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**Original Research Article**

# Perceived barriers and facilitators to diabetes screening among people living with HIV receiving antiretroviral therapy

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## ABSTRACT

**Background:** Advances in antiretroviral therapy (ART) have significantly improved the survival of people living with HIV (PLHIV), leading to a growing burden of non-communicable diseases such as diabetes mellitus. HIV infection and long-term ART use may increase diabetes risk. Despite the importance of early detection, diabetes screening among PLHIV remains suboptimal. This study assessed perceived barriers, facilitators and knowledge regarding diabetes screening among PLHIV receiving ART.
**Methods:** A facility-based cross-sectional study was conducted among 118 PLHIV attending the ART centre of District Hospital, Ramanagara, Karnataka. Participants were selected using systematic random sampling. Data were collected through face-to-face interviews using a pretested semi-structured questionnaire that assessed socio-demographic characteristics, knowledge of diabetes screening and perceived barriers and facilitators. Data was analysed using descriptive and inferential statistics.
**Results:** Among participants, 71.2% had heard about diabetes, but only 35.6% were aware that ART could increase diabetes risk. 43.2% reported knowledge of diabetes screening tests and only 24.6% knew the recommended screening frequency. Overall, 40.7% had undergone diabetes screening. Lack of awareness (52.5%), absence of symptoms (37.3%) and fear of diagnosis (34.7%) were the most common barriers. Physician recommendation (62.7%) and availability of free screening services (58.5%) were key facilitators. Doctor's advice, adequate knowledge, higher education and longer duration on ART were significant predictors of screening uptake.
**Conclusions:** Diabetes screening among PLHIV receiving ART remains suboptimal. Strengthening patient education, enhancing provider counselling and integrating routine diabetes screening within ART services may improve early detection and management of diabetes among PLHIV.

**Keywords:** Antiretroviral therapy, Barriers, Diabetes screening, Facilitators, HIV, Knowledge

## INTRODUCTION

Human immunodeficiency virus (HIV) infection continues to be a major global public health challenge despite substantial advances in prevention and treatment. The widespread availability of antiretroviral therapy (ART) has significantly improved the survival and life expectancy of PLHIV. As a result, HIV infection has increasingly transitioned from an acute fatal disease to a chronic manageable condition. Consequently, PLHIV are now living longer and are increasingly experiencing age-related and treatment-related comorbidities, particularly non-communicable diseases (NCDs) such as diabetes mellitus, cardiovascular diseases and metabolic disorders.[1] The risk of diabetes among PLHIV is influenced by several biological and treatment-related factors. Chronic immune activation, persistent inflammation and metabolic effects associated with long-term ART can contribute to insulin resistance and glucose metabolism abnormalities. Certain antiretroviral medications have also been implicated in metabolic disturbances, including dyslipidaemia and impaired glucose tolerance, thereby increasing the risk of developing diabetes mellitus.[2] Globally, diabetes has

emerged as one of the most important non-communicable diseases affecting adult populations. According to the International Diabetes Federation, the global burden of diabetes continues to rise, with a substantial proportion of cases occurring in low- and middle-income countries. India, in particular, bears a significant share of this burden and is often referred to as the "Diabetes capital of the world".[3] The coexistence of HIV and diabetes, therefore, represents an important and emerging public health concern in countries like India, where both conditions are highly prevalent. Early detection of diabetes through routine screening plays a crucial role in preventing complications such as cardiovascular disease, nephropathy, neuropathy and retinopathy. International guidelines recommend regular metabolic monitoring and screening for diabetes among PLHIV receiving ART as part of comprehensive HIV care. Integrating non-communicable disease screening into existing HIV services has been widely recommended to ensure early diagnosis and timely management of metabolic complications.[4] ART centres provide an important opportunity to implement integrated screening programs, as PLHIV regularly attend these facilities for treatment and follow-up care. However, despite the availability of such services, uptake of diabetes screening among PLHIV remains suboptimal in many settings. Several factors may influence screening behaviour, including lack of awareness, fear of diagnosis, stigma, financial constraints and limited access to healthcare services.[5] Understanding the barriers that prevent individuals from undergoing screening, as well as the facilitators that encourage screening behaviour, is essential for designing effective interventions. Identifying these factors can help strengthen patient education, improve healthcare delivery and promote integrated management of HIV and non-communicable diseases.[6]

In India, where both HIV and diabetes represent major public health challenges, integrating diabetes screening into HIV care is particularly important. However, evidence on the perceived barriers and facilitators influencing diabetes screening among PLHIV attending ART centres remains limited. Generating such evidence can support policymakers and healthcare providers in developing patient-centred strategies to improve screening uptake and reduce the burden of undiagnosed diabetes in this vulnerable population. Therefore, the present study aimed to assess the perceived barriers and facilitators to diabetes screening and the level of awareness and knowledge regarding diabetes screening among People Living with HIV receiving antiretroviral therapy at an ART centre.

## METHODS

### *Study design and setting*

A facility-based cross-sectional study was conducted to assess the perceived barriers and facilitators to diabetes screening among PLHIV receiving antiretroviral therapy (ART). The study was carried out at the ART Centre of the District Hospital, Ramanagara, Karnataka, India. The centre provides comprehensive HIV care services, including counselling, clinical monitoring and lifelong ART to registered PLHIV. The study was conducted over three months, from March to May 2025.

### *Study population and eligibility criteria*

The study population comprised PLHIV attending the ART centre for routine follow-up during the study period. Individuals aged ≥18 years, on ART for at least six months and willing to provide written informed consent were included. Patients with severe psychiatric illness impairing their ability to respond and those hospitalised within the preceding month were excluded.

### *Sample size and sampling technique*

The sample size was calculated using Cochran's formula for estimating proportions:

$$n=Z^2pq / d^2$$

where n is the required sample size, Z is the standard normal deviate at 95% confidence level (1.96), p is the expected prevalence, $q=1-p$ and d is the absolute precision. The prevalence of diabetes among PLHIV was taken as 10.3% based on a previous study by Ogbuagu et al.[7] Using a precision of 5.5%, the calculated sample size was approximately 118 participants.

A systematic random sampling technique was employed. The sampling frame included all PLHIV attending the ART centre, with an average monthly attendance of approximately 450 patients. The sampling interval (k) was calculated as $450/118 \approx 3.8$ and rounded to 4. A random starting point between 1 and 4 was selected, after which every 4th eligible patient was recruited. In cases of non-response or ineligibility, the next eligible patient was included to maintain the sampling sequence. Recruitment continued on all clinic days until the required sample size was achieved.

### *Study tool and data collection*

Data were collected using a pretested semi-structured questionnaire developed from relevant literature. The tool included sections on socio-demographic characteristics, knowledge regarding diabetes and its screening and perceived barriers and facilitators to diabetes screening. Barriers included lack of awareness, absence of symptoms, fear of diagnosis, stigma, financial constraints, transportation issues and long waiting times. Facilitators included physician recommendation, availability of free screening services, family support, awareness campaigns and presence of symptoms. Data collection was conducted through face-to-face interviews in a private setting by the investigator after obtaining written informed consent.

### *Knowledge assessment*

Knowledge regarding diabetes screening was assessed using structured questions. Each correct response was assigned a score of one, while incorrect or "don't know" responses were scored as zero. Total scores were computed and participants scoring above the mean were categorized as having adequate knowledge, while those scoring below the mean were classified as having poor knowledge.

### *Pretesting of the questionnaire*

The questionnaire was pretested among 10% of the calculated sample size at a different ART centre with similar characteristics. The pretest assessed clarity, relevance and feasibility. Necessary modifications were made based on participant feedback.

### *Statistical analysis*

Data were entered into Microsoft Excel and analysed using SPSS version 23. Descriptive statistics were used to summarize the data, with categorical variables expressed as frequencies and percentages and continuous variables as mean ± standard deviation.

Inferential statistics were applied to assess associations. The Chi-square test was used to examine the association between knowledge levels and socio-demographic variables. Binary logistic regression analysis was performed to identify predictors of diabetes screening behaviour. A p value<0.05 was considered statistically significant.

### *Ethical considerations*

Ethical approval was obtained from the Institutional Ethics Committee of Rajarajeswari Medical College and Hospital. Written informed consent was obtained from all participants. Confidentiality and anonymity were strictly maintained throughout the study.

## RESULTS

A total of 118 PLHIV receiving ART participated in the study. The majority of participants were aged 31–40 years (34.7%), with a male predominance (56.8%). The majority had secondary education (38.1%) and were engaged as labourers (30.5%) or in private employment (27.1%). Most participants had been on ART for 2–5 years (39.0%). Overall, 71.2% of participants had heard of diabetes, but only 35.6% were aware that ART could increase the risk. Awareness of diabetes screening tests was reported by 43.2%, while just 24.6% knew the recommended screening frequency. In terms of practice, 40.7% had undergone diabetes screening at least once, whereas 59.3% had never been screened. This pie chart illustrates the distribution of knowledge levels among the study participants. A majority of participants had adequate knowledge (61%), while 39% demonstrated poor knowledge.

The most commonly reported barrier to diabetes screening (Figure 2) was lack of awareness regarding the importance of screening (52.5%). Other barriers included absence of symptoms (37.3%), fear of diagnosis (34.7%) and financial constraints (30.5%). Additional factors reported were transportation difficulties (26.3%), long waiting times at healthcare facilities (23.7%) and perceived stigma (21.2%).

The most frequently reported facilitator (Figure 3) was a recommendation from a healthcare provider (62.7%). Other encouraging factors included availability of free screening services (58.5%), awareness campaigns (39.8%) and family support (32.2%). Additionally, 28.0% of participants reported undergoing screening due to symptoms.

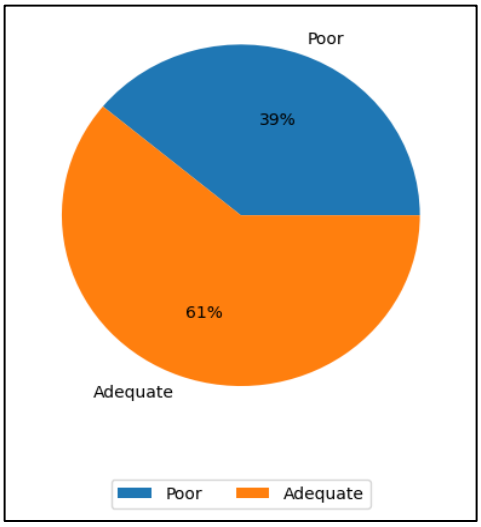



**Figure 1: Knowledge level distribution.**

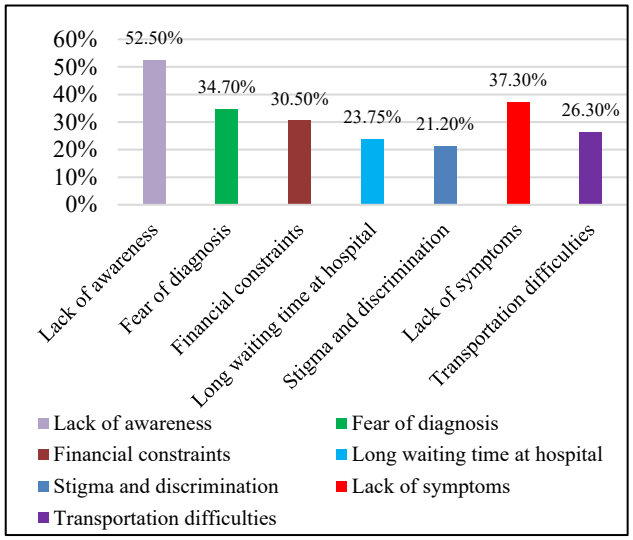



**Figure 2: Barriers to diabetes screening among PLHIV (n=118).**

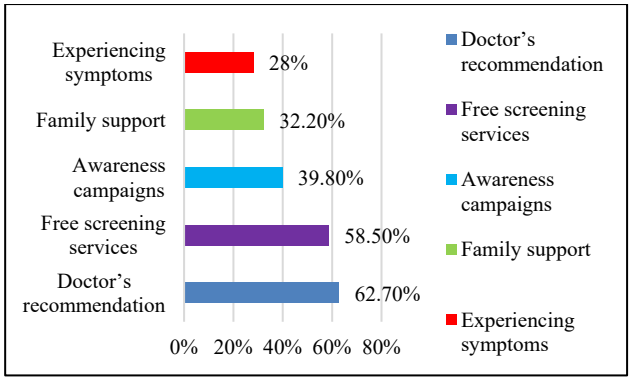



**Figure 3: Facilitators for diabetes screening (n=118).**

Table 3 presents the association between knowledge level and socio-demographic variables. Knowledge level was significantly associated with age ($\chi^2$=4.20, p=0.040), education ($\chi^2$=10.80, p<0.001) and socioeconomic status ($\chi^2$=6.75, p=0.009). No significant association was observed with gender ($\chi^2$=0.95, p=0.330). The association between knowledge level and screening behaviour (Table 7) was statistically significant ($\chi^2$=8.56, p=0.003), suggesting that participants with higher knowledge were more likely to undergo diabetes screening. The predictors of diabetes screening among PLHIV were assessed using multivariate logistic regression analysis (Table 8). Participants with higher educational status were more likely to undergo diabetes screening (Adjusted Odds Ratio (AOR)=2.3; 95% CI: 1.1–4.7; p=0.02).

Similarly, individuals who had been receiving ART for more than five years had a higher likelihood of undergoing screening (AOR=1.9; 95% CI: 1.0–3.8; p=0.04). Participants with adequate knowledge regarding diabetes screening were significantly more likely to undergo screening (AOR=2.8; 95% CI: 1.3–5.9; p=0.006).

The strongest predictor of diabetes screening was recommendation from a healthcare provider (AOR=3.1; 95% CI: 1.5–6.4; p=0.002), indicating the critical role of physician counselling in promoting preventive screening practices among PLHIV.

**Table 1: Socio-demographic characteristics of study participants.**

| Socio-demographic characteristics (n=118) | | Frequency | (%) |
|---|---|---|---|
| **Age (in years)** | 18–30 | 32 | 27.1 |
| | 31–40 | 41 | 34.7 |
| | 41–50 | 29 | 24.6 |
| | >50 | 16 | 13.6 |
| **Gender** | Male | 67 | 56.8 |
| | Female | 51 | 43.2 |
| **Education** | No formal education | 19 | 16.1 |
| | Primary | 27 | 22.9 |
| | Secondary | 45 | 38.1 |
| | Graduate | 27 | 22.9 |
| **Occupation** | Unemployed | 24 | 20.3 |
| | Labourer | 36 | 30.5 |
| | Private job | 32 | 27.1 |
| | Self-employed | 26 | 22.1 |
| **Duration on ART** | 6 months–2 years | 38 | 32.2 |
| | 2–5 years | 46 | 39 |
| | >5 years | 34 | 28.8 |

**Table 2: Knowledge level regarding diabetes screening among PLHIV.**

| Knowledge level regarding diabetes screening (n=118) | Yes | No |
|---|---|---|
| **Heard about diabetes** | 84 (71.2%) | 34 (28.8%) |
| **Aware that ART can increase diabetes risk** | 42 (35.6%) | 76 (64.4%) |
| **Aware of diabetes screening tests** | 51 (43.2%) | 67 (56.8%) |
| **Know the recommended screening frequency** | 29 (24.6%) | 89 (75.4%) |
| **Ever undergone diabetes screening** | 48 (40.7%) | 70 (59.3%) |

**Table 3: Association between knowledge level and socio-demographic variables.**

| Variable | Category | Adequate knowledge N (%) | Poor Knowledge N (%) | Chi-square | P value |
|---|---|---|---|---|---|
| **Age (in years)** | <40 | 38 (64.4%) | 21 (35.6%) | 4.20 | 0.040* |
| | ≥40 | 28 (47.5%) | 31 (52.5%) | | |

Continued.

| Variable | Category | Adequate knowledge N (%) | Poor Knowledge N (%) | Chi-square | P value |
|---|---|---|---|---|---|
| **Gender** | Male | 40 (57.1%) | 30 (42.9%) | 0.95 | 0.330 |
| | Female | 26 (54.2%) | 22 (45.8%) | | |
| **Education** | ≤Primary | 18 (36.0%) | 32 (64.0%) | 10.80 | 0.001* |
| | ≥Secondary | 48 (70.6%) | 20 (29.4%) | | |
| **Socioeconomic status** | Lower | 22 (40.0%) | 33 (60.0%) | 6.75 | 0.009* |
| | Upper | 44 (69.8%) | 19 (30.2%) | | |

*Statistically significant.

**Table 4: Association between knowledge level and diabetes screening behaviour.**

| Knowledge level | Diabetes screening | | $\chi^2$ | P value |
|---|---|---|---|---|
| | Done | Not done | | |
| **Poor** | 12 (26.1%) | 34 (73.9%) | 8.56 | 0.003* |
| **Adequate** | 36 (50.0%) | 36 (50.0%) | | |

*Statistically significant.

**Table 5: Logistic regression analysis for predictors of diabetes screening.**

| Variable | Adjusted odds ratio (AOR) | 95% CI | P value |
|---|---|---|---|
| **Higher education** | 2.3 | 1.1 – 4.7 | 0.02 |
| **Duration on ART >5 years** | 1.9 | 1.0 – 3.8 | 0.04 |
| **Adequate knowledge** | 2.8 | 1.3 – 5.9 | 0.006 |
| **Doctor's advice** | 3.1 | 1.5 – 6.4 | 0.002 |

## DISCUSSION

The present study assessed the perceived barriers and facilitators to diabetes screening among PLHIV receiving ART at an ART centre. With the widespread availability of ART, survival among PLHIV has improved significantly, leading to an epidemiological transition characterised by an increasing burden of NCDs, including diabetes mellitus. The chronic inflammatory state associated with HIV infection, along with long-term ART exposure, contributes to metabolic derangements such as insulin resistance and dyslipidaemia, thereby necessitating the integration of NCD screening into routine HIV care.[8]

In the present study, the majority of participants belonged to the 31–40 years age group, indicating that PLHIV accessing ART services are predominantly in their economically productive years. Similar age distributions have been reported across India, where middle-aged adults constitute the largest proportion of individuals receiving ART.[9,10] Findings from Bengaluru further support this demographic pattern.[11] This highlights the need for early identification and management of comorbidities such as diabetes to preserve productivity and quality of life. A slight male predominance observed in the study is consistent with other facility-based studies in India.[9,10] This may reflect gender differences in healthcare-seeking behaviour, occupational mobility and sociocultural barriers that limit women's access to healthcare services. Stigma and caregiving responsibilities may further restrict women from utilising preventive services, leading to their under-representation in institutional settings. Although awareness of diabetes was relatively high (71.2%), detailed knowledge regarding diabetes screening and ART-related metabolic risks was limited. Only a small proportion of participants were aware of the increased risk of diabetes associated with long-term ART or the recommended frequency of screening. Similar knowledge gaps have been reported in other low- and middle-income settings, where inadequate health literacy remains a key barrier to preventive care among PLHIV.[12,13]

The study revealed that only 40.7% of participants had undergone diabetes screening at least once, indicating suboptimal uptake despite regular contact with healthcare services. Similar gaps have been reported in India, where a high burden of metabolic abnormalities exists among PLHIV but routine screening remains inadequate.[14,15] This reflects missed opportunities for early detection during routine ART follow-up visits and emphasizes the need for systematic integration of NCD screening into HIV care. Several barriers to diabetes screening were identified. Lack of awareness regarding the importance of screening emerged as the most common barrier, followed by absence of symptoms, fear of diagnosis, financial constraints and logistical challenges such as transportation difficulties and long waiting times. These findings are consistent with previous studies highlighting the influence of individual, social and health system-level factors on healthcare utilisation among PLHIV.[16] The asymptomatic nature of early diabetes and low perceived risk may further contribute to poor screening uptake.

Conversely, important facilitators identified included physician recommendation, availability of free screening services and awareness programmes. Among these,

healthcare provider recommendations emerged as the strongest motivator for screening uptake. This aligns with evidence demonstrating that provider-initiated counselling significantly improves utilisation of preventive health services among PLHIV.[17] It highlights the critical role of ART centre staff in promoting integrated care through routine counselling and opportunistic screening. A significant association between educational status and knowledge regarding diabetes screening was observed, with higher education levels correlating with better awareness. Education is a key determinant of health literacy and healthcare utilisation, as supported by national-level evidence from India.[18] Furthermore, knowledge was significantly associated with screening behaviour, indicating that improved awareness translates into better health-seeking practices.

Logistic regression analysis identified doctors' recommendations as the strongest predictor of screening, followed by adequate knowledge and higher educational status. These findings highlight the combined influence of individual and healthcare system factors on screening behaviour. Strengthening patient counselling, incorporating routine NCD risk assessment into ART visits and ensuring access to affordable screening services are essential strategies to improve early detection. Integrated HIV-NCD care models have demonstrated improved accessibility and continuity of care, supporting the need for a comprehensive approach to chronic disease management among PLHIV.[19]

Overall, the findings highlight the urgent need to strengthen awareness, enhance provider engagement and integrate routine diabetes screening into ART services to address the growing burden of NCDs among PLHIV.

## CONCLUSION

Diabetes screening among PLHIV receiving ART was found to be suboptimal, with lack of awareness emerging as the major barrier. Physician recommendations, the availability of free screening services and improved patient knowledge were important facilitators of screening uptake. Integrating routine diabetes screening into ART services and strengthening patient education and counselling may improve early detection and management of diabetes among PLHIV.

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