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# Evaluation of Management of Patients with Diabetes Mellitus at Primary and Tertiary Healthcare Services

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## ABSTRACT

**Objectives:** This study aimed to evaluate the management of type 2 diabetes mellitus (DM) patients who apply to primary healthcare services (PHS) and tertiary healthcare services (THS).

**Methods:** This is a cross-sectional study that used information about patients diagnosed with DM for at least 1 year from 25 family health centers considered PHS and Health Application and Research Hospital Endocrinology and Internal Diseases Polyclinics considered THS. A questionnaire including sociodemographic characteristics, DM-related features, and laboratory parameters was applied to the DM patients.

**Results:** This study included 979 patients with DM: 515 (52.6%) patients from THS, and 464 (47.4%) from PHS. The HbA1c value was measured in 509 (98.8%) of the patients who were followed up in THS and 449 (96.8%) of the patients who were followed up in PHS (p=0.026). It was determined that 68 (13.2%) of the patients in the THS and 61 (13.1%) of the patients in the PHS had a history of cardiovascular disease (p=0.979). Hypoglycemia was detected in 66 (12.8%) of DM patients managed in THS and 34 (7.3%) of DM patients managed in PHS (p=0.005). There was no difference between PHS and THS in terms of diabetic retinopathy, diabetic nephropathy, and diabetic neuropathy (p=0.098, p=0.100 and p=0.073, respectively).

**Conclusion:** DM is a chronic metabolic disease that requires continuous medical care, and the role of PHS in DM management needs to be increased.

**Keywords:** Type 2 diabetes, family physicians, chronic disease hospital, noncommunicable disease

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## INTRODUCTION

Diabetes mellitus (DM) is a metabolic disease characterized by hyperglycemia originating from insulin effect, insulin release, or both due to the interaction of genetic, lifestyle changes, and environmental factors.[1] Evaluation of quality of life in patients with diabetes is accepted as an indicator of treatment effectiveness. Increasing the quality of life has been stated as both the primary goal in DM treatment and the most important indicator of treatment outcome.[2]

Uncontrolled DM causes acute and chronic complications and negatively affects morbidity and mortality significantly. There is a great decrease in the life expectancy of individuals diagnosed with diabetes. For example, if an individual is diagnosed with DM around the age of 40 years, life expectancy is thought to decrease by 11.6 years in men and 14.3 years in women.[3] It

is a globally accepted view that there is a vital link between good glycemic control and systematic disease management and the prevention of diabetes complications.[4] For a healthy metabolic control, not only regular blood glucose and glycated hemoglobin (HbA1c) monitoring is sufficient but it is also important that the patient is fed with the right diet and should be aware of lifestyle changes.[5]

The correct approach to diabetic patients starts with the correct diagnosis. Whether the patient is diabetic or not is determined quite simply by determining criteria. However, determining the type of diabetes may not be certain even if correct methods and follow-ups are used. Determination of the type of diabetes is very important in evaluating the patients and their relatives with whom they share a common genetic structure.[6] Ensuring the disease management and control of DM can be achieved by increasing the knowledge and sensitivity of healthcare professionals, patients, and their relatives about DM and changing their attitudes toward the disease positively.[7] Family physicians have the greatest task in this regard because of their important role in primary health care, which is easier to reach all segments of society. Disciplined follow-up is required in DM to provide both glycemic control and prevent complications.[8]

DM is one of the common chronic diseases, and chronic complications can be reduced with appropriate management. This study aimed to evaluate the disease management of patients with type 2 DM who applied to primary healthcare services (PHS) and tertiary healthcare services (THS).

## METHOD

In this cross-sectional study, patients with DM over the age of 18 years who were followed up from PHS and THS between May 18, 2017 and February 1, 2018, were included. There were a total of 276 family health centers affiliated with Eskişehir Provincial Health Directorate, and 25 family health centers were included in the study by lot randomization.[9] The patients followed in PHS were included from these 25 family health centers. The patients followed in THS were included from the Eskişehir University Health Application and Research Hospital Endocrinology and Internal Diseases Polyclinics. Patients with DM who were followed up for at least 1 year and included in the study were selected from the patients who came to the examination and applied to the outpatient clinic through lot randomization. Patients with a mental illness were excluded from the study.

A questionnaire was applied to the patients with DM by face-to-face interview method. The sociodemographic characteristics of the patients such as age, gender, marital status, level of education, and the healthcare provider who get diagnosed were recorded. In addition, body mass index, duration of illness, treatment protocols used, performing regular screening, presence of diet information, and presence of hypoglycemia were evaluated. HbA1c measured in the last 3 months was recorded, and lipid levels, such as LDL cholesterol, HDL cholesterol, and triglyceride, measured during the first visit of the patients or during the control examinations, were recorded. Microvascular complications such as retinopathy, nephropathy, and neuropathy or macrovascular complications such as cardiovascular disease were recorded. These complications were confirmed by physicians by controlling their patient files. Neurological screening of the patients included detailed neurological examinations and laboratory tests such as electromyography, if necessary. The diabetic foot was checked by physicians or diabetic foot history was recorded. The annual flu vaccination status of the patients was recorded by asking them.

The sample size was calculated using a prevalence of 50%, a margin of error of 5%, a confidence level of 95%, and missing data of 20% for each health institution. The target sample size was 461 participants for both health institutions, and it was achieved.

IBM SPSS Statistics v21.0 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.) was used in the implementation of the analyses. The Kolmogorov–Smirnov and Shapiro–Wilks tests were used to investigate the appropriateness of the data to normal distribution. Categorical variables were expressed as frequency and percentage. The continuous variables were presented as median and interquartile range. The Mann–Whitney U test was used to compare the quantitative data and the groups without normal distribution. The Chi-squared test was used to compare categorical variables. A p-value of $<0.05$ was considered for statistical significance.

## RESULTS

This study was performed on 979 patients with type 2 DM. Five hundred fifteen (52.6%) of the patients were in THS and 464 (47.4%) of the patients were in PHS. Sociodemographic features and laboratory parameters of the patients are summarized in Table 1.

The HbA1c value was measured in 509 (98.8%) of the patients who were followed up in THS and 449 (96.8%) of the patients who were followed up in PHS ($p=0.026$). Lipid measurements were performed periodically in 479 (93.0%) of the patients followed in THS and 371 (80.0%) of the patients followed in PHS ($p<0.001$). The sociodemographic

**Table 1.** Sociodemographic features and laboratory parameters of the patients

| | All patients (n=979) |
|---|---|
| Age (years) | 49.0 [16.0] |
| Gender | |
| Male | 417 (42.6) |
| Female | 562 (57.4) |
| Marital status | |
| Single | 183 (18.7) |
| Married | 796 (81.3) |
| Level of education | |
| Illiterate | 57 (5.8) |
| Primary school | 457 (46.7) |
| High school and above | 465 (47.5) |
| Duration of illness (years) | 5.0 [7.0] |
| Body mass index (kg/m$^2$) | 27.5 [6.3] |
| Treatment protocols used | |
| Only diet | 31 (3.2) |
| Oral antidiabetic drugs | 728 (74.4) |
| Insulin therapy* | 220 (22.4) |
| HbA1c (%) | 7.2 [1.4] |
| LDL cholesterol (mg/dL) | 129.0 [44.0] |
| HDL cholesterol (mg/dL) | 43.0 [14.0] |
| Triglyceride (mg/dL) | 164.0 [110.0] |
| Regular screening | 838 (85.6) |
| Presence of diet information | 814 (83.1) |
| Presence of hypoglycemia | 100 (10.2) |

Data are presented as median [IQR] and n (%).
*Insulin therapy alone or in combination with oral antidiabetic drugs.

characteristics and laboratory parameters of the patients according to the health institution they were followed are summarized in Table 2.

Patients who were 706 (72.1%) of total, all stated that their retinopathy controls were performed. In addition, 393 (55.7%) of the patients followed in THS and 313 (44.3%) of the patients followed in PHS underwent retinopathy screening (p=0.002). Patients who were 318 (32.5%) of the patients stated that neurological examinations were performed. The frequency of neurological examination of patients with THS was 186 (36.1%), and the frequency of neurological examination of patients with PHS was 132 (28.4%) (p=0.011). When the patients were asked about the periodic foot examinations in their centers, 234 (23.9%) stated that their foot examinations were performed. It was determined that 116 (22.5%) of the patients in the THS and 118 (25.4%) of the patients in the PHS made a foot examination (p=0.287). There were chronic complications in 155 (15.8%) of all patients participating in the study. While the frequency of chronic complications in THS patients was 96 (18.6%), the frequency of chronic complications in primary care was 59 (12.7%) (p=0.011). Frequencies of diabetes complications in the patients are summarized in Table 3.

One hundred and twenty-nine (13.2%) of the patients had a history of cardiovascular disease. It was determined that

**Table 2.** Sociodemographic characteristics and laboratory parameters of the patients according to the health institution they were followed

| | PHS (n=464) | THS (n=515) | p |
|---|---|---|---|
| Age (years) | 49.0 [14.0] | 47.0 [18.0] | 0.163* |
| Gender | | | |
| Male | 190 (40.9) | 227 (44.1) | 0.323† |
| Female | 274 (59.1) | 288 (55.9) | |
| Marital status | | | |
| Single | 81 (17.5) | 102 (19.8) | 0.347† |
| Married | 383 (82.5) | 413 (80.2) | |
| Level of education | | | |
| Illiterate | 27 (5.8) | 30 (5.8) | 0.845† |
| Primary school | 221 (47.6) | 236 (45.8) | |
| High school and above | 216 (46.6) | 249 (48.4) | |
| Duration of illness (years) | 5.0 [5.0] | 6.0 [7.0] | 0.004* |
| Body mass index (kg/m$^2$) | 27.0 [5.4] | 28.4 [6.6] | <0.001* |
| Treatment protocols used | | | |
| Only diet | 31 (6.7) | 0 (0.0) | <0.001† |
| Oral antidiabetic drugs | 433 (93.3) | 295 (57.3) | |
| Insulin therapy‡ | 0 (0.0) | 220 (42.7) | |
| HbA1c (%) | 7.2 [1.0] | 7.4 [1.8] | 0.001* |
| LDL cholesterol (mg/dL) | 132.0 [46.0] | 126.0 [46.8] | 0.016* |
| HDL cholesterol (mg/dL) | 44.0 [14.0] | 42.0 [14.0] | <0.001* |
| Triglyceride (mg/dL) | 166.0 [105.0] | 157.0 [116.0] | 0.433* |
| Regular screening | | | |
| Present | 391 (84.3) | 447 (86.8) | 0.260† |
| Absent | 73 (15.7) | 68 (13.2) | |
| Diet information | | | |
| Present | 343 (73.9) | 471 (91.5) | <0.001† |
| Absent | 121 (26.1) | 44 (8.5) | |
| Hypoglycemia | | | |
| Present | 34 (7.3) | 66 (12.8) | 0.005† |
| Absent | 430 (92.7) | 449 (87.2) | |

PHS: Primary healthcare services; THS: Tertiary healthcare services.
Data are presented as median [IQR] and n (%).
*Mann–Whitney U test, †Chi-squared test.
‡Insulin therapy alone or in combination with oral antidiabetic drugs.

**Table 3.** Frequencies of diabetes complications in the patients

| | PHS (n=464) | THS (n=515) | p |
|---|---|---|---|
| Diabetic retinopathy | | | |
| Present | 33 (7.1) | 52 (10.1) | 0.098 |
| Absent | 431 (92.9) | 463 (89.9) | |
| Diabetic nephropathy | | | |
| Present | 21 (4.5) | 36 (7.0) | 0.100 |
| Absent | 443 (95.5) | 479 (93.0) | |
| Diabetic neuropathy | | | |
| Present | 13 (2.8) | 26 (5.0) | 0.073 |
| Absent | 451 (97.2) | 489 (95.0) | |

PHS: Primary healthcare services; THS: Tertiary healthcare services.
Data are presented as n (%).
Chi-squared test.

68 (13.2%) of the patients in the THS and 61 (13.1%) of the patients in the PHS had a history of cardiovascular disease (p=0.979). The frequency of those who presented to the emergency department due to cardiac complaints in the last year was 111 (11.3%). Of the patients with DM, 70 (13.6%) of them followed up in THS and 41 (8.8%) of them followed up in PHS applied to the emergency service due to cardiac reasons within the last year (p=0.019).

Of all patients, 255 (26.0%) of them had annual flu vaccines: 120 (23.3%) of the applicants to the THS and 135 (29.1%) of the applicants to the PHS stated that they had annual flu vaccination (p=0.039).

## DISCUSSION

DM is one of the common chronic diseases. Its complications can be reduced and controlled with the correct diagnosis, treatment, and follow-up. Epidemiological studies conducted in recent years have revealed that even in developed societies, many people with DM are not aware of their disease.[10] According to the results of the TURDEP-II study announced in 2010, it was seen that the prevalence of DM in Turkish adults reached 13.7%.[11]

The distribution of centers where DM patients are diagnosed can be examined as an important study topic. In a study, while the diagnosis of DM disease was the most common in state hospitals, it was found that the disease controls were mostly performed in family health centers.[12] Similarly, in this study, 47.4% of patients diagnosed in PHS and 52.6% diagnosed in THS were the most referenced health service providers at first diagnosis. In the research by Özgür et al., among the applications made to the health institutions in the Southeastern Anatolia Project region, the applications made to the state hospitals acquired the first place (32.5%), while the private practice and private hospitals acquired the second place (21.6%). The application made to the family health centers was 16%.[13] All healthcare professionals should take care to prevent DM and complications after the disease formation. Family physicians have the greatest duty in this regard because of their important role in primary health care, which is easier to reach all segments of society. Therefore, policies should be developed to increase the role of family physicians in the management of chronic diseases such as DM.

In the long term, HbA1c should be measured every 3 months in patients without glycemic control and every 6 months in patients who are controlled.[14] The American Diabetes Association recommends measuring lipid levels in each patient at the first examination.[15] In addition, those with impaired lipid values should be measured once a year or more frequently, and those with normal values should be measured at least every 2 years.[15] The frequency of periodically measuring HbA1c levels of those who are under THS follow-up was found to be higher than those who were followed up in PHS. The same situation is true for periodic lipid evaluation. This indicates that DM follow-up needs to be improved in PHS.

The Turkish Society of Endocrinology and Metabolism (TSEM) recommends a fundus examination 5 years after diagnosis in type 1 DM and once a year from diagnosis in type 2 DM.[14] In a study conducted by Dervan et al. in Ireland in which the prevalence of diabetic retinopathy imaging was investigated, the frequency of those who had fundus examination was found to be 81%.[16] Many regular screenings are recommended in clinical guidelines for diabetic retinopathy, but in practice, in the United States, as reported in studies in Turkey and the Netherlands, only 58%–81% of diabetics are regularly screened for diabetic retinopathy.[17,18] In this study, 72.1% of all patients stated that their retinopathy controls were performed, and the frequency of retinopathy controls of patients with THS follow-up was higher than those with PHS follow-up. It may be because it can be screened more easily in terms of retinopathy as THS has ophthalmology outpatient clinics. However, it is necessary to increase the rate of those who have retinopathy screening among the patients followed in PHS.

Diabetic neuropathy is a heterogeneous group of diseases with an extremely complex pathophysiology and affects both the somatic and autonomic components of the nervous system.[19] It is recommended by TSEM to perform annual neuropathy screening in patients with type 1 DM

5 years after diagnosis and starting from diagnosis in patients with type 2 DM.[14] Peripheral neuropathy was found in 90% of the patients in the study conducted on 80 patients who were treated with the diagnosis of the diabetic foot at Cumhuriyet University Medical Faculty Hospital.[20] In this study, 32.5% of all patients stated that their neurological examination controls were performed, and the frequency of neurological examination controls of patients in THS was higher than those in PHS.

Diabetic nephropathy is currently the leading cause of end-stage renal disease globally. Given the increasing incidence of diabetes, many experts are of the opinion that diabetic nephropathy will eventually move toward pandemic rates.[21] In Turkey, according to the report published by the Turkish Nephrology Association in 2001, DM is involved in the etiology of 30.5% of newly diagnosed patients with end-stage renal failure.[22] In this study, there was no significant difference between the PHS and THS in terms of the presence of diabetic nephropathy.

DM is an important cardiovascular disease risk factor. Tokgözoğlu et al. examined the records of 669 patients, who were diagnosed with coronary heart disease retrospectively in the Euroaspire III study, and found that 33.6% of the patients had DM.[23] Cihan et al. examined the records of patients who underwent bypass surgery for 2 years and found that 105 of 536 patients who underwent bypass surgery had type 2 DM at the time of surgery.[24] The frequency of those who presented to the emergency department due to cardiac complaints in the last year was 11.3% in this study. In addition, 13.6% of patients with DM followed up in THS and 8.8% of patients with DM followed up in PHS applied to the emergency service due to cardiac reasons within the last year.

The limitation of the study is that the results of the study cannot be generalized due to the use of regional PHS and THS.

## CONCLUSION

In conclusion, DM is a chronic metabolic disease that requires constant medical care due to defects in insulin metabolism. Family physicians have the greatest duty in this regard because of their important role in primary health care, which is easier to reach all segments of society.

### Disclosures

**Peer-review:** Externally peer-reviewed.

**Conflict of Interest:** The authors declare that they have no competing interests.

**Ethics Committee Approval:** The approval of research was obtained from Eskişehir Osmangazi University Ethics Committee (Approval date: May 17, 2017, and Approval number: 80558721/G-167). Verbal consent was obtained from the patients.

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