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Gender-wise travel pattern and utilization of primary health centers of Karbi Anglong district, Assam

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Abstract

Healthcare accessibility remains a critical concern in Karbi Anglong district, where spatial distribution, gender-based travel patterns, and patient satisfaction levels reveal disparities in service utilization. This study employs a mixed-methods approach, integrating primary data from 140 patient surveys across seven Primary Health Centers (PHCs) and secondary health and demographic data. Using Geographic Information System (GIS) techniques such as overlay and buffer analysis, along with statistical methods, the research identifies spatial inequities and accessibility gaps. Findings indicate that PHCs located in peripheral areas serve most of the population, yet central regions remain underserved. Gender disparities in travel distance highlight socio-cultural and infrastructural barriers to healthcare access. While urban PHCs report higher patient satisfaction, rural centers face challenges related to transportation, infrastructure, and service availability. The study recommends improving healthcare equity through mobile healthcare units, gender-sensitive policies, enhanced public transportation, and infrastructure investments. These measures aim to optimize service delivery and ensure equitable healthcare access for all.

Keywords: Healthcare Accessibility; Primary Health Centers; Spatial Distribution; GIS Analysis; Gender Disparities; Patient Satisfaction

1. Introduction

Health is one of the major dimensions in socio economic development. Studies indicate that women tend to travel shorter distances for healthcare compared to men, primarily due to their lower mobility, household responsibilities, and financial constraints (1,2,3). Men, on the other hand, are more likely to travel farther distances for specialized medical care, often due to their greater independence and employment-related healthcare access (4,5,6). Women are more reliant on public transportation and walking, while men prefer private vehicles or motorbikes (7,8,9). These differences can influence the frequency of hospital visits, with women facing more barriers related to transport costs, safety concerns, and time constraints (10,11,12). Cultural norms often restrict women's movement**,** especially in low-income and rural areas (13,14,15). Studies in South Asia and Africa highlight that women require permission from family members to travel for medical care, leading to delays in seeking treatment for chronic and emergency conditions (16,17,18).

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Gender-based disparities in travel for healthcare affect health outcomes, particularly for maternal health, chronic disease management, and emergency care (19,20,21). Limited mobility among women contributes to higher rates of untreated illnesses and complications during pregnancy (22,23,24). Research on gender-wise travel and movement patterns of patients in KarbiAnglong district, Assam, is limited. However, studies from other regions in India provide insights into gender disparities in healthcare access and mobility, which may be relevant to KarbiAnglong. Gender plays a crucial role in determining healthcare-seeking behavior, with disparities observed in travel distance, transport mode, and healthcare expenditure between men and women (25,26,27). A study conducted in a rural community of West Bengal examined gender differences in healthcare-seeking behavior among children under five years old. Additionally, the expenditure per treated episode was significantly higher for boys, suggesting gender bias in healthcare access at an early age (28,29,30). Another study reassessed gender differences in the type and place of healthcare utilization in India. The study suggested that the increase in healthcare-seeking behavior among women could be attributed to improved female education and increased awareness among men regarding female empowerment (31,32,33). A study on gender differentials in inpatient healthcare services among older adults in India. Older women, particularly those facing financial strain and economic dependence, were more likely to experience negligence in accessing quality healthcare (34,35,36). While these studies provide valuable insights into gender disparities in healthcare access and mobility in different regions of India (37,38,39).

Research on gender disparities in healthcare access in Assam highlights that women often face significant challenges due to socio-economic and cultural factors (40,41,42). This inequity is further aggravated by economic constraints and societal norms that limit women's autonomy and mobility (43,44,45). Similarly, the article "Gender Disparity and Women Empowerment in Assam" highlights that despite progress in women's empowerment, significant gaps remain in healthcare access, where women's health needs are often marginalized (46,47,48). These challenges are rooted in socio-economic, cultural, and infrastructural factors that restrict their mobility and autonomy, leading to disparities in health outcomes (49).

2. Location of study area

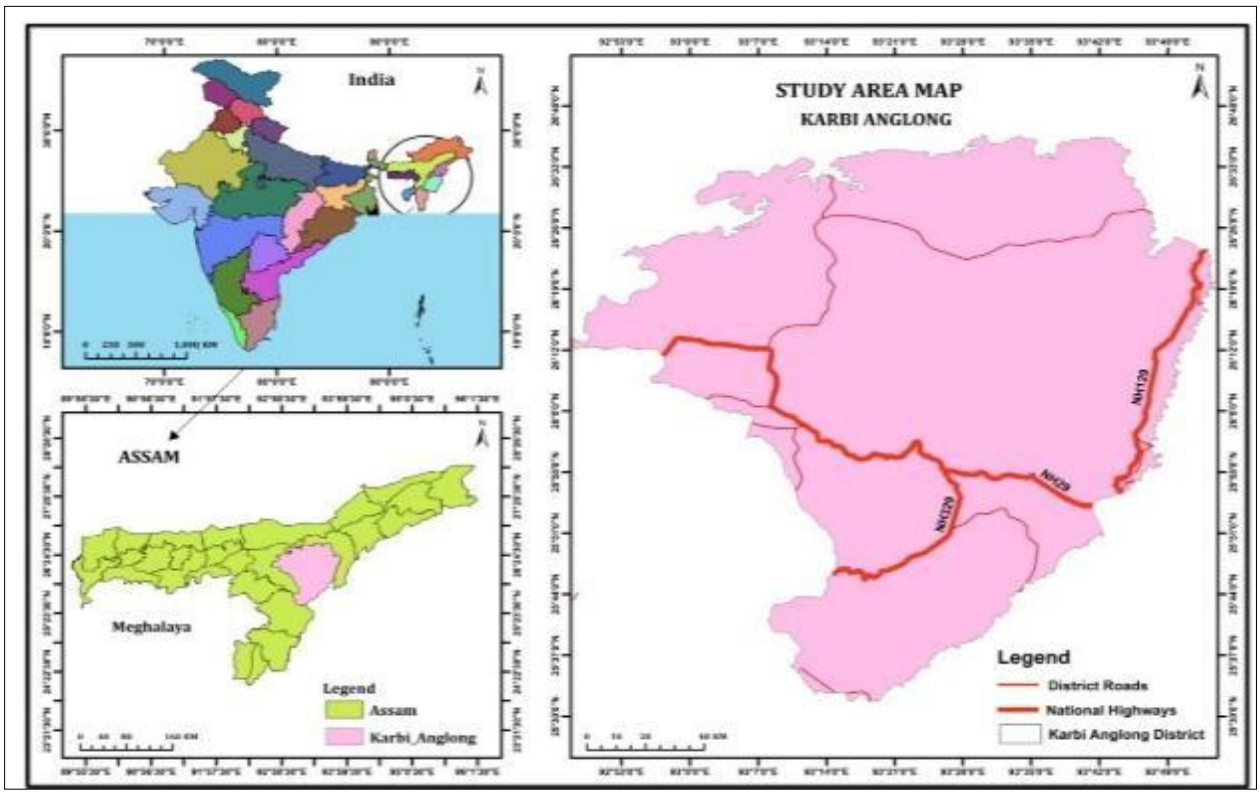

Figure 1 Location of Study Area

KarbiAnglong district is located in the central part of the Indian state of Assam. It is characterised by a hilly terrain and is the biggest district in Assam by area. (Fig 1). The district lies approximately between latitudes 25.33° N to 26.35° N and longitudes 92.00° E to 93.50° E.It is bordered by the Nagaon and Golaghat districts of Assam. It shares a boundary

with the DimaHasao district of Assam. The district is bordered by the state of Nagaland. It is bounded by the Morigaon district of Assam and Meghalaya state. KarbiAnglong is known for its rich biodiversity,andcultural heritage and as a home to the indigenous Karbi people. The district's unique geographical and cultural landscape makes it an important region in Assam.Travel distances by male and female patients across the three blocks of Lumbajong, Chowkihola, and Howraghat reveals notable variations in accessibility to healthcare facilities. (Fig 2).

Objectives

- To identify the spatial distribution of healthcare centers.
- To analyze the gender-wise travel and movement patterns of patients.

3. Methodology

3.1. Primary Data Collection

Primary data were gathered through a structured questionnaire survey conducted in seven major Primary Health Centers (PHCs) of the study area. The PHCs were selected based on stratified random sampling, considering the total number of patients categorized by age and sex. A total of 140 samples were drawn, with 20 samples uniformly collected from each PHC, ensuring a balanced representation across the spatial distribution of patients within the selected healthcare centers. The questionnaire captured key information on travel distances, satisfaction levels, demographic characteristics, and accessibility challenges.

3.2. Secondary Data Collection

Secondary data sources included health and demographic statistics obtained from the respective health statistical offices in Karbi Anglong. These data provided insights into patient distribution, healthcare infrastructure, and demographic trends, complementing the primary data analysis.

3.3. Data Analysis Techniques

The collected data were analyzed using both graphical and statistical methods

GIS Techniques

- Overlay Analysis: Used to map and visualize the spatial distribution of healthcare accessibility and travel distances.
- Buffer Analysis: Employed to assess the reach and catchment areas of the PHCs and identify potential gaps in accessibility.
- Statistical Techniques
- Descriptive Statistics: Used to summarize key demographic and travel characteristics.
- Comparative Analysis: Examined gender-wise disparities in travel distances and PHC utilization.
- Regression Analysis: Investigated relationships between demographic factors and healthcare access.

This methodology provided a comprehensive approach to understanding healthcare access and satisfaction levels in Karbi Anglong, facilitating targeted recommendations for improving healthcare equity.

4. Results and discussion

4.1. Spatial Distribution of Healthcare Centers

The spatial distribution of Primary Health Centers (PHCs) in KarbiAnglong district reveals a pattern where healthcare facilities are predominantly located in peripheral areas (Fig 2). This distribution is influenced by the central region's high elevation, which poses construction challenges. The placement of PHCs in flatter peripheral areas ensures improved accessibility for patients and facilitates infrastructure development, such as road networks. (50,51.52). However, this spatial arrangement also necessitates longer travel distances for populations residing in central and remote regions, highlighting potential accessibility concerns.

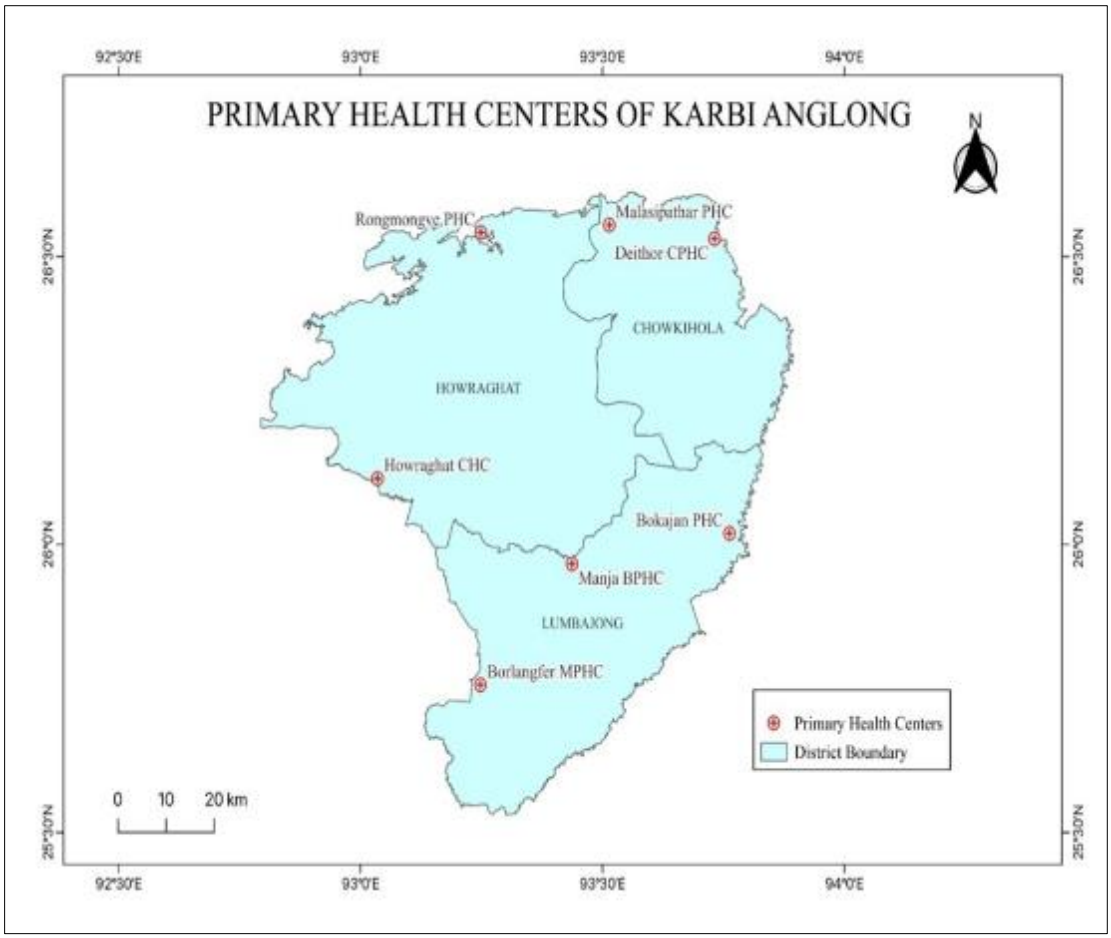

Figure 2 Location of PHC in Karbianlong

4.2. Gender-wise Travel and Movement Patterns of Patients

The analysis of gender-specific travel patterns across the three blocks—Lumbajong, Chowkihola, and Howraghat—indicates distinct disparities in healthcare accessibility (Table 1).

Lumbajong Block: Male patients in Manja PHC recorded the highest travel distance of 73.25 km (Fig 3). While male patients generally travel longer distances, the percentage of female travel distance is also significant, indicating a shared healthcare burden.Chowkihola Block: In Malasipathar and Dehori PHCs, male patients exhibited higher travel distances, with Dehori PHC showing the highest female travel distance percentage (22.25%) and male travel percentage (19.16%).Howraghat Block: Rongmongve PHC recorded the lowest female travel distance percentage among all PHCs, emphasizing accessibility challenges faced by female patients (Fig 4). The findings suggest that male patients tend to travel longer distances due to mobility advantages, while female patients may face mobility constraints due to socio-cultural factors. This disparity underscores the need for gender-sensitive interventions to enhance healthcare accessibility.

Table 1 Sex-wise Average travel distance

Sl. No.	Block Name	Name of PHC	Male				Female			
			Number of Males	*Distance (in Km)*	*Distance in %*	*Average distance*	*Number of females*	*Distance (in Km)*	*Average distance*	*Distance in %*
1	Lumbajong	Manja	7	73.25	17.74	10.46	13	44.94	3.46	18.94
		Bokajan	8	45.75	11.08	5.72	12	23.41	1.95	9.87
		Borlangfer	11	65.05	15.76	5.91	9	22.44	2.49	9.46
2	Chowkihola	Dehori	10	79.09	19.16	7.91	10	52.80	5.28	22.25
		Malasipathar	12	54.64	13.23	4.55	8	30.77	3.85	12.97
3	Howraghat	Rongmongve	11	34.47	8.35	3.13	9	18.30	2.03	7.71
		Howraghat	11	60.63	14.68	5.51	9	44.61	4.96	18.80
Total			70	412.88	100.00	43.20	100.00	237.27	24.02	100.00
					>67.34		**>67.34**			**>59.99**
Mean				**58.98**	**<32.66**		**<32.66**	**33.90**		**<40.01**

4.3. Gender wise Travel Pattern: Buffer and Overlay Analysis

To assess accessibility levels, three buffer zones were established for each PHC: First buffer zone (within 1 km): Highly accessible, with maximum patient utilization.Second buffer zone (average travel distance): Moderate accessibility, reflecting increased travel burden. Third buffer zone (beyond 2 km): Low accessibility, predominantly traversed by male patients due to mobility constraints faced by females (Fig 5).

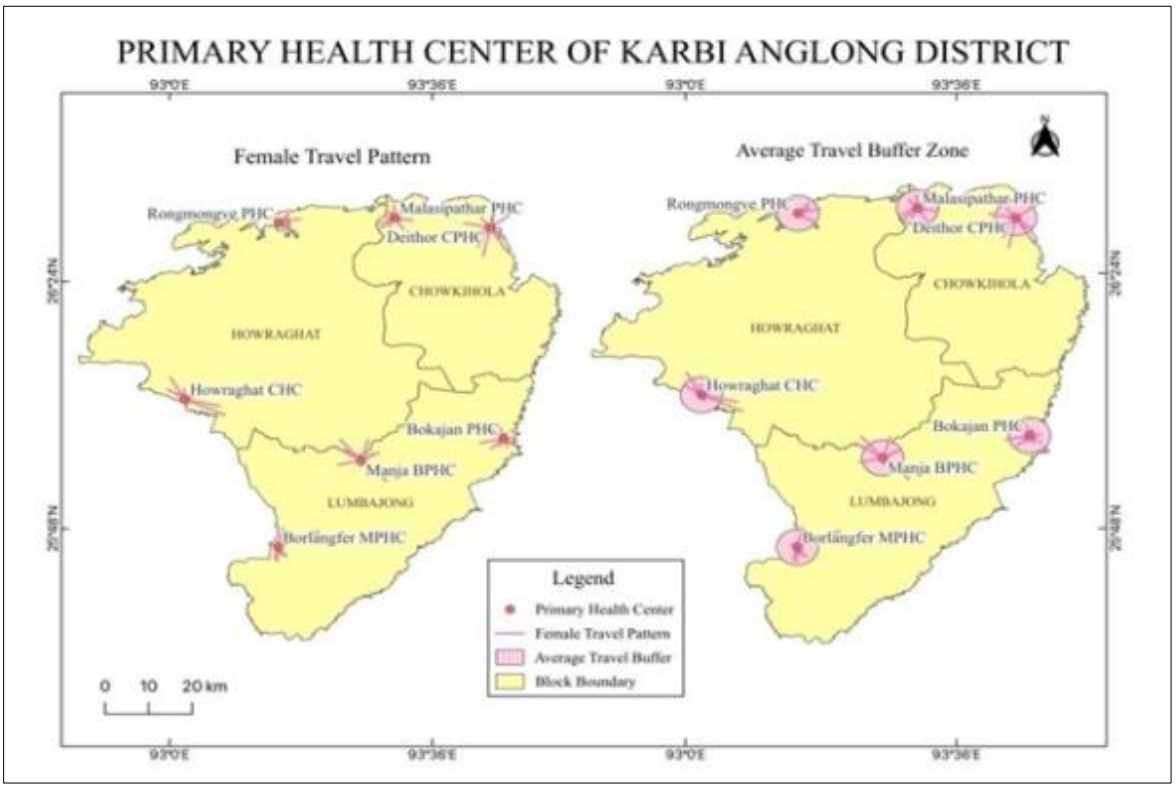

Figure 3 Female travel pattern

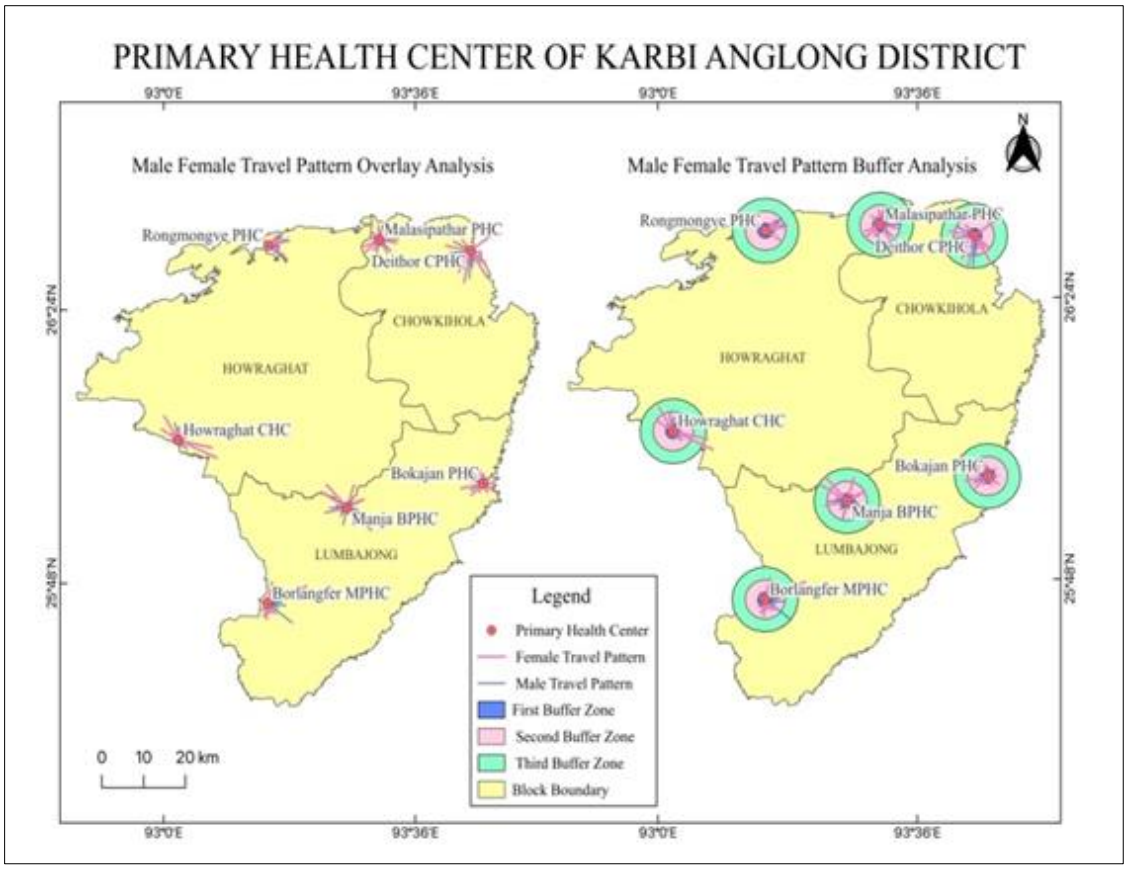

Figure 4 MaleTravel Patter

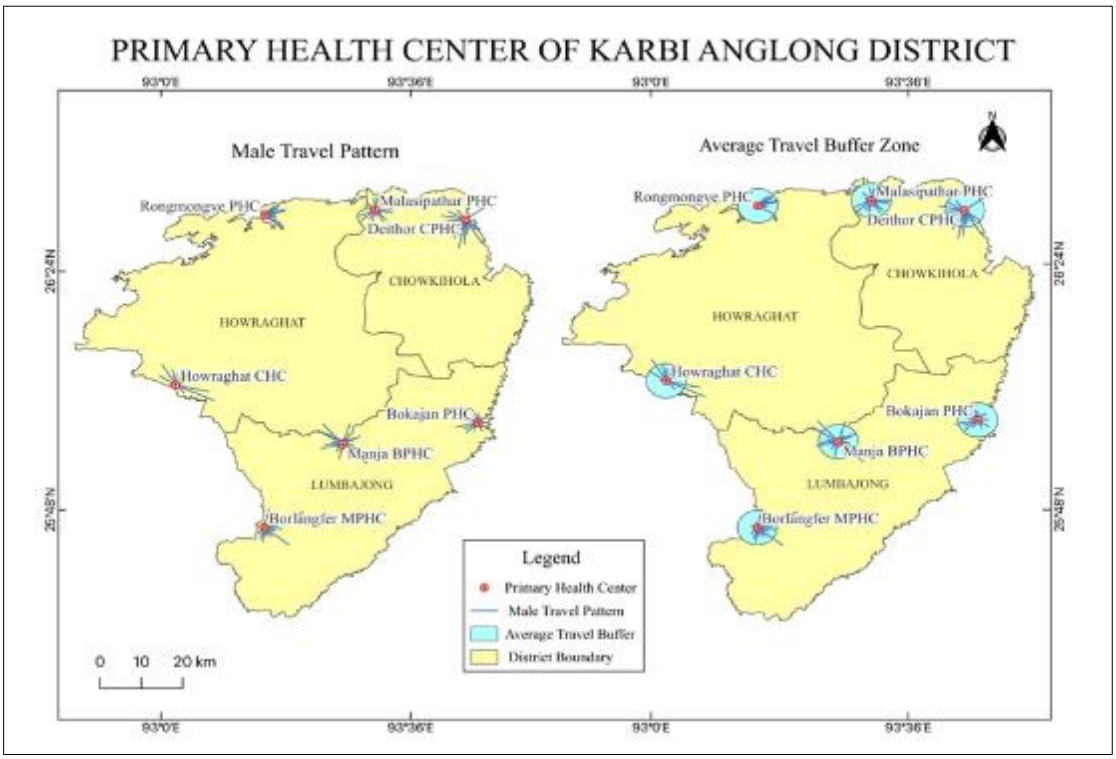

Figure 5 Male and Female Travel Patterns (Overlay and Buffer analysis)

Overlay analysis of travel patterns within these zones highlights gaps in healthcare access, particularly in remote regions where patients are required to travel extensively to reach the nearest PHC.

4.4. Utilization of PHCs in KarbiAnglong District

Satisfaction levels among patients varied across PHCs, with urban centers exhibiting higher satisfaction compared to rural areas: Lumbajong Block: Manja PHC recorded the highest satisfaction (90%), followed by Bokajan (80%) and Borlangfer (70%).Chowkihola Block: Dehori PHC had the highest satisfaction (80%), followed by Malasipathar (70%). Howraghat Block: Howraghat PHC had the highest satisfaction, with 70% of patients satisfied in Rongmongve PHC (Table 2). The lower satisfaction levels in rural areas indicate the need for infrastructure improvements and better service delivery to ensure equitable healthcare access. (53,54).

Table 2 Satisfaction Level of Patients from each PHC in KarbiAnglong

Name of Block	Name of PHC	Satisfaction Level (%)
Chowkihola	Malasipathar	70
	Dehori	80
Lumbajong	Manja	90
	Bokajan	80
	Borlangfer	70
Howraghat	Rongmongve	70
	Howraghat	80

4.5. Mode of Transportation and Infrastructure Considerations

The predominant modes of transportation varied across blocks:Lumbajong Block: 3-wheelers (33%), 4-wheelers (32%), 2-wheelers (27%), walking (8%).Chowkihola Block: 4-wheelers (43%), 3-wheelers (25%), 2-wheelers (22%), walking (10%).Howraghat Block: 3-wheelers (42%), 2-wheelers (32%), 4-wheelers (23%), walking (3%).Public transportation remains the primary mode across all blocks, highlighting its critical role in ensuring healthcare The placement of PHCs in peripheral locations necessitates enhanced public transport connectivity to minimize travel burdens for patients (55,56) (Table 3).

Table 3 Mode of Travel and Use of Private and Public Vehicle Each PHC

Name of Block	**Chowkihola Block**	**Lumbajong Block**	**Howraghat Block**
Mode of Transport	***No. of Patients***	***No. of Patients***	***No. of Patients***
2-wheeler	9	16	6
3-wheeler	10	20	17
4-wheeler	17	19	9
Walking	4	5	1
Use of Vehicle	***No. of Patients***	***No. of Patients***	***No. of Patients***
Private	27	36	22
Public	13	24	18

- Geographical Accessibility: The positioning of PHCs in peripheral areas optimizes accessibility for a majority but leaves central-region populations underserved. Future planning should consider additional mobile healthcare units or satellite clinics for remote areas.
- Gender Disparities in Travel: The notable differences in male and female travel patterns underscore the need for gender-sensitive healthcare policies. Targeted interventions, such as female-centric transportation subsidies and community-based health programs, can bridge this gap.

- Satisfaction and Service Quality: Rural PHCs exhibit lower satisfaction rates compared to urban centers. Investments in healthcare infrastructure, staffing, and medical supplies can significantly enhance service delivery in these areas.
- Public Transportation Enhancement: Strengthening public transport networks, particularly in rural regions, would improve accessibility and reduce patient travel burdens.

5. Conclusion

This study provides a comprehensive understanding of healthcare access disparities in KarbiAnglong district by analyzing spatial distribution, travel patterns, and satisfaction levels. The findings highlight the importance of integrating spatial planning, gender considerations, and infrastructure improvements to ensure equitable healthcare access. Future research could incorporate population density metrics and patient flow analysis to refine healthcare resource allocation strategies.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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