

# A Mixed Methods Multicenter Study on the Capabilities, Barriers, and Opportunities for Diabetes Screening and Management in the Public Health System of Southern Ethiopia

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**Background:** More than half of diabetics' in Ethiopia live undiagnosed, and the majority of those who already knew their status also struggle to manage their diseases. However, the underlying challenges are less understood in the study area. Therefore, this study aimed to assess diabetes screening and management capabilities, barriers, and opportunities in southern Ethiopia.

**Methods:** We applied a mixed methods study. To assess the healthcare systems' capabilities, we collected quantitative data from randomly selected ten hierarchically organized healthcare facilities, and purposive maximum variation sampling was applied to recruit twenty-nine individuals for face-to-face in-depth interviewing. The interviews were audio recorded, transcribed verbatim, thematically analyzed, and presented accordingly.

**Results:** Our study findings indicated that there were good opportunities and encouraging capabilities like government commitment and expansion of services to improve diabetes screening and management in southern Ethiopia. Nevertheless, poor governance, the system's structural problems, skilled professionals' inaccessibility and lack of teamwork, poor service integration, poor planning, and lack of monitoring and evaluation mechanisms have been hampering the service delivery at the system level. While service unaffordability, low awareness level, and lifestyle modification problems were the main challenges at the patient level. Furthermore, outdated paper-based medical record documentation, frequent essential drug stock-outting, essential laboratory service interruptions, and none-use of some available services like HbA1c have been contributing to the barriers.

**Conclusion:** Despite favorable capabilities available, diabetes management in southern Ethiopia has been struggling with solvable structural defects, poor service delivery and inaccessibility, and patients' poor lifestyle modification. Therefore, public health system restructuring, optimum financing, computerization of medical records documentation, and health system and patient capacity building are strongly recommended interventions to tackle the problem at the grass-root level.

**Keywords:** diabetes screening, management, barrier, capability, opportunity, southern Ethiopia

## Introduction

Diabetes mellitus has become one of the twenty-first century's health threats due to its increasing disease burden, high health care cost, loss of productivity, and premature deaths.<sup>1,2</sup> For instance, globally, as of the year 2000, there were 151 million diabetic patients and its age-adjusted comparative prevalence was 4.6%, however, within the next two decades, the disease burden dramatically increased to 537 million, and the age-adjusted comparative prevalence double to 9.8% by the year 2021. The available evidence also shows that unless robust policies and contextualized strategies are

devised and effectively implemented to curve this trend, the disease burden will continue to rise to 643 million by 2030 and 783 million by 2045.<sup>2,3</sup>

Similarly, the healthcare expenditure for diabetes management at the global level was USD 850 billion in 2017, which was thirteen times of annual national public budget of Ethiopia,<sup>4</sup> but within the next five years, its health expenditure climbed to 966 billion US dollars, which was 75 times of Ethiopia's national annual public budget.<sup>3</sup> On the other hand, nearly half of the global diabetics live undiagnosed; 81% of all diabetes cases come from low- and middle-income countries (LMICs)<sup>3</sup> and 80% of deaths related to chronic disease take place in low- and middle-income countries.<sup>5</sup>

To curve the rising diabetes health threat focusing on the modifiable risk factors such as behavioral risks like physical inactivity, tobacco use, harmful alcohol consumption, and unhealthy diet, and biochemical risk factors like high blood cholesterol, high blood pressure, overweight, and obesity have been and will be the main intervention areas that the world is calling for.<sup>4,6</sup> Standardized and contextualized diabetes management has been one of the three pillars to mitigate the impact of diabetes and patients with diabetes need ongoing and well-organized quality care delivered by multidisciplinary skilled healthcare providers. It should follow the implementation of standard protocols, guidelines, and clinical and non-clinical practices where it can contribute to lifestyles modifications, help the health care system to deliver tailored health education, and counseling services, monitor and control glycemic levels, detect and prevent or slowdown complication progression and promotes teamwork.<sup>7,8</sup>

This, in turn, plays a significant role in increasing productivity and reducing premature deaths, and it facilitates the utilization of affordable but effective medicines and technologies.<sup>7,9</sup> Consistent follow-ups and regular assessment of the major organs such as the eyes, kidney, cardiovascular system, and feet are equivocally important along with regular glycemic level monitoring.<sup>10</sup> Eventually, diabetes management plea for robust and ongoing, but cost-effective interventions to delay, minimize or avert its progression and/or negative consequences to the patients, families, communities, nation, or global community at large.<sup>7</sup>

On the contrary, diabetes mellitus and its management have been a less-priority problem in low-income countries like Ethiopia.<sup>7,11</sup> In these settings, poor preventive, promotive, treatment, and rehabilitative health services combined with resource shortages undermine the quality of diabetes interventions.<sup>12</sup> Moreover, access to life-saving essential medicines and technologies, including person-centered quality care and preventive measures is critically lacking in low- and middle-income countries, specifically in Ethiopia and in southern nations, nationalities, and people's regional state (SNNPRS) in particular.<sup>7,8</sup>

Furthermore, despite some economic and health gains during the last three decades, Ethiopia gave minimum to no attention to non-communicable diseases (NCDs) including diabetes prevention and control interventions. Nonetheless, the diabetes burden is alarmingly increasing, it has been common to see substandard diabetes care and there is no established system to monitor and evaluate diabetes and its management across the country.<sup>9,13,14</sup>

The prevalence of diabetes among Ethiopians ranges from 1.2–10.3%, and its complications such as nephropathy and retinopathy affect up to 30% and 45.4% of the patients respectively.<sup>7,15</sup> According to the center for disease prevention and control (CDC), diabetes has become one of the tenth leading causes of death in Ethiopia.<sup>2,3,16</sup> Yet, the morbidity and mortality data are not well documented and estimates indicate that this burden will swiftly increase in the next few decades along with epidemiological transitions, urbanization, and unhealthy lifestyles in the country.

Only six in every ten public health facilities have the capabilities to manage diabetes in the country and the services given in those health facilities have been far below any standard.<sup>17</sup> A study done in 2012 showed that only one of every three (35.1%) diabetic patients receive standard care in southern Ethiopia.<sup>18</sup> Moreover, there is a dearth of up-to-date and dependable evidence on diabetes screening and its management in the study area, which can contribute to tackling the problem at the grass-root level.

Therefore, this study was conducted to assess the capabilities, barriers, and opportunities for diabetes screening and management in southern Ethiopia, and the findings of this study will contribute to improving the overall diabetes management at the system's and patients' levels which, in turn, helps to find out the gaps and indicate the pace to achieve the sustainable development goals during the single remaining decade, 2030.

## Methods

### Study Setting

This study was nested in the project “an evaluation of diabetes management in southern Ethiopia”. Which was a policy and practice-oriented study that comprehensively evaluated the inputs, processes, and outcomes of diabetes-related interventions in southern Ethiopia.

The study was conducted in Hadiya and Kembata Tembaro zones (hereafter called sub-province) in the southern nation's nationalities and people regional state (SNNPRS), Ethiopia. The zones were randomly selected and are adjacent; has a 2,690,735 total population, of which 15.2% were urban inhabitants,<sup>19</sup> and the sub-province was administratively further divided into 28 districts, 7 urban and 21 rural. The main livelihood activities in the sub-province were un-mechanized agriculture, livestock rearing, and small businesses. There were 8 hospitals, 88 health centers, and 102 other health facilities such as drug stores and pharmacies.<sup>20</sup> The public health care system, similar to the national one, is organized into a three-tier system of primary health care units, which stands for primary hospitals, health centers, and health posts (the smallest health care level), the secondary level (general hospitals) and the tertiary level (teaching and referral hospitals).<sup>14,21,22</sup>

### Study Design and Data Collection Process

The data collection was done by using mixed methods, quantitative and qualitative methods, which were chosen based on the research question, cost, time, and feasibility of the study<sup>23,24</sup> and the intention to get a full picture of the topic at hand.<sup>25,26</sup> We followed two approaches to accomplish the aim of the study: the first approach addressed the health system's evaluation to assess the capabilities at structural and process levels that comprised the availability and use of essential supplies, equipment, technologies, guidelines, protocols, trained staffs, coordination between and among different disciplines and departments, services availability and delivery, monitoring, and evaluation mechanisms as well as the administrative structures of the region, sub-provinces, districts and randomly selected ten public health facilities. A second approach, the qualitative part, involved key informants' in-depth interviewing to discover the barriers, and opportunities at all levels to deliver the screening and diabetes management services, and we used purposive and maximum variation sampling techniques to recruit the in-depth interview participants from varying positions and backgrounds.

The in-depth interviews participants included the policymakers, healthcare providers, and service users with varying backgrounds: from the regional health bureau, zonal health departments and districts health offices NCD experts, clinicians from health facilities (internists, medical doctors, nurses, pharmacists, laboratory personnel), diabetic patients, DM patients' association members, and health facilities' leads and academia. We developed semi-structured open-ended questions by reviewing the available literature, rereading and refining, translating to Amharic language and back-translated by different translators, and pre-tested the questions before starting the actual data collection and then made the necessary improvement. Five individuals (one from the office level, two health workers, and two patients) declined the invitation to participate in the study due to time constraints.

Trained multi-lingual<sup>2</sup> data collectors did the in-depth interview by using a semi-structured and pretested topic guide; the data was captured by audio recording and supplemented by note-taking, and information saturation was reached after interviewing twenty-nine participants. We collected the quantitative data from randomly selected ten hierarchically organized public health facilities (six hospitals and four health centers) by using contextualized and pretested checklists, and the study was done from March 01 to August 30, 2020.

### Data Management and Analysis

Transcribing the qualitative data was done by the research team; an external translator from one of the public universities but not a member of the research team translated it into the English language, and the research team members who were bilingual crosschecked the translation for its accuracy. Two research teams read and re-read the transcripts, and identified codes for analysis, emerging themes, and points for further consideration. All research teams together developed and reached on consensus on a framework for coding the themes during a Skype meeting; then, the two groups independently worked on the

coding activity, and finally, thematic analysis was done during face-to-face and virtual meetings. The findings are pooled and presented against the main themes by using COREQ guidance for reporting qualitative research results.<sup>27</sup>

## Results

### Description of the Study Participants

A total of ten health facilities from the three-tiered healthcare level were critically assessed based on five main constituents of diabetes screening and management: availability of essential equipment, trained health workforce, essential laboratory tests, availability of essential drugs, and diabetes inclusive Plan, monitoring, and evaluation mechanisms. The findings indicated that some of the basic types of equipment were available at almost all levels, but the only available Glycated hemoglobin testing service at the tertiary level was never used for routine follow-ups during the last 24 months.

Among the most pressing issues from our study findings were the nonexistence of trained diabetes health educators and dieticians or nutritionists, the un-functionality of the Multi-Disciplinary Team (MDT) at all levels, and frequent stock-outing of essential drugs. Likewise, the diabetes-inclusive planning, monitoring, and evaluation components had been neglected without reason across the healthcare hierarchy (Table 1).

Besides, twelve (41.40%) of the 29 key informants (KIs) who had participated in the qualitative study were females, and the youngest, oldest, and mean ages of the KIs were 19, 67, and 36.20 years respectively. Concerning the educational attainment of KIs, 2 (7.00%) of them were illiterates and 25 (86%) had attended tertiary level (Table 2). Moreover, the main barriers to the delivery of diabetes screening and care in southern Ethiopia were mainly attributable to the

**Table 1** Health Facility Assessment Findings on Diabetes Screening and Management, SNNPRS, Ethiopia, 2020

| Component                                   | Category                            | Primary Level | Secondary Level | Tertiary Level | Overall |
|---|-------------------------------------|---------------|-----------------|----------------|---------|
| Functional Essential equipment availability | BP apparatus                        | 75%           | 100%            | 100%           | 80%     |
|   | Weighing scale                      | 63%           | 100%            | 100%           | 70%     |
|   | Measuring tape                      | 50%           | 0%              | 0%             | 40%     |
|   | Hematology or chemistry machine     | 38%           | 100%            | 100%           | 50%     |
|   | Glycated hemoglobin testing machine | 0%            | 0%              | 100%*          | 10%*    |
| Trained staff                               | Doctor(s)                           | 38%           | 100%            | 100%           | 50%     |
|   | Nurse(s)                            | 75%           | 100%            | 100%           | 80%     |
|   | Health educator(s)                  | 0%            | 0%              | 0%             | 0%      |
|   | Eye health care professionals       | 75%           | 100%            | 100%           | 80%     |
|   | Functional MDT                      | 0%            | 0%              | 0%             | 0%      |
|   | Dietician/ nutritionist             | 0             | 0               | 100%*          | 10%*    |
| Essential lab tests                         | Blood glucose                       | 100%          | 100%            | 100%           | 100%    |
|   | Urine protein and glucose           | 13%           | 100%            | 100%           | 30%     |
|   | Glycated HAlc test                  | 0%            | 0%              | 0%             | 0%      |
|   | Lipid profile                       | 38%           | 100%            | 100%           | 50%     |
|   | Others (like organ function tests)  | 0%            | 100%            | 100%           | 20%     |

(Continued)

**Table 1** (Continued).

| Component   | Category                                    | Primary Level | Secondary Level | Tertiary Level | Overall |
|---|---|---------------|-----------------|----------------|---------|
| Essential drugs availability                        | Metformin                                   | 75%           | 100%            | 100%           | 80%     |
|   | Glibenclamide                               | 50%           | 100%            | 100%           | 60%     |
|   | Other OGLA                                  | 50%           | 100%            | 100%           | 60%     |
|   | Injectable insulin                          | 38%           | 0%              | 0%             | 30%     |
|   | Injectable glucose solution                 | 63%           | 100%            | 100%           | 70%     |
|   | Statins                                     | 0%            | 100%            | 100%           | 20%     |
|   | Anti-hypertensive                           | 100%          | 100%            | 100%           | 100%    |
|   | Vitamins                                    | 63%           | 100%            | 100%           | 70%     |
| Diabetes inclusive Plan, monitoring, and evaluation | Annual plan disaggregated by month, quarter | 88%           | 0%              | 0%             | 70%     |
|   | Guideline, protocols, standards             | 25%           | 0%              | 0%             | 20%     |
|   | Internal SS & Feedback                      | 0%            | 0%              | 0%             | 0%      |
|   | External SS & feedback                      | 0%            | 0%              | 0%             | 0%      |
|   | Regular performance reviewing               | 0%            | 0%              | 0%             | 0%      |
|   | Regular client satisfaction assessment      | 0%            | 0%              | 0%             | 0%      |

**Note:** \*Available but not accessible for the patients.

**Abbreviations:** Glycated H<sub>1c</sub>, Glycated hemoglobin A1C Test; MDT, multi-disciplinary team; OGLA, oral glucose level lowering agents (drugs); SS, supportive supervision.

**Table 2** Socio-Demographic Characteristics of In-Depth Interview Participants, SNNPRS, Ethiopia, 2020

| Level                              | Position or Role     | Male n (%) | Female n (%) | Overall n (%) |
|------------------------------------|----------------------|------------|--------------|---------------|
| Policy and administrative          | Managerial level     | 2 (66.70)  | 1 (33.30)    | 3 (10.30)     |
|                                    | Expert               | 2 (50.00)  | 2 (50.00)    | 4 (13.80)     |
|                                    | Subtotal             | 4 (13.80)  | 3 (10.30)    | 7 (24.10)     |
| Healthcare facility                | Managerial level     | 3 (75.00)  | 1 (25.00)    | 4 (13.80)     |
|                                    | Service provider     | 6 (54.50)  | 5 (45.50)    | 11 (37.90)    |
|                                    | Subtotal             | 9 (31.00)  | 6 (20.70)    | 15 (51.70)    |
| Academia and patients' association | Academia             | 1 (100)    | 0 (0.00)     | 1 (3.40)      |
|                                    | Patients association | 1 (50.00)  | 1 (50.00)    | 2 (6.90)      |
|                                    | Subtotal             | 2 (6.90)   | 1 (3.40)     | 3 (10.30)     |
| Service user                       | Diabetic patients    | 2 (50.00)  | 2 (50.00)    | 4 (13.80)     |
|                                    | Total                | 17 (58.60) | 12 (41.40)   | 29 (100)      |

healthcare system itself, and also in one or another way the patients' and community-related factors were adding their share to the barriers, and the findings are thematically presented in the following paragraphs.

## Poor Managerial Role

Poor managerial roles and poor coordination were among the factors that have been affecting the diabetes interventions in southern Ethiopia, an interviewee stated,

Frankly speaking, one of the core problems in diabetes management is that diabetes gets little attention from the leadership at all levels. That is why you see unorganized service provision and reluctance in most offices or health facilities to deal with the challenges. (KI 21)

Another informant added,

The current health sector transformation plan of Ethiopia included diabetes prevention, screening, and management, however, the real problem is in its implementation, for instance, so far there is no clear indicator, strong follow-up and other mechanisms to improve diabetes screening and management (KI 22)

Furthermore, one of the interviewees confirmed this point by saying:

I am the chairman of the diabetic patients' association to represent them and present our claims to concerned bodies, sadly the managers, the clinicians, and the health facilities are less responsive to our needs for healthcare... even the leads commonly do not respond for our complaints for lifesaving drugs. (KI 27)

## Structural Neglect of Diabetes Interventions

Ethiopia's healthcare services delivery has been dominated by the public sector, and its focus and resources are dedicated to communicable diseases, and maternal and child health services. And the public and private healthcare systems are poorly organized and less appropriate to deal with the rising NCDs/diabetes burdens, specifically below provinces levels and HFs.<sup>1,7</sup>

A participant said,

To the best of my knowledge, NCDs/diabetes has been a neglected disease in SNNPRS as well as in the country (Ethiopia). (KI 1)

And another Key informant said,

Below the regional level someone working in another pinpoint gets delegated to work on NCDs/diabetes-related activities. But, the delegate is not fully accountable for failing to fulfill the duties

So,

Do you think this is not one of the root causes for the problems to sustain? (KI 29)

Additionally, another interviewee substantiated this point by saying:

The NCD/DM interventions have been neglected in this and other zones, for instance, below the regional level there is no responsible individual who works at this pinpoints, and similarly if you see the HFs there is no strong linkage between lower and upper structures to improve diabetes management. (KI 5)

## Financial Bottleneck

One of the reasons for Ethiopia's health sector's low performance and incompetence on the global stage are financial shortage, resource misuse, and lack of efficiency. One of the participants stated,

For the last two decades, I have been working in disease prevention and health promotion positions in different public health organizations. I understand that the burden of diabetes has been steadily rising, and every stakeholder is aware of it. But, even if we do have plans to undertake some interventions, we don't have the budget to do so. (KI 23)

Another interviewee confirmed and said,

You know the critical issue in our healthcare system is that, though some strategies are available, lack of finance to implement the policies or strategies and overall interventions is a problem (KI 17)

And another interviewee substantiated this point by saying,

Financial constraint is the main problem where patients live through life-threatening situations. For instance, we confirmed from the patients' families that during the last two months, two diabetics' passed away due to a lack of anti-diabetes medicines that were supposed to be supplied by the local government, and the patients and their families were unable to buy the medicines. (KI 25)

## Health Workers Inaccessibility

Skilled health workers' availability and accessibility can influence the health services delivery, utilization, and quality at large, and diabetes management in particular. To this end, our study findings indicated that health worker shortages and inaccessibility, if available, were among the barriers to diabetes management in the study area.

For instance, a KI stated:

I feel its patient's right to have consultations and basic health services from professionals... despite some shortages of senior clinicians, majority of the patients never get a single chance to consult seniors even once in a while. (KI 8)

And this idea was repeated by another KI

I have lived with diabetes for 23 years; I have been working hard to bring many people to diabetic patients' association and care and raised patients' and public awareness on diabetes... there are six internists in this facility, for your surprise, unless the patients have someone who is the senior's close friend or relative or the patient gives a visit to the senior's private clinic, most of the time, it's rare to get a chance to consult the specialist physicians. (KI 20)

Besides, another interviewee confirmed that by saying

To the best of my knowledge there are specialist physicians and rare professionals who are many highly paid at public HFs. The bad thing is that the professionals are mostly inaccessible. (KI 26)

Another respondent raised her concerns by saying,

Senior professionals are available in this hospital, but most of the time they are inaccessible. To your surprise, if we visit their private clinics, we pay very high and consult the same seniors over there that is unaffordable for the poor! (KI 4)

Furthermore,

Patients should first consult a nurse, then a GP... finally the specialist. This bureaucratic hierarchy is a common barrier for the patients to consult the seniors. (KI 14)

## Supply Shortages

To some extent supply shortages and stock-outs are bearable; however, lack of essential supplies should be dealt with without giving time or opportunity, and this point agrees with the system's evaluation findings that supply shortage has been a common problem in the study area.

An interviewee said:

Now it has been three years since I became a diabetic... since then, this HF has been the only public HF I should attend for my diabetes. Sadly, I don't remember a single day that I got all the tests and drugs in it; they (clinicians) always refer us to the private clinics or pharmacies. (KI 2)

Another respondent affirmed:

...the supply shortages in public HF's are artificial. For instance, it's becoming so common to refer patients unnecessarily to the private pharmacists or clinics and receive some commission (money) from the private facilities. (KI 12)

## Patients' Low Awareness Level

Improving the patient's awareness has been among the critical interventions to deal with chronic diseases like diabetes; however, our study findings indicated that low patient awareness is still a problem in the study area. A respondent pointed out by saying,

One of the issues we are working on, as an association, is that many patients think diabetes is curable; their understanding about diabetes and its outcome is poor but the healthcare system is not doing well to raise patients awareness. (KI 6)

Another interviewee substantiated,

I know a patient who refused to continue anti-diabetic drugs. Regrettably, she passed away while following traditional treatment. (KI 9)

Added by another interviewee:

I hardly afford to follow dietary recommendations for diabetics'... honestly, I do not adhere to it (KI 28).

Another participant confirmed,

Many patients come to HF's just for drug refilling and urge us to write prescriptions without other investigations. (KI 11)

## Poor Planning, Monitoring, and Evaluation Mechanisms

In the health sector, it is very common to have practical plans ahead of executing the activities and failing to plan has been regarded as planning to fail.<sup>14,28</sup> By considering this point, we studied the availability and functionality of diabetes screening and management plans and M&E systems. And the findings were as quoted below:

I have been working in this area for the last two years, and I confirm that no one, both internal and external, has included in a checklist about diabetes and supervised or evaluated in review meetings; we rarely find a workable plan, no one uses data to reasonably act on it. (KI 15)

Another respondent reaffirmed:

We have many patients on follow-ups at health facilities under our supervision, but we always focus on communicable diseases and skip the NCDs/diabetes whenever we have performance review meetings. (KI 3)

## Poor Services Delivery Arrangement

Health services delivery arrangement is one of the attention-demanding areas that the policymakers and health system at large should revisit to improve service quality, efficiency, and equity.<sup>14,29,30</sup> And our study participants pointed out that the current healthcare delivery system needs reorganization or revision.

As of my understanding, the patients are not getting what they deserve. Patients don't find the laboratory tests or drugs they are prescribed; they don't get health education, and sometimes only those who pay in cash for the services get priority over others. (KI 10)

On the other hand, the participants pointed out some missed opportunities too. For instance, an interviewee said,

Of course, there are many missed opportunities to improve diabetes interventions at any level. Let me point out one, these days many patients have mobile phones, and if we send them some text messages, they can learn something good for their health; but we never do that. (KI 24)

Another respondent said:

I think the government's commitment is now good towards the prevention and management of the NCDs, and we can intensify our efforts to improve diabetes care. However, our immediate leads are not taking bold actions in this regard. (KI 7)

Another respondent substantiated:

I feel the understanding and attitude towards diabetes and its effect is improving at all levels but we are not taking it seriously. If we take this opportunity and organize our efforts, we can bring a change. (KI 19)

## Poor Service Integration

The national and global situations are influencing the healthcare system to integrate services to enhance efficiency and improve health outcomes.<sup>14,31–33</sup> A participant said:

In all public HFs, diabetes-related activities are not well integrated with other existing health services, so this can be one of the barriers to improving diabetes screening and management. {KI 13}

Another respondent said,

The responsible bodies never monitor the diabetes management in the private HFs, and there is little or no partnership with the private sectors. (KI 16)

Another interviewee reaffirmed this by stating:

Unless patients develop some complications, no one cares to give them comprehensive care as HIV/AIDS and TB clinics do. (KI 18)

Even some interventions are not considered integral parts of the routine services as indicated by participants:

Some health workers reflect that health education and counseling services are extra tasks imposed by their leads, and they do not give attention to it. (KI 10)

## Discussion

Diabetes screening and management are among the vital interventions to achieve sustainable development goal three (SDG3) of reducing NCDs related mortalities by one-third by 2030.<sup>34</sup> However, Ethiopia's capabilities to do so and the actual barriers in this regard lack credible evidence.<sup>1,35</sup> Hence, it is imperative to generate credible pieces of evidence by evaluating the healthcare system to address the concerns of diabetes.<sup>1,2,7,36</sup>

Our study finding showered that Ethiopia's commitment to dealing with the alarming rising diabetes burden is not well organized and functional. For example, the maximum availability of essential supplies or equipment was 80% for an easily purchasable blood pressure measuring apparatus, and it was as low as 10% for the Glycated hemoglobin testing supplies. Further, the worst issue was that the planning, monitoring, and evaluation were neglected components of the facilities' readiness across public HFs that need due attention from all stakeholders.

Periodic healthcare system evaluation is necessary to track how the health system is responding to the people's health needs; to know the extent to which level its essential inputs and processes are functioning to meet the organization's goals, and then to consider measures to achieve the set goals.<sup>37,38</sup> To this end, our study findings showed that some crucial tests were not available at all, or not given as if not important. For instance, less than 50% of HFs health organizations have capabilities like urine glucose testing, urine protein testing, and organ function test to monitor major organ functions and take timely measures and this finding agrees with other studies findings from elsewhere in Ethiopia.<sup>39,40</sup>

The current study result showed that poor health data record keeping was one of the gaps across the study area. This finding was in line with other studies findings that indicated, though Ethiopia has intensified investments in health infrastructure, the regions, zones, districts, and HFs do not have dependable and up-to-date health information systems on NCDs, and the available data have been of poor quality.<sup>2,41</sup>

Concerning the availability and access to skilled health workers and essential drugs, our study findings showed that these essential components of diabetes management are sustained problems in the area; none of the HFs has met all five essential components to effectively respond to the diabetes burden. Hence, this finding calls for the health sector to fulfill the basic principle of guaranteeing access to quality healthcare services without preconditions.<sup>42</sup> Besides, the current study finding delineated that there were no trained diabetes educators at all public health facilities and this finding disagrees with some study findings in Ethiopia.<sup>43</sup> Therefore, to improve the competence of the healthcare system, health workers, leadership, and people's health at large, it needs concerted efforts, coordination, and collaboration beyond the health system.

Our qualitative study findings showed that regardless of available opportunities to improve diabetes screening and management in southern Ethiopia, systemic neglect of diabetes/NCDs, specifically below the region is one of the barriers to diabetes-related interventions. Someone gets delegated to run the activities, but, the delegate is not accountable for any failures and this finding supports what another study reported elsewhere in Ethiopia.<sup>44</sup>

The lack of a workable plan, monitoring and evaluation system for diabetes management was among the critical gaps that our study found-out. Preceding studies from central, north, and southwest Ethiopia<sup>19,45,46</sup> and other sub-Saharan African countries<sup>47,48</sup> have reported similar findings. This could be attributed to the fact that the Public healthcare system in many developing nations is mainly designed to deal with communicable diseases,<sup>49–52</sup> however, domestic and international bodies agreed that the primary function of the healthcare systems is ensuring minimum quality healthcare that meets the needs of people.<sup>53</sup>

Based on our study findings lack of trained health workers and low patient awareness levels were among the barriers to delivering quality diabetes screening and management in SNNPRS, and this finding substantiates a study result from Ethiopia where training shortages for health workers and low awareness levels of patients were among the barriers to diabetes management.<sup>54</sup> The possible justification for this gap is that Ethiopia's healthcare system is yet struggling with poor staffing, skilled health workforce shortage, and incompetency, specifically the lower and midlevel health workers, low health literacy level of people, and lack of quality training and education system.

The current study found that there were some guidelines and protocols at national and regional levels that yet need revisions. However, there were no such documents at zones, districts, and health facilities. This finding complements another research report on gestational diabetes management in Ethiopia.<sup>54</sup> This problem can be solved by availing the materials at the lower levels, and engaging stakeholders to fill the gaps.<sup>55,56</sup> Additionally, our in-depth interview results showed that poor knowledge and lack of skills among the health workers, frequent stock-outs of supplies, unaffordability of some important services, and organizational neglect of diabetes-related activities were among the hindering factors to curve the rising diabetes burden. This finding was consistent with a study done in northern Ethiopia.<sup>57</sup>

Diabetes management demands ongoing and comprehensive but cost-effective approaches and lifelong follow-ups from the healthcare system and others.<sup>2</sup> The current study findings indicated that diabetes management in southern Ethiopia has been challenged by financial constraints where some patients did not afford to pay for the services or drugs. This finding agrees with other study reports from Ethiopia.<sup>2,58</sup> The poor people in the country have less access to healthcare, and many of those poor who have access are pushed into impoverishment due to catastrophic out-of-pocket healthcare expenditures<sup>59</sup> the problem has been intertwined with low government health spending, lack of health insurance system, inefficiency, inequity in resources allocation, and poor harmonization of funds.<sup>60–63</sup>

Moreover, in the study area, the healthcare facilities have severe financial shortages to deal with medical equipment shortages, erratic drug availability, and a lack of facilities for renovations and repairs. This finding supports what other researchers indicated in their studies that financial constraints had been imposing a significant impact on service availability, quality, and uptake.<sup>59,63</sup> Hence, to improve the problem at the lower structures, the health systems should mobilize financial and other resources by introducing a health insurance system, lobbying governments for appropriate public budget allocation, engaging stakeholders, and improving resource efficiency in the healthcare system.

The diabetes screening and management services were not well integrated into the existing district health information system (DHIS2) and some of the included indicators were not clear for health workers or data managers. This finding supports some other study reports from central Ethiopia,<sup>57</sup> China,<sup>64</sup> and India<sup>65</sup> that the lack of a well-established system to monitor and evaluate NCDs interventions has critical setbacks to achieving the SDGs. Furthermore, the study

participants repeatedly indicated that the partnership and collaboration among stakeholders have been poor to improve diabetes screening and management. This result also supports some other study findings from Ethiopia<sup>66</sup> and somewhere else<sup>67</sup> that presented, in diabetes responses, lack of multi-sectorial approaches and poor stakeholders' engagement were sustained problems.<sup>67</sup>

## Conclusion

This study evaluated diabetes screening and management in a three-tiered hierarchically organized healthcare system in one of the most populated regions of Ethiopia, SNNPRS, by triangulating healthcare system evaluation and key informants' in-depth interviews. Our study findings indicated that diabetes screening and management in southern Ethiopia has suffered from multidimensional but solvable problems like the system's lack of capabilities, organizational defects, poor staffing, poor service delivery, and poor data documentation practices across the healthcare hierarchy.

Diabetes screening and management in southern Ethiopia has been an orphan healthcare service where its neglect starts at the policy and strategies formulation level and extends to its implementation gaps at its subsequent lower health system structures. Diabetes has been systematically neglected at the structural level, services delivery was ill-organized, essential supplies are usually unavailable and in most circumstances, senior professionals were inaccessible for the patients' to consult them. The patients' awareness level, adherence to recommendations, and preventive practices were poor, and the patients were economically struggling to afford some of the services.

To improve diabetes screening and management and to mitigate its impacts on the patients, patient's families, and healthcare systems at large, the following recommendations are made: the ministry of health, universities, and colleges are strongly suggested to train diabetes health educators and build health-workers capacity; the inaccessibility of senior or rare professionals needs a check mechanism or should be substituted by training medium-level professionals and revision of office organization and services delivery, particularly below the region is recommended. The planners should update the district health information systems (DHIS2) and revise its indicators definitions to improve poor documentation practices.

The province-level leadership should consider resource allocation for diabetes interventions, equip the health facilities with at least essential supplies, and avail standard guidelines and protocols. The healthcare facilities are recommended to give due attention to delivering focused counseling and tailored health education and promoting lifestyle modification. Furthermore, at least the secondary and tertiary level HFs should start computer-based medical record-keeping practices and the patients are strongly suggested to strictly adhere to treatment and lifestyle modifications recommendations.

## Strengths and Limitations of the Study

The strengths of this study are: it is the first in its kind so far done in Ethiopia by triangulating quantitative and qualitative methods to evaluate diabetes screening and management capabilities, barriers, and opportunities in the hierarchically organized healthcare system, and it addressed both supply and demand-sides perspectives. However, the study has some limitations such as not including the private healthcare facilities and those health workers who work, and the patients receiving the healthcare services at private HFs.

## Data Sharing Statement

All the data used to support the result of this study were incorporated in the article; however, whenever more information and/or data are required, the corresponding author will present it upon reasonable request.

## Ethics and Consent Statement

This study was first approved by the Tehran University of medical sciences institutional review board with a reference number IR.TUMS.SPH. REC.1398.078; then the SNNPRS health bureau approved it again; the declaration of Helsinki consideration was strictly followed where each study participant gave informed written consent to participate and also agreed on the publication of anonymized responses.

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## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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## Disclosure

The authors report no conflicts of interest for this work.

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