Brand versus Generic Rosuvastatin in Egyptian Patients with Hyperlipidemia; Cost-Minimization Analysis

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Abstract

Background: Serum level of cholesterol is one of the most vital risk factors for cardiovascular diseases (CVD). Statins are highly effective drugs for reducing serum cholesterol; hence, preventing coronary heart disease (CHD). Rosuvastatin (Crestor) is one of the most potent and widely prescribed statins. Even though generic statins have been approved based on their bioequivalence with brand-name drugs, there remains considerable concern as regards their effectiveness and safety. Most clinicians and patients welcome the generic drug decreased costs; however, it is indispensable for them that effectiveness and safety are not compromised. Thus, the rationale intended for this study is to compare brand rosuvastatin and generic rosuvastatin as regard their economic impact using a cost-minimization analysis. **Methods:** This cost-minimization model estimates potential impact of rosuvastatin brand versus generic on the healthcare resource utilization for one-year frame from the payer perspective. The model conforms to real practice of management of hyperlipidemia in Egypt and was validated by experts. **Results:** The drug costs in the rosuvastatin brand group were 3,155,250 EGP while in the generic group were 2,299,030 EGP. The costs of CVD events in the rosuvastatin brand group were 5,863,558 EGP, while in the generic group were 6,810,180 EGP. The total costs in the rosuvastatin brand group were 9,018,808 EGP, while in the generic group were 9,109,210 EGP with a difference of −100,047 EGP. **Conclusions:** In conclusion, the real cost of generic treatment is more than that of the brand statin when taking into consideration the cardiovascular events.

1. Introduction

The serum level of cholesterol is one of the most vital risk factors for cardiovascular diseases (CVD). Statins are highly effective drugs for reducing serum cholesterol; hence, preventing coronary heart disease (CHD) [1]. They are considered a first choice for the reduction of the serum level of LDL-cholesterol [2].

Atorvastatin, pravastatin, simvastatin, and rosuvastatin are among the available statins, of which rosuvastatin has been proven, in recent studies, to be comparatively more effective for cholesterol reduction and reaching LDL-C level targets [3] [4].

Rosuvastatin (Crestor) is one of the most potent and widely prescribed statins. One Cochrane review searched for all the experimental evidence from trials reporting the effect of rosuvastatin on cholesterol. They found 108 trials involving 19,596 participants. Based on the comparison with atorvastatin, three-fold lower doses of rosuvastatin are needed to lower cholesterol by the same amount [5].

Chemically, generic medications have identical active ingredients as the brand-name medications, but they are not exact replicas as the inactive ingredients differ [6]. Many research studies demonstrated that the total impurity rate of generics is superior to 3% in comparison to their brands, which has been reported to have an impact on the bioavailability of the drug and hence, its therapeutic efficacy [7].

Even though generic statins have been approved based on their bioequivalence with brand-name drugs, there remains a considerable concern as regards their effectiveness and safety. Most clinicians and patients welcome the generic drug decreased costs; however, it is indispensable for them that effectiveness and safety are not compromised [8]. However, in the case of the statin medications, the effectiveness in lowering serum level of LDL-cholesterol is reflected in the long-term impact on cardiovascular events. Controlled LDL leads to a 62% reduction in cardiovascular events [9].

Thus, the rationale intended for this study is to compare brand rosuvastatin and generic rosuvastatin as regards their economic impact using a cost-minimization analysis. The main objective behind conducting this study was to compare the cost (direct or indirect) of rosuvastatin brand versus rosuvastatin generic in patients with hyperlipidemia, in the Egyptian patients, from the payer perspective over a one-year time horizon.

2. Methods

This cost-minimization model estimates the potential impact of rosuvastatin brand versus generic on the healthcare resource utilization for a one-year frame

from the payer perspective. A spreadsheet-based country-specific population model was developed. The population included in the analyses consisted of a hypothetical cohort of 1000 patients who may be given rosuvastatin. The model is based on the decision-analytic method. The population will be partition to take either 1) rosuvastatin brand, 2) rosuvastatin generic. MS Excel® was used to build a model to estimate the economic impact. Resource usage and cost values, as well as their distributions, are the public price. Costs are expressed in local currency, year 2018 (exchange rate 1 EGP = 0.056 USD). The model conformed to the real practice of management of hyperlipidemia in Egypt and was validated by experts.

3. Clinical Data

Clinical data were obtained from the appropriate randomized controlled trial, as shown in the following table. Clinical and efficacy parameters and their distributions were based on Bart *et al.* (2016), Lopez *et al.* (2007), AbdElaziz *et al.* (2014), Abd-Allah *et al.* (2017) and Almahmeed *et al.* (2012) (**Table 1**) [9] [10] [11] [12] [13].

The long-term maintenance cost of rosuvastatin brand versus generic was assessed in terms of the cost of reducing low-density lipoprotein cholesterol (LDL-C) levels to the recommended goals. Patients began therapy with 5 mg of rosuvastatin; the dose of study drug was titrated every 12 weeks up to 40 mg rosuvastatin until the LDL-C goal was reached. The estimated average annual maintenance cost was based on the distribution of the final daily dosing regimens and the public drug prices for each regimen.

Table 1. Clinical parameters included in the study.

Clinical parameter	Percent	Reference
Cardiovascular Events Prevented by Controlled LDL	**62%**	[9]
Percent of Patients Reaching Target on Rosuvastatin brand	**83%**	[10]
Rosuvastatin generic	**70%**	
Coronary Heart Diseases (CHD) Risk in Egypt According to Framingham Equation (10-Year Risk)		[11]
Low CHD risk	51.6%	
Moderate CHD risk	27.7%	
High CHD risk	9.4%	
High-very CHD risk	11.3%	
Rate of Stroke in Egypt	0.6%	[12]
Rate of Coronary Heart Diseases in Egypt	8.3%	[13]
Myocardial infarction	6.0%	
Angina	2.3%	

4. Sensitivity Analyses

To test for the Robustness of our results to variation in the estimates of the input model parameters, we performed uni-dimensional and multi-dimensional sensitivity analysis, as recommended by Consolidated Health Economic Evaluation Reporting Standards (CHEERS): ISPOR Taskforce report [14].

A second-order probabilistic sensitivity analysis (PSA) was carried out based on the Monte Carlo simulation technique with 1000 iterations. Variability was incorporated into the clinical parameters and resource utilization parameters. All model inputs were varied through reasonable ranges/confidence intervals determined from different published sources.

5. Results

5.1. Base-Case Analysis

The drug costs in the rosuvastatin brand group were 3,155,250 EGP while in the generic group were 2,299,030 EGP. The costs of CVD events in the rosuvastatin brand group were 5,863,558 EGP, while in the generic group were 6,810,180 EGP. The total costs in the rosuvastatin brand group were 9,018,808 EGP, while in the generic group were 9,109,210 EGP with a difference of −100,047 EGP (Table 2).

Despite that the drug cost of the brand rosuvastatin is more than that of the generic rosuvastatin, the costs due to CVD events in the brand rosuvastatin groups was less than that in the generic rosuvastatin. That rendering that the total cost of the brand rosuvastatin group is less than that of the generic rosuvastatin group (Table 3 & Figure 1).

5.2. Uncertainty Analyses

A one-dimensional sensitivity analysis (Figure 2) revealed that the model is robust when changing the costs of the brand and the generic within plausible range (20% higher or lower), as the difference still below zero EGP.

Table 2. Drug prices (EGP) included in the analysis.

	Brand	Generic, average
Rosuvastatin 5 mg, one tablet	4.63	2.23
Rosuvastatin 10 mg, one tablet	6.55	3.70
Rosuvastatin 20 mg, one tablet	10.86	4.35

Table 3. Decision analysis model results (cohort size = 1000).

	Brand	Generic	Difference
Drug cost, EGP	3,155,250	2,299,030	856,221
Cardiovascular events costs, EGP	5,863,558	6,810,180	−946,622
Total cost, EGP	9,018,808	9,109,210	−90,401
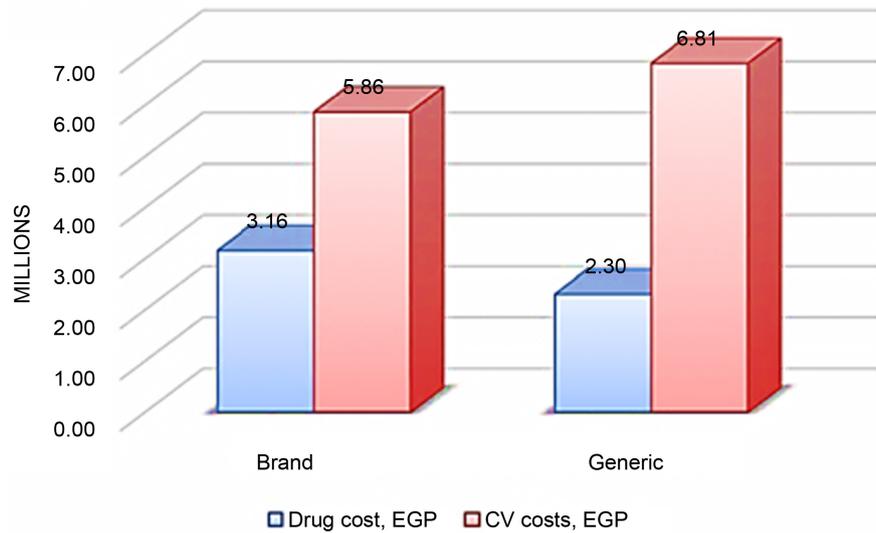
Figure 1. Costs (EGP) in brand and generic cohorts (CV: cardiovascular events).
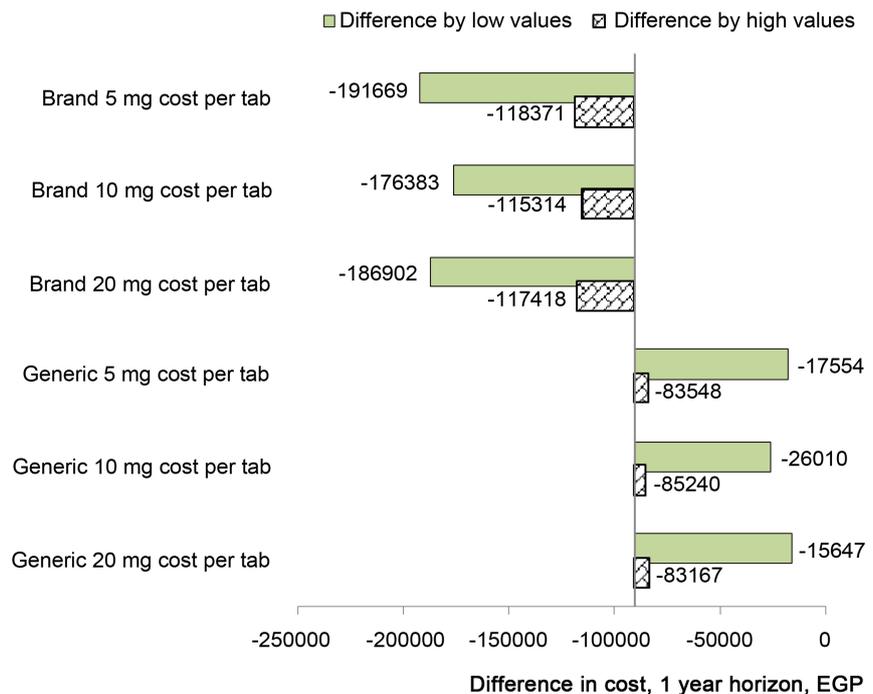
Figure 2. One-dimensional sensitivity analyses for the difference in costs.

6. Discussion

The main target of pharmacoeconomics is to recognize, quantify, and compares the costs of different drug therapies to the payer, either the society or the health-care system. In addition, it assists the clinicians, payers, and other decision-makers to appraise the costs and outcomes of various options via different methods of analysis like cost-effectiveness, cost-utility, cost-benefit, and cost-minimization analyses [15] [16] [17].

This current study adopted the cost-minimization analysis methodology. The

results of this cost-minimization analysis showed that the cost of drug therapy by brand rosuvastatin is more than that of generic rosuvastatin. However, does the cost of treatment for hyperlipidemia include only drug therapy?

According to the literature, Lopez *et al*. (2007) showed that CHD events could be prevented by controlled LDL by 62% [9]. Thus, the control of LDL can indirectly affect not only the health of patients but also the total costs due to hyperlipidemia.

In our current study, we made an economic evaluation of both brand and generic rosuvastatin. The cost-minimization analysis included direct and indirect costs in both groups. Direct costs included drug therapy, and the indirect costs included costs due to significant subsequent events like CHD and stroke.

Despite the fact that the drug therapy is more in the case of the brand than in the generic rosuvastatin group, the indirect costs due to CVD events and the total costs are more in the generic than in the brand rosuvastatin groups.

Generic might lead to therapeutic failure in a particular proportion of patients; also, a higher drug concentration might expose patients to an increased risk of dose-dependent adverse-events. Overall, it is worthwhile to evaluate the generic formulations during the therapeutic phase [7].

Of course, the apparent lower cost of generic drugs helps in patients' adherence to therapy. However, this is a misperception of the reality, because they only see a small part of the total picture of the hyperlipidemia case. Every one percent increase in the total number of patients with controlled LDL coincides with a decrease in CVD risks with all its healthcare and economic consequences.

7. Conclusion

In conclusion, the real cost of generic treatment is more than that of the brand statin when taking into consideration the cardiovascular events.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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