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Original Research Article

Exploring healthcare providers' perspectives on type 1 diabetes management in rural and resource-limited settings

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ABSTRACT

Background: Type 1 diabetes mellitus (T1D) is a chronic autoimmune condition requiring lifelong insulin therapy and comprehensive care. In India, especially in rural and resource-limited settings, challenges in availability of insulin, provider training, patient education, and psychosocial support persist. Most studies emphasize patient experiences; however, healthcare providers' perspectives remain underexplored.
Methods: A mixed-methods cross-sectional study was conducted among 82 healthcare providers, including endocrinologists, nurses, diabetes educators, and primary care physicians. Data were collected using structured questionnaires (quantitative) and semi-structured interviews/focus group discussions (qualitative). Quantitative data were analyzed using descriptive statistics, while qualitative transcripts underwent thematic analysis. Findings were integrated through convergent analysis.
Results: Among participants, 85% identified irregular insulin supply and affordability as major barriers, while 78% reported low patient awareness and literacy. Insufficient provider training (70%) and lack of systematic follow-up (65%) were also highlighted. Only 30% reported regular interdisciplinary coordination, and just 20% addressed psychosocial issues during consultations. Qualitative themes reinforced these findings, highlighting four domains: (1) systemic care barriers (supply shortages, workload, inadequate infrastructure), (2) patient engagement challenges (low literacy, stigma, myths), (3) limited team-based care (poor referrals, lack of formal coordination), and (4) neglected psychosocial support (absence of counseling, unmet family needs).
Conclusions: Providers face significant systemic, educational, and psychosocial challenges in managing T1D in rural India. Strengthening provider training, ensuring insulin availability, enhancing patient education, establishing multidisciplinary networks, and integrating psychosocial services are critical to improve outcomes.

Keywords: Type 1 diabetes, Healthcare providers, Rural health, Psychosocial support, Interdisciplinary care

INTRODUCTION

Type 1 diabetes mellitus (T1D) is a chronic autoimmune disease characterized by pancreatic β-cell destruction leading to lifelong insulin dependence. Globally, over 1.85 million individuals under the age of 20 years live with T1D, and incidence continues to rise by nearly 3% annually.[1,2] International diabetes federation (IDF) reports that approximately 513,000 new cases diagnosed in year 2025 worldwide, posing urgent public health challenge.[3]

India contributes substantially to the global burden of T1D. Current estimates suggest that nearly 940,840 individuals in India live with T1D, making it one of the countries with the largest number of affected youth.[3] Despite this, national health programs remain primarily oriented towards T2D, often overlooking the unique needs of individuals with T1D.[4,5] The rising burden of T1D among Indian children and adolescents necessitates timely diagnosis, uninterrupted insulin access, structured patient education, and continuous psychosocial support.[6,7]

Rural areas face disproportionate challenges in diabetes care delivery. Studies show that only about 45% of rural patients with diabetes in India have access to adequate care, compared to 68% in urban areas.[8] Furthermore, awareness levels in rural populations remain alarmingly low, with only 36.8% reporting knowledge of diabetes, compared to 58.4% in urban populations.[9] The lack of structured education, inadequate diagnostic facilities, stockouts of essential medicines, and scarcity of trained specialists exacerbate these disparities.[10,11]

Healthcare providers play a critical role in bridging these gaps. They are often the first point of contact for patients and families in resource-limited settings, yet they themselves face constraints including insufficient training, overwhelming workloads, and limited referral pathways.[12] A national situational analysis highlighted systemic obstacles such as overcrowded outpatient services, poorly integrated follow-up systems, and underutilization of diabetes educators.[13] Additionally, psychosocial aspects of T1D management-such as coping with stigma, treatment fatigue, and family stress are frequently neglected due to the absence of mental health professionals in rural care frameworks.[14,15]

Existing literature emphasizes the importance of patient-centered, multidisciplinary models that combine medical, educational, and psychosocial components of diabetes care.[16,17] However, there is little empirical research that captures healthcare providers' perspectives on managing T1D in rural Indian settings, where barriers are unique and multifactorial. Understanding these perspectives is essential to design locally relevant, sustainable interventions.

Therefore, this study aimed to explore healthcare providers' perspectives on the barriers and facilitators of T1D management in rural Vijayapura District, Karnataka, using a mixed-methods approach. Specifically, it examined care delivery challenges, patient engagement practices, interdisciplinary coordination, and gaps in psychosocial support.

METHODS

Study design

We adopted a convergent mixed-methods design combining quantitative and qualitative approaches. The quantitative component comprised a structured questionnaire administered to healthcare providers to quantify perceived barriers in T1D care. The qualitative component included semi-structured interviews and focus group discussions (FGDs) to explore perceptions in greater depth. Both datasets were collected concurrently and integrated during analysis to generate a comprehensive understanding of provider perspectives.[18,19]

A schematic diagram of the study design is provided in Figure 1.

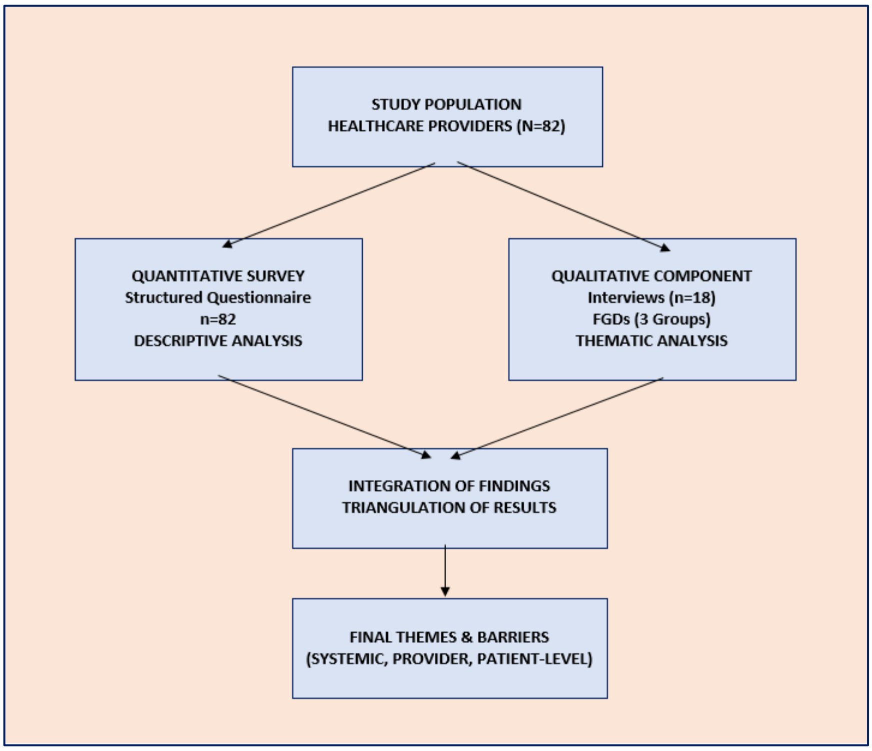

Figure 1: Flow diagram of study design.

Study setting

The study was conducted in Vijayapura District, Karnataka, a predominantly rural district in southern India with limited health infrastructure. Data were collected from government primary health centres (PHCs), community health centres (CHCs), private clinics and the district hospital. The study was done for a total duration of six months, from March 2025 to August 2025.

Study population and sampling

Healthcare providers involved in diabetes management formed the study population. A total of 82 healthcare providers were recruited, including endocrinologists, staff nurses, diabetes educators and primary care physicians.

Inclusion criteria

Healthcare providers currently practicing in Vijayapura District and at least one year of experience in managing patients with T1D were included.

Exclusion criteria

Providers unwilling to provide informed consent and interns and trainees without independent clinical responsibilities were excluded.

Participants were identified from institutional rosters, professional networks, and snowball sampling to ensure diverse representation across care levels.

Data collection

Quantitative survey

A structured questionnaire was developed after literature review and expert consultation.[20,21] It included sections on provider demographics, training, perceived barriers in T1D care (insulin access, patient literacy, provider training, follow-up systems), patient engagement, interdisciplinary coordination, and psychosocial support. Items measured using Likert scales (e.g., strongly agree-strongly disagree) and yes/no responses. Tool was pilot-tested among 5 providers for clarity before administration.

Qualitative interviews and FGDs

A semi-structured interview guide explored themes including: Barriers to diagnosis and treatment, patient education and adherence challenges, interdisciplinary coordination and referrals and psychosocial support for patients and families.

In-depth interviews (IDIs): Conducted with 18 participants (~45 minutes each).

FGDs: 3 sessions with 4-6 participants each (~60-90 min). Interviews were conducted in English or Kannada, audio-recorded, transcribed verbatim, and translated into English where required.

Ethical considerations

This study was approved by the institutional review board [BLDE (DU)/IEC/1155/2024-25] by BLDE (DU) Shri B. M. Patil medical college, hospital and research centre, Vijayapura, Karnataka. Written informed consent was obtained from all participants. Anonymity and confidentiality were maintained throughout.

Data analysis

Quantitative analysis

Data were entered in SPSS v26. Descriptive statistics (frequency, percentages, means) summarized provider characteristics and responses.

Qualitative analysis

Thematic analysis followed Braun and Clarke's six-step framework.[22] Two researchers independently coded transcripts, generated themes and resolved discrepancies through discussion. Themes were triangulated with quantitative findings.

RESULTS

Participant characteristics

Of the 82 providers, 20 were endocrinologists, 15 diabetes educators (Graduation in public health, nutrition, pharmacology, occupational and physiotherapy), 30 staff nurses, and 17 primary care physicians (Table 1).

Table 1: Characteristics of healthcare providers, (n=82).

Characteristics		N (%)
Profession	Endocrinologists	20 (24.4)
	Diabetes educators	15 (18.3)
	Staff nurses	30 (36.6)
	Primary care physicians	17 (20.7)
Gender	Male	48 (58.5)
	Female	34 (41.5)
Years in practice	<5	22 (26.8)
	5-10	35 (42.7)
	>10	25 (30.5)

Quantitative findings

Reported barriers in T1D management

A majority of providers (n=82) reported systemic challenges to effective T1D care (Table 2).

Table 2: Reported barriers to T1D management, (n=82).

Barriers	Reporting agrees/ strongly agree, N (%)
Irregular insulin supply and affordability	70 (85.4)
Low patient awareness and literacy	64 (78.0)
Inadequate provider training in T1D care	57 (69.5)
Lack of systematic follow-up of patients	53 (64.6)
Insufficient laboratory facilities (HbA1c, etc.)	50 (61.0)
Poor interdisciplinary co-ordination	58 (70.7)
Limited psychosocial support for patients/families	66 (80.5)

Patient engagement practices

Only 28% of providers reported that they routinely spend >15 minutes per patient on diabetes education. The 40% reported using structured educational materials (pamphlets, charts). 62% believed myths and stigma (e.g., “insulin addiction”, “dietary taboos”) were major causes of poor adherence.

Interdisciplinary coordination

Only 25 (30.5%) reported regular collaboration with other professionals (e.g., team meetings or shared care plans). 40% reported occasional referrals to dietitians or psychologists, largely dependent on patient request.

Psychosocial support

Only 20% reported routinely screening patients for psychological distress. 15% reported that counseling services were available at their facility.

Nearly 80% agreed that psychosocial support was “critically needed but underprovided.”

Qualitative findings

Thematic analysis of 18 in-depth interviews and 3 FGDs yielded four overarching themes (Figure 2).

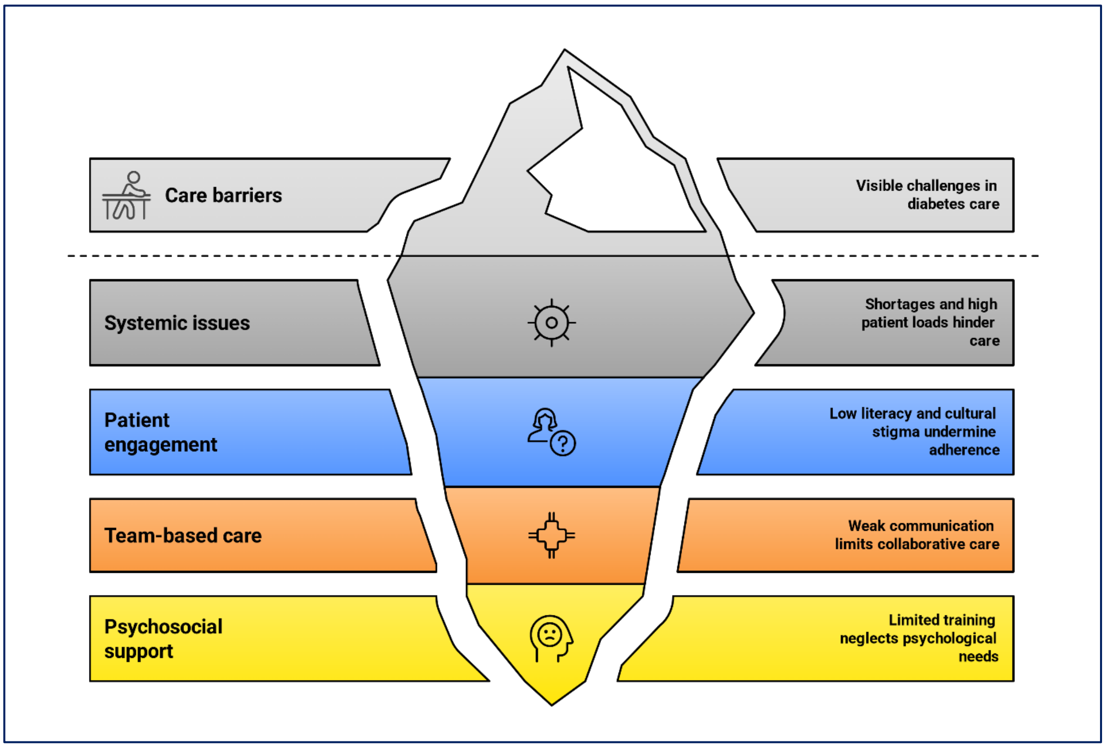

Figure 2: Barriers to T1D management in rural settings.

Theme 1. Systemic care barriers

Providers highlighted shortages of insulin, glucometers, and diagnostic facilities. Many cited high patient loads and lack of structured follow-up systems. “*We often run out of insulin stock at the PHC; families must buy from private pharmacies, which they cannot afford.*”

Theme 2. Patient engagement challenges

Low health literacy, misconceptions, and cultural stigma were recurring barriers. Providers noted that adherence was often undermined by myths about insulin or dietary restrictions. “*Patients often believe insulin is addictive or a sign of worsening disease, so they avoid it.*”

Theme 3. Limited team-based care

Respondents described weak referral linkages and poor communication between providers. "*If I refer to a specialist in the city, I rarely get feedback on the patient's progress*." Nurses and educators expressed willingness to collaborate more, but noted no formal mechanisms.

Theme 4. Neglected psychosocial support

Providers admitted limited training in addressing psychological needs. Many reported family stress and patient depression as visible but "silent" issues. "*We see young people frustrated with daily injections, but we don't have a counsellor to help them cope*."

DISCUSSION

This mixed-method study provides valuable insights into the perspectives of healthcare providers on managing T1D in rural and resource-limited settings of Vijayapura District, Karnataka. The findings reveal substantial systemic, educational and psychosocial barriers that hinder optimal diabetes care delivery.

Systemic barriers

The majority of providers (85%) identified irregular insulin supply and affordability as major barriers. This aligns with previous research by Basu et al and Bhatia et al documenting inconsistent insulin availability in rural India and high out-of-pocket expenditure that compromises adherence.[23,24]

Inadequate laboratory facilities and weak follow-up systems were also highlighted, echoing studies that describe poor infrastructure and weak continuity of care in rural health facilities.[25,26] Similar concerns have been raised in LMICs, where supply-chain interruptions and lack of structured diabetes program undermine management.[27]

Patient engagement challenges

In our study, providers emphasized that low literacy, myths, and stigma hinder patient adherence. Nearly 78% reported poor patient knowledge as a barrier, consistent with national surveys ICMR-INDIAB study by Deepa et al, where rural populations reported significantly lower awareness of diabetes compared to the urban counterparts.[28]

Qualitative accounts in our study underscored that insulin is often perceived as a sign of disease progression or "addiction," findings supported by the DAWN (Diabetes attitudes, wishes and needs) study, which showed widespread patient resistance to insulin initiation.[29] This indicates the urgent need for culturally tailored patient education strategies, as emphasized in earlier community-based interventions by Ali et al.[30]

Limited interdisciplinary coordination

Only 30% of providers reported regular collaboration with other professionals. In the qualitative narratives, providers described weak referral linkages and lack of communication channels between PHCs, specialists, and educators. This mirrors studies from rural India and sub-Saharan Africa, where diabetes care is fragmented and primarily physician-centered, with minimal team-based involvement.[31,32]

Effective interdisciplinary care incorporating dietitians, diabetes educators, and mental health professionals has been shown to improve glycemic outcomes and patient satisfaction, yet remains underutilized in rural Indian settings.[33]

Psychosocial support gaps

Perhaps the most concerning finding was the neglect of psychosocial support. Only 20% screened patients for psychological distress, and just 15% reported access to counselling. This is in stark contrast to international guidelines (e.g., ISPAD, ADA) which emphasize psychosocial care as an integral component of T1D management.[34,35] Indian studies by Ghosh et al similarly highlight depression, anxiety, and family burden as common among youth with T1D, but rarely addressed in routine practice.[36] Our findings suggest that while providers are aware of these issues, lack of training and resources limit their ability to respond.

Comparison with previous studies

Our findings are consistent with previous Indian studies that identified insulin stockouts, patient stigma, and provider hesitancy as key barriers.[37] A situational analysis by Joshi et al, on rural diabetes care also documented inadequate referral systems and low utilization of diabetes educators.[38]

Similar to our findings, a qualitative study in South India by Sudha et al reported that healthcare providers struggle to balance heavy workloads with patient education, often resulting in inadequate counselling.[39]

Internationally, rural healthcare systems in countries like Nigeria and Kenya face comparable challenges like poor drug supply, low community awareness and lack of specialist availability.[40,41]

However, pilot programs integrating diabetes educators and community health workers into care teams, demonstrated improved adherence and patient empowerment, underscoring the potential for such models in the Indian context.[42]

Findings from this study can be synthesized into a multilevel framework (Figure 3).

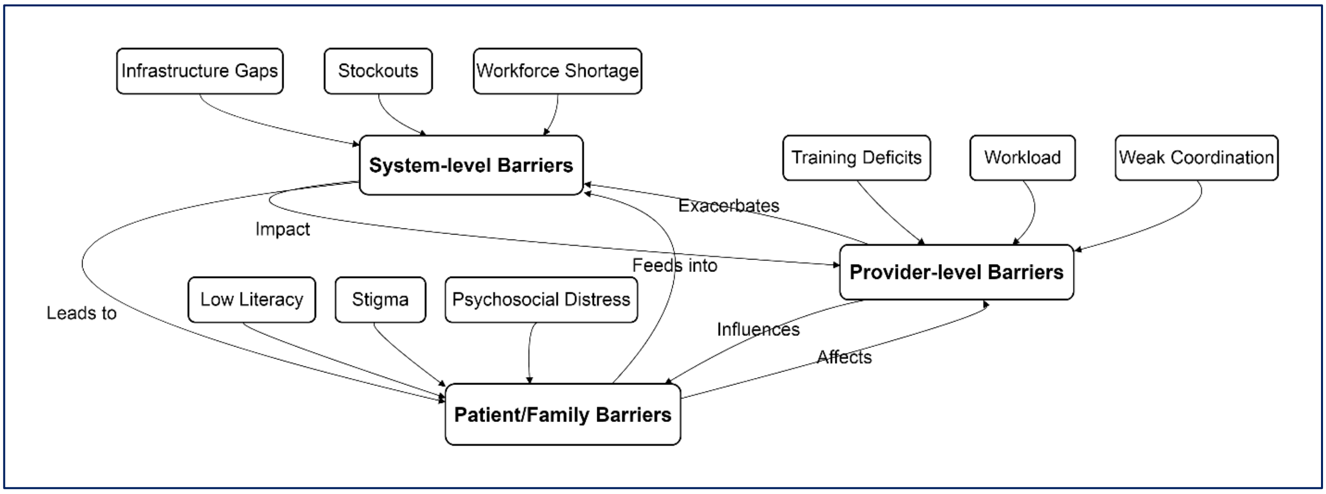

Figure 3: Multilevel barriers to T1D care in rural India.

Strengths and limitations

First mixed-methods study in this region capturing both quantitative and qualitative provider perspectives. Inclusion of diverse cadres (endocrinologists, staff nurses, diabetes educators, PCPs) ensured a holistic understanding.

Study was conducted in a single district; generalizability to other rural settings may be limited. Self-reported data may be influenced by social desirability bias. Patient perspectives were not included, though complementary to provider insights.

Implications for practice and policy

Our study underscores the urgent need for strengthening supply chains to ensure uninterrupted insulin and diagnostic resources. Provider training programs on patient-centered communication and psychosocial support. Multidisciplinary care models, integrating educators, dietitians, and counsellors into rural diabetes teams. Community-based education campaigns to dispel myths and reduce stigma. Policy alignment to explicitly include T1D in rural health strategies, beyond the current focus on type 2 diabetes.

CONCLUSION

This mixed-methods study highlights critical systemic, educational, and psychosocial barriers perceived by healthcare providers in the management of T1D in rural Vijayapura District, Karnataka. Providers identified irregular insulin supply, inadequate infrastructure, limited training, poor interdisciplinary coordination, and neglected psychosocial support as major challenges. Despite their awareness of patient-level barriers such as stigma and low literacy, providers reported insufficient time and resources to address these comprehensively.

To improve outcomes, there is a pressing need to strengthen health systems through consistent insulin supply, training for rural providers, structured referral networks and integration of psychosocial services into diabetes care. Policy initiatives must explicitly include T1D in rural health frameworks, with emphasis on community-based education and multidisciplinary team approaches. Addressing these challenges will be pivotal in advancing equitable diabetes care in India’s underserved populations.

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Ethical approval: The study was approved by the Institutional Ethics Committee REF: BLDE (DU)/IEC/1155/2024-25

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