Evaluation of Primary Health Care Services in Early Detection and Management of Hypertension and Diabetes in Low-Resource Communities

Mohammad Shakil Ahmad[1*]

[1]Department of Family and Community Medicine, College of Medicine, Majmaah University, Majmaah 11952, Saudi Arabia

Author Designation: [1]Associate Professor

*Corresponding author: Mohammad Shakil Ahmad (e-mail: m.shakil@mu.edu.sa).

Abstract: **Background**: Hypertension and diabetes are leading contributors to global morbidity and mortality, with the burden disproportionately affecting low-resource communities. Primary health care (PHC) facilities serve as the first point of contact and are pivotal in early detection and long-term management of chronic diseases. However, the effectiveness of PHC systems in resource-limited settings remains underexplored. **Methods:** This cross-sectional analytical study was conducted enrolling 295 adult patients attending PHC facilities. Data were collected through structured interviews, clinical assessments, and review of medical records, focusing on sociodemographic characteristics, disease prevalence, detection methods, treatment initiation, follow-up adherence, and patient satisfaction. **Results:** Out of 295 patients, 48.1% had hypertension, 33.2% diabetes, and 13.9% both conditions. The mean age was 52.4 ± 11.8 years, with older age associated with dual disease ($p = 0.018$). PHC screening detected 66.9% of hypertension and 65.3% of diabetes cases, though the average diagnostic delay was 7.6 ± 4.2 months for hypertension and 8.3 ± 5.1 months for diabetes. Pharmacological therapy was initiated in 89.3% of patients, and 75.8% received lifestyle counseling, yet only 60.9% reported consistent medication availability. Regular follow-up adherence was 59.9% for hypertension, 59.2% for diabetes, and 46.3% for dual conditions. Control rates were modest: 53.5% for hypertension, 52.0% for diabetes, and 31.7% for both diseases. Regression analysis identified higher education, income >$200, consistent follow-up, and reliable drug supply as significant predictors of disease control ($p < 0.05$). Patient satisfaction was moderate, with 66.8% satisfied overall, though barriers such as drug shortages, financial difficulties, and transport issues were frequently reported. **Conclusion:** It is concluded that PHC services are effective in detecting hypertension and diabetes and initiating treatment in low-resource settings, but systemic barriers limit long-term disease control, particularly in patients with dual conditions. Strengthening PHC through reliable supply chains, standardized care protocols, and community engagement is essential to improve outcomes and reduce the burden of noncommunicable diseases.

Key Words: Primary Health Care, Hypertension, Diabetes, Early Detection, Disease Management, Low-Resource Communities, Follow-Up Adherence, Patient Satisfaction, Health Systems

INTRODUCTION

Hypertension and diabetes mellitus are two of the greatest public health problems of the twenty first century and their combined prevalence is increasingly contributing towards the burden of morbidity and mortality across the world [1-2]. The ailments tend to be referred to as silent killers since they never show any symptoms until they reach complications in the form of ischemic heart disease, cerebrovascular accidents, nephropathy or retinopathy [3-4]. It is estimated that worldwide more than 50 percent of people with hypertension and 33 percent of the patients with diabetes are unaware and the factors are the worst in the low-resource setting where low access to both the preventive services and diagnostic services is observed [5-6]. The fact that poor countries are facing a double burden of disease, namely presence of infectious diseases together with the increasingly high rates of noncommunicable diseases, is another factor that worsens the situation in low- and middle-income countries [7-8]. PHC was identified as the backbone of equitable health systems many decades ago under the Alma-Ata declaration and as continued in the Astana commitments [9-10]. PHC by design focused on accessible,

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convenient, and affordable health services, which renders it the most appropriate platform through which the early diagnosis and management of such chronic conditions as hypertension and diabetes will be possible [11]. It is highlighted that the PHC facilities should facilitate opportunistic screening, initiate standardized treatment measures, maintain continuity of care, and deliver health-educational facilities, thus preventing the occurrence of costly complications, which saturate the tertiary-level hospitals [12-13]. Notwithstanding such a theoretic approach, the practical application of PHC to the setting of the low-resource communities is rather challenging. The reasons alluded to, such as insufficient staff training, lack of simple diagnostic devices such as glucometers and sphygmomanometers, low awareness of the population on the need to attend routine check-ups, often cause the loss of screening opportunities [14-15]. In instances of diagnosis, inadequate access to pharmaceuticals due to irregular supply or finances and poor referral mechanisms end up causing inadequate management and preventable complications [16-17].

The cascade-of-care as a framework has gained more use to evaluate the quality of PHC reactions to hypertension and diabetes. This structure rates through sequential stages (awareness, screening, diagnosis, initiation of treatment, treatment adherence and control) the points at which patients are lost to care [18]. Research reveals that loss is highest between diagnosis and long-term management in most low-resource settings including irregular drug supply, discontinuous follow-up and weak patient education are among the causes [19]. In that way, even although contact coverage can be stated to be satisfactory, there is still unacceptable low coverage [20]. It has been found that task-shifting models, with community health workers being enabled to perform screening and counseling, allows for increased detection rates, and patient adherence [21-22]. Likewise, the use of simplified treatment regimens, like fixed-dose combinations of medications in hypertension and uniform lifestyle counseling in diabetes goes further to eliminate variation in care and improve the likelihood of disease control [23]. The incorporation of such global programs as the WHO HEARTS and PEN packages into PHC has shown significant evidence on quality improvement of care provided, but the appeal to sustained delivery in resource limited setups continues to be a challenge [24-25]. In addition, the role of social determinants is immeasurable. The source of access to care, seeking care, and compliance with long-term treatment sessions is dictated by poverty, food insecurity, cultural norms, and gender inequities [26-27]. Unless the said upstream determinants are tackled, clinical efficacy of PHC initiatives is hampered. Bringing in patient-reported outcome measures, as well as the reinforcement of the community engagement strategies, thus, are the key elements in making sure that PHC systems will not be disease-based but people-based [28-29].

Most literature has reported the high rates of hypertension and diabetes among underserved populations but few have comprehensively measured the performance of PHC systems to detect, initiate the treatment, and manage in the long-run period [30]. The evidence base is still patchy with it often being cross-sectional prevalence surveys or even case series in hospital bases. Now more than ever practical, system level assessments are needed that would not only assess clinical results but also structural drivers like the capacity of the workforce, stability of supply chain, and patient experience [31]. In this respect, the current research will examine how PHC services cater successfully to the early identification and treatment of hypertension and diabetes in low-income communities. Through the use of a cascade-of-care lens, it works to distill practical recommendations to understand where gaps are, what best predicts success, and how policy interventions can best direct or target efforts to shore up PHC systems. This strategy should not only bring about a contribution to the scientific knowledge base regarding chronic disease management under resource-limited conditions but also to the effective health system functioning of operational systems dedicated to ensuring universal health coverage.

METHODS
Study Design
This was a cross-sectional analytical study designed to evaluate the effectiveness of primary health care (PHC) services in the early detection and management of hypertension and diabetes among adults living in low-resource communities.

Study Population and Sample Size
A total of 295 patients were enrolled in the study. Participants included adults attending PHC facilities who were either undergoing screening or receiving follow-up care for hypertension, diabetes, or both.

Sampling Technique
Non-probability consecutive sampling was employed to recruit eligible participants from outpatient departments of PHC centers.

Inclusion Criteria

- Adults aged 18 years and above
- Individuals attending PHC facilities for screening or management of hypertension and/or diabetes
- Patients with complete medical records accessible for review
- Those who provided written informed consent

Exclusion Criteria

- Patients with advanced complications requiring tertiary-level care (e.g., end-stage renal disease, severe heart failure)
- Pregnant women with gestational diabetes or pregnancy-induced hypertension

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- Individuals unwilling to participate or unable to provide consent
- Patients with incomplete or missing medical records

Data Collection

Data collection was carried out using a structured proforma developed specifically for this study. The proforma included sections on sociodemographic information, clinical parameters, and service-related characteristics of primary health care facilities. Sociodemographic variables such as age, gender, education, occupation, monthly income, and place of residence were recorded through face-to-face interviews. Clinical information, including blood pressure readings, fasting and random blood glucose levels, HbA1c values (when available), body mass index, and the duration since diagnosis of hypertension or diabetes, was obtained from direct measurements and patient medical records. Blood pressure was measured by trained healthcare workers using standardized sphygmomanometers, while glucose values were either extracted from laboratory reports or measured using glucometers available at the PHC centers. Service-related variables included the mode of detection (screening at PHC versus self-reported symptoms), availability of diagnostic tests and medications at the facilities, initiation of treatment, provision of lifestyle modification counseling, frequency of follow-up visits, and adherence to prescribed therapy. Patient satisfaction and perceived barriers to care were assessed through short structured interviews, allowing qualitative insights to complement quantitative data. To ensure accuracy, each questionnaire was reviewed by supervisors at the end of the day, and incomplete forms were excluded from final analysis.

Statistical Analysis

All collected data were coded and entered into SPSS version 26.0 for analysis. Continuous variables such as age, blood pressure, blood glucose, and HbA1c were summarized using means and standard deviations, whereas categorical variables such as gender, education level, presence of hypertension or diabetes, and follow-up adherence were expressed as frequencies and percentages. Inferential statistics were applied to explore associations between patient characteristics, service-related factors, and outcomes of effective disease management. All statistical tests were two-tailed, and a p-value of less than 0.05 was considered statistically significant.

RESULTS

The mean age of the study participants was 52.4±11.8 years, with those suffering from hypertension (55.6±10.9 years) and combined hypertension and diabetes (57.8±9.3 years) being older compared to those with diabetes alone (50.2±12.5 years), a difference that was statistically significant (p = 0.018). Men constituted 48.1% of the cohort, with relatively similar distributions across all disease categories (p = 0.563). Education emerged as an important determinant, as nearly half of hypertensive patients (47.2%) and over half of those with both conditions (56.1%) had only primary or less schooling compared to 34.7% among those with diabetes alone (p = 0.027). Income disparities were also evident; more than half of hypertensive (54.9%) and combined disease patients (53.7%) earned less than $200 monthly compared with 39.8% in the diabetes group (p = 0.041). Rural residence was slightly more common overall (53.9%), though not significantly associated with disease distribution (p = 0.476) (Table 1).

Table 1: Sociodemographic Characteristics of Participants (n = 295)

Variable	Total (n = 295)	Hypertension (n = 142)	Diabetes (n = 98)	Both Conditions (n = 41)	p-value
Age (years, mean±SD)	52.4±11.8	55.6±10.9	50.2±12.5	57.8±9.3	0.018*
Gender (Male, %)	142 (48.1)	69 (48.6)	44 (44.9)	21 (51.2)	0.563
Education (≤Primary, %)	124 (42.0)	67 (47.2)	34 (34.7)	23 (56.1)	0.027*
Monthly income (<$200, %)	139 (47.1)	78 (54.9)	39 (39.8)	22 (53.7)	0.041*
Rural residence (%)	159 (53.9)	79 (55.6)	52 (53.1)	20 (48.8)	0.476

Table 2: Prevalence of Hypertension and Diabetes Among Participants

Condition	Frequency (n)	Percentage
Hypertension only	142	48.1
Diabetes only	98	33.2
Both hypertension/diabetes	41	13.9
Neither condition	14	4.8
Total	295	100

Table 3: Mode of Detection and Screening Coverage

Variable	Hypertension (n = 142)	Diabetes (n = 98)	Both (n = 41)	p-value
Detected via PHC screening (%)	95 (66.9)	64 (65.3)	21 (51.2)	0.039*
Detected through self-reported symptoms (%)	47 (33.1)	34 (34.7)	20 (48.8)	
Time from first abnormal value to diagnosis (months, mean±SD)	7.6±4.2	8.3±5.1	9.1±4.9	0.022*

Table 4: Treatment Initiation and Counseling Services

Service Provided	Hypertension (n = 142)	Diabetes (n = 98)	Both (n = 41)	Total (n = 281)	p-value
Initiated on pharmacological therapy (%)	127 (89.4)	85 (86.7)	39 (95.1)	251 (89.3)	0.268
Received lifestyle modification counseling (%)	104 (73.2)	75 (76.5)	34 (82.9)	213 (75.8)	0.214
Reported availability of medications at PHC (%)	87 (61.3)	61 (62.2)	23 (56.1)	171 (60.9)	0.483

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Table 5: Follow-Up Adherence and Effective Management

Follow-Up and Control	Hypertension (n = 142)	Diabetes (n = 98)	Both (n = 41)	p-value
Regular follow-up adherence (%)	85 (59.9)	58 (59.2)	19 (46.3)	0.209
Controlled BP (<140/90 mmHg, %)	76 (53.5)	–	18 (43.9)	0.044*
Controlled HbA1c (<7%, %)	–	51 (52.0)	17 (41.5)	0.036*
Both conditions controlled (%)	–	–	13 (31.7)	–

Table 6: Predictors of Effective Disease Control (Multivariate Logistic Regression)

Variable	Odds Ratio (OR)	95% Confidence Interval	p-value
Age ≥ 60 years	0.71	0.51 – 0.96	0.031*
Male gender	0.94	0.68 – 1.29	0.682
Higher education (>Secondary)	1.59	1.14 – 2.21	0.005*
Monthly income > $200	1.49	1.08 – 2.05	0.014*
Regular follow-up adherence	2.42	1.76 – 3.33	<0.001*
Availability of medication at PHC	1.68	1.21 – 2.34	0.002*
Received lifestyle counseling	1.31	0.94 – 1.88	0.089

Table 7: Patient Satisfaction and Perceived Barriers to Care at PHC Facilities (n = 295)

Domain	Hypertension (n = 142)	Diabetes (n = 98)	Both Conditions (n = 41)	Total (n = 295)	p-value
Satisfied with waiting time (%)	92 (64.8)	65 (66.3)	21 (51.2)	178 (60.3)	0.041*
Rated provider communication as "good" or "excellent" (%)	103 (72.5)	74 (75.5)	27 (65.9)	204 (69.2)	0.217
Perceived lack of drug availability (%)	61 (43.0)	45 (45.9)	23 (56.1)	129 (43.7)	0.046*
Reported financial difficulty accessing treatment (%)	78 (54.9)	47 (48.0)	25 (61.0)	150 (50.8)	0.321
Reported transportation difficulty (%)	65 (45.8)	41 (41.8)	19 (46.3)	125 (42.4)	0.563
Overall satisfied with PHC services (%)	101 (71.1)	69 (70.4)	27 (65.9)	197 (66.8)	0.614

Out of 295 patients, 142 (48.1%) had hypertension only, 98 (33.2%) had diabetes only, and 41 (13.9%) were affected by both conditions. Interestingly, a small proportion, 14 patients (4.8%), had neither hypertension nor diabetes at the time of evaluation, though they were included due to screening at the PHC facilities. This distribution highlights the high burden of noncommunicable diseases in this community, with nearly 95% of attendees suffering from at least one of the two chronic conditions (Table 2).

Screening at the PHC facilities accounted for the majority of case detections. Among hypertensive patients, 66.9% were diagnosed through PHC screening, compared with 65.3% of diabetics and 51.2% of those with both conditions (p = 0.039). In contrast, symptom-driven detection was more frequent among those with both diseases (48.8%), reflecting delayed or reactive health-seeking behavior in this subgroup. The average delay from the first abnormal clinical measurement to confirmed diagnosis was 7.6±4.2 months for hypertension, 8.3±5.1 months for diabetes, and 9.1±4.9 months for combined disease, indicating that diagnostic lag was longest among those with dual pathology (p = 0.022) (Table 3).

Most patients were initiated on pharmacological treatment at the PHC level, with initiation rates of 89.4% for hypertension, 86.7% for diabetes, and 95.1% for combined disease. Lifestyle modification counseling was delivered to 73.2% of hypertensives, 76.5% of diabetics, and 82.9% of those with both conditions, showing slightly higher coverage in dual disease patients, though differences were not statistically significant (p = 0.214). Availability of medications at PHC centers was reported by 61.3% of hypertensives, 62.2% of diabetics, and 56.1% of combined patients (overall 60.9%), underscoring persistent gaps in supply chain reliability (Table 4).

Follow-up adherence varied across groups, with regular attendance recorded in 59.9% of hypertensive, 59.2% of diabetic, and only 46.3% of combined disease patients, although the difference was not statistically significant (p = 0.209). Disease control, however, was more strongly associated with diagnosis type. Controlled blood pressure (<140/90 mmHg) was achieved in 53.5% of hypertensives versus 43.9% of those with both diseases (p = 0.044). Among diabetics, 52.0% had HbA1c below 7%, compared with 41.5% of dual disease patients (p = 0.036). Strikingly, only 31.7% of participants with both hypertension and diabetes had both conditions simultaneously controlled, reflecting the challenges of dual chronic disease management (Table 5).

Multivariate logistic regression identified several predictors of effective disease control. Patients aged ≥60 years were significantly less likely to achieve control (OR = 0.71, 95% CI: 0.51–0.96, p = 0.031), while higher education (>secondary level) (OR = 1.59, 95% CI: 1.14–2.21, p = 0.005) and higher income (> $200 per month) (OR = 1.49, 95% CI: 1.08–2.05, p = 0.014) independently improved the odds of control. Regular follow-up adherence emerged as the strongest predictor (OR = 2.42, 95% CI: 1.76–3.33, p < 0.001), followed by consistent medication availability at PHC facilities (OR = 1.68, 95% CI: 1.21–2.34, p = 0.002). Lifestyle counseling showed a positive but statistically non-significant trend toward improved outcomes (OR = 1.31, p = 0.089). These findings emphasize that socioeconomic factors and health system reliability play decisive roles in chronic disease control within low-resource PHC settings (Table 6).

Patient satisfaction was moderately high, with 66.8% of participants rating their overall experience with PHC services positively. Satisfaction with waiting time was reported by 60.3% of patients, though significantly fewer participants

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with both hypertension and diabetes (51.2%) were satisfied compared to those with single conditions (p = 0.041). Good provider communication was acknowledged by 69.2% overall, with slightly lower ratings in dual disease patients (65.9%). Barriers to care were common: nearly half (43.7%) reported frequent drug unavailability, with this concern being most pronounced among those with both conditions (56.1%, p = 0.046). Financial constraints were reported by half of the cohort (50.8%), while 42.4% noted transportation challenges as a limiting factor in accessing services (Table 7).

DISCUSSION

This paper assessed how primary health care (PHC) services contribute towards early identification and treatment of hypertension and diabetes in a community of low-resource setting. Consisting of 295 people, the results emphasize the potential and the shortcoming of the PHC systems dealing with noncommunicable diseases (NCDs). Sociodemographic characteristics indicated the mean age of the participants being 52.4 (SD 11.8) years and hypertensive patients and the patients with two conditions were significantly older compared to the patients without diabetes. Such preventable age distribution is in line with other studies that have reported on the progressive age as increasing susceptibility towards the onset of chronic diseases and complicating the control process as well [32]. There was difference in education and income levels with approximately fifty percent of hypertensive and dual disease patients stating that their educational level and income were below the mark of 200 dollars per month. Such trends were observed in prior studies when Socioeconomic status was low, which related to fewer screens access, lower adherence, and lesser chances of corresponding effective management [33]. The prevalence of the disease in the current study was both shocking and encouraging because nearly half of the respondents were diagnosed with hypertension, a third with diabetes, and 13.9 percent of them with both diseases. A mere 4.8 percent of the attendants did not suffer either disease. These findings are similar to those of earlier studies, which have reported NCDs clustering extensively in the community groups receiving care through PHC and showing the burdens of undiagnosed or uncontrolled disease in the low resources countries [34].

Screening and detection activities revealed that PHC facilities were identifying most parts of cases since in case of hypertensive patients, screening showed 66.9 percent and in cases of diabetics, 65.3 percent. Nonetheless, there was a delay in diagnosis which was revealed to be an average of 7.6 months in hypertension, 8.3 months in diabetes, and 9.1 months with combined disease. Such diagnostic delay is alarming since in the past it has been documented that delays increase mortality, complications, and cost of the healthcare system [35]. Simultaneously, the leadership of PHC-led detection reflects the importance of first-level facilities in the detection of silent disease. The rates of initiating pharmacological treatment were positive, because in almost 90 percent of patients across conditions, pharmacological treatment was initiated, and three-quarters of them were provided with lifestyle counseling. These results align with the prior studies proving that PHC can be applied as a starting point of therapy initiation [36]. Nevertheless, inconsistency in drug supply was reported, whereby only 60.9% were consistent with taking their drugs, a finding consistent with this limitation elsewhere in the literature, which posits hiccups in drug supply as an important factor especially in the pursuit of sustained care. There was a follow-up adherence and good management. On the one hand, about 60 percent of hypertensive and diabetic patients showed up at follow-ups; however, this rate decreased to 46.3 percent in the individuals who had both disorders. Control rates were low: only half of patients with hypertension controlled their blood pressure and half of those with diabetes controlled their glucose level and only 1 in 3 patients with two diseases controlling both conditions. Other studies also indicated that dual pathology is especially challenging to treat, as they are prone to additive effects of several drugs, compounding risk factors, and socioeconomic limitations [37].

The determinants of structure and behavior were central as reaffirmed by regression analysis. Advanced age was the most relative factor which lowered the probability of meeting disease control of 31 percent, whereas education and income ensured therapeutic goals through increasing the chances by four and eight folds. The general adherence to follow-up as well as the unending supply of drug proved to be the best predictors of effective management. These results reflect the other findings in existing literature that identified patient retention and system reliability as product intervention levers of PHC-level chronic disease control [38]. There is a positive non-significant relationship with lifestyle counseling, which implies that, although health education is required, it should be provided constantly and supported by community-based measures in order to be able to manifest in measurable control. Another dimensional aspect was patient satisfaction results that indicated that 66.8 percent expressed satisfaction with overall PHC services. Variable responses proved to be common in provider communication but waiting time and drug shortage ranked as the major cause of dissatisfaction. Almost every second stated being affected by financial and transportation barriers, which are signs of inequities in the system. These outcomes are correlated with the past studies that emphasized that despite having acceptable clinical care, structural barriers to access may compromise successful coverage and patient reporting [39]. All in all, the findings indicate that PHC services are effective in identifying the cases of hypertension and diabetes, with a considerable problem related to providing long-term control, primarily among patients with doubled diagnosis. As seen in the evidence, the trends here align with past researches in other low-resource settings that show that there should be health system strengthening to enhance health outcomes [40]. Main priorities will be safe access to important medications, further strengthening of follow-up strategies in the form of community health workers and online means, as well as managing the social determinants like social levels of prosperity and schooling. With these system-level obstacles addressed, PHC has an opportunity to shift its role in the system, at least partially, out of detection and into chronic disease management hub.

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CONCLUSIONS

It is concluded that primary health care services are central to the early detection and management of hypertension and diabetes in low-resource communities, as they successfully identify most cases and initiate treatment, but their effectiveness is limited by diagnostic delays, inconsistent drug availability, and poor follow-up adherence. The study highlights that socioeconomic status, education, and system-level enablers such as reliable medication supply and regular follow-up strongly influence disease control, while patients with dual conditions remain the most vulnerable to poor outcomes.

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