is part of the cost, has been included as this is a transfer and hence also a benefit for the household. The total of benefits accrued from the intervention for one cohort amounts to about Rs 4,400 crore, after discounting at 5 percent.

Intervention 2: Preventing anemia among adolescent girls through iron and folic acid supplementation

Overview

At the current prevalence rate, more than 30 lakh adolescent girls suffer from any type of anemia, of which around 80 thousand are suffering from severe anemia. The immediate impact of iron deficiency is reduced physical fitness, which affects academic performance. In the long run, this affects maternal and child health and further increases the burden of the disease.

The proposed intervention aims to provide weekly iron and folic acid supplementation and biannual deworming with an aim of covering all adolescent girls aged 10 to 19 years. For school-going girls, the intervention will be implemented through the existing educational set up, where teachers can act as supervisors and spread awareness about the efficacy of this program. For out-of-school adolescent girls, monthly counselling sessions by healthcare providers at the community level will be conducted for awareness generation. This intervention is in line with the existing weekly iron and folic acid supplementation (WIFS) program. The WIFS program includes both boys and girls, but the proposed intervention in this study covers only girls for cost effectiveness and other reasons cited above.

² The baseline has taken the child marriage rate at 33 percent in Andhra Pradesh (NFHS-4)

Implementation Considerations

The providers, within and out of schools, will prepare a demand chart at least two months prior to the date of distribution to ensure adequate supply of the supplements and other materials in a timely manner. Lack of awareness in terms of benefits as well as side-effects and resulting poor adherence are major challenges in the success of this intervention. It is proposed that apart from the counselling and supervision by teachers and community health workers, a mechanism should be developed where peers keep a check to ensure better program adherence. Moreover, data on coverage of the program, and gaps and challenges during implementing the same will be conveyed to supervising officials for better decision making. The program can be later scaled up to include all adolescents, irrespective of their gender.

Costs and Benefits

Costs

The costs of providing iron and folic acid supplements and of facilitating counselling sessions for the program are considered as direct costs. The opportunity cost of time spent by the out-of-school girls for attending counselling sessions has also been included in the cost and has been valued on the basis of the existing wage rate for the given education level in the state. Adding these two components, the total annual cost of the intervention is Rs 44 crore.

Benefits

The number of cases with mild, moderate and severe anemia has been calculated on the basis of existing prevalence rate in the state. Disability weight is applied to each category to estimate the value of years lived with disability (YLDs). The intervention is expected to bring down the prevalence rate from the existing 69 percent to 40 percent, a reduction of 42 percent- averting 13 lakh cases in the target group. The benefit from this intervention is the averted number of cases in different categories and the total value of averted YLDs after excluding the impact of side-effects suffered by some beneficiaries during the course of the program. The estimated total value of benefits per annum is Rs. 655 crores at 5 percent discount rate (Table 1).

Table 1: Total anemia cases averted and accrued benefits due to iron and folic acid supplementation in adolescent girls in Andhra Pradesh under the proposed intervention

Anemia	Cases Averted	YLD Per case	Total YLDs	Value per DALY, 2017 (in Rs.)	Total benefits (in Rs. crore)	Total benefits after adjustment for side effect (in Rs. crore)
Mild	825686	0.00262	2166	370560	80.3	71.2
Moderate	424399	0.03410	14470	370560	536.2	476.0
Severe	33616	0.09770	3284	370560	121.7	108.0
Total	1283701		19920		738.1	655.3

Source: Authors' calculation; benefits assume a 5% discount rate

Intervention 3: School-based behavioral screening and further mental health services for the adolescents

Overview

Mental health is one of the neglected areas in the healthcare sector in developing countries. According to WHO, the rate of treatment for severe cases of mental disorder in less developed countries is in the range of 14-23 percent³. The unmet need for mental health in adolescents hampers their overall development, which further affects their lives at a later stage. This intervention will consider adolescents enrolled in both private and public schools from classes VI to XII, which roughly covers the 11-17 years age group of the state's school-going population. It comprises screening the mental health status of adolescents, referring them to appropriate care providers and treating them for respective disorders. The participation will be voluntary and require the consent of the adolescent and their parent or guardian. The screening will be carried out through a self-administered questionnaire based on three scales - mood and feeling questionnaire, youth self-report aggression scale and 3-point Likert scale. The students screened positive for illnesses will be scheduled for clinical behavioral health evaluation. Positive cases found at that stage will be referred for specialized mental healthcare services with adequate follow-ups to ensure that the child is linked to a facility for proper treatment.

³ <https://pdfs.semanticscholar.org/6898/1d738295a4abf860df5bcab080a96f2d93ee.pdf>

Implementation Considerations

The screening questionnaire will be reviewed, assessed and modified upon consultation with educationists, psychiatrists and psychologists. Cultural appropriateness will be examined, and necessary modifications will be carried out prior to the intervention. Parents and teachers will be informed about the purpose of the intervention and their role throughout the process. These key stakeholders have critical roles to play for ensuring that adolescents participate in this intervention.

Costs and Benefits

Costs

The cost of human resources dedicated to different stages of screening, material development and dissemination for the screening, and other costs related to the intervention are calculated. Additionally, the proportional cost for clinical assessment and to prepare the students for referral, cost for successful linkage to specialized care providers and the average cost of mental health services for each adolescent is calculated as the cost per beneficiary. The total annual cost of the intervention amounts to Rs. 122 crores at 5 percent discounting.

Benefits

The number of years of life lost (YLL) and years lived with disabilities (YLD) due to mental illness among the adolescents is calculated from the *Global Burden of Diseases* data. Further, the number of averted YLL and YLD is calculated following the intervention and it is multiplied with the respective values of statistical life years and disability adjusted life. The sum of annual benefit for the intervention at 5 percent discount rate is Rs. 296 crores.

BCR Table

Table 2: BCR Summary Table

Intervention	Benefit (in Rs. crore)	Cost (in Rs. crore)	BCR	Quality of Evidence
Delaying child marriage via direct incentives	4401	1449	3.0	Medium
Preventing anemia among adolescent girls	655	44	14.9	Strong
School based behavioral screening and further mental health services for the adolescents	296	122	2.4	Medium

Notes: All figures are provided in Rs crore, assuming a 5 percent discount rate

1. Introduction

Adolescence is a transitional stage of life from puberty to adulthood which ranges between 10 to 19 years of age (WHO, 2014). A spectrum of physical, psychological, and social and development occurs during this period. Although adolescence is not considered as a risk period for most infectious diseases, the health status of adolescents is often affected by varying conditions emerging from their transitional state, as well as diverse social determinants of health (Laski, 2015). Critical health problems start or aggravate during this period of life; which includes substance abuse, mental health problems such as depression, anxiety, mood disorders, psychological disorders, eating disorders, etc. (Sunitha and Gururaj, 2014). Each of these health issues can affect the development of an adolescent, resulting in higher disease rates as well as economic burden to the affected individual, their caregivers, families and communities.

Though most of the problems associated with adolescents are common across the globe, some are more peculiar to less developed countries. One such problem is child marriage. There are more than 700 million women around the globe who get married before 18 years of age and most of them live in low- and middle-income countries (UNICEF, 2014). The number continues to increase by 37,000 each day and nearly 15 million each year (UNICEF, 2014; Wodon *et al.*, 2017). More than one-third of all girls become victims of child marriage in developing countries, contributing to a spectrum of health hazards and allied socioeconomic consequences (UNICEF, 2014). Apart from health-related issues, child marriage primarily affects the educational and economic opportunities of adolescent girls in their adulthood. Early marriage often leads to teenage pregnancy, which results in higher fertility and population growth (Wodon *et al.*, 2017). It also affects maternal health outcomes to varying extents. Adolescent girls under 15 years of age are nearly five times more likely to die during childbirth, compared to the women in their 20s (IWHC, 2017). They are also at higher risk for pregnancy-related injuries like obstetric fistula, unsafe sexual practices leading to unsafe abortions, and sexually transmitted infections and other complications. Moreover, teenage pregnancies contribute to the mortalities and morbidities of the offspring, which is a serious concern for population health. Children born to teenage mothers suffer from low birthweight, stunting and other nutritional disorders (Raj *et al.*, 2010). According to another

study, child marriage contributes to 6.3 percent of all cases of under-five stunting, which revalidates the impact of child marriage across generations (Presler-Marshall and Jones, 2017). Another estimation has revealed that undernutrition may lead to a loss of more than 10 percent of Gross Domestic Product in sub-Saharan Africa and south Asian countries due to lost productivity (Shekar, Dayton Eberwein and Kakietek, 2016).

In addition to these physical impacts, child marriage also affects the brain development and cognitive capabilities of the offspring with lasting consequences in their adulthood (Wodon, 2016). Moreover, girls who get married at an early age often lack autonomy and become victims of historical maldistribution of power in conjugal life, leading to intimate partner violence that affects the physical and psychological wellbeing of the victim as well as the offspring and increases the risk of violence during adulthood (UNFPA, 2014, WHO, 1997, Aizer, 2011, Crombach and Bambonyé, 2015).

As per NFHS-3 (2006), around 47 percent of married women aged 20-24 years were married before the age of 18, which is the legal marriageable age for women in India. A decade later, around 27 percent women in the same age group reported being married before the legal age (NFHS-4). The burden of child marriage is higher in the rural population. It has also been observed that the median age at first marriage is 22.7 years for women with 12 or more years of schooling, compared to 17.2 years for women without any schooling, indicating the significance of education in preventing child marriages.

The rate of child marriage in Andhra Pradesh is much higher than the national average. Among respondents within the same age group, the rate of those who got married before the legal age of marriage is 33 percent. In rural areas of Andhra Pradesh, the prevalence is even higher at 36 percent (NFHS-4).

Another critical adolescent health problem is the high prevalence of anemia, especially in less developed countries. It is characterized by reduced hemoglobin concentration, red cell count or packed cell volume which subsequently affect oxygen delivery at the tissue level (Balarajan *et al.*, 2011). The World Health Organization defines anemia based on hemoglobin concentration levels which vary in different population groups as following - for children aged 12 -15 years and non-pregnant women aged more than 15 years, the threshold level of hemoglobin used to define anemia is less than 12 gm/dL, whereas the level is considered as

less than 11 gm/dL for children up to 5 years and pregnant women, for men aged above 15 years, a hemoglobin concentration less than 13 gm/dL is considered as anemic (Beutler and Waalen, 2006).

During 2015-16 in India, the prevalence of any anemia (hemoglobin level <12 gm/dl) among women aged 15 to 49 years was 53 percent, which included 40 percent cases with mild anemia (hemoglobin level between 10 to 11.9 gm/dl), 12 percent cases of moderate anemia (hemoglobin level between 7 to 9.9 gm/dl) and 1 percent cases with severe anemia (hemoglobin level less than 7 gm/dl) (NFHS-4). The prevalence across India is much higher among the population with lowest wealth index (58.6 percent) compared to the highest wealth index (48.1 percent). Also, rural women have higher prevalence (54.2 percent) compared to their urban counterparts (50.8 percent).

In Andhra Pradesh, the prevalence of anemia among women aged 15 to 49 years is 60 percent, higher than the nationwide prevalence (NFHS-4: Andhra Pradesh, 2016). A study in a tribal area of Andhra Pradesh found 88.9 percent adolescent girls to be anemic, whereas 17.8 percent were found to be severely anemic with mean hemoglobin concentration as low as 9.7 gm/dL. The highest prevalence of anemia was seen in the age group of 12-15 years at around 85 percent (Amarnath and Lakshmanrao, 2013). The variation in the prevalence rate was similar to the national trend in terms of wealth index, geographic location and educational attainment. Poorer women with no schooling who lived in rural areas, had higher prevalence of anemia. In addition, the prevalence is slightly higher (61.1 percent) among adolescents aged 15 to 19 years with a distribution of 39.3 percent, 20.2 percent and 1.6 percent cases of mild, moderate and severe anemia, respectively (NFHS-4: Andhra Pradesh, 2016).

Adolescent mental health is a growing area of public health concern which defines the course of development, and quality of lives and prospects in the productive future of adolescents. Many neuropsychiatric conditions affect their journey to adulthood and these disorders are considered to be the leading causes of disability among young people around the globe (WHO, 2018). Many mental health disorders begin during late childhood and early adolescence. It is estimated that 10 to 20 percent children and adolescents experience

mental health disorders, and about half of all mental illnesses emerge by the age of 14 years and three-quarters by the mid-20s (WHO, 2018).

Several psychiatric epidemiological studies have been conducted in India to estimate the prevalence of different psychiatric disorders. A lack of awareness about mental health and allied disorders in the country often leads to poor access to mental health services. In most cases, only patients with severe mental disorders are diagnosed and treated, leaving those with minor mental disorders without timely diagnosis and treatment (Math and Srinivasaraju, 2010). Many of these disorders emerge during adolescence and if left untreated, can carry forward to adulthood, increasing the burden of disease and making treatment difficult and costlier.

There is a substantial gap in research focusing on the specific prevalence of different mental health disorders among adolescents in India (Malhotra, 2014). However, epidemiological evidence is available from countries with similar contexts that shows the burden of mental and developmental disorders, and illustrate their impact on health-seeking and other dimensions of adolescent lives. Earlier epidemiological studies have revealed the prevalence of child and adolescent mental disorders in the context of India, which considered the whole spectrum of child and adolescent age groups, i.e. 0 - 19 years. A systemic review and meta-analysis provided the overall prevalence from sixteen community-based studies on 14594 children and adolescents and seven school-based studies on 5687 children and adolescents (Savita Malhotra, 2014). The prevalence of child and adolescent mental health disorders in the community was found to be 6.7 percent, and within schools it was found to be 23 percent.

The National Mental Health Survey of India - 2016 has reported that the prevalence of mental disorders is 7.3 percent among children aged 13 to 17 years (MoHFW, 2016). The prevalence among children in urban metros is nearly double (13.5 percent) compared to rural children (6.9 percent). Major illnesses include depressive disorders (2.6 percent), disabilities affecting intellectual status (1.7 percent), agoraphobia (2.3 percent), autism (1.6 percent), psychotic disorders (1.3 percent) and phobic anxiety disorders (1.3 percent). There is a gap in evidences that can illustrate the true burden of mental health disorders among adolescents

in Andhra Pradesh, but the high prevalence in the country warrants careful assessment and management of such disorders.

In this paper, the authors discuss prospective interventions to address each of the above-mentioned adolescent health problem and analyze the benefit-cost ratio for the same in the context of Andhra Pradesh.

2. Delaying child marriage in Andhra Pradesh by providing incentives

2.1 Description of intervention

Under the proposed intervention, the authors intend to apply the learnings from earlier schemes to ensure that incentives offered to delay marriages for girls are effective and efficient. Considering the poor performance of cash incentives, the authors have chosen the transfer of a consumable to the household of the target cohort. For their calculations, the authors have taken a static model in which only girls in the age group of 14 years in rural households are taken as a target cohort, which is followed for the next four years till they reach the age of 18. The consumable to be transferred is not pre-decided and has been kept variable to allow flexibility. It can be decided by policy makers based on local social, cultural and economic needs given, the vast geographical spread of the state. The consumable is transferred at regular intervals in a year to the eligible household on the condition that the girl is not married off in this period. Non-conformity would debar the household from availing the benefits of the program. Though it is expected that girls' enrolment would increase in secondary education due to delay in marriage, the program does not differentiate between school-going and out-of-school girls. Age, marital status and area (rural) are the only conditions for eligibility.

The cost of the intervention will be the direct cost of the incentive itself and the cost of running the program in the state. It will use the existing framework of the *panchayati raj* system to identify beneficiaries and revise the list on a regular basis.

The enrollment, disbursement and monitoring data of the intervention will be included to the Management Information Systems to minimize false enrollments or any other discrepancy in the demand and/or supply side of the program. The intervention will benefit 4.5 lakh 14-year-old girls in rural Andhra Pradesh who will receive the incentive for the next four years.

2.2 Data

The authors have collected the data required for this analysis from various sources. First, they have used the census data, data from published government reports and large-scale population-based surveys such as the National Family Health Survey. Further, they have searched for, retrieved and reviewed published literature from PubMed and Google Scholar using relevant keywords, without applying any specific time frame for the publication. They have reviewed published reports and other documents put out by different development agencies working in the context of Andhra Pradesh. They have also collected administrative data from the Department of Women and Child Development, Government of Andhra Pradesh.

2.3 Literature Review

The economic and social impacts of child marriage involve a range of costs starting from the individual to the entire population. Child marriage encourages girls and women to have children earlier, adversely affecting their reproductive health outcomes and increasing direct and indirect costs over their lifetime (Wodon *et al.*, 2017). In such scenarios, the direct costs will be hospitalization and other healthcare expenditure during pregnancy, on childbirth and while treating complications following parturition (Kingkaew *et al.*, 2016). In contrast, indirect costs would include the healthcare cost of children born to teenage mothers, missed educational attainment of the girls and loss of productivity throughout their lifetime, and low quality of living (UNFPA, 2013). Further, the social cost of child marriage would include intimate partner violence, lack of autonomy and decision-making, inadequate awareness about healthcare and other rights leading to under-utilization of available services, poverty at the household level and so on (Parsons *et al.*, 2015). Furthermore, child marriage costs the nation in terms of higher fertility, undesired population growth, burden of illiteracy, poor health and poverty. This implies ending child marriage can yield great benefits to the nation

(UNFPA, 2012). Previous studies show benefits accrued from lower population growth by ending child marriage in 106 countries would be \$566 billion in 2030 (Wodon *et al.*, 2017). Moreover, other benefits accrued from saving child lives and preventing childhood malnutrition would provide benefits worth \$16 billion and \$82 billion in 2030 for averted cases of under-five mortality and stunting, respectively (Wodon *et al.*, 2017).

Most of the schemes for preventing girl child marriage by various state governments as well as the Union government include conditional cash transfers in various stages of the life of a girl child, beginning with birth - which is conditional upon institutional delivery, till marriage - which is conditional on attaining age of 18 years, the legal lower limit of marriageable age for a female in the country. Most of these schemes aim to break the stereotype where a girl child is looked upon as a burden for the household.

One of the earliest such programs was *Apni Beti Apna Dhan (ABAD)*, or “Our Daughter, Our Wealth” initiated by the Government of Haryana in 1994. The scheme was supposed to encourage further education of girls and cause a rise in their age of marriage by changing the attitude of families towards girl children. However, a study by the International Center for Research on Women (ICRW) shows the program had no effect on delaying the age of marriage among girls who participated in the program. On the other hand, the study found beneficiaries were more likely to get married exactly at age 18. According to the study, “this is likely because many beneficiary families saw the cash as a way to help defray the cost of a wedding or to contribute to a dowry payment”⁴. Hence, incentives under such schemes need to be designed carefully to achieve desired results and more importantly, to avoid any unfavorable outcomes.

Another study based on the cycle distribution program in Bihar to reduce the gender gap in secondary education found that the enrolment of girls increased by 30 percent. The cycle distribution program was effective at increasing girls’ enrolment compared to other conditional cash transfer programs carried out in similar settings. It was suggested that

⁴ <https://www.icrw.org/news/icrw-releases-results-of-conditional-cash-transfer-evaluation-to-tackle-child-marriage-in-india/>

transfer of a non-cash item / consumable generated externalities beyond the cash value of similar programs and are hence more likely to succeed (Muralidhran and Prakash, 2013).

A randomized trial in southern Bangladesh examined a program under which free cooking oil was given to girls between the ages of 15 to 17 years on the condition that they stay unmarried. The oil incentives led to significantly reduced child marriage rates and increased years of schooling for girls, in relation to girls in the control group. Girls who participated in the program were 21-30% less likely to marry under the age of 16 and 19-22% more likely to be in school⁵ (Buchmann, et al. n.d). The findings from this program have been used in framing the intervention for this study.

Over the last few decades, multiple programs and schemes have been implemented to effect reduction in child marriage and improve the status of the girl child in Andhra Pradesh. The state government launched the Girl Child Protection Scheme (GCPS) in 1996-97 which enrolled girls aged less than 3 years from households with annual family incomes less than Rs 11000 at that time. Cash incentives were given to households on the condition of progressive enrolment to ensure school education for the girl child. This scheme was revised in 2003 with modified eligibility criteria to allow enrolment for girl children up to 3 years of age, with priority being given to single-girl child families below the poverty line, then to families with two girl children and then to the families with one girl and one boy. In this revised scheme, a girl child was entitled to receive Rs 500 on primary school enrolment, Rs 500 on enrolment in class VII, Rs 500 on enrolment in class X and some cash incentive for marriage at maturity period. To implement the same, Rs 5000 was deposited in each enrolled girl's bank account, irrespective of age, for a term of 20 years.

The GCPS scheme was then revised again and rolled out as New Girl Child Protection Scheme 2005 which considered a girl child for enrolment to the program based on the following conditions: if the child were up to 3 years of age, born to the families with single girl children or two girls, the parents had undergone family planning and family's annual income was not more than Rs. 24000 in rural and Rs. 48000 in urban areas (WCD-GoAP, 2009). However, the family's income limit was flexible to up to Rs 1 lakh for girls with up to 80 percent disability.

⁵ http://www.copenhagenconsensus.com/sites/default/files/field_child_marriage.pdf

Other priorities were same as similar schemes. The entitled benefits were a disbursement of Rs 1200 per annum from classes IX to XII and Rs 1 lakh after 20 years of age. This scheme additionally offered Rs 30000 in case a family had two girls, Rs 30000 as death insurance, and Rs 37500 and Rs 75000 for partial and full disability, respectively.

Bangaru Talli was another similar initiative implemented by the state government in 2013. This scheme was for girl children born after May 1, 2013 till she reaches 21 years of age (GoAP, 2016). Priority for enrolling into this program was given to economically backward families and the first two children of the household. Financial benefits were given as follows – Rs. 2500 at birth, Rs. 1000 per year on 2nd and 3rd birthdays, Rs. 1500 every year on 4th and 5th birthdays, Rs 2000 per year from 6th to 10th birthdays, Rs 2500 annually for 11th to 13th birthdays, Rs 3000 per year for 14th to 15th birthdays for studying till classes IX-X, Rs 3500 on 16th and 17th birthdays for attending school till classes XI-XII, Rs 4000 per annum from 18th to 21st birthdays for college education. If the girl completes her school education (passes class XII), she will be given an additional Rs. 50,000, and if she completes her college education, she is entitled to Rs. 100000 (GoAP, 2015).

As can be observed, most of the initiatives so far have focused on providing cash incentives to the household or the girl, conditional on her attaining education. There is evidence to prove the age of first marriage rises with an increase in number of years of schooling in girl children. However, there is a lack of strong evidence to prove that such cash incentives improve school enrolment for females and hence delay marriages. On the contrary, few studies quoted earlier say cash incentives are not as effective as transfer of consumables to the household for reducing the age of marriage in girls.

2.4 Calculation of Costs and Benefits

In this proposed intervention, the authors estimate the costs as well as benefits for a cohort of 4.6 lakh adolescent girls aged 14 years in rural Andhra Pradesh till they reach 18 years of age. The baseline for child marriage rate in Andhra Pradesh is taken as 33 percent (NFHS-4). Therefore, the number of girls marrying before the age of 18 is estimated to be around 1.5 lakh for the next four years or approximately 37,500 every year. The authors expect 25

percent reduction in child marriages among girls after the intervention, based on the outcome of similar interventions in Bangladesh, mentioned earlier.

Based on the above assumptions, the number of averted cases of child marriage in Andhra Pradesh after the intervention would be around 9400 per year. For consistency in cost and benefit, the value of the consumable is based on the intervention in Bangladesh, which comes to around 2.4 percent of the per capita GSDP of Andhra Pradesh per year or Rs. 2903. This is provided to each girl in the cohort who is not married on her 15th, 16th, 17th and 18th birthdays. The total annual cost changes over the years as progressively more girls are married and become ineligible for the transfer. For a program covering a cohort of 14 year old girls, the first years' payment is 124 crore, and the last year's payment is estimated at 100 crore. The total cost of the transfer for the program is 398 crores over four years at a 5% discount rate.

In addition, the study from Bangladesh suggests conditional cash transfers reduce school dropout rates and increase enrolment per year by 20.5 percent. This would boost enrolment rates of secondary schooling from 52 percent to 63 percent and senior secondary rates from 51 percent to 59 percent after adjusting for dropouts. Approximately 48000 more girls would attend secondary school and 35000 girls would attend senior secondary as a result of the intervention. The additional cost of schooling for these girls (Rs 7895 for secondary, and Rs 14,014 for upper secondary) and the opportunity cost for work they could have done if they had stayed out of school leads to a total cost of additional education of Rs. 23 crores at a 5 percent discount rate.

The last category of cost is the indirect cost per child to implement this intervention, which includes costs of training, transportation, human resources, awareness campaigns and other behavioral change communication programs, and costs for monitoring and evaluation. In the Bangladesh study this component of cost was very large, probably due to the high costs of transporting and distributing oil, the consumable used in that program. The equivalent cost in the Andhra Pradesh context would be Rs. 7490 per girl. It is possible that the scaled cost of this would be lower if, for example, consumables were distributed using the public distribution system for food grains. However, in the absence of any other information we

apply the unit cost identified in the Bangladesh study, which leads to a total cost of Rs. 1027 crore at the 5% discount rate.

Adding the direct cost of the incentives, additional cost of schooling - including the opportunity cost, and the indirect costs, the authors have arrived at the total cost for the proposed four-year intervention- which is 1449 crores at a 5% discount rate.

For calculating the benefits of preventing child marriage, the authors have estimated the social cost of child marriage, which includes costs due to higher fertility rate, domestic violence, stunting among children and high maternal mortality- from another paper in the *Andhra Pradesh Priorities* series (Mithal, 2018). The avoided social cost of child marriage is the major benefit of the intervention and equals 11-12 lakh per girl depending on the year she would have otherwise been married. The total benefit from avoided marriage is 3,766 crore at the 5% discount rate. Additionally, the authors have also estimated incremental benefits in lifetime wages that accrue due to increased years of schooling. This equals 237 crores at the 5% discount rate. Finally, the value of the consumable, which will be provided to each beneficiary and is included as a benefit as well.

For costs and benefits, the authors estimate discounted values at 3 percent, 5 percent and 8 percent. Table 3 gives the benefit cost ratio (BCR) of preventing child marriage in Andhra Pradesh.

Table 3: Benefit Cost Ratio of delaying child marriage by providing incentives

Discount rate	Benefit (in Rs. crore)	Cost (in Rs. crore)	BCR
3%	7,240	1,516	4.8
5%	4,401	1,449	3.0
8%	2,410	1,356	1.8

Source: Author's calculations

2.5 Assessment of Quality of Evidence

The structure of the intervention is based on evidences from another south Asian country, Bangladesh, which has similar cultural and socioeconomic dimensions as India. Though there are differences in population dynamics if the context of Andhra Pradesh is considered,

societal challenges have shown similar trends in the past. Problems like illiteracy and poverty aggravate the issue of child marriage in the patriarchal social structures of both countries, as well as the respective states considered. In the light of such ideations, the authors consider the quality of evidence as “medium”. However, population-based projections are derived from large-scale surveys that adopt generalizable samples providing better acceptability of the estimates derived through economic analysis.

3. Preventing anemia in adolescent girls through iron and folic acid supplementation

3.1 Description of intervention

Although anemia is prevalent among adolescent boys and girls, its prevalence is much higher among girls, as has been evident from multiple large population-based surveys (Gol, 2000; DLHS-4: Andhra Pradesh, 2013). There are several reasons for the higher prevalence of anemia in adolescent girls. First, adolescent girls experience chronic blood loss due to monthly menstrual cycles (NHLBI, 2014). Moreover, adolescent girls, particularly those who get married before 18 years and who live in rural areas, start childbearing during late adolescence and often experience repeated pregnancies. It is evident that mothers with greater number of pregnancies and deliveries will have higher chances of developing chronic anemia (Masukume *et al.*, 2015). Third, adolescent females experience hormonal changes in their bodies during pregnancy and lactation that increase the demand for iron and calcium, leading to chronic iron deficiency anemia (WHO, 2006). Fourth, adolescent girls are seen to be negligent about nutrition – a critical requirement for their growth and development (MoHFW, 2013). Moreover, recurrent infections such as urinary tract infections are common in adolescent girls, increasing their susceptibility to anemia (Cullis, no date). Adolescent girls also contribute more to household chores than boys. Increased physical labor and inadequate dietary intakes make them vulnerable to iron-deficiency anemia (Wouthuyzen-Bakker and van Assen, 2015). Considering the higher prevalence and magnitude of anemia among girls, the proposed intervention will focus only on adolescent girls. However, the intervention can be eventually scaled up with necessary adjustments in the design to cover all adolescents, irrespective of their gender.

This intervention will be implemented by providing weekly iron and folic acid supplementation and biannual deworming with an aim to cover all girls aged 10 to 19 years in Andhra Pradesh. The beneficiaries will undergo an awareness building exercise for one hour per month to improve the compliance with timely consumption. This will be conducted in schools by trained teachers as part of the regular curriculum and by healthcare providers at the community level focusing on out-of-school adolescent girls. The providers within the school as well as out of the school will prepare a demand chart at least two months prior to the date of distribution to ensure adequate supply of the supplements and other materials in a timely manner.

Both the providers and the beneficiaries will be informed about the benefits of the intervention, short and long-term consequences of anemia and the importance of their participation. Data on coverage of the program, and gaps and challenges during its implementation will be conveyed to supervising officials in the state for better decision making.

3.2 Data

For this intervention, the authors have used data from multiple sources. This includes data from Census of India, latest published government reports and different rounds of large-scale population-based surveys conducted in the state like National Family Health Survey, District Level Household and Facility Survey report for Andhra Pradesh, and published literature from PubMed and Google Scholar searched using relevant keywords. In this process, the authors have primarily focused on papers that provide data specific to the context of Andhra Pradesh, or other Indian States/UTs, or studies based on other developing countries. They have also collected administrative data from the National Health Mission Office, Government of Andhra Pradesh. Further, they have reviewed published reports and other documents by different development agencies working in the context of Andhra Pradesh.

3.3 Literature Review

The consequences of anemia are documented in various studies conducted in different contexts. Anemia can alter the health status in critical situations of maternity. Excessive loss of blood before, during and after childbirth can diminish the reserves of blood within the circulatory system. A reduced level of hemoglobin less than 4 g/dL increases the risk of heart failure during any stage of maternity (Buseri *et al.*, 2008). Anemia also increases mothers' susceptibility to various infections, resulting in poor perinatal health outcomes (WHO, 2015). With a wide range of adverse effects to the health of pregnant women, anemia contributes to 20 percent of all maternal deaths (Khaskheli *et al.*, 2016).

In addition, anemia in mothers often affects the health of children, including adverse birth outcomes, preterm birth and low birthweight (Balarajan *et al.*, 2011). More importantly, iron deficiency anemia is associated with poor cognitive and motor development of children (Saloojee and Pettifor, 2001). A meta-analysis estimated an increased association (odds ratio 1.73, 95 percent CI 1.04 to 2.41) of IQ points per 10 g/dL increase in hemoglobin level (Balarajan *et al.*, 2011).

Anemia affects the transportation of oxygen to the tissue level in adults, resulting in impaired productivity of affected individuals. Such phenomenon is observed in developing countries where physical labor is still prevalent. Decreased productivity further reduces quality of life at an individual level; whereas lost income affects the individual's dependent household and the entire economy suffers from lost production. The economic burden of that lost productivity for human capital of South Asia is estimated at \$4.2 billion annually (Balarajan *et al.*, 2011).

Many preventive strategies are suggested in scientific literature to control anemia. This includes; improving dietary intake both in terms of quality and quantity, increasing diversity within the consumed food materials with higher bioavailability of iron, fortification of staples with iron, fortification of targeted foods for high-risk, controlling diseases that are associated with anemia like malaria and helminth infestations, improving knowledge and practices among the communities, and providing iron and folic acid supplementation to the vulnerable population who are at higher risk of anemia which includes adolescent girls as well (Balarajan *et al.*, 2011).

In all the states of India, a notable measure to address the challenge of anemia among adolescents aged 10 to 19 years is the Weekly Iron and Folic Acid Supplementation (WIFS) program which includes supervised consumption of iron (100 mg) and folic acid (500 microgram) supplements with biannual deworming medications (NHM, 2015). It targets in-school adolescents from classes VI to XII and out-of-school adolescent girls. It utilizes the existing human resources framework and works through the convergence of multiple agencies for the implementation of the programme.

Results from earlier studies have shown good compliance with IFA supplements and more than 90 percent of the girls consumed most of the tablets (85 out of 90 tablets), resulting in an increment of 17.3 gm/L haemoglobin among the beneficiaries (Kanani and Poojara, 2000). This consumption was associated with a significant weight gain of 0.83 kg in the intervention group, compared to girls in the control group. This indicates the potential of this supplement for anemia correction and growth promotion among adolescent girls. As adolescent girls are more prone to be anemic and iron deficiency anemia is most prevalent among all types of anemia, providing iron folic acid supplement with adequate support can serve as an effective strategy to overcome the challenge of adolescent anemia in Andhra Pradesh.

3.4 Calculation of Costs and Benefits

The authors have taken the prevalence of anemia (69%) for adolescent age group from 10 to 19 years in Andhra Pradesh from the Annual Health Survey 2014. Further, they estimate a reduction of 42 percent over a period of six months due to the intervention, based on the findings from a large-scale study in a district of Uttar Pradesh (Vir et al., 2008).

Given 44 lakh adolescent girls in the state, this provides the estimated number of averted cases of anemia for each year as around 13.3 lakh. The distribution of type of anemia (mild, moderate or severe) among women aged 15 to 19 years has been taken from the state report of the National Family Health Survey-4 for Andhra Pradesh and with some adjustments applied for the distribution of adolescent girls aged 10 to 19 years. Using the proportion of that distribution to three groups - mild anemia (10-11.9 g/dL), moderate anemia (7-9.9 g/dL) and severe anemia (less than 7.0 g/dL), they estimate the prevalence of different levels of anemia among adolescents. They have estimated the rate of averted cases in each group

assuming that the weightage of correction of anemia is the same for each group. Applying this rate to the total number of anemia averted cases, they calculate the number of adolescents who have had mild, moderate and severe anemia earlier. For each of the adolescents belonging to any of these categories, they estimate the years lived with disabilities due to anemia using the following equation (Murray, 1996):

$$YLD = D * [k * c * e^{ra} / (r+b)^2 (e^{-(r+b)(L+a)} - (r+b)^{-1} - e^{-(r+b)a} - 1)] + [(1-k)/r] (1 - e^{-rL})$$

Here, “k” is age weighting factor, “c” is constant, “r” is the discount rate. “a” is age at onset of disability, “b” is the parameter from age weighting function, “L” is the duration of disability and “D” is the weight for disability.

In this equation, the authors apply $r=0.03$, $K=1$ and $\beta=0.04$ for the base cases. Further, they use the values for K, C, r, a, b, L and D as 0, 0.1658, 0.03, 16, 0, 0.67 and 0.004. In addition, they apply the disability weights to mild, moderate and severe anemia as 0.004, 0.052 and 0.149 respectively (GBD, 2015). Based on these estimates, 13 lakh cases of anemia avoided from the intervention correspond to 19,920 YLDs avoided per year.

As per *Andhra Pradesh Priorities* common assumptions, each YLD is valued at 3 times GSDP per capita, or Rs. 3.7 lakh. This gives a total value of 655 crore per year at the 5% discount rate, after adjusting for side-effects, reported by 18.7 percent of the beneficiaries (Vir *et al.*, 2008).

The cost of intervention per adolescent per year based on earlier studies is estimated at Rs 49, after adjusting for inflation (Vir *et al.*, 2008). This study has also found a compliance rate of more than 90 percent for school-going adolescents and 86 percent for out-of-school adolescents. The direct costs total Rs. 21.6 crore per year. As mentioned earlier, the intervention includes components of counseling for awareness about and compliance with the intervention for out-of school girls, which represent 26% of the target group. Assuming monthly sessions of one hour of counselling totaling 12 hours per annum, it is equivalent to 1.5 working days for the out-of-school girls. The authors have also calculated the opportunity cost for out-of-school girls on the basis of prevailing wage rates adjusted for the education

level as well as the age group. Adding this indirect cost of Rs. 26.4 crore to the previously calculated direct cost of intervention, the total cost of the intervention for one year is arrived at and then further scaled up for four years, the proposed period of the intervention. Based on these calculations the Benefit Cost Ratio (BCR) is given in table 4.

Table 4: Benefit Cost Ratio of preventing anemia among adolescent girls

Discount	Benefit (in Rs. crore)	Cost (in Rs. crore)	BCR
3%	660	44	15.0
5%	655	44	14.9
8%	649	44	14.8

Source: Author's calculations

3.5 Assessment of Quality of Evidence

Authors have derived cost data for this intervention from a study that was conducted on a large sample of 1.5 lakh adolescent girls in a central district of Uttar Pradesh. Although differences in size and population exist between the two states, the likelihood of similarities in health behavior among adolescent girls is high in both states. Also, to calculate other components of the calculations, they have adopted data from population-based projections as on large-scale surveys which adopted generalizable samples. It allows the findings to have better credibility in the context of Andhra Pradesh. Therefore, quality of the evidence is considered to be “strong”.

4. School-based behavioral screening and further mental health services for adolescents

4.1 Description of intervention

This intervention will consider adolescents in secondary and higher secondary schools (classes VI to XII) in the state. It provides for screening the mental health status of the adolescents, referring them to appropriate providers and treating them for respective disorders. The intervention also promotes positive mental health through increasing

awareness among students, parents or guardians and teachers, who advocate for mental well-being among school-going adolescents.

Though the program will be offered to all students, participation will be voluntary and will require the assent of the adolescent and the consent of the parent or guardian. Authorizations from the school authority, relevant school health institutions and local health authorities will be taken to conduct the program.

Parents and teachers will be informed about the purpose of the intervention and their roles throughout the process. These key stakeholders have critical roles to play for facilitating adolescents' participation in this intervention.

Prior to the intervention, students will be informed about the program thoroughly. Considering the presence of learning difficulties and communication disorders among adolescents within the same class, the message of communication should be prepared in a way such that it is understandable by a student of primary level or class V, which is lower than the intervention group. The intervention should not be conducted during class timings, affecting regular educational activities. Instead, a convenient time should be fixed upon following a participatory discussion with students, teachers, parents or guardians and the mental healthcare providers.

The students will be enrolled into the intervention and the screening procedure will be conducted, as per an appropriate schedule. They will be asked to complete a self-administered questionnaire written in simplified language for easier communication. As this step doesn't require mental health experts to administer the questionnaire, teaching staff and social workers can conduct the same. This can be an effective strategy in the context of severe paucity in mental health professionals. However, additional staff will be deployed to explain the questions if required. Special attention should also be given to differently-abled students to read/understand the questions. The questionnaire will be prepared based on three scales - mood and feeling questionnaire, youth self-report aggression scale and 3-point Likert scale. The questionnaire will be reviewed, assessed and modified upon consultation with educationists, psychiatrists and psychologists. Its cultural appropriateness will be

examined, and necessary modifications will be made prior to its administration in the intervention group.

The findings will be assessed by the mental healthcare providers and positive cases will be sorted out for the screening process. The screened-positive students will be scheduled for the next step of the intervention. At this step, trained clinical mental health evaluators will conduct sessions ranging from half an hour to one hour per student to assess their current and past mental health status, including behavioral disorders, bodily discomforts of psychosomatic origin, learning difficulties, etc. The status of mental health and level of mental illness will be determined, which requires referral to specialized care. A global study shows that only around 19 percent adolescents received mental health services in developing countries, implying an unmet need for similar services for 81 percent adolescents (WHO, 2004) which would be the target section for this intervention.

Following different rounds of screening, the positive-screened students will be shortlisted, and the findings will be communicated to their parents or guardians. Through motivational interviews and discussions, the necessity of referral and benefits of timely care for better educational and professional outcomes in the future will be explained. Possible barriers like social stigma that requires multiple sessions of discussion, and distance between the residence and mental healthcare centers or providers will be assessed and addressed at this stage, ensuring better compliance with the referrals.

Follow-up visits, telephone calls and interviews will be conducted for timely visits to the specialized provider. The diagnosis and prognosis throughout the clinical management will be followed up in a timely manner.

The opinions of all students who are enrolled in the intervention, their parents or guardians, teachers, schools and other authorities, healthcare providers and other stakeholders will be collected, evaluated and adopted for better implementation of the intervention within the sociocultural context of the school as well as the population.

4.2 Data

The authors have retrieved relevant data for this intervention from the Census of India, National Mental Health Survey 2015-16, published government reports and large-scale population-based surveys conducted in Andhra Pradesh like National Family Health Survey third and fourth rounds, District Information System for Education, published literature from PubMed and Google Scholar found using relevant keywords of interest. In this process, the focus has primarily been on papers that provide data specific or similar to the context of Andhra Pradesh. Further, they have reviewed grey literature, and other reports and documents published by different development agencies.

4.3 Literature Review

The socioeconomic impact of untreated mental health conditions can be enormously high. Such illnesses severely affect the development of children, their educational attainments and their potential to lead productive lives (WHO, 2018). Children with mental illnesses often face major challenges due to social stigma, discrimination within peer groups and isolation. Poor mental health has spillover effects into various health and social outcomes such as higher rate of crimes; increased consumption of alcohol, tobacco and other addictive substances; unsafe sexual activities leading to STDs and adolescent pregnancies, etc. It is evident from the National Mental Health Survey 2016 that there is wide gap in treatment of mental disorders in the total population, indicating lack of awareness about mental diseases, lack of availability and accessibility of services, and utilization of the same (MoHFW, 2016) resulting in higher disease burden.

The treatment gap in overall population is about 50-60 percent for schizophrenia, 88 percent for depression, 97 percent for substance abuse and 22-95 percent for seizure disorders. The treatment gap for common mental disorders is 95 percent and 76 percent for severe disorders (MoHFW, 2016).

Another critical issue for mental health is the population's utilization pattern for health services. Several factors like median duration of mental illness, delay in seeking care from time of onset, choice of providers, distance from health center and number of visits to the

service provider further contribute to this issue. Previous studies have reported a median duration of depressive disorders as 36 months; this is about 72 months for diseases like bipolar disorder. A delay of 2.5 months was reported for depressive disorders and about 12 months for conditions like epileptic disorders. Further, the median number of visits to service providers was 2, ranging from 1 to 30. In 4 to 50 percent cases, the preferred provider was based on government institutions (MoHFW, 2016).

Earlier studies conducted in European countries indicated the cost of mental disorders varied between 3 to 4 percent of the GNP during 1990. Of this, nearly 2 percent was attributable to treating mentally-ill individuals (WHO, 2003). In addition, the aggregated cost of all mental disorders was USD 148 billion and the indirect cost of mental disorders was equal to or more than the direct cost (WHO, 2003). Similar studies conducted in Canada in 1998 revealed the cost of treatment was 6.3 billion Canadian dollars and cost of lost productivity was 8.1 billion Canadian dollars (Scott *et al.*, 2001). Another study conducted in UK demonstrated the cost of mental illness was 32 billion GBP in 1996-97, of which 45 percent was due to lost productivity (Patel *et al.*, 2013).

The cost of childhood mental illness is huge both in the short and long run. An estimation by WHO shows treating mental disorders for those who suffer from conduct disorders at early ages can incur 70000 USD, whereas similar patients with no previous history of early mental illness required treatment cost of less than 10000 USD (WHO, 2005). The cost of education and criminal justice for an adult with early mental disorders were significantly higher than that for a normal adult (Parkar, Dawani and Apte, 2001). Another study demonstrated that the cost of behavioral abnormalities were 10 times higher in adulthood for those who suffered from mental illnesses at earlier ages (Patel *et al.*, 2013). On the other hand, families incur cost of treatment and miss opportunities to earn livelihoods as they have to spend more time with affected adolescents (WHO, 1975). These findings inform policy makers to invest more in child and adolescent mental health to yield better population health outcomes for the future adult population. But the budget provisions specific to adolescent mental health are rarely found in national and state budgets in India and other countries with similar economies. Therefore, financial expenses for adolescent mental illness are met by out-of-pocket (OOP) expenditures.

In addition to the cost burden, the efficiency and effectiveness of existing psychiatric and psychological interventions for adolescent mental illnesses are studied in different contexts. Evidence shows therapeutic interventions resulted in the improvement of more than 50 percent of beneficiaries compared to the non-treated group, indicating that timely psychiatric, psychological and behavioral interventions can reduce mental health disabilities among adolescents (WHO, 2005). Additionally, community-based outreach programs to ensure lower cost of drugs and basic psychological support can reduce disease burden to a greater extent.

A study in rural India has demonstrated the gradual reduction in cost of treatment as well as dramatic improvement among schizophrenia patients over a follow-up period of 18 months (WHO, 2003). A review of 83 trials of different psychological interventions aimed at prevention of depression among children and adolescents revealed that most of the trials (n=67) were conducted in school settings with a handful of studies at the community-level (Hetrick *et al.*, 2016). Among these trials, 29 were conducted in unselected populations and 53 in targeted populations. As many as 32 trials with 5965 participants reported a reduced rate of depression diagnoses among the participants, compared to the control groups. Overall, the results show small benefits for preventing depressive symptoms and depression diagnosis up to 12 months, but not beyond that.

Various studies have found that the introduction of integrated mental health improvement programs in educational institutions targeting children and adolescents lead to long-term benefits such as enhanced emotional and social behavior and academic attainments, which are also cost-effective (Levin and Chisholm, 2016). In India, programs for peer counselling and teachers' training on mental health and substance abuse are provided as part of a multicomponent adolescent health intervention called Rashtriya Kishor Swasthya Karyakram (RKSK). Such programs aim to promote adolescent mental health, but have shown limited feasibility and effect due to various logistical and financial barriers in the socioeconomic context of India (Balaji *et al.*, 2011). The evaluation of a school-based preventive program targeting the adolescent population in Mauritius has shown short-term benefits to coping skills, self-esteem and feelings of depression and hopelessness (Rivet-Duval, Heriot and Hunt, 2011). These findings provide insights about the acceptability and feasibility of the intervention in the long term (Levin and Chisholm, 2016). However, most of these analyses provide evidences from high-income countries and there is a lack of adequate evidence on the

cost-effectiveness of interventions for adolescent mental health in Andhra Pradesh or any other state in India.

4.4 Calculation of Costs and Benefits

To calculate the cost of each stage of the intervention, the authors have taken proportionate cost inputs from different studies with similar objectives. For the screening programs, they have adopted the cost-effectiveness analysis of a school-based emotional health screening program conducted by Kuo et al. that used a framework borrowed from existing literature on the cost-effectiveness analyses of breast cancer (Kuo *et al.*, 2009).

The authors have considered the cost of human resources dedicated to different stages of screening, material development and dissemination for the screening, and other costs related to the intervention. Cost of the school staff and teachers, value of the parents' time provided for the intervention or any other indirect cost are not considered.

Moreover, the authors have assumed 80 percent enrolment on voluntary basis, based on the experience of the study mentioned above. Since this intervention is implemented through schools, out-of-school children tend to be left out. Enrollment of 80 percent school-going adolescents between classes VI and XII means coverage of around 33 lakh adolescents in Andhra Pradesh. Kuo et al. had estimated that 18 percent students would be screened positive and would require further clinical assessment, and 60 percent of them would require referral services. The same rate is assumed for this analysis to estimate the number of students who would be opting for clinical assessment within the school and the number of the students who would be shortlisted for referrals. The authors have used the same framework to estimate the proportional cost for clinical assessment and for preparing the students for referral. The proportional cost for successful linkage of these referred adolescents to specialized care providers is then calculated. These proportional costs are based on the same study used to arrive at the total screening cost for adolescents in Andhra Pradesh.

The average annual cost of treatment for serious cases of mental health problems among adolescents has been calculated as per the estimation, after adjustments, in the context of Andhra Pradesh, by Access Economics, which adopted a costing framework from earlier

studies (Gavin Andrews *et al.*, 2004; Access-Economics, 2009). The opportunity cost of the students' time in the entire process was calculated and was estimated using the prevailing wage rate in the state for different levels of education. The three different costs: screening, treatment and opportunity costs were added to arrive at the total cost of the intervention for Andhra Pradesh. The calculation of different costs has been depicted in Table 5 below.

Table 5: Calculation of costs for school based mental health services for the adolescents

Costs	No. of beneficiaries	Cost per student (in Rs.)	Total cost (in Rs. crore)
Stage 1 – Enrolment and screening (Assuming 80% compliance)	32.57 lakh	30	9.75
Stage 2 – Clinical evaluation (Assuming 18% in Stage 1 screen positive and require clinical evaluation)	5.86 lakh	200	11.80
Stage 3 – Referral (Assuming ~60% of students in Stage 2 need specialized mental care)	2.84 lakh	333	9.46
Stage 4 – Linkage to specialized mental healthcare provider (Assuming 72% successful linkage)	2.05 lakh	468	9.60
Cost of treatment	2.05 lakh	4,057	83.15
Total cost of treatment + screening			Rs. 123.65 crore
Opportunity cost of time for treatment + caregivers' time			Rs. 3.75 crore
Total cost (undiscounted)			Rs. 127 crore

Source: Authors' calculations

Global Burden of Disease data indicate that for 10-19 year olds 509 lives are lost each year due to self-harm and there are 13,759 YLDs from mental illness. The rate of averted cases has been adopted from the same frameworks from which the cost of treatment is calculated (Gavin Andrews *et al.*, 2004; Access-Economics, 2009). These studies inform a reduction of 39.9 percent after evidence-based treatment in the best-case scenario with 100 percent coverage. As per WHO, the average unmet need for mental health services to address serious mental illnesses in less developed countries is 80.9 percent. Based on this the authors assess

that the intervention would avoid 164 deaths from self harm and 4,439 YLDs from mental illness.

Applying the value of a statistical life year and disability adjusted life year for 2017 in Andhra Pradesh, the benefits of the intervention amount to 296 crore at the 5% discount rate. This one round of the intervention is expected to be spread over one year. The total value of benefits and costs for this intervention are given in Table 6 below.

Table 6: Benefit cost ratio of school based mental health services for the adolescents

Discount	Benefit (in Rs crore)	Cost (in Rs crore)	BCR
3%	302	124	2.4
5%	296	122	2.4
8%	288	118	2.4

Source: Author's calculations

4.5 Assessment of Quality of Evidence

The estimation of the burden of mental illness among adolescents in Andhra Pradesh and associated cost for the same is challenged by a substantial lack of context-specific data. However, the authors have used data from other studies conducted in different states of India to estimate the disease burden. Also, the cost data has been calculated on the basis of a study conducted outside India. However, these studies provide adequate ground to answer research questions of interest related to the cost-effectiveness through quantitative study designs. Moreover, data from systematic reviews and comparative studies allowed enhanced interpretation of the cost as well as benefit data. Reviewing the overall strengths and weaknesses, the quality of evidences used in analyzing benefit-cost ratio of the mental health intervention for adolescents in Andhra Pradesh has been perceived to be “medium”.

5. Limitations of this Study

There are some limitations in this cost-benefit analysis for all three interventions addressing adolescent health issues in Andhra Pradesh. First, the authors have calculated the cost and benefits of a single cohort (14 years of age) for the intervention on child marriage. Though it gives some insights, it may be unable to capture the problem in its entirety.

A common public health problem like anemia affects the general population at large. However, the authors have only included adolescent girls in the intervention, given their unique set of problems in the absence of treatment and resulting benefits post-treatment. Other vulnerable groups such as children, male adolescents, and the overall adult population have been kept outside the purview of this study, which is another limitation. Additionally, the authors have estimated benefits as averted DALYs, whereas an alternative methodology to estimate the benefits in terms of increased productivity following correction of anemia would provide a different benefit-cost ratio for the same intervention.

In the absence of any credible study for India or any less developed country, the authors have calculated a stage-specific cost structure and benefit accrued due to successful linkage to treatment of adolescent mental illness based on studies in developed countries. Moreover, there is no baseline prevalence of mental illness among school-going adolescents. In addition, the crisis is also prevalent among out-of-school adolescents who would experience higher social cost of mental illnesses. This group has been excluded, given that this intervention is implemented through the schools in the state. Lack of context-specific evidences illustrating costs and benefits of diagnosing and treating mental health problems among the adolescents is another limitation of this study.

6. Discussion and Conclusion

Adolescence offers an opportunity for children to develop themselves as responsible and productive citizens who will lead fulfilling lives in the future. This period requires support from families, communities, societies and the nation at large to combat challenges affecting the health of millions of adolescents in Andhra Pradesh. Apart from other problems, high prevalence of child marriage and anemia predominantly suppress the development of adolescent girls.

All adolescents - both boys and girls - are exposed to the mental health problems emerging from a wide range of risk factors, including their vulnerable age and sociobehavioral aspects. In this analysis, the authors have found that child marriage, anemia in adolescent girls, and childhood mental illnesses result in substantial costs (sum total of economic and social cost) to the individual as well as the economy. In most cases, indirect costs incurred by families of the adolescents and the burden of disease on the state's economy outweigh the direct costs

to the affected adolescent. This reiterates the responsibility of policy makers to formulate effective policies that secure the health of adolescents in particular, and the overall population in general.

Child marriage prevention through incentives, both conditional and unconditional – have shown promise to reduce rates in child marriage and improve educational attainment leading to better productivity (Field *et al.*, 2016). Though the transfer of incentive to the household can help in delaying the age of marriage for girls in Andhra Pradesh, more important is the behavioral change in a society that considers girl children as a liability.

Another health intervention focusing on reducing anemia among adolescent girls shows higher cost-effectiveness if cognitive development and labor force participation are considered as potential benefits of the intervention (Horton and Ross, 2007). It informs the opportunity to address a single problem to yield multiple benefits at the individual and population levels through cost-effective and evidence-based interventions. In addition to providing supplementation, other efforts to minimize the risk of anemia should be considered as a part of the holistic approach to improve the overall health of adolescents.

The last intervention discussed in this paper is about improving mental health among adolescents through school-based screening and provision of specialized mental health services to affected individuals. The benefits appear to be nearly twice the cost of the intervention. Though the value of averted years lived with disabilities has been considered as potential benefits, it is likely to be higher if the benefits of improved quality of life and social benefits like lower crime and other benefits are estimated in the context of Andhra Pradesh. The assessment and management of mental illnesses in Andhra Pradesh should be improved in a cost-effective manner, focusing on both curative and preventive measures, to fully tap the potential of the youth in the state.

The study has reviewed preventive as well protective measures for each of the interventions and analyzed the cost-effectiveness. With varying methodologies adopted, all three adolescent health interventions are found to be cost-effective, even in altered scenario with variations in key variables. The evidence-based results show the interventions can be adopted as prioritized policies in Andhra Pradesh, as adolescents play a pivotal role in the future of the state.

Table 7: Final Summary Table

Intervention	Discount rate (%)	Benefit (in Rs Crore)	Cost (in Rs Crore)	BCR	Quality of Evidence
Delaying child marriage via direct incentives	3%	7,240	1,516	4.8	Medium
	5%	4,401	1,449	3.0	
	8%	2,410	1,356	1.8	
Preventing anemia among adolescent girls	3%	660	44	15.0	Strong
	5%	665	44	14.9	
	8%	649	44	14.8	
School based behavioral screening and further mental health services for the adolescents	3%	302	124	2.4	Medium
	5%	296	122	2.4	
	8%	288	118	2.4	

Source: Author's calculations

7. References

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As a new state, Andhra Pradesh faces a bright future, but it is still experiencing many acute social and economic development challenges. It has made great strides in creating a positive environment for business, and was recently ranked 2nd in India for ease of doing business. Yet, progress needs to be much faster if it is to achieve its ambitions of becoming the leading state in India in terms of social development and economic growth. With limited resources and time, it is crucial that focus is informed by what will do the most good for each rupee spent. The Andhra Pradesh Priorities project as part of the larger India Consensus – a partnership between Tata Trusts and the Copenhagen Consensus Center, will work with stakeholders across the state to identify, analyze, rank and disseminate the best solutions for the state. We will engage people and institutions from all parts of society, through newspapers, radio and TV, along with NGOs, decision makers, sector experts and businesses to propose the most relevant solutions to these challenges. We will commission some of the best economists in India, Andhra Pradesh, and the world to calculate the social, environmental and economic costs and benefits of these proposals



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