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Awareness and Importance of Periodic Glucose Monitoring in Diabetes Management Among Low-Income Diabetic Population in Semi-Urban Bangalore

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Abstract

Diabetes is a growing public health crisis in India, with semi urban low income population and underprivileged populations facing the greatest challenges in disease awareness, diagnosis, and management. In the semi urban Bangalore region and its adjacent areas, limited access to health infrastructure, lack of education, and financial constraints severely hinder effective monitoring and control of blood glucose levels. This paper highlights the urgent need to educate semi urban communities on diabetes, emphasizing the importance of daily blood glucose testing and lifestyle modification. It also examines the role of affordable and subsidized home glucose monitoring tools—particularly glucometers and glucose strips—in empowering individuals to manage their health proactively. By bridging the gap between awareness and access, these interventions can significantly reduce the long-term burden of diabetes and its complications. The study recommends community-based health education programs, public-private partnerships, and government subsidies as strategic solutions to address this critical healthcare gap in semi urban low-income areas of Bangalore.

Introduction

Diabetes mellitus, particularly Type 2 diabetes, has emerged as a silent epidemic in India, affecting most low-income semi urbans and rural regions alike. However, rural communities, such as those in the Bangalore outskirts, often remain underserved in terms of health education, screening facilities, and consistent medical guidance. These populations frequently encounter barriers such as low health literacy, economic hardship, and limited access to diagnostic services. As a result, early detection and daily self-monitoring of blood glucose—a vital aspect of diabetes management—are often neglected. This lack of awareness and testing not only delays diagnosis but also increases the risk of severe complications. Addressing this issue requires targeted interventions that combine education with affordability. This paper explores the significance of diabetes education in semi urban low-income areas within Bangalore and its adjacent areas, emphasizing the critical role of subsidized home glucose monitoring systems in promoting proactive health management among the marginalized. Such efforts are essential to reduce disease burden and improve long-term community health outcomes.

Keywords

Diabetes Awareness, semi urban Bangalore, Blood Glucose Monitoring, Health Education, Subsidized Glucometers

Objectives of the Study

1. To assess the level of awareness and understanding of diabetes among underprivileged populations in the semi urban low-income areas of Bangalore and its adjacent areas.
2. To identify the barriers faced by semi urban communities in accessing and using blood glucose monitoring tools.
3. To evaluate the willingness of individuals to adopt subsidized home-based glucose monitoring solutions.

4. To recommend targeted strategies for improving diabetes education and self-monitoring practices through affordable healthcare interventions.

Literature Review

1. Diabetes in India: A Growing Rural Concern

India is home to over 100 million people with diabetes, with numbers projected to rise dramatically over the coming decades (International Diabetes Federation, 2023). While urban areas have seen increased diagnostic and treatment facilities, rural populations are disproportionately affected due to poor awareness, limited access to healthcare, and lack of preventive screening (Mohan et al., 2019). A study by Anjana et al. (2011) revealed that nearly 60% of people with diabetes in rural India are unaware of their condition until complications arise.

2. Health Education and Lifestyle Awareness

Health education has proven effective in increasing awareness and promoting early intervention. Peer-reviewed studies highlight that community-based education programs lead to better self-care, medication adherence, and glycemic control (Shrivastava et al., 2013). However, rural populations often lack targeted diabetes education campaigns, leading to continued reliance on traditional or incomplete knowledge systems.

3. Importance of Self-Monitoring of Blood Glucose (SMBG)

Self-monitoring is a cornerstone of effective diabetes management. It empowers individuals to track their condition, make informed dietary decisions, and avoid emergency complications (American Diabetes Association, 2022). Yet, the cost of glucometers and testing strips is a significant barrier in rural regions (Kumar et al., 2020). Studies indicate that subsidizing these tools can improve testing frequency and long-term glycemic control, especially among low-income groups.

4. Barriers in Rural Bangalore

Rural Bangalore, despite being adjacent to a major metropolitan hub, continues to struggle with health disparities. Research shows that health infrastructure in villages around Bangalore is often overburdened or inaccessible (Narasimhan et al., 2018). Moreover, stigmas, myths, and fatalistic attitudes toward chronic illness further reduce the likelihood of regular testing or early diagnosis.

5. Government and NGO Initiatives

India has initiated programs like the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS), which aims to address NCDs in rural populations. While these efforts have laid the groundwork, there is limited integration of subsidized glucose testing or consistent health education outreach at the grassroots level. Partnerships between NGOs, healthcare companies, and local governments have shown promise in other regions (e.g., Tamil Nadu, Maharashtra) and can serve as models for Bangalore's rural zones.

6. Technology and Mobile Health (mHealth)

Mobile-based health education and telemedicine are emerging as powerful tools for rural diabetes management. According to a 2021 study by Gopichandran et al., SMS-based reminders and glucose monitoring apps significantly improved patient adherence to testing and medication schedules in rural areas. However, digital literacy remains a concern, necessitating hybrid models of intervention that combine personal health workers with digital tools.

Research Methodology

1. Research Design

This study adopts a **qualitative-descriptive research design** to explore the awareness, practices, and challenges related to diabetes education and blood glucose monitoring among underprivileged populations in semi urban low-income areas within Bangalore and its adjacent areas. The research also includes a **limited quantitative component** to gather supporting data through structured surveys and interviews.

2. Study Area

The research is focused on semi urban low-income area within Bangalore and few adjacent areas. These regions were chosen due to their proximity to urban centres yet significant healthcare access disparities.

3. Population and Sampling

The target population comprises **adults aged 30 and above**, both diagnosed and undiagnosed with diabetes. The sample also includes **community health workers**, **primary care doctors**, and **local NGO representatives** involved in diabetes-related outreach. A **purposive sampling** technique was used to select 50 individuals and 10 key informants based on availability and relevance to the study.

4. Data Collection Methods

- **Interviews**: Semi-structured interviews were conducted with individuals to explore their knowledge about diabetes, testing practices, affordability of glucometers, and attitudes toward health education.
- **Surveys**: A simple questionnaire was administered to assess daily lifestyle habits, access to healthcare, and frequency of blood glucose testing.
- **Observations**: Field visits were made to assess local healthcare infrastructure, availability of subsidized test kits, and the functioning of primary health centers.
- **Secondary Sources**: Government health reports, NGO publications, and academic articles were reviewed to support primary data findings.

Data Analysis

Data collected through surveys and interviews were analyzed using **descriptive statistics and thematic analysis**. Both **primary** and **secondary data** were used to identify awareness levels, testing practices, and barriers in diabetes management in semi urban low-income areas of Bangalore.

1. Primary Data Analysis

Among the 50 surveyed participants, a significant portion demonstrated low awareness and limited access to diabetes-related healthcare. Only **22%** knew diabetes is a chronic, lifestyle-linked disease. Even fewer understood the importance of regular blood glucose monitoring. Just **10%** had ever used a glucometer, while **86%** expressed a willingness to use one if provided at a subsidized rate.

Table 1: Awareness and Testing Practices among Participants (n = 50)

Variable	Yes (%)	No (%)
Aware of diabetes as a chronic disease	22%	78%
Aware of the need for regular blood sugar tests	18%	82%

Ever used a glucometer at home	10%	90%
Willing to use subsidized glucometer	86%	14%

When asked about barriers to glucose testing and disease management, most participants cited **cost** and **lack of knowledge**. About **76%** found glucometers or test strips unaffordable, and **70%** did not know how to use them. Many also mentioned lack of local healthcare guidance.

Table 2: Perceived Barriers to Diabetes Monitoring (Multiple Responses Allowed)

Barrier	Number of Responses	Percentage of Participants (%)
High cost of glucometer/test strips	38	76%
Lack of knowledge	35	70%
No access to health professional	31	62%
Fear or stigma of disease	18	36%

2. Secondary Data Interpretation

Government reports (ICMR, NPCDCS) indicate that over **40%** of rural diabetic patients remain undiagnosed. Health camps are irregular, and most Primary Health Centres (PHCs) lack glucometers. NGO reports from the Bangalore district confirm that most low-income families cannot afford testing kits, resulting in delayed diagnosis and poor disease control.

3. Integration of Findings

The primary data findings align closely with secondary data trends. The evidence points to a critical **awareness-access-affordability gap**. While communities show willingness to learn and adopt testing practices, they lack the tools, training, and trust in the health system. This justifies the urgent need for **subsidized glucometers**, regular **health education campaigns**, and **localized interventions** tailored to semi urban low-income areas of Bangalore.

Findings and Discussion

The study's findings present a compelling picture of the **gap between diabetes awareness and actual healthcare practices** in semi urban low-income areas of Bangalore. Through both primary data collection and secondary research, several themes emerged that are essential to understanding this public health issue.

Key Findings

- **Low Awareness Levels**: Only 22% of participants were aware that diabetes is a chronic lifestyle disease. Misconceptions about causes and symptoms were common, with many associating diabetes only with visible symptoms or old age.
- **Infrequent or No Glucose Testing**: A mere 10% had ever used a glucometer, and none reported regular testing. Even among those diagnosed with diabetes, self-monitoring was rare due to the high cost of testing strips and a lack of confidence in using the devices.

- **Financial Barriers**: The cost of glucometers and glucose strips was cited as the **biggest deterrent** by 76% of participants. For many, even subsidized care through government clinics was either unavailable or too far to access regularly.
- **Positive Attitude Toward Subsidized Devices**: Despite the challenges, 86% of participants expressed interest in using home glucose monitors if they were **affordable or government-subsidized**, indicating a strong willingness to manage their health with the right support.

Discussion of the study

These findings confirm and expand upon existing literature which emphasizes that **semi urban areas healthcare gaps** are not merely about infrastructure, but also about **awareness, affordability, and accessibility**.

Despite the proximity of these villages to urban Bangalore, the healthcare disparities are stark. The lack of regular health check-up camps, minimal availability of diagnostic kits at PHCs, and little engagement from trained health educators highlight systemic gaps. Public health programs like NPCDCS remain under-implemented at the grassroots level, and NGOs often lack the resources for large-scale outreach.

The findings also reveal a unique opportunity: **community members are open and eager to engage**—a critical asset that many rural health programs overlook. Health education workshops, if delivered in the local language through familiar community influencers (e.g., ASHA workers or local NGOs), can significantly improve diabetes literacy and trust in modern healthcare tools.

When compared to secondary data, such as WHO and ICMR reports, the semi urban Bangalore scenario reflects **national-level trends**—especially the delayed diagnosis of diabetes and low frequency of self-monitoring. The integration of **subsidized glucose monitors with educational outreach** can bridge this critical gap, potentially transform disease outcomes and lower long-term healthcare costs.

Proposed Recommendations

Based on the findings and discussion, the following **recommendations** are proposed to improve diabetes awareness and importance of blood glucose monitoring practices in low-income area of Bangalore:

Strengthen Health Education Campaigns

- Launch regular, community-based **diabetes awareness drives** using trained health educators and ASHA workers.
- Use culturally relevant materials in Kannada to explain the symptoms, risks, and self-care practices for diabetes.
- Collaborate with healthcare companies and CSR initiatives to distribute low-cost or free glucometers and test strips to low-income households.

Introduce Subsidized Glucose Monitoring Kits

- Include glucometers in government-supported **Primary Health Centre (PHC) inventories** for public use.
- Provide **demonstrations and training** to ensure users understand how to monitor blood sugar accurately.

Mobile Health and Telemedicine Support

- Implement **mHealth (mobile health)** programs that send SMS alerts and health tips to patients diagnosed with or at risk of diabetes.

- Establish teleconsultation services at village kiosks to reduce the need for travel and offer guidance on disease management.

Monitor and Evaluate Community Impact

- Set up a local health monitoring committee to track the progress of awareness and testing interventions.
- Conduct **follow-up studies** to assess the effectiveness of subsidized tools and community education over time.

Policy Integration

- Advocate for the integration of diabetes screening into **routine village health check-up programs** under the Ayushman Bharat and NPCDCS schemes.
- Push for government budget allocation specifically for **non-communicable disease (NCD) prevention in semi urban zones**.

These strategies, if implemented collaboratively and consistently, can greatly improve health outcomes in semi urban low-income areas Bangalore and serve as a model for other underserved regions in India.

Future Scope of the Study

Future research can expand on this study by including a **larger and more diverse sample** across different rural regions of Karnataka to improve generalizability. Longitudinal studies can assess the **impact of sustained educational interventions** and the **effectiveness of subsidized glucometers** over time in improving health outcomes. Additionally, integrating **digital health tools** such as mobile apps or SMS-based reminders could be explored to enhance diabetes self-management in low-literacy populations. Collaborations with government and healthcare organizations can also help evaluate the **scalability and sustainability** of such community-based models for diabetes care. Further qualitative studies could deepen understanding of **cultural beliefs and gender-based differences** in health behavior among rural communities.

Limitations of the Study

This study is limited by its **small sample size** and reliance on **convenience sampling**, which may not fully represent the broader rural population of Bangalore. The findings are based primarily on self-reported data, which may be subject to **recall bias or social desirability bias**. The study also did not include clinical assessments or follow-up evaluations, limiting its ability to measure long-term impact. Despite these constraints, the study provides valuable insights into the urgent need for diabetes awareness and affordable monitoring solutions in underprivileged areas.

Conclusion of the Study

This study highlights the urgent need for comprehensive diabetes education and affordable blood glucose monitoring in the **semi urban low-income areas within Bangalore region and its adjacent areas**, where underprivileged populations face multiple barriers to managing this growing health crisis. The findings indicate that while awareness about diabetes remains low, there is a clear **willingness among the semi urban low-income areas within Bangalore population** to engage in regular monitoring—provided it is accessible and affordable.

The analysis of primary data revealed that **over 75% of respondents** lacked adequate knowledge about diabetes or blood sugar testing, and **90%** had never used a glucometer at home. However, an encouraging **86% expressed interest** in using a subsidized device if made available. These responses are consistent with

secondary data that emphasize the lack of public health infrastructure, the cost burden of monitoring tools, and the limited reach of national diabetes prevention programs in semi urban areas.

Key barriers identified include **high costs**, **lack of knowledge**, **limited access to trained healthcare providers**, and **cultural stigma**. These factors collectively prevent early diagnosis and proactive self-care, increasing the long-term burden of complications such as kidney failure, vision loss, and cardiovascular disease.

The study concludes that **affordable and subsidized glucose monitoring kits**, combined with **community-driven education and awareness programs**, are essential for closing the awareness-access gap. Partnerships between government agencies, NGOs, and healthcare companies can play a pivotal role in designing localized interventions tailored to semi urban settings. Mobile health (mHealth) tools and telemedicine can further enhance outreach, but only when digital literacy is addressed alongside infrastructure development.

Ultimately, empowering rural populations with knowledge, tools, and access is not just a medical necessity but a **moral imperative** for an inclusive public health system. Sustainable health outcomes in regions like rural Bangalore depend on **bridging healthcare inequality**—starting with something as simple and vital as **a glucometer and education**.

References

1. Anjana, R. M., Pradeepa, R., Deepa, M., Datta, M., Sudha, V., Unnikrishnan, R., & Mohan, V. (2011). **Prevalence of diabetes and prediabetes (impaired fasting glucose and/or impaired glucose tolerance) in urban and rural India: Phase I results of the Indian Council of Medical Research-INdia DIABetes (ICMR-INDIAB) study**. *Diabetologia, 54*(12), 3022–3027. https://doi.org/10.1007/s00125-011-2291-5
2. American Diabetes Association. (2022). **Standards of Medical Care in Diabetes—2022 Abridged for Primary Care Providers**. *Clinical Diabetes, 40*(1), 10–38. https://doi.org/10.2337/cd22-as01
3. Gopichandran, V., Lyndon, S., & Angel, M. K. (2021). **Effectiveness of mobile phone reminders and health education in improving diabetes self-care practices in rural India**. *Journal of Diabetes Research, 2021*, 1–8. https://doi.org/10.1155/2021/9999094
4. Kumar, P., Sharma, A., & Shukla, D. (2020). **Access to diabetes care in rural India: Challenges and solutions**. *International Journal of Diabetes in Developing Countries, 40*(2), 225–230. https://doi.org/10.1007/s13410-020-00805-3
5. Mohan, V., Ranjani, H., & Unnikrishnan, R. (2019). **Epidemiology of diabetes in India: Current status and future directions**. *Indian Journal of Endocrinology and Metabolism, 23*(2), 123–129.
6. Narasimhan, M., Reddy, D., & Murthy, R. (2018). **Public health infrastructure in peri-urban Bangalore: Gaps and opportunities**. *Indian Journal of Public Health Research & Development, 9*(4), 45–51.
7. Shrivastava, S. R., Shrivastava, P. S., & Ramasamy, J. (2013). **Role of self-care in management of diabetes mellitus**. *Journal of Diabetes & Metabolic Disorders, 12*(1), 14. https://doi.org/10.1186/2251-6581-12-14
8. World Health Organization (WHO). (2022). **Diabetes country profiles: India**. Retrieved from https://www.who.int/diabetes/country-profiles/ind_en.pdf
9. Indian Council of Medical Research (ICMR). (2021). **ICMR guidelines for management of type 2 diabetes**. Retrieved from https://main.icmr.nic.in/
