**Original Article**

# Associations between non-medical social needs and glycemic control among adults with type 2 diabetes in Zahedan, Southeast Iran

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## Abstract

**Background:** Social determinants of health (SDOH) and non-medical needs play a critical role in diabetes management, particularly in less-developed regions where structural barriers are prevalent. This study examined the associations between non-medical needs and glycemic control among adults with type 2 diabetes mellitus (T2DM) in Zahedan, southeast Iran.

**Methods:** A cross-sectional study was conducted among 312 adults with T2DM. HbA1c values were categorized into controlled (<7%) and uncontrolled (≥7%) groups. Binary logistic regression identified independent predictors of poor glycemic control. Social determinants analyzed included food insecurity, employment status, housing problems, transportation barriers, and exposure to violence.

**Results:** The mean age of participants was (53.89 \pm 9.02) years, and 60.9% were female. A total of 84.6% reported frequently worrying about food running out. Significant predictors of uncontrolled HbA1c (≥7%) included older age (OR = 1.052, 95% CI: 1.008–1.098), unemployment (protective effect of employment: OR = 0.289, 95% CI: 0.111–0.753), lower education level (OR = 5.608, 95% CI: 1.936–16.241), and food insecurity (OR = 2.973, 95% CI: 1.503–5.880). Housing pest infestation ((P = 0.071)) and verbal violence ((P = 0.055)) demonstrated borderline associations.

**Conclusion:** Poor glycemic control among adults with T2DM in Zahedan is strongly shaped by social vulnerabilities, particularly food insecurity and unemployment, alongside socioeconomic and environmental stressors. These findings highlight the need for integrated, multisectoral interventions addressing social needs in resource-limited settings.

**Keywords: Diabetes Mellitus, Type 2; Glycated Hemoglobin; Iran; Social Determinants of Health; Vulnerable Populations.**

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## Introduction

Type 2 diabetes mellitus (T2DM) is a common metabolic disease and a substantial public-health concern worldwide. Urban growth, reduced physical activity, and changes in dietary patterns have accompanied its increasing prevalence. The International Diabetes Federation estimated that 537 million adults had diabetes in 2021 and projected a total of 783 million by 2045 (1). Related global

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health spending was estimated at USD 966 billion in 2021 (2, 3). In Iran, estimated T2DM prevalence is 10.3%, with obesity and inactivity also increasing (4). The condition imposes considerable economic costs, including substantial annual out-of-pocket expenditure per patient (5). Together, these patterns point to the importance of effective prevention and sustained disease management.

Glycated hemoglobin (HbA1c), a measure reflecting average glycemia over roughly the previous 8–12 weeks (6), is widely used to monitor T2DM management. Suboptimal glycemic control is associated with increased cardiovascular and microvascular risk (7, 8). Outcomes are shaped not only by clinical characteristics but also by social determinants of health (SDOH). These determinants encompass the circumstances in which people are born, develop, reside, work, and grow older, and can influence both healthcare access and health-related behaviors (9, 10). Difficult social circumstances may make medication use, dietary recommendations, and physical activity harder to sustain, potentially compromising glycemic management (10). In this paper, SDOH denotes the broader structural and societal influences on health, whereas non-medical social needs are specific unmet needs reported by patients that may be recognized and addressed through clinical or community services. We examine the latter because they can be screened for and may prompt practical assistance in clinical settings; screening, however, does not itself alter upstream structural conditions.

In Zahedan, there is limited evidence on the prevalence of particular, potentially actionable non-medical social needs and their cross-sectional relationship with glycemic status in adults with T2DM. Zahedan lies in Sistan and Baluchestan Province, an area characterized in prior publications as socioeconomically underserved (11,12). We therefore sought to describe these needs and assess their cross-sectional associations with glycemic control, using both continuous HbA1c and HbA1c category, among adults with T2DM receiving care at a referral clinic in Zahedan, Iran.

## Methods

We undertook a descriptive-analytical cross-sectional investigation in 2025 at the Diabetes Clinic of Ali Ibn Abi Talib Hospital, a referral center in Zahedan, Iran. Participants were eligible if they were at least 18 years old, had confirmed T2DM, and had a recent HbA1c result. We excluded individuals with incomplete questionnaires or severe, uncontrolled psychiatric disorders. Using the single-proportion sample-size equation, p=0.5 and d=0.055 yielded a target of 317; 312 eligible patients were ultimately included. Recruitment followed a convenience approach, with consecutive enrollment during clinic visits. Participants ranged in age from 35 to 84 years.

Information was obtained with a structured questionnaire alongside a demographic and clinical data form. We measured non-medical social needs using the American Academy of Family Physicians (AAFP) 15-item Social Needs Screening Tool, which addresses housing stability, food security, transportation, financial strain, utility security, and personal safety. The total score was reported on a 0–40 scale; larger values represent a greater burden of unmet needs. The Persian-language instrument had previously been reported as validated in Iranian populations (13). For regression, food insecurity was represented by a binary composite based on the two food questions: concern that food would run out and food insufficiency. For participants with limited literacy, trained interviewers administered questions according to a standardized, neutral procedure.

Analyses were performed in SPSS, version 26 (IBM Corp., Armonk, NY, USA). We summarized continuous and categorical characteristics using means and standard

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deviations, and counts and percentages, respectively. HbA1c was examined as a continuous measure and as a binary outcome; HbA1c of at least 7.0% denoted uncontrolled glycemia. Pearson's correlation coefficient was used to assess the relationship between the total social-needs score and continuous HbA1c.

We used binary logistic regression with backward stepwise likelihood-ratio selection to evaluate cross-sectional correlates of HbA1c ≥7.0%. Age was modeled continuously. The candidate variables were age, sex, diabetes duration, residence, employment, education, the food-insecurity composite, pest infestation, and verbal/emotional abuse. Coding was as follows: employed=1 and unemployed=0; food insecurity present=1 and absent=0; low education (illiteracy, primary, or middle-school education)=1 and high-school or university education=0; and yes=1/no=0 for pest infestation and verbal/emotional abuse. The food-insecurity variable combined responses to the two food items. Its exact Boolean rule and response cut-off should be checked against the original analysis code before submission.

Sex, diabetes duration, and residence were considered potential confounders at the initial modeling stage but were excluded by the stepwise procedure according to its significance criteria. Variance inflation factors were below 2 for all variables, providing no indication of substantial multicollinearity. The Hosmer–Lemeshow goodness-of-fit test yielded P>0.05. We present adjusted odds ratios (ORs) with 95% confidence intervals (CIs); statistical significance was defined as P<0.05.

The Zahedan University of Medical Sciences Ethics Committee approved the protocol (IR.ZAUMS.REC.1404.026). Before data collection, every participant provided written informed consent. Enrollment was voluntary, and participant anonymity and confidentiality were protected throughout the research.

## Results

Table 2 presents the frequency of individual non-medical social needs. Worry that food would run out, reported sometimes or often, was endorsed by 308 of 312 participants (98.7%); 294 (94.3%) reported sometimes or often experiencing food insufficiency. These item-specific figures should not be conflated with the binary food-insecurity composite entered in regression, which was constructed from both questions as described above. Housing instability affected 21.8% of participants, while 32.7% reported transportation problems that delayed medical care. Difficulty meeting bills sometimes or often was reported by 43.0%, and 20.5% reported verbal or emotional abuse. Total social-needs score had a weak positive correlation with continuous HbA1c (Pearson r=0.158, p=0.006), indicating that higher needs scores co-occurred with higher HbA1c.

In the adjusted logistic model (Table 3), each additional year of age corresponded to 5.2% higher odds of uncontrolled HbA1c (adjusted OR 1.052, 95% CI 1.008–1.098; P=0.021). The odds were lower among employed participants (OR 0.289, 95% CI 0.111–0.753; P=0.011). Higher odds were observed for food insecurity (OR 2.973, 95% CI 1.503–5.880; P=0.002) and low education (OR 5.608, 95% CI 1.936–16.241; P=0.001). For pest infestation (OR 4.383, 95% CI 0.879–21.739; P=0.071) and verbal/emotional abuse (OR 3.176, 95% CI 0.978–10.321; P=0.055), estimates were imprecise; the wide CIs crossed the null and neither association met the P<0.05 criterion.

## Discussion

We assessed the relationship between non-medical social needs and glycemic status in adults with T2DM attending a Zahedan referral clinic. In the final regression model, age, employment, food insecurity, and educational level were associated with HbA1c category.

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Table 1. Background Characteristics of the Participants

| Variable | Category or Measure | (n) (%) | Mean ± SD | Min–Max |
|---|---|---|---|---|
| Sex | Female | 190 (60.9) | — | — |
| | Male | 122 (39.1) | — | — |
| Residency | Urban | 254 (81.4) | — | — |
| | Rural | 58 (18.6) | — | — |
| Education level | Illiterate | 92 (29.5) | — | — |
| | Primary school | 56 (17.9) | — | — |
| | Middle school | 38 (12.2) | — | — |
| | High school | 26 (8.3) | — | — |
| | University | 100 (32.1) | — | — |
| HbA1c category | <7.0% | 160 (51.3) | — | — |
| | ≥7.0% | 152 (48.7) | — | — |
| Age (years) | — | — | 53.89 ± 9.02 | 35–84 |
| Duration of diabetes (years) | — | — | 7.63 ± 4.96 | 1–25 |
| HbA1c (%) | — | — | 7.42 ± 1.41 | 5.2–13.1 |
| Total non-medical needs score | — | — | 10.47 ± 3.44 | 6–23 |

Table 2. Distribution of Non-Medical Social Needs among Participants ((n = 312))

| Domain | Variable | Response Category | (n) (%) |
|---|---|---|---|
| Housing | Housing instability | Yes | 68 (21.8) |
| | Pest infestation | Yes | 24 (7.7) |
| | Inadequate heating | Yes | 48 (15.4) |
| | Cooking facility problems | Yes | 42 (13.5) |
| Food security | Concern about food running out | Often/Sometimes | 308 (98.7) |
| | Food insufficiency | Often/Sometimes | 294 (94.3) |
| Transportation | Delayed care due to transportation barriers | Yes | 102 (32.7) |
| Utilities | Risk of service disconnection | Sometimes/Often | 158 (50.7) |
| Employment | Employment status | Employed | 178 (57.1) |
| Financial strain | Difficulty paying bills | Sometimes/Often | 134 (43.0) |
| Safety | Verbal/emotional abuse exposure | Sometimes/Often | 64 (20.5) |
| | Physical violence | Not reported | 0 (0.0) |
| Assistance | Requested assistance for social needs | Yes | 92 (29.5) |

Table 3. Multivariable Logistic Regression Analysis of Factors Associated with Elevated HbA1c (≥7.0%)

| Variable | Adjusted OR | 95% CI | (P)-value |
|---|---|---|---|
| Age (per year increase) | 1.052 | 1.008–1.098 | 0.021 |
| Employment (employed vs. unemployed) | 0.289 | 0.111–0.753 | 0.011 |
| Food insecurity (present vs. absent) | 2.973 | 1.503–5.880 | 0.002 |
| Low education (vs. higher education) | 5.608 | 1.936–16.241 | 0.001 |
| Pest infestation (yes vs. no) | 4.383 | 0.879–21.739 | 0.071 |
| Verbal/emotional abuse (yes vs. no) | 3.176 | 0.978–10.321 | 0.055 |

Note: The final model included age, employment, food insecurity, low education, pest infestation, and verbal/emotional abuse. Sex, residency, and duration of diabetes were candidate covariates but were not retained after backward likelihood-ratio selection. VIF <2 for all retained variables; Hosmer–Lemeshow P>0.05. Reference categories: unemployed, no food insecurity, higher education, no pest infestation, and no abuse exposure.

Although the estimates for housing pest infestation and verbal/emotional abuse pointed toward possible associations, they were imprecise and did not satisfy the conventional significance threshold. The results fit within the wider SDOH perspective outlined by the World Health Organization (9) and Hill-Briggs et al. (14), but the cross-sectional design cannot determine which came first or support causal conclusions.

The observed relationship between increasing age and higher HbA1c is compatible with the discussion by Kirkman et al., who described how accumulating comorbidity, functional limitations, and reduced capacity for self-management can

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accompany aging (15). Walker et al. likewise discussed the way social and physiological vulnerabilities may compound over time and affect glycemic outcomes (16). Our cross-sectional findings identify an association, rather than establishing such a pathway.

Participants who were employed had lower odds of poor glycemic control in this analysis. This accords with reports by Patel (17) and Walker et al. (10), which propose that work may support financial security, healthcare access, and continuity with treatment. Employment should not, however, be assumed to ensure adequate diabetes care. Karachaliou et al. noted that healthcare access limitations and the cost of medicines can remain important obstacles in settings with constrained resources (18).

Food insecurity was associated with elevated HbA1c in this sample. Prior cohort research by Berkowitz et al. linked nutritional insecurity with challenges in diabetes self-management (19), while Gordon discussed the potential relationship of unstable access to food with hyperglycemia (20). A meta-analysis by Beltran et al. also reported an overall association between food insecurity and uncontrolled diabetes across settings (21). More broadly, Rawshani et al. underscored the metabolic vulnerability experienced by socially disadvantaged populations (22). These previous findings provide context, although they do not establish the mechanism underlying the association observed here.

The association between limited formal education and poor glycemic control warrants interpretation in light of local conditions. Although education often functions as a protective socioeconomic resource, results from lower-resource contexts have not been uniform. Kim et al. described links between socioeconomic position and diabetes outcomes, with effects influenced by the organization of healthcare (23). Castillo-Laborde et al. likewise noted that structural obstacles, including difficulty obtaining medicines, may constrain the benefits normally associated with education (24). Educational attainment alone may therefore be insufficient to offset health-system barriers in resource-limited settings.

An important contribution of this study is its examination of patients in an underserved part of southeastern Iran. Nonetheless, the single-clinic recruitment strategy means that the findings may not represent other clinical or community populations. Keene and Guo have emphasized that place-based health systems and structural inequities shape chronic-disease outcomes (25). Multiple social risks can co-occur and interact (14); Hatef et al. also found that social needs tend to cluster and may intensify disparities in healthcare use (26). Our study describes needs in one clinic and cannot determine the effects of these broader processes.

Pest infestation and verbal/emotional abuse did not show statistically significant associations under the prespecified threshold, and their confidence intervals were wide. The estimates are therefore uncertain and should not be treated as confirmatory evidence. Nevertheless, unsafe housing and psychosocial stress could plausibly be relevant to metabolic regulation; chronic stress responses have been discussed in earlier regional work (27). Further research with larger samples and more precise exposure measurement is needed.

Practice implications: Diabetes clinics may consider incorporating a short needs assessment into routine visits, with the patient's permission to discuss any identified concerns. Where feasible, positive screens could prompt connections to food assistance, social work, transportation options, or utility support. A current directory of community services and a defined follow-up process would help translate screening into action. Such procedures need to reflect local capacity

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and should be evaluated; this observational study did not assess an intervention.

### *Limitations of the Study*

Several limitations merit consideration. First, the cross-sectional design does not establish temporal sequence and cannot support causal inference. Second, self-report and interviewer-assisted data collection may have introduced recall or social-desirability error. Standardizing interviewer procedures may have reduced variation, but measurement bias remains possible, particularly for participants with limited literacy. Third, unmeasured factors—including diet, physical activity, and mental health—could have confounded the observed associations. Finally, participants came from one clinic in Zahedan, a resource-limited setting; accordingly, the results may not generalize to people who do not attend clinics or to other populations.

### *Conclusion*

In this cross-sectional sample of adults with T2DM, non-medical social needs, especially food insecurity, were associated with glycemic status. Clinics could consider a brief assessment during routine diabetes care and, following a positive response, discuss privately which needs the patient wishes to address and offer referrals to available nutrition, social-work, transportation, or community services. A practical service directory and follow-up pathway would be important, while recognizing that screening by itself cannot remove structural barriers. These results do not establish cause and effect. Longitudinal research and intervention studies are needed to clarify timing and determine whether referral-supported services improve clinical outcomes.

### *Authors' contribution*

Narjes Sargolzaei has contributed in conceptualization, methodology, formal analysis, writing the original draft and supervision, Leila Keikha in data curation, methodology, validation and writing, Azra Karimkoshteh in clinical data collection, investigation, writing, review & editing and Ali Bameri in data acquisition, software, formal analysis and writing the original draft.

### *Informed consent*

Informed consent was obtained from all individual participants included in the study. The study protocol was approved by the Ethics Committee of Zahedan University of Medical Sciences (Ethics Code: IR.ZAUMS.REC.1404.026).

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### *Conflict of interest*

The authors declare that they have no conflict of interests.

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