

## ORIGINAL ARTICLE - PUBLIC HEALTH

## REVEALING INSIGHTS: A COMPREHENSIVE SECONDARY ANALYSIS OF RBSK AND MMU VEHICLE DISTANCE DATA ACROSS DISTRICTS OF TAMIL NADU FROM APRIL TO SEPTEMBER 2023"

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Abstract

**INTRODUCTION :** This study scrutinizes the operational dynamics of Rashtriya Bal Swasthya Karyakram (RBSK) and Mobile Medical Units (MMUs) in providing healthcare services to children and people in Indian districts. The aim is to enhance services, optimize resource allocation, and inform policy development. RBSK, launched in 2013, focuses on early detection and intervention for children's health, while MMUs extend healthcare services to underserved areas.

**MATERIALS AND METHODS :** Data from RBSK and MMU GPS dashboards, collected over a six-month period (April 2023 to September 2023), were analyzed. The study assessed vehicle distance coverage, identified factors influencing it, and compared RBSK and MMU performance.

**RESULTS :** RBSK demonstrated steady growth in distance coverage, increasing from 527,360.1 Km in April to 863,959.4 Km in September 2023. MMU coverage also expanded from 121,722.4 Km to 345,884.9 Km during the same period. Variations were observed across districts, with local conditions and patient demand influencing performance.

**CONCLUSION :** This study provides valuable insights into RBSK and MMU services' operational dynamics, highlighting positive developments and areas needing improvement. It recommends investigating inactivity and operational issues, understanding district-specific factors, addressing data anomalies, monitoring service performance, enhancing reporting mechanisms, and engaging stakeholders. The findings offer a basis for decision-making and resource allocation to enhance healthcare services in the studied districts.

**KEYWORDS :** RBSK, MMU, child healthcare, distance coverage, resource allocation

**INTRODUCTION**

Launched in 2013, the Rashtriya Bal Swasthya Karyakram (RBSK) is a pivotal child health program dedicated to addressing the healthcare needs of children aged 0-18 years. This initiative operates with the robust support of the National Health Mission (NHM) and the Tamil Nadu Health System Project (TNHSP). Alongside the RBSK program, Mobile Medical Units (MMUs) play a crucial role in extending healthcare services to remote and underserved areas, serving as a mobile lifeline that offers medical care and expertise.

Embracing modern technology, including Global Positioning System (GPS) tracking, both RBSK and MMUs effectively monitor the movements and reach of their mobile health teams. This utilization of GPS technology ensures efficient coverage and timely healthcare delivery. The GPS services are provided by Glovision, the designated GPS vendor.

Tamil Nadu serves as an exemplary model, with 805 active RBSK teams catering to the health needs of children in government and government-aided schools. These teams are distributed across 385 rural blocks, 8 corporations, and the Greater Chennai Corporation (GCC). Operating through a network of dedicated RBSK teams, with two teams assigned to each rural block and additional teams serving

in corporations and urban areas, underscores the scale and significance of RBSK operations. These teams are equipped with dedicated vehicles, highlighting the commitment to reaching children in diverse geographical locations.

The core mission of RBSK is to screen children at Anganwadi Centers, government, and government-aided schools to identify and address the "4 D's" - Defects at birth, Deficiencies, Diseases, and Developmental Delays. Early identification and intervention in these areas hold the potential to significantly impact the health and well-being of children, potentially altering the course of their lives for the better.

Mandated by the Ministry of Health and Family Welfare, the RBSK program has indeed made notable progress in improving child and adolescent healthcare in India. However, recognizing the need for continuous adaptation to meet evolving healthcare demands, understanding the travel behavior and service reach of RBSK and MMU vehicles is



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imperative for optimizing their impact and strengthening the program's effectiveness.

This study embarks on an in-depth secondary data analysis that scrutinizes the operational dynamics of RBSK and MMU vehicles over a five-month period, from April 2023 to August 2023, aiming to enhance services, optimize resource allocation, and inform policy development.

## OBJECTIVES

1. Identifying patterns and trends in vehicle distance coverage.
2. Assessing the impact of various factors on distance coverage.
3. Evaluating the efficiency and utilization of RBSK and MMU resources.
4. Providing insights that can guide decision-making and resource allocation for healthcare services.
5. Suggesting potential improvements for the delivery of healthcare services in the studied districts

## METHODOLOGY

### DATA COLLECTION AND PRE-PROCESSING:

The data for this secondary study were sourced from the RBSK and MMU GPS dashboard, which is operational in all districts and provides distance reports.

The collected data were initially in Excel format and required pre-processing. Raw data was organized and structured for analysis.

Data pre-processing encompassed tasks such as data cleaning, sorting, and categorization of the distances travelled by RBSK and MMU vehicles.

### DATA COLLECT:

Continuous variables were presented using descriptive statistics, allowing for a clear and concise representation of the data's characteristics.

To provide a comprehensive view of the study population, data distributions were effectively summarized and displayed in tables and other appropriate formats.

## RESULTS

The table provides a comprehensive overview of the distance coverage by RBSK, highlighting the steady growth from 527,360 Km in April 2023 to 863,959 Km in September 2023. Notably, RBSK outperformed MMU in terms of distance covered throughout this period. This data showcases the continuous improvement in RBSK's performance, suggesting that it travelled greater distances compared to MMU.

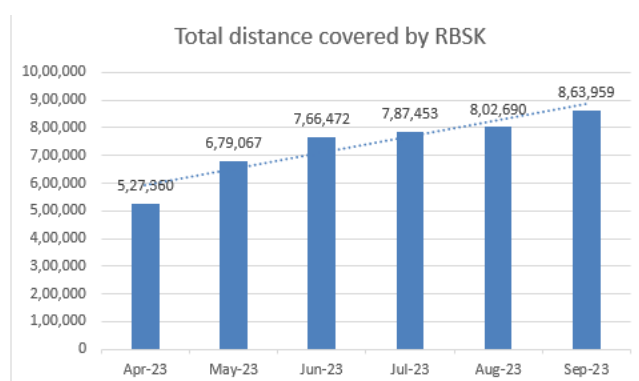


Figure 1 : Analysis of RBSK vehicle Distance Coverage from April to September 2023

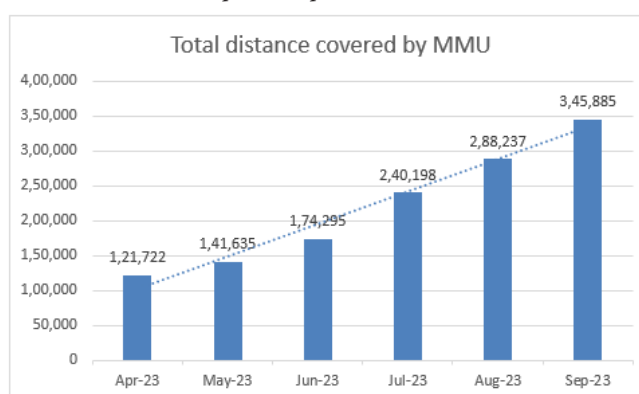


Figure 2 : Analysis of MMU vehicle Distance Coverage from April to September 2023

The figure provides a detailed breakdown of the distance coverage by MMU. The total distance covered by MMU started at 121,722 Km in April 2023 and steadily increased to 345,884 Km by September 2023. Similar to RBSK vehicle distance travelled, this data reveals a consistent growth trend in distance coverage over the six-month period.

The table presents a detailed analysis of RBSK distance coverage from April to September 2023, highlighting key trends and variations. Total distance covered across districts ranged significantly, with Trichy leading at 38,751 Km by September, signifying substantial growth. Districts displayed marked differences, with Trichy, Sivagangai, and Thiruvallur consistently covering longer distances, while Poonamallee and Pudukkottai reported relatively lower coverage. Notably, a common pattern emerges across all districts, showing increased distance coverage as the months progressed. This may be indicative of heightened activity or improved operational efficiency.

In April, there were 42 instances where no distance was covered by RBSK units. This number decreased to 33 in May but slightly decreased to 29 in June. However, from July onwards, there was a significant rise in instances of zero kilometers covered, reaching its peak at 45 in September. Investigating the reasons behind these occurrences can be essential for improving the efficiency and utilization of RBSK.

resources during these periods.

Table 1 : OVERVIEW OF DISTRICT AND MONTH WISE RBSK DISTANCE COVERAGE: RBSK TOTAL DISTANCE

District	April	May	June	July	August	September
Aranthangi	9,990	9,818	10,675	11,718	11,649	13,976
Ariyalur	5,378	20,959	16,215	17,312	16,455	10,629
Athur	17,582	20,199	20,368	23,304	18,280	20,427
Chengalpattu	9,252	11,787	18,891	17,511	16,886	18,188
Chennai	3,936	5,115	8,935	9,021	6,847	7,023
Cheyar	11,840	12,820	14,860	14,581	17,841	15,738
Coimbatore	13,795	15,350	24,597	26,905	25,385	20,767
Cuddalore	18,802	20,555	23,853	23,981	24,318	20,728
Dharmapuri	12,726	15,251	15,109	15,634	14,965	13,275
Dindigul	10,919	10,800	13,080	13,601	13,511	13,626
Erode	12,677	16,122	22,880	22,926	24,645	22,106
Kallakurichi	8,588	18,800	21,016	18,904	22,269	20,800
Kanchipuram	4,678	6,574	7,108	6,335	6,294	6,976
Kanyakumari	11,403	11,616	12,730	14,182	14,576	12,376
Karur	11,485	15,558	16,230	16,394	17,065	11,991
Kovilpatti	10,744	9,993	11,859	9,635	10,402	9,075
Krishnagiri	7,256	17,357	18,365	16,707	16,332	15,446
Madurai	22,071	24,935	23,612	23,298	19,232	22,012
Nagapattinam	5,436	15,839	13,717	15,470	14,619	13,950
Namakkal	18,859	19,114	20,735	20,143	19,715	21,389
Nilgiris	5,213	7,986	9,576	9,688	10,019	8,437
Palani	7,795	9,035	13,819	15,067	12,914	12,495
Paramakudi	7,852	9,979	16,520	14,800	14,539	14,140
Perambalur	6,095	7,302	13,611	14,618	15,224	14,762
Poonamallee	293	396	264	131	146	241
Pudukkottai	8,113	20,382	21,200	20,854	22,754	20,305
Ramanathapuram	8,652	11,919	12,409	13,331	12,596	12,629
Ranipet	11,716	15,472	13,969	16,604	16,625	13,583
Salem	16,871	22,520	25,284	23,805	22,706	25,772
Sivaganga	23,111	25,269	28,480	29,199	27,805	25,344
Tenkasi	13,762	14,303	19,288	18,205	18,792	16,342
Thanjavur	20,112	24,786	26,167	27,433	25,436	23,885
Theni	9,866	10,514	16,938	18,688	19,806	13,447
Thiruvallur	10,145	20,699	18,278	18,852	18,333	14,802
Thiruvannamalai	22,217	22,778	23,881	24,289	28,999	26,254
Thiruvaur	22,056	25,187	23,845	21,442	19,245	17,584
Thoothukudi	8,342	10,379	13,032	14,748	12,950	9,242
Tirunelveli	15,518	20,846	22,083	21,507	21,228	17,050
Tirupattur	5,200	9,689	12,721	13,143	12,951	13,369
Tiruppur	11,995	14,417	16,552	18,300	17,141	16,343
Trichy	30,039	31,194	32,355	36,627	38,752	29,621
Vellore	10,725	12,510	13,798	18,551	18,506	17,420
Villupuram	17,441	20,791	22,345	22,012	23,126	19,485
Virudhunagar	7,709	12,154	15,223	18,000	22,968	19,837

Table 2 : MONTHWISE RBSK VEHICLE OKM COVERAGE

RBSK	April	May	June	July	August	September
No. of vehicles	42	33	29	35	42	45

Table 3 : OVERVIEW OF DISTRICT AND MONTH WISE MMU DISTANCE COVERAGE

District	April	May	June	July	August	September
Aranthangi	1,365	2,433	4,525	3,558	2,940	3,506
Ariyalur	608	4,150	4,223	4,648	4,293	3,756
Athur	1,420	1,709	2,301	2,548	2,952	2,311
Chengalpattu	829	875	978	1,890	3,036	2,419
Cheyar	1,417	1,531	3,355	3,679	3,620	3,107
Coimbatore	2,597	2,345	4,442	4,697	4,441	4,421
Cuddalore	4,201	7,202	4,329	5,571	2,908	10,418
Dharmapuri	5,624	6,474	9,068	9,318	8,785	6,775
Dindigul	2,066	1,499	4,526	5,024	4,768	4,715
Erode	4,938	583	12,570	12,288	11,718	12,162
Kallakurichi	1,523	604	3,671	4,058	6,098	3,739
Kanchipuram	2,444	2,722	1,523	3,551	3,980	3,662
Kanyakumari	3,121	7,256	6,590	7,178	8,891	7,565
Karur	2,590	2,407	2,349	3,998	2,630	5,025
Koilpatti	1	5	310	1,744	105	62
Kovilpatti	1,229	1,640	1,223	8,400	1,496	1,581
Krishnagiri	3,952	3,155	3,396	7,560	8,466	7,475
Madurai	4,215	3,903	1,280	7,312	9,233	7,355
Nagapattinam	3,966	2,653	2,026	14,192	6,886	6,367
Nagapattinam	242	389	83	3,252	14,237	7,158
Namakkal	4,521	6,124	6,601	4,159	3,931	13,084
Nilgiris	2,208	2,922	3,803	3,145	4,810	1,673
Palani	1,371	2,230	5,486	4,285	4,100	3,538
Paramakudi	2,352	1,890	2,021	845	3,495	3,450
Perambalur	1,927	1,255	1,240	5,750	777	4,400
Poonamallee	1	1,690	11	2,570	5,578	743
Pudukkottai	2,897	706	6,174	6,962	3,182	4,383
Ramanathapuram	1,094	720	2,626	17,346	7,840	2,065
Ranipet	2,561	1,652	3,499	11,993	16,373	8,158
Salem	7,451	5,634	14,884	3,376	13,392	15,538
Sivaganga	3,224	7,688	10,458	2,479	3,014	13,247
Sivakasi	1,221	1,146	2,421	7,395	2,478	3,075
Tenkasi	2,278	4,130	2,751	7,418	7,166	3,204
Thanjavur	2,779	5,151	2,378	2,437	7,511	7,706
Theni	1,994	4,567	3,166	2,542	2,537	6,621

Thiruchirapalli	1,501	1,848	2,156	9,587	1,501	3,753
Thiruvallur	2,144	2,184	2,078	3,676	8,526	2,060
Thiruvannamalai	2,769	5,423	2,950	1,210	3,655	8,741
Thiruvaurur	1,788	3,114	3,773	7,164	1,533	3,463
Thoothukudi	993	848	1,835	3,040	7,891	1,171
Tirunelveli	3,241	4,453	4,725	6,021	1,119	6,874
Tirupattur	4,612	2,888	1,941	4,418	5,599	4,355
Tiruppur	5,488	3,124	3,308	2,191	4,188	5,681
Trichy	6,836	6,825	2,600	3,959	3,505	5,794
Vellore	2,300	3,275	4,104	1,765	3,631	4,225
Villupuram	2,959	5,359	3,474	2,191	3,563	9,537
Virudhunagar	865	1,255	1,067	3,959	959	2,353

The data underscores significant disparities in MMU distance coverage across districts, with certain areas, including Cuddalore, Thiruvannamalai, and Perambalur, consistently reporting longer distances covered, while others, like Poonamallee and Koilpatti, indicated substantially shorter distances.

Furthermore, when examining the monthly patterns, noticeable fluctuations become apparent. Some districts experienced peak performance during specific months, whereas others displayed more consistent patterns over time. These variations can be attributed to a range of factors, including local conditions, fluctuations in patient demand, or operational efficiencies.

Nonetheless, it is crucial to address the presence of extremely low values, such as 1.33 in Koilpatti and 1.35 in Poonamallee, as these values may signify data anomalies, potentially arising from data entry errors or days with minimal MMU activity.

Table 4 : MMU MONTHWISE 0KM COVERAGE

MMU	April	May	June	July	August	September
	30	30	28	44	44	44

During April, there were 30 instances when MMU services reported zero kilometers covered, indicating a lack of activity. This number remained constant at 30 in May and decreased slightly to 28 in June. However, a notable trend emerged from July onwards, with a substantial increase in the occurrences of zero kilometers covered, reaching its peak at 44 instances in both August and September.

**REAL-TIME MONITORING FOR RBSK PROGRAM:**

A special feature of RBSK GPS monitoring is real-time vehicle tracking through GPS. The RBSK Dashboard provides a comprehensive overview of critical operational

dynamics, facilitating real-time tracking and management of mobile health teams. Key components such as Total RBSK Teams, Active Teams, Moved Vehicles, Idle Vehicles, and GPS Inactive Vehicles are monitored to ensure seamless healthcare delivery. Additionally, planned visits to Anganwadi Centers and schools, as well as vehicle diversions, are also included. The system's adherence to the Annual Tour Plan (ATP) ensures efficient scheduling, contributing to the overall optimization of healthcare service delivery for children.



Figure 3 : Real-Time Monitoring Snapshot of RBSK Vehicle GPS dashboard (As of 20-9-2023, 10:34AM)

**REAL-TIME MONITORING OF MMU AND FUTURE INTEGRATION OF FIXED TOUR PLAN (FTP):**

This real-time monitoring of MMU vehicles enables the tracking of total devices, moving devices, idle devices, speeding devices, and offline devices, ensuring effective monitoring. In the future, the integration of a Fixed Tour Plan (FTP) will enhance monitoring by tracking adherence to the FTP and identifying any diversions, ensuring timely and targeted healthcare service delivery.

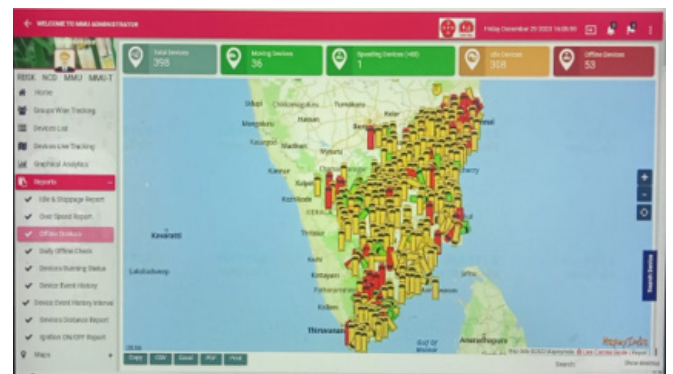


Figure 4 : Real-Time Monitoring of MMU Vehicles (Snapshot as of 20.9.2023, 16:05)

**DISCUSSION**

The study identified clear patterns and trends in vehicle distance coverage for both the Rashtriya Bal Swasthya Karyakram (RBSK) and Mobile Medical Units (MMU). These trends provide valuable insights into the evolution of healthcare service delivery over a six-month period. RBSK exhibited steady growth in distance coverage, increasing from 527,360 Km in April 2023 to 863,959 Km in September 2023. In contrast, MMU showed similar growth from 121,722 Km

to 345,884 Km over the same period, indicating an expansion of healthcare services in the studied districts.

The study highlights the impact of several factors on distance coverage for RBSK and MMU. Variations were observed across different districts, suggesting that local conditions and patient demand influence the performance of healthcare vehicles. Some districts consistently covered longer distances than others, potentially due to factors such as population density, geographical terrain, and the prevalence of healthcare facilities. Monthly patterns revealed fluctuations in performance, attributed to operational efficiencies and specific demand spikes.

The results indicate an overall increase in distance coverage for both RBSK and MMU. However, a concerning trend emerged, with an increased number of instances of zero kilometers covered by both services from July onwards. This suggests potential inefficiencies or resource underutilization that healthcare authorities should investigate and address to ensure efficient resource allocation and utilization. Understanding the reasons behind these instances of inactivity, such as vehicle breakdowns, staff availability, or logistical issues, is essential for improving service delivery.

The data generated by this study can guide decision-making and resource allocation for healthcare services. Decision-makers can use this information to identify districts or regions where healthcare services need improvement or expansion. The study also emphasizes the importance of addressing disparities in distance coverage among districts and identifying areas with potential data anomalies. It may be necessary to reallocate resources to areas with consistently low distance coverage or to investigate and rectify data entry errors that may skew the results.

## FUTURE SCOPES

Extending GPS monitoring to "Makkalai Thedi Maruthuvam"(MTM) vehicles presents a promising future for the program, providing essential healthcare services to individuals over 45 with diabetes and high blood pressure. The initiative includes home medication delivery and vital services such as physiotherapy and palliative care administered by a dedicated team of professionals. This expansion enhances accessibility and ensures comprehensive healthcare support for those unable to visit hospitals.

## ETHICAL CONSIDERATIONS:

**Data Privacy:** All data used in this study will be anonymized and aggregated to protect the privacy of individuals and comply with ethical data usage standards.

## RECOMMENDATIONS

1. Investigate the rise in instances of zero kilometers covered from July to September for RBSK and MMU services to address potential inactivity and operational issues.

2. The fluctuations in distance coverage by districts can be attributed to local conditions and patient demand. It is recommended to conduct a detailed analysis of these factors in high-performing and low-performing districts to better understand the drivers of these variations.

3. The presence of extremely low values in some instances should be addressed. This could be due to data entry errors or days with minimal activity. Implement data quality checks and validation procedures to ensure the accuracy of the data.

4. Continuously monitor and compare the performance of RBSK and MMU units to identify factors contributing to RBSK's superior distance coverage.

5. Enhance reporting and tracking mechanisms for both services to identify and address issues in real-time for improved service delivery.

6. Engage stakeholders, including healthcare professionals, local authorities, and community members, in decision-making for insights into local dynamics affecting distance coverage.

## LIMITATIONS

1. The study's findings may be specific to the region and time period under consideration (April 2023 to September 2023). Generalizing the results to different regions or time frames should be done cautiously.

2. The study's data is limited to a specific time frame, which may not capture seasonal variations or long-term trends that could influence RBSK vehicle movement and service reach.

3. The analysis does not consider external factors that could influence distance coverage, such as weather conditions, road infrastructure, patient demand, or changes in healthcare policies. These factors can significantly impact the results and should be considered when drawing conclusions.

4. The study relies solely on quantitative data from the GPS dashboard. It does not incorporate the perspectives and insights of RBSK program stakeholders, which could provide a more comprehensive understanding of the operational dynamics.

## CONCLUSION

The study provides valuable insights into the trends and patterns of vehicle distance coverage for RBSK and MMU services, highlighting both positive developments and areas in need of improvement. These findings serve as a foundation

for decision-making and resource allocation to enhance healthcare services in the studied districts. Comparing these results with similar studies from other regions can offer a broader perspective on healthcare service delivery challenges and successes.

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