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Mapping and analysis of type 2 diabetes healthcare referral pathways in primary health care in Iran

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Abstract

Objective

To map the healthcare referral pathways of patients with Type 2 Diabetes (T2D) across primary and secondary levels and to identify obstacles to an effective healthcare referral system in Isfahan Province, Iran.

Methods

A qualitative case study was conducted through semi-structured interviews with twenty-nine participants, including health workers and patients with T2D. We conducted a thematic analysis, and the T2D referral pathways were visualized with a process map.

Results

The referral system was implemented through an Integrated Electronic Primary Health Care Information System, known as SIB, following relevant guidelines, such as IraPEN. Three overarching themes emerged. Access-related constraints and limited capacity of primary health care (PHC), particularly due to deficiencies in E-referral functionality and insufficient specialists for diabetes, undermined the successful T2D referral system. Inadequate coordination and communication, and a lack of an integrated electronic information record between PHC and other healthcare providers, contributed to the fragmentation of T2D care.

Conclusion

The findings reveal system-level barriers to effective T2D healthcare referral pathways, underscoring the necessity of addressing them to improve effective management of T2D.

Introduction

Type 2 diabetes (T2D) is a chronic metabolic disorder, where lack of early detection and comprehensive management leads to microvascular and macrovascular complications (1). A coordinated, integrated, and multidisciplinary care involving primary care physicians and specialist diabetes services can improve early diagnosis, continuous monitoring, and treatment of T2D, leading to improved health outcomes (2). Referral system provides functional linkages across healthcare services with varying levels of complexity and specialty (3). Breakdowns in referral processes may result in poor continuity of care, delayed diagnosis, redundant tests, and dissatisfaction among both healthcare providers and patients (4).

T2D care should primarily be delivered at the primary care level (5) and referrals to specialist care at higher levels should be considered early in the course of the disease to optimize management of blood sugar and cardiovascular risk factors (6). In Iran, T2D prevention and management in the district health network (DHN) is delivered across primary, secondary, and tertiary levels of care. Primary care is primarily responsible for screening high-risk individuals, early diagnosis, and treatment of prediabetes and T2D. Primary care also functions as a gatekeeper within the DHN, ensuring patient access to higher levels (7). Secondary care mainly focuses on early diagnosis and treatment of complications and poorly glycemic-controlled cases, while tertiary care is responsible for the management of advanced complications (8). Patient pathways at each level should operate within a well-functioning referral system. It has been shown that the T2D referral pathways in Iran are often one-way, and patients frequently bear the responsibility of arranging their own retinopathy referral visits. The referral arrangements are also not routinely and systematically documented and audited, resulting in a lack of data on the effectiveness and coverage of the corresponding healthcare services (9).

Comprehensive T2D care delivery across multiple levels of specialization is supported by effective referral pathways; however, it operates within a complex adaptive health system shaped by many interlinked components and processes that influence its performance (10). Understanding how these components and processes interact, as well as the underlying barriers influencing the effectiveness of the referral system, is essential. This qualitative case study, therefore, aims to map the healthcare referral pathways of patients with T2D across outpatient primary and secondary levels, using the process mapping technique, and to identify bottlenecks that impede adequate performance of the referral system in Isfahan province, Iran.

Methods

Study design

This study was conducted in Iran in 2023 through semi-structured interviews, followed by a thematic analysis of interviews. Our study followed the Consolidated Criteria for Reporting Qualitative Research (COREQ)(11).

Study setting

This study took place in Isfahan Province, Iran, with a total population of 4,791,905 and 11,59% prevalence of diabetes in 2021 (12). We focused on a DHN, serving as the operational structure of the primary health care (PHC) system. We approached individuals at village health houses, rural health centers, urban health posts, and urban health centers in the DHN under the supervision of Isfahan University of Medical Sciences.

The primary care in Iran represents the first contact point of patients with T2D, supported by IraPEN, the adaptation of the WHO package of essential noncommunicable disease interventions for primary health

care (PHC) in low-resource settings (WHO PEN) (13). The IraPEN interventions address four major cardiovascular risk factors, such as T2D and hypertension (14), and support higher-level referrals when necessary through e-referral, serving as a key component of the health information technology initiatives (15). The e-referral system in Iran has been implemented since 2017 (16).

Data collection

The first author conducted all one-on-one semi-structured interviews from September 2023 to November 2023. We developed interview guides based on the research objectives and discussed them within the research team to ensure addressing the research questions. The interviewees included patients with T2D, general practitioners (GPs), official community health workers (called Behvarz in Iran), health technicians recruited in urban areas (called Moragheb Salamat in Iran), and district health officials. The interview guides were piloted with two participants from each group to ensure clarity and relevance. The interviews took place in health facilities and in the workplaces of health officials. Both purposive and snowball sampling techniques (17, 18) were used to identify participants. Healthcare workers at the facilities helped the first author in inviting patients with T2D. The first author interviewed patients who were available and interested. Interviews were documented via voice recording and note-taking. Five participants refused the voice-recording, and the first author took notes. The average interview time was 21 minutes for health workers and 11 minutes for patients. The twenty-nine interviews continued until data saturation was reached, when no new relevant information emerged (18). All the interviews were conducted once and in Persian. The interviews did not return to participants for comment/or correction.

Ethical considerations

Ethical approval of the study was obtained from the Ethics Committee of Northwest and Central Switzerland (EKNZ) (Statement ID: AO_2022-00069) and Tehran University of Medical Sciences (approval ID: IR.TUMS.MEDICINE.RER.1401.432). The study was performed in accordance with the guidelines of the Declaration of Helsinki. Participation in the interview was voluntary, and participants were free to withdraw at any stage. The interviews were conducted after informed consent was obtained from all participants. During transcription, names and other details that would lead to a direct link to an individual were anonymized.

Data analysis

We conducted a thematic analysis, including familiarization, coding, generating initial sub-themes and themes, reviewing, refining and naming themes and sub-themes, and reporting (19). All interviews were transcribed verbatim and translated from Persian to English. The first author reviewed the transcripts multiple times to gain familiarity with the data. Our analysis consisted of two complementary parts. First, we applied a deductive approach based on the cascade of care framework (20, 21), which enabled us to identify both how the processes, tasks, and interactions involved in the healthcare referrals are carried

out and by whom they are performed. Second, we conducted inductive coding to identify obstacles influencing the effective performance of the healthcare referrals. The inductive coding was derived from participants' narratives across interviews. We additionally applied a second deductive lens informed by a World Health Organization policy brief on "strategies to strengthen referral from primary care to secondary care" (22), which outlines factors affecting the effective healthcare referral system. This enabled us to compare emerging perceptions with existing conceptual categories.

All codes were reviewed and refined, and then grouped into sub-themes and clustered into overarching themes through an iterative process within the research team. This combined inductive-deductive approach ensured that our analysis was grounded in participants' perceptions and experiences while also aligned with relevant frameworks and literature. MAXQDA 24 was used to facilitate data analysis and management.

Process mapping development

Process mapping offers a structured and systematic approach to understanding patient pathways (21) serving as a graphical representation and a visual snapshot of end-to-end processes. This tool provides a holistic view of the relationships of key stakeholders, flows, activities, and underlying bottlenecks and inefficiencies that weaken the performance of the system (23, 24). We therefore developed a process map of T2D referral pathways based on the structured information that emerged from the data analysis using Bizagi Modeler software version 4.1.0.002.

Rigor and trustworthiness

To establish rigor in our study, multiple strategies were employed following the guidelines from Lincoln and Guba (25, 26) to ensure the study's robustness. The first author engaged in regular self-reflection to examine personal assumptions and preconceptions about the research topic to ensure reflexivity. In particular, the first author maintained a reflexive journal throughout the data analysis process. The first author also engaged in peer debriefing with a co-author, who challenged the first author with critical questions to uncover potential biases, perspectives, and assumptions in the interpretation of findings, a process known as peer debriefing. The research team members with various expertise and backgrounds were engaged in checking the results and incorporated feedback to enhance credibility. Moreover, the district health officials shared with the first author relevant published documents, such as guidelines, policies, clinical protocols, and strategies in Persian. The first author also retrieved relevant national and provincial documents in Iran, such as laws, regulations, policies, plans, and clinical care protocols. The first author reviewed the content of all included documents (27) and highlighted those parts of the texts that appeared to be relevant to the tasks, processes, and interactions involved in the primary and secondary healthcare referral levels. This enabled the research team to enhance the validity of the process map. Neither health workers nor patients were invited to provide feedback on the findings.

Results

Participants characteristics

Fourteen health workers and fifteen patients with T2D were included in the study. Participants' demographic characteristics are summarized in Table 1.

Table 1
Demographic characteristics of the participants

	Health workers		Patients		Total	
	Number	**%**	**Number**	**%**	**Number**	**%**
Total	14	48	15	52	29	100
Category						
General practitioner	5	36	-	-	5	17
Behvarz and Moragheb	6	43	-	-	6	21
District Health Official	3	21	-	-	3	10
Gender						
Female	10	71	10	67	20	69
Male	4	29	5	33	9	31
Age group						
30–40 years	4	29	1	7	5	17
41–50 years	9	64	0	0	9	31
51–60 years	1	7	9	60	10	35
Over 60 years	0	0	5	33	5	17

Mapping T2D healthcare referral pathways

We unpacked the key actors, processes, and interactions within the T2D referral pathways along each stage of the cascade of care. The results are presented following the cascade of care for T2D.

Screening

CHWs and health technicians conduct risk assessments of major cardiovascular events in individuals over the age of 30 and offer T2D screening if indicated. The risk assessment is based on the IraPEN guidelines, context adapted from the WHO package of essential noncommunicable (PEN) disease interventions for PHC. The T2D screening is undertaken through measurements of capillary blood glucose in the primary health care facilities. The risk assessment and T2D screening also take place when individuals seek care with symptoms or attend primary care facilities for other health issues. Some

special events also provide opportunities to involve populations in cardiovascular risk assessments and raise their awareness. Next, patients with fasting blood glucose levels of equal to or greater than 100 mg/dL are referred to the GPs for further evaluation, whereas further follow-up for others is scheduled according to the results of cardiovascular risk assessment. The details of screening are shown in Fig. 1.

Diagnosis

The GP refers a patient to a laboratory for a Fasting Blood Glucose (FBG) measurement; subsequently, individuals whose fasting blood glucose levels are between 100 and 125 mg/dL are classified as prediabetics, and those whose fasting blood glucose is equal to or greater than 126 mg/dL, on two separate tests, are classified as diabetic. The laboratory test is provided free of charge for the first time to individuals for whom a GP has requested it to utilize laboratories covered by the DHN. The details of the diagnosis are illustrated in Fig. 2.

Treatment

The GP refers the results of the evaluation back to CHWs and health technicians through the electronic health information system in primary care, known as SIB. Patients confirmed with a T2D diagnosis are initiated on a treatment regimen and regular follow-ups by healthcare workers according to the clinical protocols, such as IraPEN guidelines. Patient's condition should be evaluated by a GP every three months, with the assessment interval reduced if deemed necessary, and CHWs should conduct monthly follow-ups in primary care facilities. In the quarterly follow-up visits by GPs, the patient must be instructed to undergo monthly fasting blood glucose tests and a single HbA1c test in the healthcare facilities.

Further, once a diagnosis of diabetes is confirmed, according to IraPEN guidelines, the patient should be referred to specialists at the secondary level annually for the detection of complications. Additionally, patients whose blood glucose remains high three months after a previous visit, as well as those in whom any sign of complications is detected during quarterly routine follow-up, are referred by a GP to district-based specialized outpatient clinics at the secondary level. All referrals are performed through the E-referral system, supported by the electronic information system (SIB). The details of treatment pathways are shown in Fig. 3.

Factors undermining the effective T2D healthcare referral system

We identified interconnected system-level barriers according to the participants' viewpoints, spanning PHC capacity limitations, access-related constraints, and fragmentation of T2D care (Table 2).

Table 2
Themes, subthemes of healthcare referrals' barriers

Themes	Subthemes
Limited capacity of PHC	• Weak health information technology systems and e-referral functionality • Insufficient specialist availability for diabetes • Loss of the focal point center for diabetes care in the DHN
Access-related constraints	• Limited access to higher levels of care in remote areas and certain populations • Hospital overcrowding and waiting time
Fragmentation of T2D care	• Lack of coordination and communication between PHC facilities and other healthcare providers • Weak unified and integrated electronic patient record and patient tracking between PHC and various healthcare providers

Suboptimal information technology systems and deficiencies in the E-referral infrastructure contributed to challenges for physicians in scheduling patient appointments and hindered effective electronic feedback and communication between primary and secondary care levels. "*It is not possible to observe the [electronic] specialist's feedback [in secondary level]... E-referrals are a new approach, and the infrastructure is weak. The district hospital does not admit patients without an appointment from my side [GP], but it is challenging to use this platform for scheduling an appointment*" (H3). Participants from some health facilities, particularly those in rural areas, also noted that they face unstable internet connections. *"…internet connection is unstable in our facility [rural health center]*" (H10).

A limited number of specialists for diabetes, particularly at district hospitals and clinics, also generated multiple downstream effects, such as overcrowding hospitals, patients seeking care from alternative health providers, and reduced quality communication between levels of care. "*I try to book an available appointment with whichever specialist the patient prefers; if that specialist has no availability, I have to find another one… patients often regret it and say it's better to go to a private clinic"* (H3). A CHW also stated, *"There are very few nutritionists, for example, one expert at the district hospital should cover many villages"* (H9). The limited time of specialists may also reduce interaction and communication with primary care providers through the electronic e-referral feedback system. *"The best strength of e-referral is to link to the specialists [at the secondary level]; however, they don't provide feedback … because they are too busy"* (H13). A district health official also added, *"The specialist is expected to provide feedback to our primary care physician [GP], although it may not always happen, as they [specialists] report they lack the time. Similarly, the nurse is also expected to provide feedback, which is likewise not delivered. Overall, it reflects that the system is still not being implemented properly with sufficient quality"* (H14).

Healthcare workers noted the prior establishment of a specialized diabetes unit within the DHN that not only addressed challenges related to diabetes specialist availability but also created an integrated and

coordinated referral pathway that enabled continuity and traceability of patient care. *"I think we need a focal point center of diabetes care in each district. We previously had such clinics in the [PHC] district, and we knew patients were under follow-up and control of trained physicians and nurses, and we referred them to the clinic. It was in our system [PHC], and we could track the patients"* (H3). Another physician stated, *"The diabetes clinics of the district network were terminated about 6 years ago …, there are no specialized diabetes clinics in the public sector other than Social Security Organization (SSO) [a key public purchaser and provider], but these specialized clinics are more in the private sector"* (H8).

Participants further underscored that healthcare referrals made by healthcare workers to higher levels of care may be declined due to barriers in accessing higher-level healthcare facilities, particularly among older adults, individuals lacking transportation, or residents of remote regions. "*We initiate to refer patients with high levels of blood sugar, blood pressure, and those with high BMI to a nutritionist based on the available schedule of nutritionists in the SIB system. However, many patients do not attend the referred appointment due to long travel distances, age, or reliance on their caregivers, such as their adult children, for transportation*" (H8). A 60-year-old woman in a rural area also said, "*Because my blood sugar might drop, I need to take a car. It's somewhat inconvenient to get to the county."* (P15). Patients referred from the primary level to the district specialized clinics often face overcrowding. As a result, some patients seek care from alternative providers, such as the private sector, outside the PHC district network. *"My physician booked an appointment for me to see a specialist at the district hospital, but it was too crowded, so I went to a private clinic"* (P8).

Although participants highlighted the limitations of PHC capacity and access-related constraints, SSO clinics (a public sector provider outside the DHN) offer coverage for healthcare and essential first-line antidiabetic drugs with low deductibles, enabling patients to directly access specialized clinics without adhering to a structured referral pathway in the DHN. *"Many patients would go to SSO clinics … medications are affordable"* (H10). A patient stated, "*They [SSO clinic] give us our required medications at a low price"* (P11). However, not all medications are covered by basic SSO, leading patients to obtain prescriptions from private clinics and purchase medications privately, despite the financial burden. A patient stated, "*I go to the SSO clinic to get my medication, but they do not have insulin, and my heart medication is not covered by my health insurance"* (P14).

Patients may access multiple healthcare providers operating at higher levels; however, these providers often function in siloes, resulting in fragmentation of care when coordination and communication among them are inadequate. *"We follow up patients who visit SSO clinics, but we are two different systems and do not have any collaboration and connection."* (H9). Due to the lack of an integrated and unified electronic patient record, participants also reported that weak communication across levels of care is driven by insufficient patient information sharing, further contributing to the fragmentation of care across referral pathways. *"We do not have an integrated system… It would have been great if we were able to see patients' status who visit private clinics"* (H10). It reflects that healthcare workers are unable to track patients' clinical status, leading to loss to follow-up and dropout of care, hindering continuous care in PHC.

Discussion

This study illustrates the healthcare referral pathways of patients with T2D in a DHN in Isfahan province, Iran, and delineates the underlying barriers shaping the performance of the healthcare referral system.

PHC constitutes a cornerstone of effective T2D care management, with the referral system serving as a significant mechanism for ensuring structured care pathways. Our findings suggest that the capacity of PHC and access to higher levels still require strengthening to support the effective T2D referral system. Although electronic health information systems and E-referral have been established in Iran's PHC, their functionality and effective integration remain deficient. E-referral leverages the integration of primary, secondary, and tertiary care, improves access to care, optimizes the efficient use of specialty resources, and enhances primary care capacity through unnecessary referrals, reducing wait times and enhancing workflows (28, 29). Although E-referral holds significant potential, its effective implementation remains challenging in many settings. For example, a study reported that E-referral systems in Southern African public hospitals often fail to meet the real needs of healthcare providers due to factors such as design-reality gaps, inadequate system functionalities, and poor information technology support (30).

A shortage of specialists for T2D also persists as a barrier, impairing the effective function of the referral system. The involvement of specialists in primary healthcare teams has been shown to significantly reduce HbA1c levels (31). Likewise, a study found that the integrated care model of diabetes specialists with an active endocrinologist involvement in collaboration with primary care health professionals positively affected HbA1c (32). Previous evidence in Iran shows that the number of trained specialists is considerably lower than needed (33). A study also highlighted that despite all PHC healthcare facilities in Iran having trained physicians and Behvarz or health caregivers, around 35% and 18% of urban health centers lacked trained nutritionists and psychologists, respectively, while rural health centers experienced shortages of these health workers (34). These findings highlight the importance of having a multidisciplinary team of healthcare workers with various levels of specialty. Notably, the structure of the referral system in PHC varies across different settings. In some countries, referral systems are highly formalized, with patients either incentivized or required to consult primary care providers before accessing specialist services, and primary care acts as a gatekeeper to specialist care. In contrast, other countries have more informal referral systems, with minimal gatekeeping (22). In Iran, limited capacity within primary healthcare and a weak gatekeeping role of primary care allow T2D patients to directly access specialist services at higher levels (35). Nevertheless, in remote regions, particularly among the elderly who often rely on caregivers, limited access to higher-level services may remain limited, compromising the effective referral pathways. Earlier research has also identified similar challenges (36, 37), consistent with our results.

In Iran, PHC is provided by both public and private sectors in urban areas and predominantly by the public sector in rural areas. The public holds attitudes for a higher quality of services by private providers (38); as reported in a study, over half of patients with T2D in large provinces in Iran, such as Isfahan, are registered in private facilities. Despite the higher cost of private care compared to public care, it is

associated with an increase in life expectancy of T2D patients (39). Although patients have the opportunity to seek care from multiple providers weak coordination among PHC and other providers and a lack of effective communication between multiple providers reduce the effective integration of referral pathways for T2D patients, contributing to fragmented continuous care. Fragmented care pathways may cause failure in patients' tracking and follow-ups in the PHC network and even hinder patients from returning to the PHC facilities, continuing to weaken the effective referral completion. A study reported that among individuals over the age of 30 covered by PHC facilities across Iran, 53% had visited a physician in the last three months, 57.2% were referred for dietary assessment, and 72.5% were referred to secondary care levels (34). Furthermore, an effective integrated health information system supports a functional referral system, while our findings reveal that it is suboptimal. For example, the integration of SIB, the electronic health record portal in primary care settings in Iran, with higher levels of care, and the establishment of a coherent referral system remain challenging (40). As a result, the lack of integration hinders the timely, structured, and smooth flow of patient information (41). Efficient e-feedback and information sharing can improve communication and help reduce the T2D care fragmentation. Previous research highlighted that poor communication across different levels of healthcare, as well as between referring physicians and specialists in higher levels in many settings, continues to undermine the effective health referral network (42). These findings underscore the relevance of robust communication across referral levels to minimize the fragmentation of care pathways and to improve health outcomes.

Strengths and limitations

This qualitative study was carried out in a district in Isfahan province, Iran, comparable in the healthcare services structure to other PHC districts of the province, yet generalizability to other populations or regions with different structures should be made with caution. A key strength of our study lies in applying process mapping through a rigorous qualitative method, which may inform future research and practice. Although we interviewed a range of diverse health workers, further research is recommended to explore the perceptions of higher-level specialists at the hospital level, and potentially among providers beyond PHC in Iran.

Conclusions

Effective T2D management requires coordinated care across various levels of care to support patients' long-term and continuous needs, supported by well-structured referral pathways. Our findings suggest that effective performance of the referral system in Iran's PHC requires efforts toward strengthening digital health infrastructure, establishing an effective integrated health information system, improving the availability of diabetes specialists in the PHC system, increasing access to higher-level care, particularly in remote regions and for certain populations, and enhancing coordination and communication among multidisciplinary healthcare workers across levels of care and different health providers.

References

1. Chatterjee S, Khunti K, Davies MJ (2017) Type 2 diabetes. Lancet 389(10085):2239–2251
2. Baldo V, Lombardi S, Cocchio S, Rancan S, Buja A, Cozza S et al (2015) Diabetes outcomes within integrated healthcare management programs. Prim Care Diabetes 9(1):54–59
3. Borrás C, Cadman P (2017) Patient Referral to Secondary and Tertiary Health Care Levels. In: Borrás C (ed) Defining the Medical Imaging Requirements for a Rural Health Center. Springer Singapore, Singapore, pp 135–146
4. Esquivel A (2008) Characterizing, assessing and improving healthcare referral communication
5. Siah QZ, Ubeysekara NH, Taylor PN, Davies SJ, Wong FS, Dayan CM et al (2021) Referral rates of patients with diabetes to secondary care are inversely related to the prevalence of diabetes in each primary care practice and confidence in treatment, not to HbA1c level. Prim Care Diabetes 15(3):513–517
6. Bajaj HS, Aronson R, Venn K, Ye C, Sharaan ME (2016) The Need Associated with Diabetes Primary Care and the Impact of Referral to a Specialist-Centered Multidisciplinary Diabetes Program (the NADIR Study). Can J Diabetes 40(2):120–125
7. Moradi T, Yousefzadeh N, Mohamadi E, Kiani MM, Aryankhesal A, Manesh AO et al (2025) How Iranian primary health care policies influenced equity: a historical critical analysis from policymakers' perspectives. BMC Health Serv Res 25(1):1527
8. Azizi F, Gouya M, Vazirian P, Dolatshahi P, Habibian S (2003) The diabetes prevention and control programme of the Islamic Republic of Iran. East Mediterr Health J 9(5–6):1114–1121
9. Katibeh M, Kalantarion M, Mariotti SP, Safi S, Shahraz S, Kallestrup P et al (2017) A stakeholder perspective on diabetes mellitus and diabetic retinopathy care in Iran; a qualitative study. Arch Iran Med 20(5):288–294
10. Thelen J, Sant Fruchtman C, Bilal M, Gabaake K, Iqbal S, Keakabetse T et al (2023) Development of the Systems Thinking for Health Actions framework: a literature review and a case study. BMJ Global Health 8(3):e010191
11. Tong A, Sainsbury P, Craig J (2007) Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. Int J Qual Health Care 19(6):349–357
12. Heidari K, Ahmadian M, Hosseinkhani R, Ravankhah Z, Taherian Z, Amini Z (2021) Results of non-communicable diseases prevention and control program in Isfahan province. Sci J Kurdistan Univ Med Sci 26:1–12
13. World Health Organization (2020) WHO package of essential noncommunicable (PEN) disease interventions for primary health care
14. World Health Organization (2017) Islamic Republic of Iran on a fast-track to beating non communicable diseases. Accessed June. ;20
15. Vafaee-Najar A, Hooshmand E, Pourtaleb A, Chenar HR (2024) New experience of implementing patient e-referral in the Iranian health system: a qualitative study. BMC Med Inf Decis Mak 24(1):290

16. Tajari F, Mahmoudi G, Dabbaghi F, Yazdani-Charati J (2022) Designing a model for evaluating the performance of electronic patient referral system in the healthcare system of Iran. Iran Red Crescent Med J 24(8):e2089
17. Sedgwick P (2013) Snowball sampling. BMJ. ;347
18. Etikan I, Musa SA, Alkassim RS (2016) Comparison of convenience sampling and purposive sampling. Am J theoretical Appl Stat 5(1):1–4
19. Braun V, Clarke V (2006) Using thematic analysis in psychology. Qualitative Res Psychol 3(2):77–101
20. Stafford LK, Gage A, Xu YY, Conrad M, Beltran IB, Boyko EJ, et al. Global, regional,and national cascades of diabetes care, 2000–23: a systematic review and modelling analysis using findings from the Global Burden of Disease Study. The Lancet Diabetes& Endocrinology
21. Socha A, Thiam S, Barboza J, Seck K, Steinmann P, Sécula F et al (2025) Investigating the enablers and barriers for hypertension control in Dakar: a qualitative system effectiveness study. BMJ Open 15(3):e089548
22. Hort K, Gilbert K, Basnayaka P, Annear PL (2019) Strategies to strengthen referral from primary care to secondary care in low-and middle-income countries
23. Cobos Muñoz D, de Savigny D, Sorchik R, Bo KS, Hart J, Kwa V et al (2020) Better data for better outcomes: the importance of process mapping and management in CRVS systems. BMC Med 18(1):67
24. De Savigny D, Blanchet K, Adam T (2017) Applied systems thinking for health systems research: a methodological handbook. McGraw-Hill Education (UK)
25. Lincoln YS, Guba EG (1985) Naturalistic inquiry. Newberry Park
26. Lincoln YS (1995) Emerging criteria for quality in qualitative and interpretive research. Qualitative Inq 1(3):275–289
27. Assarroudi A, Heshmati Nabavi F, Armat MR, Ebadi A, Vaismoradi M (2018) Directed qualitative content analysis: the description and elaboration of its underpinning methods and data analysis process. J Res Nurs 23(1):42–55
28. Chen AH, Murphy EJ, Yee HF (2013) eReferral—a new model for integrated care. N Engl J Med 368(26):2450–2453
29. Azamar-Alonso A, Costa AP, Huebner L-A, Tarride J-E (2019) Electronic referral systems in health care: a scoping review. ClinicoEconomics Outcomes Res 11(null):325–333
30. Kapepo M (2025) Investigating the use of electronic referrals to facilitate the patient referral process in Southern African public hospitals. University of Cape town
31. Li J, Xu Z, Zhou H, Li Z, Yuan B (2025) The involvement of specialists in primary healthcare teams for managing diabetes: a systematic review and meta-analysis. BMC Prim Care 26(1):45
32. Zarora R, Immanuel J, Chivese T, MacMillan F, Simmons D (2022) Effectiveness of Integrated Diabetes Care Interventions Involving Diabetes Specialists Working in Primary and Community Care

Settings: A Systematic Review and Meta-Analysis. Int J Integr Care 22(2):11

33. Sharifi A, Farzi Y, Roshani S, Ghamari A, Tabatabaei-Malazy O, Djalalinia S et al (2022) A new model for optimization of diabetes clinics with the case study in Iran. J Diabetes Metabolic Disorders 21(1):817–822
34. Molaeipour L, Koohi F, Ostovar A, Etemad K, Hezaveh AM, Yousefi E et al (2025) Health indicators in the management of diabetes in Primary health care: Iran-package of Essential Non-communicable diseases (IraPEN) program. J Diabetes Metabolic Disorders 24(1):40
35. Heidarzadeh A, Hedayati B, Alvandi M, Rezaei M, Farrokhi B, Dadgaran I et al (2023) Referral System Challenges of the Family Physician Program in Iran: A Systematic Review. Med J Islam Repub Iran 37:49
36. Pillsbury MKM, Mwangi E, Andesia J, Njuguna B, Bloomfield GS, Chepchumba A et al (2021) Human-centered implementation research: a new approach to develop and evaluate implementation strategies for strengthening referral networks for hypertension in western Kenya. BMC Health Serv Res 21(1):910
37. Akeju DO, Okusanya BO, Ukah UV, Orimaye SO, Dirisu O (2023) Editorial: Policy issues and perspectives in referrals and access to quality health care services. Front Health Serv. ;Volume 3–2023
38. Understanding the private health sector in the Islamic Republic of Iran. Cairo: WHO Regional Office for the Eastern Mediterranean (2024) Licence: CC BYNC-SA 3.0 IGO. 2024
39. Shahtaheri RS, Bayazidi Y, Davari M, Kebriaeezadeh A, Yousefi S, Hezaveh AM et al (2022) Long-term cost-effectiveness of quality of diabetes care; experiences from private and public diabetes centers in Iran. Health Econ Rev 12(1):44
40. Doshmangir L, Bazyar M, Majdzadeh R, Takian A (2019) So Near, So Far: Four Decades of Health Policy Reforms in Iran, Achievements and Challenges. Arch Iran Med 22(10):592–605
41. Naseriasl M, Adham D, Janati A, E-referral Solutions (2015) Successful Experiences, Key Features and Challenges- a Systematic Review. Mater Sociomed 27(3):195–199
42. Nakayuki M, Basaza AH, Namatovu HK (2021) Challenges affecting health referral systems in low- and middle-income countries: A systematic literature review

Figures

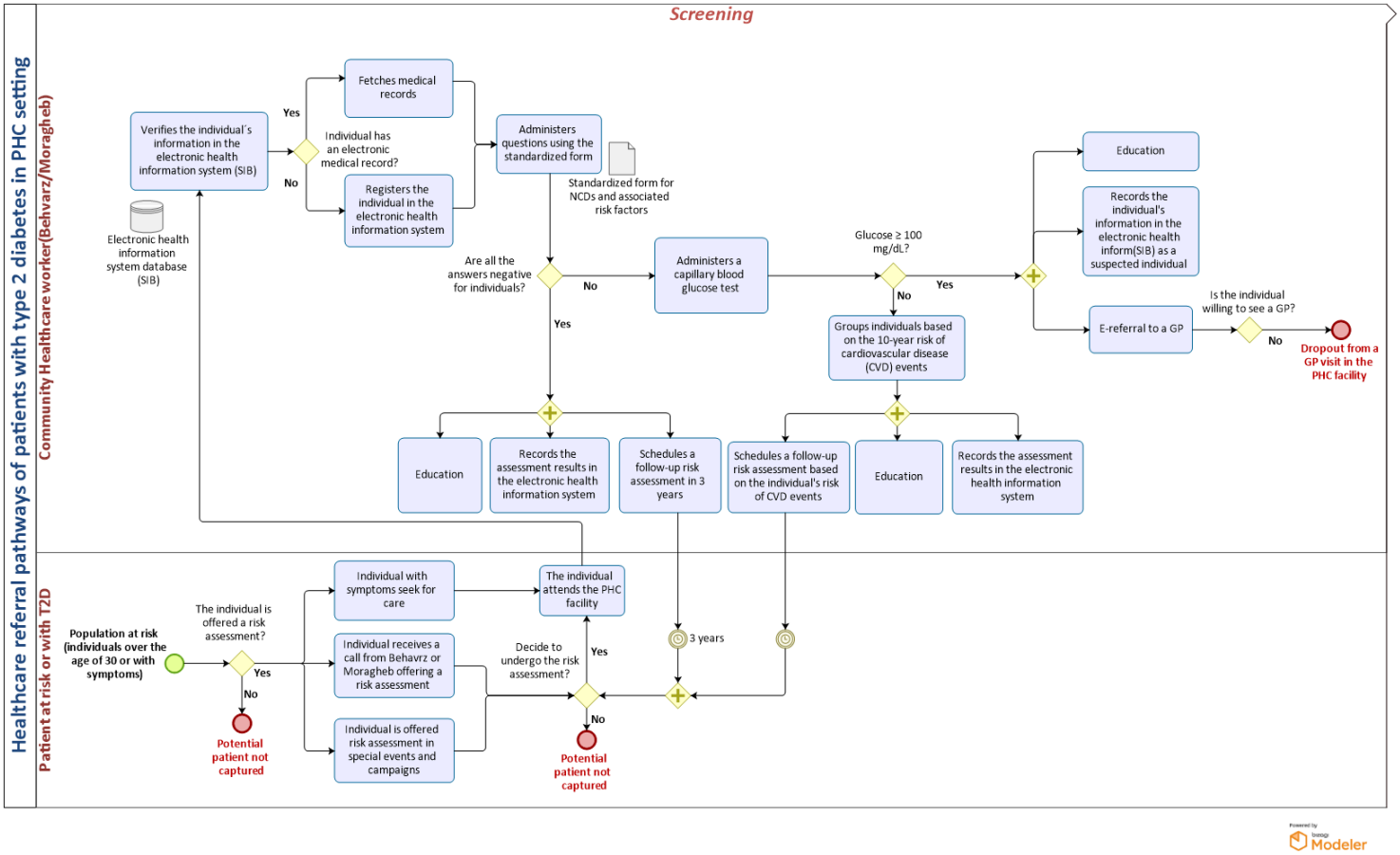


Figure 1

A process map for screening in the PHC network in Isfahan, Iran. Key actors involved in screening were assigned through different lanes. The screening was divided into one milestone. Different elements, such as green circle, blue boxes, yellow diamonds, and red circles, represent the start of the process, the tasks of each actor, decision points, and patient dropout/not being captured, respectively

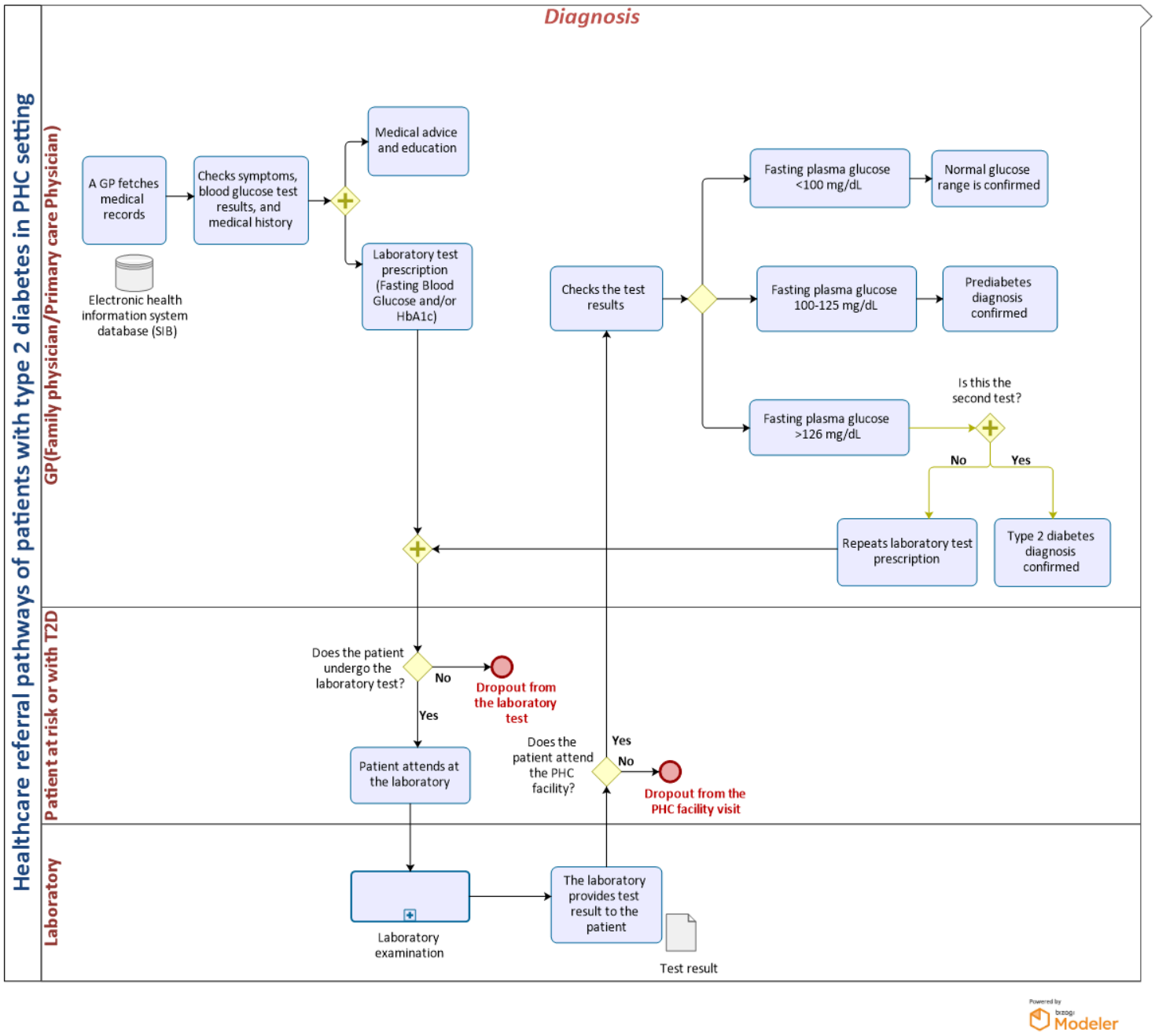


Figure 2

A process map for diagnosis in the PHC network in Isfahan, Iran. Key actors involved in screening were assigned through different lanes. Different elements, such as blue boxes, yellow diamonds, and red circles, represent the tasks of each actor, decision points, and patient dropout, respectively

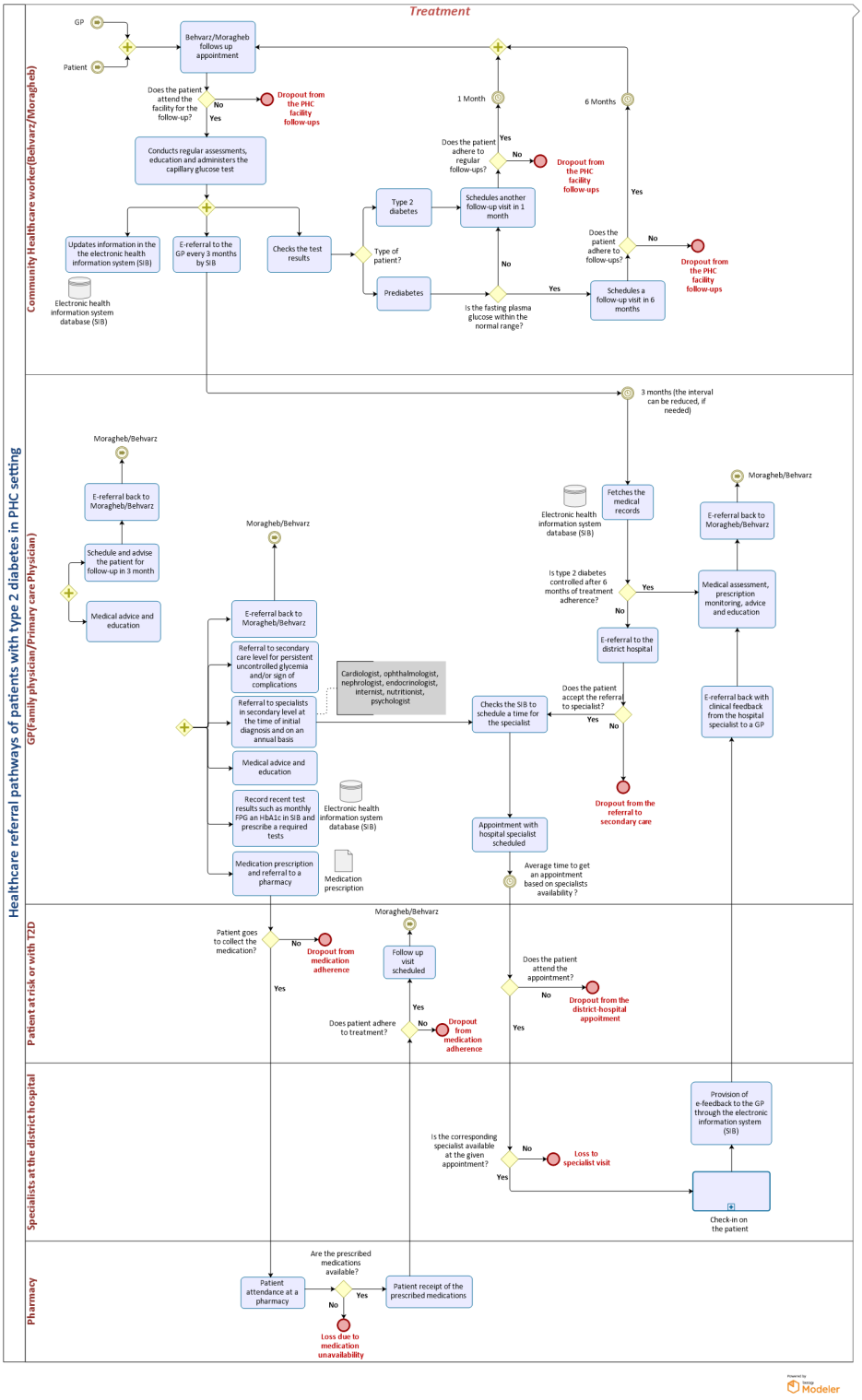


Figure 3

A process map for T2D treatment in the PHC network in Isfahan, Iran. Key actors involved in treatment were assigned through different lanes. Different elements, such as blue boxes, yellow diamonds, and red circles, represent the tasks of each actor, decision points, and patient dropout/loss, respectively