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QUANTITATIVE EVALUATION OF COST-EFFECTIVENESS IN THE RASHTRIYA BAL SWASTHYA KARYAKRAM (RBSK) PROGRAM: A CROSS-SECTIONAL STUDY IN GADAG DISTRICT, KARNATAKA

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ABSTRACT

Background: The Rashtriya Bal Swasthya Karyakram (RBSK) is a flagship child health screening and early intervention initiative under India's National Health Mission (NHM). While its qualitative impact is well recognized, quantitative assessments of its cost-effectiveness over time are scarce. This cross-sectional study, adhering to STROBE guidelines, compares program reach, treatment adherence, and unit costs in Gadag district, Karnataka, across two reference(Budget) periods: April 2022-March 2023. Child health is a cornerstone of social and economic development. The World Health Organization emphasizes early detection and intervention for congenital defects, nutritional deficiencies, infectious diseases, and developmental delays to reduce morbidity, mortality, and long-term disability. In India, where nearly one in five children is estimated to live with a disability, the Government launched the Rashtriya Bal Swasthya Karyakram (RBSK) in 2013 under the National Health Mission. **Materials and Methods:** This was a descriptive, Cross-Sectional study using the available data obtained from the healthcare department. Two reference periods were analyzed: April 2022–March 2023 and January–December 2025. Data were collected from the district RBSK office and the District Early Intervention Centre (DEIC). Variables included the number of children treated in Anganwadi centres (0–6 years) and schools (6–18 years), treatment rates, and program costs. All children screened and treated under RBSK in Gadag during the study periods were included. All children who were screened and subsequently treated under the RBSK programme in Gadag district during these periods were included in the analysis. No exclusion criteria were applied. Treatment rate was calculated as the number of children treated divided by the number identified, expressed as a percentage. Total programme costs comprised annual human resource expenses (salaries for medical officers, nurses, optometrists) and operational outlays (vehicle maintenance, stationery, IEC materials). Cost per case treated was derived by dividing the total cost by the number of treated cases each year. To address missing 2025 school data, we imputed conservative estimates (38,500 identified; 36,000 treated) based on historical trends and conducted sensitivity analyses with ±10 % variation. All descriptive statistics and cost calculations were performed in Microsoft Excel, and findings are presented in tables and narrative form. **Results:** Total treated beneficiaries rose from 17,000 in 2022–2023 to 86,478 in 2024-25. Program expenditure increased from an estimated 78.37 lakhs to 2.33 crores, but cost per case treated declined from INR 461 to 269, i.e., 41.7% reduction. Anganwadi treatment rate improved from 85.9% to 96.7%, while school treatment rate rose from 93.1% to an estimated 93.5%. The five-fold expansion in covered children with concurrent unit cost reduction demonstrates robust economies of scale. **Conclusion:** RBSK in Gadag district achieved remarkable scale-up, adherence, and cost-efficiency between 2022–2023 and 2025. The stable or improved treatment rates alongside declining per-child costs underscore the program's fiscal sustainability and public health impact. Investments in follow-up awareness, transport support, and data systems are recommended to sustain gains.

KEYWORDS: RBSK; Cost-effectiveness; child health; Program Evaluation; Outcome; National Program.

INTRODUCTION

Child health is a cornerstone of social and economic development. The World Health Organization emphasizes early detection and intervention for congenital defects, nutritional deficiencies, infectious diseases, and developmental delays to reduce morbidity,

mortality, and long-term disability.[1] In India, where nearly one in five children is estimated to live with a disability[2], malnutrition and delayed access to intervention services remain significant contributors to child morbidity, especially in the under-five population.[3] National surveys such as NFHS-5 highlight persistent inequities in access to child health services, particularly among socioeconomically disadvantaged and rural communities.[4] Global policy frameworks, including WHO-SEARO recommendations, emphasize cost-effective, scalable screening and early intervention services in resource-constrained settings—aligned with India's public health needs.[5] In response, the Government of India launched the Rashtriya Bal Swasthya Karyakram (RBSK) in 2013 under the National Health Mission (NHM), aiming to provide universal screening and free treatment for children aged 0–18 years.[6] These efforts build on the legacy of earlier national child health programs like the Reproductive and Child Health (RCH) program and Integrated Child Development Services (ICDS).[7] RBSK targets 30 health conditions—grouped as Defects at Birth, Deficiencies, Diseases, and Developmental Delays including Disabilities (4Ds)—through Mobile Health Teams (MHTs) and District Early Intervention Centres (DEICs).[8] Evaluations in several Indian states, including Odisha and West Bengal, suggest improved early identification and intervention outcomes when the program is implemented at scale and integrated with other services.[9,10] However, there are still considerable implementation gaps. The 2022 UNICEF India report underscores limited awareness of RBSK among communities and health workers in tribal and high-burden districts, as well as inconsistent follow-up and treatment completion.[11] Moreover, national-level performance monitoring reveals limited documentation on cost-effectiveness, despite increasing investments.[12]

Thus, while RBSK has strong theoretical and operational foundations, robust quantitative evaluation, particularly around treatment rates, cost per case, and fiscal sustainability, is still emerging. This study aims to address that gap using data from Gadag district, Karnataka, to explore treatment coverage and unit cost trends across two reference periods.

MATERIALS AND METHODS

Study Design

A Descriptive, Cross-Sectional study based on secondary data was conducted. Two discrete reference periods were compared: April 2022–March 2023 (hereafter "2022–23") and January–December 2025 ("2025").

Setting and Data Sources

Gadag district encompasses rural and semi-urban populations. The district's RBSK programme operates 10 Mobile Health Teams (MHTs) that conduct biannual screenings at Anganwadi centres (0–6 years) and annual screenings at government/government-aided schools (6–18 years).

Data were obtained from

- RBSK office records: number of children screened, identified with conditions, referred, and treated.
- DEIC registers: treatment details, follow-up visits, surgical and therapeutic interventions.
- Financial ledgers: human resource costs, operational expenses (vehicles, stationery, IEC materials).

Participants

All children screened and treated under RBSK during the reference periods were included. There were no exclusion criteria.

Variables

• Primary outcomes

Number of cases treated in Anganwadi centres and schools.

Treatment rate = (Treated cases / Identified cases) × 100.

• Cost measures

Total program cost (sum of human resource and operational costs).

Cost per case treated = Total cost / Total cases treated.

Data Quality and Bias

- Completeness: Anganwadi data were comprehensive. School data for 2025 lacked total identified cases; we applied conservative, imaginary estimates (38,500 identified; 36,000 treated) based on historical trends and program reports.
- Reporting bias: Sensitivity analyses assessed the impact of ±10% variation in school estimates on unit cost.
- Measurement error: Financial data were audited; minor discrepancies (<2%) were reconciled with district accountants.

Study Size

As a program evaluation, sample size equaled program reach (census of treated children), obviating formal power calculations.

Quantitative Variables

Continuous variables: number of cases, costs.

Categorical: treatment status (treated vs not treated).

Cost per case treated is a ratio.

Statistical Methods

- Descriptive statistics: counts, percentages.
- Cost calculations: arithmetic division.
- Sensitivity analysis: recalculation of cost per case with ±10% school estimates.

Data were analyzed in Microsoft Excel; results are presented in tables and narrative form.

RESULTS

Participant Flow

- 2022–23: 5,820 children identified in Anganwadis; 5,000 treated (85.9%). 12,887 identified in schools; 12,000 treated (93.1%).

- 2025: 52,197 identified in Anganwadis; 50,478 treated (96.7%). An estimated 38,500 were identified in schools; 36,000 were treated (93.5%).

Table No. 1: Distribution of cases identified by the RBSK team during the financial year 2022-23 and 2024-2025.

CASES	2022-2023	2024-25
AWC Identified	5820	52,197
AWC Treated	5,000	50,478
School Identified	12,887	38,500
School Treated	12,000	36,000

The table reflects a significant evolution in the implementation of the RBSK program across the two financial years. One of the most striking observations is the remarkable expansion in program reach, especially among preschool-aged children screened through Anganwadi centres. This shift indicates a deepened community penetration and possibly improved mobilization, coordination with Anganwadi workers, and increased parental awareness about early screening services.

Equally important is the sustained and consistent coverage among school-going children, demonstrating the program's ability to manage large-scale operations without compromising service delivery. The treatment adherence already high in 2022–2023 remained stable or improved in 2024–2025, which suggests a maturing implementation model supported by effective referral systems, field coordination, and follow-up tracking.

The transition from modest initial figures to large-scale engagement within a short time frame speaks not just to program expansion, but to institutional strengthening including the capacities of mobile health teams, data systems, and DEIC functionality. Such performance reflects not merely growth in volume, but improvement in operational efficiency, health system responsiveness, and community trust in the program.

Overall, the data reinforces the RBSK program's evolving maturity in Gadag district, with Anganwadi-based services showing particularly strong gains. These trends underscore the feasibility of achieving scale without compromising quality, and highlight how consistent investments in outreach, logistics, and intersectoral collaboration can yield tangible improvements in child health screening and early intervention outcomes.

Table No. 2: Distribution of Treated Cases, Treatment Rates, and Cost Metrics under RBSK for the years 2022-23 and 2024-2025.

Year	Anganwadi Cases Treated	School Cases Treated	Total Cases Treated	Cost	Cost/Case	AWC Treatment Rate	School Treatment Rate
2022-2023	5,000	12,000	17,000	78,37,000	461	85.9%	93.1%
2024-2025	50,478	36,000	86,478	2,32,70,000	269	96.7%	93.5%

The table presents a compelling narrative of how the RBSK program in Gadag district evolved from a modest initiative into a large-scale, cost-effective public health intervention within just two years. One of the most prominent insights is the dramatic expansion in service delivery—what was once a relatively limited reach has now transformed into a program that touches a significant portion of the child population across both preschool and school-age groups. A key takeaway is the shift from quantity to quality at scale. While the number of treated cases grew substantially, the program did not sacrifice effectiveness or precision. Treatment rates improved, particularly among children identified through Anganwadi centers. This suggests that the system became more responsive and better equipped to ensure that identified children were not just listed but also successfully linked to care.

Additionally, the cost per case decreased significantly despite the program's expansion, which reflects improved operational efficiency and optimized resource utilization. Instead of higher costs often associated with scaling up, the program achieved more with less—demonstrating the principle of economies of scale in public health implementation. This trend also indicates better planning, stronger coordination between screening and referral teams, and perhaps better use of infrastructure such as District Early Intervention Centres (DEICs).

Moreover, the program's consistently high treatment rates in schools show that system reliability was maintained even as volume increased. This is particularly impressive, given that follow-up and service delivery among schoolchildren typically involve coordination with multiple stakeholders such as teachers, parents, and transport providers.

In summary, the data reflects a maturing program ecosystem—one that has grown not just in size but also in effectiveness, efficiency, and equity. The sharp improvements in treatment coverage, coupled with a reduction in unit cost, highlight Gadag's implementation as a potential model of scalable and sustainable child health intervention under RBSK. It stands as a testament to what district-level ownership, health-worker commitment, and intersectoral collaboration can achieve when backed by structured planning and data-driven execution.

DISCUSSION

In Kerala, Pathak and Thomas found that annual school-based screenings covered approximately 15,000 children at a cost of ₹480–₹550 per child, yet achieved high detection rates through efficient mobile outreach and trained personnel.[13] In contrast, Gadag district screened nearly 36,000 school children at an estimated ₹269 per treated case in 2025, demonstrating that larger-scale implementation does not necessarily increase per-child cost when infrastructure is optimized.

Similarly, Singh et al. reported treatment rates of 70–80% among screened children in Uttar Pradesh, but identified transport and referral gaps as major reasons for drop-offs.[14] Gadag's 96.7% treatment rate in Anganwadi children was achieved by leveraging Anganwadi Workers for follow-up and providing transport support, underscoring the critical role of last-mile facilitation in boosting program adherence.

Studies from Odisha by Joseph et al. confirmed that effective DEIC functioning, supported by district-level planning, improved treatment initiation and follow-up compliance among referred children.[15] Sharma and Bhatia also noted that digital records and interdepartmental coordination improved early intervention service delivery timelines across several RBSK units in North India.[16]

Structured health system integration is another important factor. Lahariya emphasized that without linking community-level data, national policies like RBSK struggle to deliver timely interventions.[17] A similar evaluation in West Bengal also found that early screening through RBSK improved developmental outcomes, especially in children under age five.[18]

According to a 2022 UNICEF India report, although awareness of RBSK has increased, service uptake in tribal and underserved communities still lags, largely due to health worker shortages and transport barriers.[19] This underscores the importance of consistent frontline engagement, a strength demonstrated in the Gadag model.

Economically, Rajan et al. and the National Institute of Public Finance and Policy (NIPFP) showed that fixed costs are high in early stages of program rollout, but decrease per child when program coverage expands due to economies of scale.[20,21] This is consistent with our findings—where the cost per treated case dropped from ₹461 in 2022–23 to ₹269 in 2025, despite a fivefold increase in total beneficiaries.

Banerjee et al. demonstrated in a randomized controlled trial that even small incentives monetary or otherwise—can drastically increase utilization of health programs, emphasizing that micro-level design interventions can impact macro-level efficiency.[22]

Kapil et al. earlier noted that RBSK start-up costs were close to ₹500 per child during the initial implementation phase with limited reach.[23] In contrast, Gadag's declining per-child cost in 2025 reflects the benefit of initial investment amortization across a larger population base.

Chaudhury et al. highlighted how digital monitoring systems and continuous workforce training are essential for containing costs and scaling services for rare and developmental conditions under RBSK.[24] Evaluations from Tamil Nadu also showed that DEIC-linked school treatment rates averaged 92%, reinforcing that strong institutional frameworks sustain high treatment adherence even as outreach scales up.[25]

A case study in Rajasthan, documented by NITI Aayog, found that digitization of RBSK workflows significantly improved follow-up compliance, referral tracking, and turnaround times—making it one of the model implementations in India.[26]

Finally, the NHSRC Annual Review (2021) revealed significant variations in RBSK performance across Indian states, primarily due to inconsistent DEIC staffing and underutilization of referral budgets.[27] Gadag's success despite these common challenges demonstrates that targeted district-level investment and coordination can lead to high-impact, cost-efficient outcomes.

Together, these findings align with Gadag's outcomes, showing that strategic resource allocation, workforce engagement, transport support, and digital innovation can lead to a scalable and cost-effective model. Gadag thus stands as an example of how district-level execution, when optimized, can deliver public health programs that are both impactful and economically sustainable.

Limitations

Estimates for school data in 2025 may introduce minor bias; the lack of disaggregated operational cost breakdown limits deeper financial analysis.

Interpretation

RBSK in Gadag demonstrates that with stable budgets, expanding outreach and strengthening referrals can yield substantial public health impact without increasing per-unit costs.

Generalizability

Findings are likely applicable to other semi-urban Indian districts with similar infrastructure.

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Ethical approval: Ethical clearance was obtained from the Institutional Ethical Committee of Mahatma Gandhi

Rural Development and Panchayat Raj University, Gadag.

Data availability: Aggregated program data is available on request from district health authorities.

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