Centralized Pan-Middle East Survey on the Under-Treatment of Hypercholesterolemia: Results from the CEPHEUS II Study in Egypt

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ABSTRACT

Introduction: As part of the CEPHEUS study, CEPHEUS I was conducted in 2010 and 2011 in Cairo and then the CEPHEUS II study was carried out in Alexandria and Delta Regions in Egypt between April 2014 and August 2015 to determine the proportion of dyslipidemic patients on lipid-lowering treatment reaching LDL-C treatment goals.

Methods: We conducted an open-label, observational, multicenter, cross-sectional survey where 90 investigators enrolled 1127 patients receiving lipid-lowering drugs for at least 3 months. After signing informed consent forms, the study questionnaires were completed by patients and investigators. Blood samples were taken for laboratory investigations. Patients with missing LDL-C data were excluded from the analysis and results from 896 patients were analyzed according to European Atherosclerosis Society and EAS/ESC 2011 guidelines.

Results: Out of 896 patients enrolled based on the risk stratification of EAS/ESC 2011 guidelines, 12.4% were classified as low risk, 20.0% as moderate risk, 2.5% as high risk, and 65.2% as very high risk. Achievement goals were 84.7, 44.7, 18.2, and 22.3% for low-risk, moderate-risk, high-risk, and very high risk patients, respectively, with an overall achievement goal of 34.4%. The study population included 50.2% diabetes, 64.4% hypertension, 54.9% metabolic syndrome, 32.2% family history of cardiovascular disease, 23.1% smokers, and 33.8% secondary prevention. Lipid-lowering agents were prescribed as a monotherapy to 90.1% and in combination in 9.9% with goal achievements of 34 and 38%, respectively ($p < 0.05$). Statins were prescribed to 86.9% of patients. The most frequent prescribed statins were rosuvastatin...
(47.1%) and atorvastatin (36.0%), followed by simvastatin (9.2%). Treatment goal was achieved in 34.2, 36.0, and 31.7% for rosuvastatin, atorvastatin, and simvastatin, respectively, with no significant difference in achievement goals (p > 0.05).

**Conclusions:** Hypercholesterolemia is still not being effectively managed in many at-risk patients in Egypt. The majority of patients enrolled in the study were being actively treated with lipid-lowering medications yet the percentage goal achievement was less when compared to CEPHEUS results.

**Keywords:** Cardiovascular; CVD; Cardiovascular risk; CEPHEUS; Egypt; Hypercholesterolemia; Statins

**INTRODUCTION**

Cardiovascular diseases (CVD) are the leading cause of death worldwide. Multiple risk factors contribute to CVD. A recent standardized case–control study in 52 countries specifically focusing on acute myocardial infarction identified that six risk factors (dyslipidemia, smoking, hypertension, diabetes mellitus, abdominal obesity, and stressful psychosocial factors) account for 90% of myocardial infarctions in men and 94% in women [1].

Epidemiological surveys have shown that elevated total serum cholesterol (TC) and particular elevated low-density lipoprotein cholesterol (LDL-C) levels are strongly correlated with CHD risk. Many guidelines identify LDL-C as the primary target of cholesterol-lowering therapy and recommend LDL-C goals either numerical or percentage of reduction that are based on the risk category a patient belongs to [2, 3].

Hypercholesterolemia treatment has shown clear benefits in the primary and secondary prevention of CVD. However, cross-sectional surveys conducted in Europe [5, 6], and the USA [6–8] on the management of risk factors in patients with CHD have indicated that hypercholesterolemia continues to be inadequately treated [4–6]. Accordingly, many studies are required to assess the current level of under-treatment of hypercholesterolemia, defined as receiving lipid-lowering drug therapy but having uncontrolled TC and/or LDL-C levels and to understand better why patients on pharmacological treatment do not achieve their treatment goals [4–7].

This study is part of the worldwide conducted CEPHEUS studies; Centralized Pan-Middle East Survey on the under-treatment of hypercholesterolemia and the second wave of the Centralized Pan-Middle East Survey on the under-treatment of hypercholesterolemia: results from the CEPHEUS Study in Egypt [8]. The current study is based on the European Atherosclerosis Society 2011 and the European Society of Cardiology guidelines (EAS/ESC 2011) [8]. The primary objective is to determine the proportion of patients on lipid-lowering pharmacological treatment reaching the LDL-C goals in Egypt according to the EAS/ESC 2011 guidelines. Secondary objectives were to determine the proportions in pre-defined subpopulations including primary and secondary prevention, metabolic syndrome, patients’ risk profile category, and identification of determinants (patient and physician characteristics) for patients not reaching their treatment goals and physician characteristics associated with the allocation of different treatment regimens.

**METHODS**

This is an open-label, observational, non-interventional, multicenter, single-visit cross-sectional survey conducted on patients under lipid-lowering pharmacological treatment. Ninety investigators enrolled 1127 patients on lipid-lowering drugs between April 24, 2014 and August 29, 2015 from Alexandria and Delta Regions in Egypt as part of the CEPHEUS study (NIS-EG-CRE-2012/01). Patients of age 18 years or more receiving lipid-lowering drug for at least 3 months with no dose change for at least 6 weeks signed informed consent to participate and comply with study procedures. Before assessment, after signing informed patient consent, the study questionnaires were completed by patients and investigators. The investigators completed case record forms (CRF) with
the patient’s demographics, known cardiovascular risk factors, cardiovascular medical history, current lipid-lowering drug treatment, and the reason for the current therapy. Samples were taken for total cholesterol, LDL cholesterol, HDL cholesterol, triglycerides, HbA1c, and the ratio of total cholesterol/HDL-C was calculated. The investigators received results within 5 days and completed the CRFs. Under-treatment was defined as receiving lipid-lowering pharmacological treatment and not reaching the LDL-C goals according to the EAS/ESC 2011 guidelines. Non-HDL-C goals was defined as patients with HDL-c <40 mg/dl and fasting triglycerides >200 mg/dl.

Among the 1127 enrolled patients, patients with missed LDL-C data (n = 231) were excluded from the analysis and results from 896 patients are presented here.

**Statistical Analysis**

Data of 896 subjects were analyzed in this study. This gives a margin error of ±3.2% at 95% confidence level with expected number of patients achieving treatment goals at 50%.

Number and percentage (n and %) presented the categorical data and Chi-square test (or its subsidiaries) was used to obtain p values to test significance for difference between groups. Descriptive statistics (mean ± SD) presented the numerical data and Student’s t test (or its subsidiaries) was used to obtain p values to test significance for difference between groups. The calculation of statistics and proportions did not include the missing data. Missing values were presented in separate tables.

**Compliance with Ethics Guidelines**

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1964, as revised in 2013. Informed consent was obtained from all patients for being included in the study. This article does not contain any new studies with human or animal subjects performed by any of the authors.

**RESULTS**

Eight hundred ninety-six subjects were included in the analysis. The mean age was 53.9 ± 10.7 years and 57.6% were male. The main reason of pharmacological therapy was for primary prevention with 59.4% of patients. Statins were the most prescribed agents with 95.2% (853 of 896) of patients; 90% (768) used statins as monotherapy and 10% (85) in combined therapy. Rosuvastatin was the most frequently prescribed statin. It was prescribed to 47.1% (422 of 896) from which 391 were monotherapy and 31 were combined therapy. Other and more detailed demographic data and patients characteristics are shown in Table 1.

**LDL Target Goal Achievement**

Overall, 34.4% (308 of 896 patients) achieved their LDL-C target goal according to the EAS/ESC 2011 guidelines.

A total of 84.7% of low-risk patients achieved target LDL-C goal (<155 mg/dl), 44.7% of moderate-risk patients achieved target LDL-C goal (<115 mg/dl), 18.2% of high-risk patients achieved target LDL-C goal (<100 mg/dl) and 22.3% of very high risk patients achieved target LDL-C goal (<70 mg/dl or ≥50% reduction).

From the patients who were on rosuvastatin, 33.2% reached the goal with monotherapy and 48.4% with combined therapy, with an overall achievement of 34.2%. From patients who were prescribed treatment for primary prevention: 36.1% achieved LDL-C goal, for secondary prevention 29.9%, and familial hypercholesterolemia 36.2%. (p = 0.082). For special populations, the goal was reached for 67.7% of patients with metabolic syndrome and 63.1% without (p = 0.087); the goal was reached for 21.6% of patients with diabetes mellitus and 46.5% without (p < 0.001), and finally, goal was reached for 29.6% of patients with arterial hypertension and 42.6% without (p < 0.001) (Tables 2, 3).
| Parameter                        | Variable                                      | Valid answer (base) | Missing | Mean and SD or N and % |
|--------------------------------|-----------------------------------------------|---------------------|---------|------------------------|
| Age                            |                                               | 896                 | 0       | 53.9 10.7              |
| Weight                         |                                               | 892                 | 4       | 92.3 17.1              |
| Height                         |                                               | 887                 | 9       | 168.8 8.8              |
| BMI                            |                                               | 887                 | 9       | 32.5 6.4               |
| Waist circumference            |                                               | 857                 | 39      | 99.5 21.3              |
| Systolic BP                    |                                               | 893                 | 3       | 133.9 15.9             |
| Diastolic BP                   |                                               | 893                 | 3       | 84.4 9.1              |
| Gender                         | Male, n (%)                                   | 896                 | 0       | 516 57.6%              |
|                                | Female, n (%)                                 |                     |         | 380 42.4%              |
| Nationality                    | Egyptian, n (%)                               | 896                 | 31      | 859 99.3%              |
|                                | Other (Syrian), n (%)                         |                     | 6       | 0.7%                   |
| Ethnicity                      | Middle Eastern (including North Africa)       | 869                 | 27      | 857 98.6%              |
|                                | Caucasian (including Europe and North America)|                     | 6       | 0.7%                   |
|                                | Other, n (%)                                  |                     | 6       | 0.7%                   |
| Reason for pharmacological therapy | Primary prevention                           | 876                 | 20      | 520 59.4%              |
|                                | Secondary prevention                          |                     |         | 296 33.8%              |
|                                | Familial hypercholesterolemia                 |                     |         | 60 6.8%                |
| Medical history                | History of coronary heart disease, n (%)      | 896                 | 0       | 309 34.5%              |
|                                | History of peripheral artery disease, n (%)   | 894                 | 2       | 118 13.2%              |
|                                | Cerebrovascular atherosclerotic disease, n (%)| 896                 | 0       | 62 6.9%                |
|                                | Established CVD                               | 886                 | 10      | 376 42.4%              |
| Comorbid condition             | Arterial hypertension, n (%)                  | 871                 | 25      | 561 64.4%              |
|                                | Diabetes, n (%)                               | 877                 | 19      | 440 50.2%              |
|                                | Family history of premature cardiovascular disease, n (%) | 845 | 51 | 272 32.2%              |
|                                | Current smoker, n (%)                         | 872                 | 10      | 207 23.1%              |
Results of the Investigators’ Questionnaire

There were 41.4% of the investigators that mentioned that they use EAS/ESC 2011 guidelines. Most of the investigators use guidelines to set individual cholesterol targets; 94.4% depend on LDL-C as an indicator.

Percent split of prescriptions as reported by investigators was 86.9% for statins, 9.5% for fibrates, and 3.6% for bile acid sequestrants and other drugs. Investigators review their patients mostly every 3 months, and they stated that an average of 55.6% of patients achieved their target cholesterol level. Detailed results of the investigators’ questionnaire are presented in Table 4.
Table 2  EAS/ESC 2011 risk-profile category, number and percent in each group, lipid-lowering drug, mean and SD of the used dose and number and percent of patients achieving the LD-C treatment goal

| EAS/ESC 2011 risk profile category | Base | Lipid-lowering agents | Dose | Achieved treatment goal |
|-----------------------------------|------|-----------------------|------|-------------------------|
|                                   |      | Name                  | Mean | SD          | N  | %      |
| All                               | 896  | Rosuvastatin          | 442  | 14.6 5.1   | 152 | 34.4  |
|                                   |      | Atorvastatin          | 323  | 24.8 14.8  | 118 | 36.5  |
|                                   |      | Simvastatin           | 82   | 25.7 16.2  | 26  | 31.7  |
|                                   |      | Ezetimibe             | 63   | 15.0 7.1   | 26  | 41.3  |
|                                   |      | Fenofibrate           | 56   | 260.0 64.8 | 21  | 37.5  |
|                                   |      | Fluvastatin           | 10   | 10.0       | 1   | 10.0  |
|                                   |      | Pravastatin           | 3    | 20.0       | 1   | 33.3  |
|                                   |      | Lovastatin            | 3    | 40.0       | 1   | 33.3  |
|                                   |      | Bezafibrate           | 1    |            | 0   | 0.0   |
|                                   |      | Gemfibrozil            | 1    |            | 0   | 0.0   |
|                                   |      | Undefined statin      | 32   | 21.1 11.7  | 9   | 28.1  |
| Very high risk                    | 584  | Rosuvastatin          | 272  | 16.3 5.2   | 56  | 20.6  |
|                                   |      | Atorvastatin          | 215  | 25.1 14.2  | 57  | 26.5  |
|                                   |      | Simvastatin           | 52   | 31.0 20.2  | 10  | 19.2  |
|                                   |      | Ezetimibe             | 40   | 14.2 5.1   | 12  | 30.0  |
|                                   |      | Fenofibrate           | 33   | 253.3 70.0 | 9   | 27.3  |
|                                   |      | Fluvastatin           | 8    |            | 0   | 0.0   |
|                                   |      | Pravastatin           | 2    | 20.0       | 1   | 50.0  |
|                                   |      | Lovastatin            | 1    |            | 0   | 0.0   |
|                                   |      | Bezafibrate           | 1    |            | 0   | 0.0   |
|                                   |      | Gemfibrozil            | 1    |            | 0   | 0.0   |
|                                   |      | Undefined statin      | 22   | 26.7 11.5  | 3   | 13.6  |
| High risk                         | 22   | Rosuvastatin          | 11   | 15.0 7.1   | 2   | 18.2  |
|                                   |      | Atorvastatin          | 7    | 15.0 7.1   | 2   | 28.6  |
|                                   |      | Fenofibrate           | 3    | 300.0      | 1   | 33.3  |
|                                   |      | Simvastatin           | 2    |            | 0   | 0.0   |
|                                   |      | Ezetimibe             | 2    |            | 0   | 0.0   |

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Results of the Patients’ Questionnaire

Eight hundred ninety-two patients returned completed questionnaires. More than 75% of the patients were aware of good and bad cholesterol and mentioned that their doctor told them about their level of cholesterol and target goals and discussed the proper lifestyle, diet, and prescribed medications; 78.5% mentioned that they were satisfied with the information they had about high cholesterol. Results showed that patients were trying to take drugs as they were prescribed but 41% mentioned that they sometimes forgot to take the tablet every day. Most of the patients reported that they did not change the drug they take and few of them (3.3%) reported that they had changed the prescribed drug more than two times. Of the patients, 49% stated that they achieved their target cholesterol level and 75% were satisfied with the treatment they were taking. A strong correlation was found between achieving treatment goal as obtained from CEPHEUS II results and patient compliance as obtained from patients’ questionnaire (p < 0.001). Table 5 shows detailed results of the patients’ questionnaire.

DISCUSSION

CEPHEUS surveys in different countries worldwide have aimed to investigate the proportion of patients receiving lipid-lowering drugs and
| Determinant               | Variable                      | Base   | Achieved | Not achieved | p value |
|--------------------------|-------------------------------|--------|----------|--------------|---------|
|                         |                               | Yes    | %        | No           | %       |
| Reason for treatment     | Primary prevention            | 520    | 189      | 36.3         | 331     | 63.7   | 0.082  |
|                         | Secondary prevention          | 296    | 86       | 29.1         | 210     | 70.9   |
|                         | Familial hypercholesterolemia | 60     | 23       | 38.3         | 37      | 61.7   |
| Metabolic syndrome       | Metabolic syndrome            | 492    | 159      | 32.3         | 333     | 67.7   | 0.087  |
|                         | Non-metabolic syndrome        | 404    | 149      | 36.9         | 255     | 63.1   |
| Gender                   | Male                          | 516    | 167      | 32.4         | 349     | 67.6   | 0.140  |
|                         | Female                        | 380    | 141      | 37.1         | 239     | 62.9   |
| Age distribution         | <20 years                     | 1      | 0        | 0.0          | 1       | 100.0  | 0.081  |
|                         | 20–34 years                   | 40     | 21       | 52.5         | 19      | 47.5   |
|                         | 35–39 years                   | 39     | 19       | 48.7         | 20      | 51.3   |
|                         | 40–44 years                   | 89     | 34       | 38.2         | 55      | 61.8   |
|                         | 45–49 years                   | 132    | 45       | 34.1         | 87      | 65.9   |
|                         | 50–54 years                   | 170    | 60       | 35.3         | 110     | 64.7   |
|                         | 55–59 years                   | 163    | 50       | 30.7         | 113     | 69.3   |
|                         | 60–64 years                   | 122    | 32       | 26.2         | 90      | 73.8   |
|                         | 65–69 years                   | 85     | 26       | 30.6         | 59      | 69.4   |
|                         | 70–74 years                   | 33     | 15       | 45.5         | 18      | 54.5   |
|                         | 75–79 years                   | 10     | 3        | 30.0         | 7       | 70.0   |
|                         | >79 years                     | 12     | 3        | 25.0         | 9       | 75.0   |
| Ethnic origin            | Middle Eastern (including North Africa) | 857 | 297 | 34.7 | 560 | 65.3 | 0.135 |
|                         | Caucasian (including Europe and North America) | 6 | 1 | 16.7 | 5 | 83.3 |
|                         | Others                        | 6      | 0        | 0.0          | 6       | 100.0  |
| Current smoking          | Smokers                       | 207    | 71       | 34.3         | 136     | 65.7   | 0.971  |
|                         | Non-smokers                   | 665    | 229      | 34.4         | 436     | 65.6   |
| Diabetes mellitus        | Diabetics                     | 440    | 95       | 21.6         | 345     | 78.4   | 0.000  |
|                         | Non-diabetics                 | 437    | 203      | 46.5         | 234     | 53.5   |
| Arterial hypertension    | Arterial hypertension         | 561    | 166      | 29.6         | 395     | 70.4   | 0.000  |
|                         | Non-arterial hypertension     | 310    | 132      | 42.6         | 178     | 57.4   |
| Family history of CVD    | History of CVD                | 272    | 91       | 33.5         | 181     | 66.5   | 0.643  |
|                         | No history of CVD             | 573    | 201      | 35.1         | 372     | 64.9   |

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### Table 4 Answers of investigators’ questionnaire

| Question                                                                 | Answers                                                                 | Valid Answer (base) | Missing | Mean & SD or N & % |
|--------------------------------------------------------------------------|-------------------------------------------------------------------------|---------------------|---------|-------------------|
| Q1 For what proportion of patients do you set individual target cholesterol levels expressed as an actual number. |                                                                         | 82                  | 8       | 76.9 27.2         |
| Q2 Which lab measures do you generally use to set individual target cholesterol levels. (Yes) | Q2 Total Cholesterol | 90                  | 0       | 70 77.8%          |
| Q2 HDL-C                                                                 | 90                  | 0       | 64 71.1%          |
| Q2 LDL-C                                                                 | 90                  | 0       | 85 94.4%          |
| Q2 Triglycerides                                                         | 90                  | 0       | 67 74.4%          |
| Q3 Do you utilize any guidelines to help establish individual cholesterol targets for your patients? (yes) |                                                                         | 88                  | 2       | 84 95.50%         |
| Q4a) Which guidelines do you use? You can give more than one answer     | * Joint European guidelines (SCORE)                                     | 29                  | 61      | 12 41.4%          |
| Q4b) Which one do you mainly use? Give only one answer                   | * NCEP ATP III guidelines (FRAMINGHAM)                                 | 29                  | 61      | 13 44.8%          |
| Q4c) Individual practice guidelines/recommendations                      | * National guidelines (if present)                                     | 29                  | 61      | 7 24.1%           |
| Q4d) Other (write in)                                                    | * Local healthcare authority guidelines/recommendations                | 29                  | 61      | 3 10.3%           |
| Q4e) Unable to name the precise guidelines used                          | * Individual practice guidelines/recommendations                       | 29                  | 61      | 9 31.0%           |
| Q5 When patients are first diagnosed with hypercholesterolemia do you generally inform them of their cholesterol level? | Yes                                                                      | Yes 83              | 98.8%   |                  |
| Q6 In what proportion of patients do you                                | Q6a) not mention extent of reduction at all                           | 86                  | 4       | 8.8 12.2          |
| Q6b) provide a target cholesterol level expressed as an actual number   |                                                                         | 86                  | 4       | 63.1 28.8         |
| Q6c) provide a percentage or proportion reduction                       |                                                                         | 86                  | 4       | 14.8 15.3         |
| Q6d) provide a more general description such as a need to reduce by ‘a little’ or ‘a lot’ |                                                                         | 86                  | 4       | 13.3 15.4         |
| Q7 When informing your patients which of the following types of lipid parameters measurement do you generally use? You can give more than one answer (Yes) | Q7 Total cholesterol                                                  | 88                  | 2       | 70 79.5%          |
| Q7 HDL-C                                                                | 88                  | 2       | 56 63.6%          |
Table 4 continued

| Question | Option 1 | Option 2 | Option 3 | Option 4 | Option 5 | Mean Score |
|----------|----------|----------|----------|----------|----------|------------|
| Q7 LDL-C | 88 2     | 78       | 88.6%    |          |          |            |
| Q7 Triglycerides | 88 2 | 59 | 67.00% |          |          |            |
| Q8 Focusing now on pharmacological treatment for hypercholesterolemia, for what percentage of your patients do you recommend treatment with: | | | | | | |
| Q8a) Statins | 88 2 | 86.85 | 12.6 |          |          |            |
| Q8b) Fibrates | 88 2 | 9.45 | 10.4 |          |          |            |
| Q8c) Bile acid sequestrants | 88 2 | 1.42 | 3.0 |          |          |            |
| Q8d) Other | 88 2 | 2.27 | 4.8 |          |          |            |
| Q9 How frequent do you see the patient to review their cholesterol level? | | | | | | |
| Less frequent than once per year | 88 2 | 1 | 1.1% |          |          |            |
| Once per year | 88 2 | 3 | 3.4% |          |          |            |
| Once every 6 months | 88 2 | 12 | 13.6% |          |          |            |
| Once every 3 months | 88 2 | 58 | 65.9% |          |          |            |
| More frequent than once per 3 months | 88 2 | 14 | 15.9% |          |          |            |
| Q21 In summary, thinking of all your hypercholesterolemia patients what percentages of those that have been set a target cholesterol level fall into the following categories? | | | | | | |
| Q21a) Reached their target cholesterol level and continue to stay at this level | 85 5 | 55.6% | 21.1% |          |          |            |
| Q21b) Generally stay at their target cholesterol level but their cholesterol is sometimes too high | 85 5 | 18.8% | 11.5% |          |          |            |
| Q21c) Reached their target cholesterol level in the past but have now lapsed | 85 5 | 14.7% | 10.0% |          |          |            |
| Q21d) Have never reached their target cholesterol level | 84 6 | 10.8% | 12.1% |          |          |            |
| Q22 In general, once a patient has reached their target cholesterol level after what length of time do you ask that patient to come back to review their hypercholesterolemia? (months) | | | | | | |
| One month | 85 5 | 3 | 3.50% |          |          |            |
| 2 months | 85 5 | 7 | 8.20% |          |          |            |
| 3 months | 85 5 | 52 | 61.20% |          |          |            |
| 6 months | 85 5 | 22 | 25.90% |          |          |            |
| 12 months | 85 5 | 1 | 1.20% |          |          |            |
| Q23 What percentage of patients actually attends this review? | | | | | | |
| | 85 5 | 69.7% | 19.9% |          |          |            |

Q10-20 Please circle the most applicable number that meets how much you agree/disagree with each one (1 is disagree strongly and 5 is agree strongly). The same scale will be used for all statements.

| Statements | Base | Strongly Disagree (1) | Disagree (2) | Neither / Nor (3) | Agree (4) | Strongly Agree (5) | Mean Score |
|------------|------|-----------------------|-------------|------------------|------------|-------------------|------------|
| Q10 I feel frustrated that I am not always able to effectively treat my patients with cardiovascular disorders | 86 | 40.7% | 16.3% | 14.0% | 11.6% | 17.4% | 2.49 |
| Q11 I find it stressful trying to get my patients to their cholesterol targets | 84 | 27.4% | 14.3% | 21.4% | 16.7% | 20.2% | 2.88 |
| Q12 I feel pressured to get patients to their target cholesterol levels | 85 | 22.4% | 14.1% | 14.1% | 20.0% | 29.4% | 3.20 |
reaching their LDL-C treatment goals according to international guidelines. Compared to the CEPHEUS I survey that had been conducted in Egypt between October 2010 and June 2011, achievement of treatment goal was 32.5% (339 patients out of 1043) according to the NCEP ATP III Updated 2004 guidelines [8]. CEPHEUS II in Egypt showed a slight improvement in terms of achieving treatment goals compared to CEPHEUS I according to NCEP ATP III Updated 2004 guidelines, as 39.6% (355 out of 896) in CEPHEUS II achieved their LDL-C treatment goal.

CEPHEUS surveys in other countries were reported and the achievement was 57% in combined Western European countries [9], 49% for combined Asian countries [10], and 49.1% in combined eight Asian countries (Korea, Taiwan, Thailand, Indonesia, Philippines, Malaysia, Vietnam, Hong Kong SAR, and China) [10]. The individual results were 52% for South Africa [11], 49% for Greece [7], 83% for Hong Kong [12], 50% for Taiwan [13], 31.3% for Indonesia [14], and 53% for Thailand [15].

Our study (CEPHEUS II) showed that the lowest target LDL-C goal achievements were obtained with diabetes mellitus (21.6%), followed by secondary prevention (29.1%) and arterial hypertension (29.6%), and metabolic syndrome (32.3%). On the contrary to previous findings from the CEPHEUS Pan-Asian survey, most of our patients with diabetes mellitus and hypertension did not achieve LDL goals. It is worth mentioning that ezetimibe achieved LDL-C goal with the highest percentage of 41.3% (63 out of 89 patients), in contrast to current knowledge in the literature about statins.

| Question continued | Yes | No | Possibly | Strongly Agree | Strongly Disagree | P-value |
|--------------------|-----|----|----------|----------------|------------------|---------|
| Q13 A sufficient number of patients reach their target cholesterol levels | 86 | 5.8% | 4.7% | 20.9% | 31.4% | 37.2% | 3.90 |
| Q14 I’m frustrated that the guidelines instruct me to advise lifestyle changes alone as first line therapy in all patients | 86 | 38.4% | 10.5% | 23.3% | 12.8% | 15.0% | 2.56 |
| Q15 I’m frustrated that the guidelines instruct me to prescribe a low dose of lipid-lowering drug to all patients and titrate upwards | 86 | 37.2% | 10.5% | 20.9% | 16.3% | 15.1% | 2.62 |
| Q16 I tend to prescribe a lipid lowering drug only to patients who have proved they can adhere to diet and exercise change | 85 | 49.4% | 22.4% | 10.6% | 5.8% | 11.8% | 2.08 |
| Q17 Patient compliance decreases if lipid lowering drugs take too long to have an effect | 86 | 12.8% | 10.5% | 17.4% | 34.9% | 24.4% | 3.48 |
| Q18 I feel constrained to use less effective lipid lowering drugs first line | 86 | 41.9% | 20.9% | 12.8% | 10.4% | 14.0% | 2.34 |
| Q19 Patients become concerned that their condition is more severe if their lipid lowering drug is titrated up | 86 | 12.8% | 17.5% | 26.7% | 22.1% | 20.9% | 3.21 |
| Q20 Patients become concerned that their condition is more severe if their lipid lowering drug is frequently changed | 86 | 7.0% | 15.1% | 20.9% | 33.7% | 23.3% | 3.51 |
### Table 5: Answers of patients’ questionnaire

| Question                                                                 | Answers                      | Valid Answer (base) | Missing | Mean & SD or N & % |
|--------------------------------------------------------------------------|------------------------------|---------------------|---------|--------------------|
| S1 Have you ever heard or been told about bad cholesterol, otherwise known as LDL-C? |                              |                     |         |                    |
| Yes                                                                      | 891                          | 1                   | 707     | 79.3%              |
| No                                                                       | 134                          |                     |         | 15.0%              |
| Don’t Know                                                               | 50                           |                     |         | 5.6%               |
| S2 Have you ever heard or been told about good cholesterol, otherwise known as HDL-C? |                              |                     |         |                    |
| Yes                                                                      | 891                          | 1                   | 675     | 75.7%              |
| No                                                                       | 161                          |                     |         | 18.0%              |
| Don’t Know                                                               | 56                           |                     |         | 6.3%               |
| S3 When you were first told by your doctor that you had high cholesterol did your doctor tell you what your cholesterol level was? |                              |                     |         |                    |
| Yes                                                                      | 892                          | 0                   | 740     | 83.00%             |
| No                                                                       | 152                          |                     |         | 17.00%             |
| S4 Did your doctor give you a target cholesterol level to aim for?        |                              |                     |         |                    |
| Yes                                                                      | 890                          |                     | 692     | 77.80%             |
| No                                                                       | 198                          |                     |         | 22.20%             |
| S4b Did your doctor give you a target cholesterol level to aim for?       |                              |                     |         |                    |
| * Only prescribe a tablet                                                | 890                          | 2                   | 106     | 11.9%              |
| * Both advise lifestyle changes and prescribe a tablet?                   |                              |                     | 733     | 82.3%              |
| * Only advice you to change your lifestyle e.g. change your diet, stop smoking and/or do more exercise? |                              |                     | 50      | 5.6%               |
| * Neither advice lifestyle changes nor prescribes a tablet               |                              |                     | 2       | 0.2%               |
| S5 As a first step when you were diagnosed with high cholesterol, did the doctor: |                              |                     |         |                    |
| * Only prescribe a tablet                                                | 890                          | 2                   | 106     | 11.9%              |
| * Both advise lifestyle changes and prescribe a tablet?                   |                              |                     | 733     | 82.3%              |
| * Only advice you to change your lifestyle e.g. change your diet, stop smoking and/or do more exercise? |                              |                     | 50      | 5.6%               |
| * Neither advice lifestyle changes nor prescribes a tablet               |                              |                     | 2       | 0.2%               |
| S6 Which one of the following best describes the number of times your cholesterol lowering tablets has been changed since it was first prescribed? |                              |                     |         |                    |
| * Still on the same tablet - go to Q8                                    | 890                          | 2                   | 106     | 11.9%              |
| * Still on the same tablet but the dose has increased - continue         |                              |                     | 733     | 82.3%              |
| * Have changed tablets once or twice (may include adding another tablet) - continue |                              |                     | 50      | 5.6%               |
| * Have changed tablets several times (may also include adding other tablets) - continue |                              |                     | 2       | 0.2%               |
Table 5 continued

| Question                                                                 | Yes | No | %   |
|-------------------------------------------------------------------------|-----|----|-----|
| S7 How did you feel about your cholesterol lowering tablets having to be changed i.e. having the dose of your tablets increased or taking a different tablets? |     |    |     |
| a. Satisfied                                                            | 892 | 0  | 249 | 27.9% |
| b. Concerned that your condition was now a ‘serious illness’            | 892 | 0  | 130 | 14.6% |
| c. No strong feelings                                                   | 892 | 0  | 81  | 9.1%  |
| d. Less motivated to keep taking your tablets                          | 892 | 0  | 32  | 3.6%  |
| e. Irritated at having to keep making changes                           | 892 | 0  | 79  | 8.9%  |
| f. Disappointed that treatment was not successful                       | 892 | 0  | 41  | 4.6%  |
| S8 I am satisfied with the level of information available to me about high cholesterol: |     |    |     |
| Agree                                                                   | 892 | 0  | 700 | 78.50% |
| Disagree                                                                | 104 | 12 | 88  | 9.90%  |
| Don’t know/not applicable                                              |     |    |     |
| S9 I am frustrated that I still do not know whether my tablets have been effective enough in lowering my cholesterol. |     |    |     |
| Agree                                                                   | 889 | 3  | 185 | 20.8% |
| Disagree                                                                | 602 | 68 | 102 | 11.5%  |
| Don’t know/not applicable                                              |     |    |     |
| S10 I always take my tablets to lower my cholesterol every day.         |     |    |     |
| Agree                                                                   | 889 | 3  | 790 | 88.90% |
| Disagree                                                                | 88  | 10 | 11  | 1.20%  |
| Don’t know/not applicable                                              |     |    |     |
| S11 I stopped taking my tablets when my cholesterol level returned to normal. |     |    |     |
| Agree                                                                   | 889 | 155| 17.4% |
| Disagree                                                                | 690 | 78.0% |
| Don’t know/not applicable                                              | 44  | 4.9% |
| S12 Sometimes I forgot to take my cholesterol lowering tablets.         |     |    |     |
| Agree                                                                   | 889 | 3  | 368 | 41.4% |
| Disagree                                                                | 505 | 57.0% |
| Don’t know/not applicable                                              | 16  | 1.8% |
| S13 Approximately how often do you forget to take your cholesterol lowering tablets? |     |    |     |
| * Once a week                                                           | 474 | 135 | 28.5% |
| * Once every two weeks                                                  | 97  | 20.5% |
| * More than once a week                                                 | 102 | 21.5% |
| * Once a month or less                                                  | 140 | 29.5% |
| S14 How often do you think you can miss a tablet without affecting your cholesterol levels? |     |    |     |
| * Once a week                                                           | 871 | 21  | 215 | 24.7% |
| * Once every two weeks                                                  | 120 | 13.8% |
| * More than once a week                                                 | 156 | 17.9% |
| * Once a month or less                                                  | 380 | 43.6% |
Finally, this study was an observational rather than interventional study, and as such, it suffers from many limitations. Most of the variables that may affect treatment goals were considered; however, many variables were not counted, such as differences in clinical practice between study investigators, lifestyle, diet factors, adverse events, and socioeconomic status.

**CONCLUSIONS**

Statins are the most frequently used lipid-lowering drugs and have a significant impact on achieving target LDL-C goals. As per the current CEPHEUS II results, hypercholesterolemia is still not being effectively managed in many at-risk patients in Egypt. The majority of patients enrolled in the study, all of whom were being actively treated with lipid-lowering medication, were considered at high risk of a cardiovascular event; hypercholesterolemia was particularly poorly managed in this group. Initiatives are needed to improve physicians’ management of these patients with more focus on their risk profiles. Patient compliance to treatment is still urgently needed.

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