



Cost-Effectiveness Analysis of Hydroxyurea Oral Suspension as Prophylaxis for the Management of Sickle Cell Anemia in Children

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Recommendations

- Hydroxyurea Oral Suspension and dispersible tablet formulations were found to be cost-effective options for children aged 2-7 years old compared to the capsules that are currently available in the public health system.
- The incremental cost of introducing Liquid suspension over capsule in seventeen high endemic states is 28.23 cr and 10.51 cr for dispersible Tablets annually.
- Strategy of introducing the liquid suspension for 2-4 yr olds and tablet for children ≥ 5 years could help reduce the overall expenditure.

Key Findings

- The Incremental Cost-Effectiveness Ratio (ICER) per DALY averted is INR 1800 (0.008 times GDP per capita) by using Liquid suspension and INR 694 (0.003 times GDP per capita) by using Dispersible Tablet.
- The incremental total DALYs averted were 2,05,038 for Liquid suspension and 2,32,447 DALYs for Dispersible Tablet over a period of 5 Yrs.
- The additional life years gained were 4392 Yrs for Liquid suspension and 4312 Yrs for Dispersible Tablet over a period of 5 Yrs.
- The number of acute events averted were 2243 for liquid Suspension and 1495 for dispersible Tablet annually.
- The Annual cost per child treated is INR 22,356 for Liquid Suspension and INR17,377 for Dispersible tablet while for capsule is INR14,426
- Annually 36 child deaths could be avoided by using Liquid Suspension and 28 deaths by using Dispersible Tablet.
- The incremental annual costs of introducing Liquid Suspension over capsule is 28.23 crores and Dispersible tablet over capsule is 10.51 crores in sixteen states.

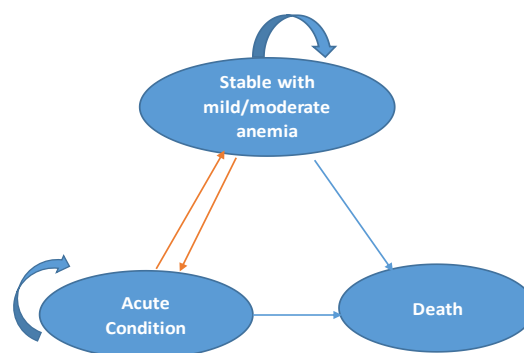
The study assessed the cost-effectiveness of oral Liquid Hydroxyurea suspension as well as Dispersible tablet formulation comparing it with the Hydroxyurea capsule, which is standard of care in public health settings

Inputs for the economic model were derived from Literature review and primary data collected from SCD patients on out-of-pocket expenditure and health related events that they faced in last one year. 37% families experienced catastrophic health expenditure

Background

- In India, approximately 40,000 sickle homozygous births are estimated every year. Children with SCDs start to have signs of the disease during the first year of life.
- Hydroxyurea prophylaxis in children above 2 yrs. of age is recommended by the national guidelines for management of sickle cell disease, MOHFW, 2023. India
- Currently, Hydroxyurea is available in capsule form (500 mg) in India which is tedious to use in pediatric population considering low dose requirements, wastage and palatability issues.
- An indigenous oral hydroxyurea suspension is now approved and marketed in India, offering a more suitable option for pediatric use. Additionally, dispersible tablet formulations of hydroxyurea are available in limited research settings within the country.

Population	Cohort of children of 2 years of age diagnosed with sickle cell disease and who are on hydroxyurea treatment
Intervention	- Hydroxyurea liquid suspension for prophylactic management of sickle cell disease in children - Hydroxyurea dispersible Tablet (200mg) for prophylactic management of sickle cell disease in children
Comparator	Hydroxyurea capsule (500mg) for prophylactic management of sickle cell disease in children
Outcome	- Cost per patient treated with prophylaxis for management of sickle cell disease (oral suspension, tablet and capsule) among children - Cost per DALY averted (oral suspension, tablet and capsule) - Incremental cost-effectiveness ratio - Number of acute events averted - Number of Blood Transfusions averted - Number of Deaths averted due to Sickle Cell Disease - Incremental Life years gained - Incremental DALY averted - Incremental Net health benefit and Budget impact
Time Horizon	5 years from age 2 to 7 years
Perspective	Abridged Societal Perspective



Markov Model

Product features of Liquid Hydroxyurea

- Flavored and palatable formulation
- Eliminates requirement for cold storage
- India mart price: 100ml bottle - Rs 700-800
- Company negotiated price 600Rs /100 ml bottle

Product features Hydroxyurea Tablet

- Hydroxyurea 200 mg dispersible tablet available on prescription for Cancer treatment and used in research settings for SCD
- Tablet cutter provided, hence wastage avoided
- Procured at costs Rs 7 per tablet

Based on expert opinion, adherence is assumed to be 80% for oral suspension, 70% for dispersible tablets and 50% for capsules.

Results

	Liquid Suspension	Dispersible Tablet	Capsule
Total Costs(INR) for 5years	₹ 397,95,17,120	₹ 309,32,49,810	₹ 256,79,29,076
Total DALY s for 5 years	2,05,038 DALYs	2,32,447 DALYs	9,89,010 DALYs
Total Life years for 5 years	2,02,126 Life Yrs.	2,02,031 Life Yrs.	1,97,714 Life Yrs
Incremental Costs over 5years	₹ 141,15,88,043	₹ 52,53,20,734	
Incremental Life Years gained over 5years	4,392 Life yrs	4,317 Life Yrs	
Incremental DALY averted over 5years	7,83,972 DALYs	7,56,563 DALYs	
ICER per DALY averted	₹ 1,800.56	₹ 694.35	
Acute events averted per year	2243	1495	
Blood Transfusion averted per year	1602	1068	
Deaths due to SCD averted per year	36	28	
Annual cost per case treated	₹ 22,356	₹ 17,377	₹ 14,426
Incremental Net Benefit over 5 years	₹ 1,64,79,04,61,155	₹ 1,59,86,59,44,425	

Sensitivity Analysis:

- One way sensitivity analysis (OWSA) shows that ICER for both oral suspension and dispersible tablet forms of hydroxyurea is most influenced by drug costs and hospitalization expenses.
- The Cost Effectiveness analysis shows both the interventions are 100% cost effective at current GDP per capita.

Budget Impact analysis:

- The overall annual budget required for introducing Liquid suspension is 79.59 cr, 61.86 cr for Dispersible Tablet and 51.36 cr for Capsule in sixteen states reported in National Sick Cell Elimination Program(Ref: https://sickle.nhm.gov.in/home/guest_dashboard)
- The incremental annual cost of introducing Liquid suspension over capsule is 28.23 cr and Tablet over capsule is 10.51 cr.

Conclusion:

- The incremental cost-effectiveness ratio per DALY averted is INR 694 (0.003 times GDP per capita), using hydroxyurea tablet.
- The incremental cost-effectiveness ratio per DALY averted is INR 1800 (0.008 times GDP per capita), using hydroxyurea liquid suspension for treating children aged 2–7 years with SCD for India.
- The Incremental Net Benefit (INB) was ₹ 1,64,79,04,61,155 for using Liquid Suspension and ₹ 1,59,86,59,44,425 for Tablet for the cohort of 2-7 years with SCD for India.
- The number of acute events averted were 1495 for tablet 2243 for liquid suspension and deaths averted were 28 for tablet and 36 for Liquid suspension.
- Liquid Hydroxyurea could be more palatable and easy to administer to young children and is also very cost effective to be introduced into the public health system.
- The dispersible tablet could be considered for older children, which is less expensive and avoids wastage.

References:

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