Lipid Control in Patients with Diabetes across Primary and Tertiary Government Health Sectors in Dubai: A Five-year Pattern

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ABSTRACT

Objectives: A key aspect for the prevention of vascular complications in diabetes is control of hyperlipidemia, and that has always been a global challenge. The prevalence of diabetes mellitus in the UAE is estimated to be 18.98%. However, despite this high prevalence, very few studies have evaluated the control of lipids in patients with diabetes in our region. We sought to assess lipid control in patients with diabetes across the different sectors of the Dubai Health Authority (DHA) over five years (2012–2016). Additionally, we aimed to compare lipids control in both primary and tertiary care as well as between nationalities and diabetes types. *Methods*: We conducted a retrospective analysis of the electronic medical records of all patients within the DHA over five years. All patients with diabetes were included, and evaluation of lipids panel control was done according to the American Diabetes Association standards. *Results:* This review includes a total of 26 447 patients. The mean low-density lipoprotein (LDL) was lower in tertiary care patients across the years. Annual means of all lipid parameters were higher in primary care patients. Around 60.5% of patients achieved LDL levels < 100 mg/dL. Non-high-density lipoprotein cholesterol levels < 130 mg/dL were achieved in 67.9% of patients in tertiary care in 2012 compared to 60.9% in primary care. UAE nationals had better lipids control across the study duration compared to expatriates. *Conclusions:* This is the largest cohort of patients evaluated for diabetes and lipids control in the UAE and the Middle East region. The percentage of patients with diabetes across the DHA primary and tertiary health care centers achieving lipid targets is amongst the highest reported in the region and, perhaps, globally. Significantly better lipid control indices were achieved in tertiary care compared to primary care.

Non-communicable diseases are the fastest growing threat to global health and development and economic growth. These conditions are responsible for 63% of deaths worldwide, with half occurring in working-age individuals.[1] Diabetes mellitus is one of the leading causes of the increase in non-communicable diseases, with the Middle East being one of the regions with the highest prevalence.[2] A key aspect of diabetes control is the prevention of major macrovascular and microvascular complications. Improving glycemic control is one component for reducing complications.[3] However, the role of non-glycemic risk factors such as hypertension, hyperlipidemia, and hypercoagulability are additional factors contributing to cardiovascular risk specifically and should be targeted in treatment.[4] Cardiovascular diseases (CVDs) include stroke, coronary heart disease, and peripheral vascular disease. More than one-third of the global deaths (37%) are attributed to CVD in patients under the age of 70.[5] Without active intervention in managing CVD risk factors, those figures are expected to escalate from 17.5 million deaths per year in 2012 to 22.2 million deaths by 2030.[5] In the UAE, a report from the Ministry of Health showed that CVD deaths are a major cause of mortality (specifically myocardial infarction).[6]

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In 2016, the World Health Organization reported that 44% of mortality in the UAE was due to CVD. However, CVD mortality improved between 2000 and 2016, and is expected to improve further until 2025.[7]

The American Diabetes Association (ADA) has set clear targets for lipid management in patients with diabetes as part of macrovascular risk management presumed to be of atherosclerotic origin.[8] Attaining the ADA benchmark in lipid control has always been a global challenge.[9–12] The prevalence of diabetes in the UAE is estimated to be 18.98%.[2] However, despite this high prevalence, there are few studies evaluating diabetes and its associated risk factors control patterns over the last few years in our region.[13–17]

The Dubai Health Authority (DHA) is the main governmental health sector in Dubai. The DHA has 13 primary care centers that manage patients with diabetes. Additionally, there are three hospitals with specialized diabetes care departments.

We believe that our study is unique, since the total population of Dubai is just above 2.9 million individuals[18] and we have studied around 26 447 patients, which is around 1% of the population. We searched the medical database and included patients with an International Classification of Diseases (ICD) code for diabetes. Moreover, the data included was over five years including all the primary and tertiary care centers in the governmental health sector of Dubai. Those, collectively, would make the outcomes of this study quite robust and has an important epidemiological reflection of the real-life lipids control in patients with diabetes.

Our main aim was to assess lipid control in patients with diabetes across the DHA points of care over five years (2012–2016). Additionally, we aimed to compare the lipid control between primary and tertiary care and between UAE and non-UAE nationals.

METHODS

We conducted a retrospective analysis of the electronic medical records of all patients who attended hospitals and primary health care centers in the DHA from January 2012 to December 2016. All patients with an ICD coding of type 1 and 2 diabetes, with or without complications, who had at least one lipids reading per year were suitable for inclusion in the study. Having only one eligibility screening tool, the ICD coding of diabetes may have veiled a large number of patients with diabetes who were coded under other diseases (missed cases), however, at the same time, this gives the study the power of having 100% confirmed diabetes patients, without any inclusion bias.

Since the data was retrospectively collected, we randomly selected the latest lipid panel tests within the fourth quarter in each year, which we thought will reflect the outcome of that particular year, which again led to missing a sizable number of data points if the lipids panel test was not done during that time period (fourth quarter of the year).

Patients were categorized based on the different lipids parameters including total cholesterol (TC), triglycerides (TG), high-density lipoprotein (HDL), low-density lipoprotein (LDL), and non-high-density lipoprotein (non-HDL) levels. All control targets for each lipid parameter were assessed according to the ADA standards,[5] since all the study population was patients with diabetes. ADA targets for patients with diabetes to lower cardiovascular risk are < 150 mg/dL for TC, TG < 150 mg/dL, LDL < 100 mg/dL, and non-HDL < 130 mg/dL.[8] According to the ADA cutoff points, data was analyzed to obtain the mean of each parameter's control annually, as well as the percentage of patients at target.

Different variables of lipids panel were further compared between primary versus tertiary services,

Table 1: Demographic distribution of the study population.

Category	Frequency	Percentage (%)
Males	12 765	48.3
Females	13 682	51.7
UAE nationals	19 508	73.8
Expatriates	6939	26.2
T1DM	2625	9.9
T2DM	23 822	90.1
Tertiary care patients	10 967	41.5
Primary care patients	15 480	58.5
DM without CV or renal complications	24 432	92.4
DM with CV or renal complications	2015	7.6

UAE: United Arab Emirates; T1DM: type 1 diabetes mellitus; T2DM: type 2 diabetes mellitus; DM: diabetes mellitus; CV: cardiovascular.

Table 2: Lipid profile means and percentages in primary and tertiary care and in UAE nationals and expatriates between 2012 and 2016.

Category	Primary care	Tertiary care	Total	UAE nationals	Expatriates
TC, mg/dL	170.0 ± 41.5	165.0 ± 40.6	167.0 ± 41.1	168.0 ± 40.9	165.0 ± 41.3
TG, mg/dL	136.0 ± 92.7	131.0 ± 84.2	133.0 ± 88.5	131.0 ± 89.6	140.0 ± 91
HDL, mg/dL	49.0 ± 13.2	50.0 ± 14.0	49.0 ± 13.6	51.0 ± 13.9	46.0 ± 12.2
LDL, mg/dL	99.0 ± 36.2	92.0 ± 34.8	96.0 ± 35.5	96.0 ± 35.5	96.0 ± 35.8
LDL, < 100 mg/dL, %	56.0	65.0	60.5	61.1	58.9
Year	Primary care LDL < 100 mg/dL	Tertiary care LDL < 100 mg/dL	Primary care TC < 150 mg/dL	Tertiary care TC < 150 mg/dL	Primary care non-HDL < 130 mg/dL
2012	52.9%	62.6%	31.2%	35.5%	60.9%
2013	59.6%	65.6%	36.4%	39.4%	67.0%
2014	59.5%	67.2%	35.8%	41.6%	66.2%
2015	52.5%	63.7%	33.4%	39.7%	60.7%
2016	55.7%	66.1%	34.9%	41.2%	61.6%

UAE: United Arab Emirates; TC: total cholesterol; TG: triglycerides; HDL: high-density lipoprotein; LDL: low-density lipoprotein; non-HDL: non-high-density lipoprotein.

UAE nationals versus expatriates, and between patients with type 1 versus type 2 diabetes.

Data were statistically described in terms of mean±standard deviation, median and range, or frequencies (number of cases) and percentages when appropriate. Comparison of numerical variables between the study groups was made using Student's *t*-test for independent samples in comparing two

TC: total cholesterol; TG: triglycerides; LDL: low-density lipoprotein; non-HDL: non-high-density lipoprotein.
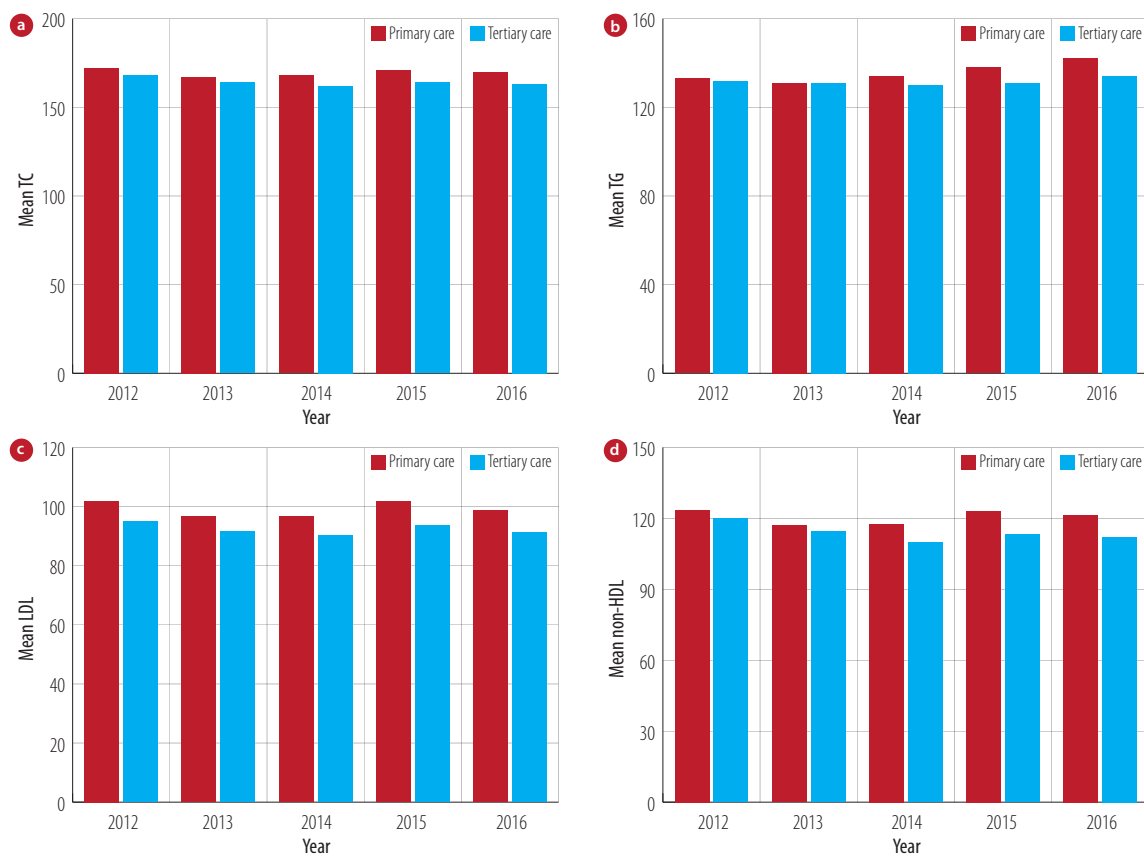
Figure 1: Mean lipid parameter control between primary and tertiary care centers across the study duration (2012–2016).

groups and one-way analysis of variance (ANOVA) test with post-hoc multiple two-group comparisons for comparing more than two groups. Within-group comparison between the different years was made using repeated measures of ANOVA test. For comparing categorical data, the chi-square test was performed. Fisher's exact test was used instead when the expected frequency was less than five. A p-value < 0.050 was considered statistically significant. All statistical calculations were done using SPSS Statistics (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.).

RESULTS

A total of 26 447 patients with diabetes were included in this analysis; the male to female distribution was similar (48.3% and 51.7%, respectively). Being a governmental sector (where all nationals receive free treatment), 73.8% of patients in our cohort were Emirati nationals (n = 19 508), while expatriates were only 26.2% (n = 6939). As expected, type 1 diabetes mellitus patients made up to 9.9% (n = 2625) of the cohort [Table 1].

In total, amongst both primary and tertiary care patients, the mean values of all lipid profile components over the study duration was within the target range as per the ADA standards of care [Table 2]. Interestingly, around 60.5% of patients achieved an LDL < 100 mg/dL [Figure 1]. Tertiary care patients achieved a mean LDL of 92.0±34.8 mg/dL while in primary care the mean was 99.0±36.2 mg/dL. We noted a statistical difference in the LDL targets achieved between patients attending tertiary versus primary care centers (p < 0.001). Sixty-five percent of patients in tertiary care had an LDL < 100 mg/dL compared to 56.0% of patients in primary care [Figure 2].

UAE nationals had higher TC levels compared to expatriates (168.0±40.9 mg/dL and 165.0±41.3 mg/dL, respectively). However, their TG levels over the five years were lower than expatriates (131.0±89.6 mg/dL and 140.0±91.0 mg/dL,

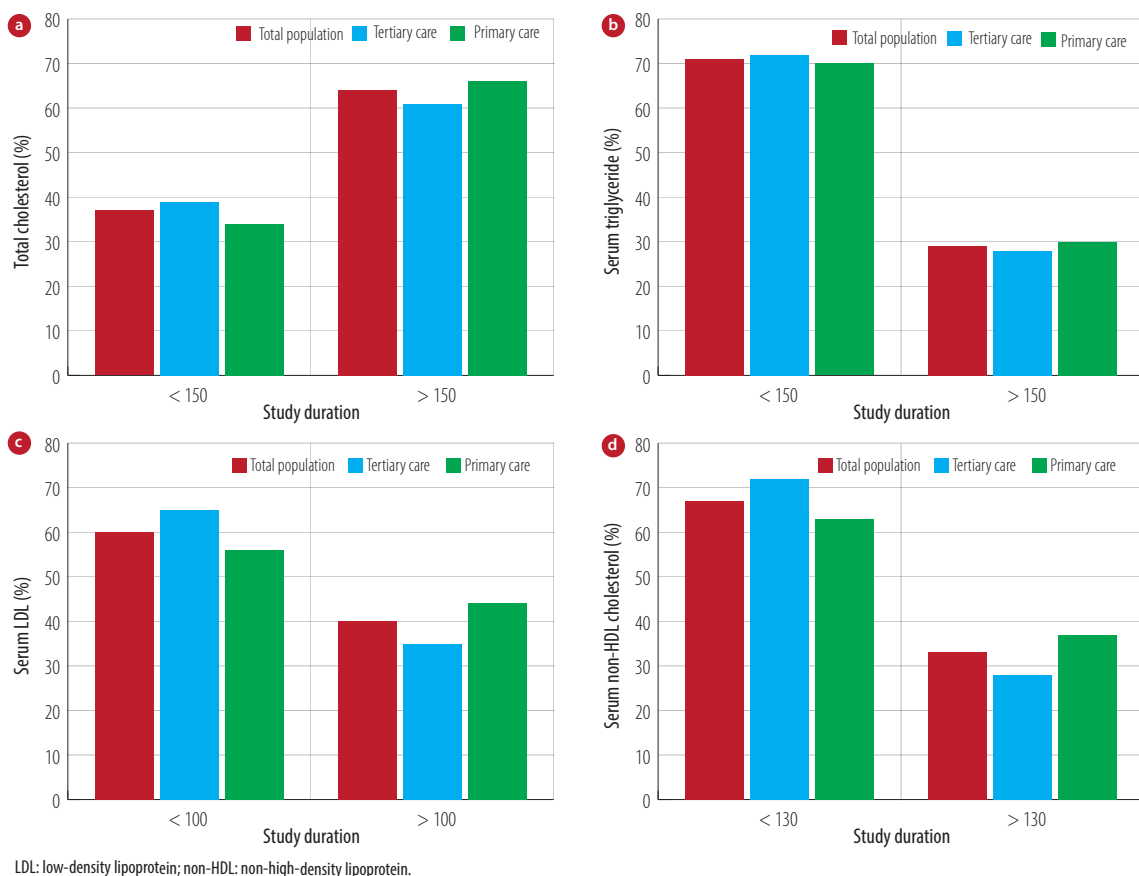LDL: low-density lipoprotein; non-HDL: non-high-density lipoprotein.

Figure 2: Percentage of patients with target lipid parameter control between primary and tertiary care centers across the study duration (2012–2016).

respectively). Interestingly, mean LDL was similar in UAE nationals and expatriates (96.0 ± 35.5 mg/dL and 96.0 ± 35.8 mg/dL, respectively), despite the higher TC in UAE nationals [Table 2]. This might be attributed to higher HDL levels in UAE nationals compared to expatriates, which was statistically significant ($p < 0.001$).

The non-HDL cholesterol (non-HDL-C) of < 130 mg/dL was achieved in 67.9% in tertiary care in 2012 compared to 60.9% in primary care, and this difference was statistically significant ($p < 0.001$) [Table 2]. Reassuringly, tertiary care centers achieved tighter lipids indices across the study period, which may be attributed to looking after patients at higher risk of CVD.

DISCUSSION

CVD is a leading global cause of morbidity and mortality amongst patients with diabetes.[5] In the Middle East, the volume of CVD deaths is one of the highest in the world.[19]

Diabetes is associated with a two- to four-fold increased risk for CVD and is considered a coronary artery disease (CAD) risk equivalent.[20] LDL-cholesterol (LDL-C) appears to have the major role in atherosclerosis and CAD development, and, hence, its management may take precedence over glycemic reduction to reduce CAD risk in individuals with diabetes. Surprisingly, despite the benefits of treating dyslipidemia in both primary and secondary prevention of CVD, a significant number of patients do not achieve their target lipid levels in many countries, particularly those patients at higher CVD risk.[21–25]

The ADA has put forth specific guidelines and LDL targets for patients with diabetes as they constitute a high-risk category. However, achieving those targets is a formidable task.[8]

Our review includes 26 447 patients with diabetes making it the largest cohort of patients evaluated for diabetes and lipid control at both primary and tertiary levels in the UAE and the Middle East region.[13,14,26–29] Sixty-five percent of our patients in tertiary care had an LDL < 100 mg/dL compared to 56.0% of patients in primary care. This might be explained by the fact that patients attending tertiary care are mostly high-risk groups who are targeted to lower their LDL levels.

The Centralized Pan-Middle East Survey on the under-treatment of hypercholesterolemia (CEPHEUS) using lipid-lowering drug therapy included 5276 patients in six Arabian Gulf countries (Bahrain, Saudi Arabia, Qatar, Oman, Kuwait, and the UAE). LDL-C goal was attained in 52% of the cohort according to the updated National Cholesterol Education Program, Adult Treatment Panel-III. However, the CEPHEUS did not have a separate analysis of patients with diabetes.[30]

On the other hand, results from the Dyslipidemia International Study-Middle East, in which more than three-quarters of patients were classified as very high-risk (based on European Society of Cardiology guidelines) demonstrated that the most prevalent lipid abnormality, despite chronic statin treatment, was elevated LDL-C levels. Goal LDL-C levels (< 70 mg/dL) were not attained in 61.8% of all patients and 69.5% of very high-risk patients, which included a cohort of patients with diabetes.[26]

In our cohort, 60.5% of patients achieved a target LDL < 100 mg/dL. Similar results were reported in another retrospective cohort study in Dubai, which found 71% of patients met the LDL targets.[17] The study analyzed the patterns of care and treatment target success in patients with diabetes. However, the study population was only 250 patients selected from a single tertiary care setup over six months, which minimizes the reliance on these figures from an epidemiological point of view. Moreover, the patients selected were only Emirati nationals. Our study included 6939 non-Emirati patients giving a better epidemiological estimate.

In tertiary care, patients achieved a mean LDL level of 92.0 mg/dL while in primary care the mean was 99.0 mg/dL. This might be explained by the fact that patients attending tertiary care are mostly high-risk groups who are targeted to lower LDL levels. Nonetheless, in both levels of care, patients were able to achieve desirable mean LDL levels.

Non-HDL-C levels < 130 mg/dL were achieved in 67.9% of patients in tertiary care in 2012 compared to 60.9% in primary care ($p < 0.001$). Non-HDL-C is gradually gaining the attention of the guidelines, and calculating non-HDL has become a recommended routine in the dyslipidemia management.[8,31]

Although UAE nationals had higher TC compared to expatriates, their TG levels over the five years were lower. We do not have a specific explanation for this observation, but perhaps the dietary habit and lifestyle may play a role. Interestingly, the mean LDL mean was similar in UAE nationals and expatriates,

despite the higher TC in UAE nationals. This might be attributed to higher HDL levels in UAE nationals compared to non-nationals, which was statistically significant ($p < 0.001$).

This study may have a valuable impact on health strategies and health economics regulations since we were able to evaluate five years of data from a huge number of confirmed diabetes mellitus cases. Moreover, this study calls for further efforts to improve physicians' and patients' awareness of dyslipidemia management in diabetes. Additionally, based on this data, short and long-term non-communicable diseases strategic plans need to include this data as an important estimate of the volume of the problem and to replicate similar studies to track the change.

Our data missed the detailed patient record including the duration of diabetes, and the stage of underlying cardiovascular or renal disease, being retrospectively captured data from the electronic record. Our data were derived from different centers within the same healthcare authority in a single emirate. The study does not describe the medications background and the patients' compliance details. Hence, the issue of whether we need to focus on physicians inertia or patients' awareness still needs to be unveiled.

CONCLUSION

This is the largest epidemiological analysis in the region. The percentage of patients with diabetes across the DHA primary and tertiary health care centers achieving lipid targets is amongst the highest reported in the region and, perhaps, globally. There were significantly better lipid control indices achieved in tertiary care compared to primary care. Such studies need to be routinely replicated to boost physician-patient efforts in improving the lipids parameters.

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