Efficacy, Safety, Cost, and Clinical Outcomes After the Switch to Generic Rosuvastatin Compared with Consistent Brand-Name Atorvastatin Treatment.

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Title

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Abstract

Background:

The efficacy, safety, and clinical outcomes for patients switch to generic rosuvastatin, compared with patients taking other brand-name atorvastatin, is unclear.

Method:

We retrospectively collected electronic medical records from January 1, 2013, to December 31, 2020, of patients who switched medication, because of hospital policy, from brand-name to generic rosuvastatin after March 14, 2018. we only considered patients who had taken the medication at least 1 year prior to and 1 year after that date. We also collected records of patients who consistently used brand-name atorvastatin during the same period. The efficacy of lipid control, potential adverse effects, clinical outcomes of major cardiovascular events (MACE), and medical expenses were compared between the 2 groups. Propensity score matching (PSM) was conducted to balance potential cofounders.

Result:

After 1:1 PSM, 592 patients were enrolled in the rosuvastatin and atorvastatin groups, and no significant difference was observed in their total cholesterol (TC) level difference (−4.38 ± 23.0 vs. −3.72 ± 26.95 mg/dL, $P = 0.702$), low-density lipoprotein (LDL-C) (−2.38 ± 19.89 vs. −2.42 ± 23.63 mg/dL, $P = 0.976$), or glycated hemoglobin (−0.05% ± 0.7% vs. −0.08% ± 0.76%, $P = 0.543$). No significant differences were noted in their cumulative MACE (2.70% vs. 3.89%, log-rank $P = 0.265$) after the switch date, and each person in the

generic group had a 16% average reduction in their medical expenses.

Conclusion:

Switching to generic rosuvastatin led to comparable lipid-lowering efficacy, safety, and clinical outcomes and fewer medical expenses compared with consistently using brand-name atorvastatin.

Keyword: statin, cholesterol, generic, hyperlipidemia, HMG-CoA reductase

Introduction

HMG-CoA reductase, frequently referred to as statin, is currently the first-line medication used to treat patients with hyperlipidemia for both primary and secondary prevention, according to their individual risks with regard to underlying comorbidities, family histories, age, and their calculated 10-year risk of fatal CVD [1,2]. Both rosuvastatin and atorvastatin are categorized as high-potency lipid-lowering agents, and for each 1 mmol/L (38.67 mg/dL) reduction of LDL-C by statin, they may reduce major vascular events by 22%[2].

Generic medication represents opportunities for patients who cannot afford essential brand-name medications and to reduce public health expenses. Generic medications must have identical active ingredients that produce the same or acceptable pharmaceutical results as the referenced brand-name medication, with respect to pharmacokinetic and pharmacodynamic properties. According to a report by Warraich et al., from 2012 to 2014, the availability of generic atorvastatin led to a 28% reduction in atorvastatin-associated expenditure in the United States[3]. Manzoli et al. performed a meta-analysis of studies comparing generic and brand-name atorvastatin and simvastatin, and they demonstrated a similar aggregated effect size of clinical efficacy in terms of soft outcomes (0.04, 95% CI: −0.10 to 0.18) and safety in mild to moderate adverse events (−0.06, 95% CI: −0.40 to 0.27) ([4]). Using data from a large retrospective cohort, Gao et al. also reported that major adverse cardiovascular events (MACE) did not differ significantly between generic and brand-name statin (pitavastatin, atorvastatin, pravastatin, simvastatin, or fluvastatin) users[5]. However,

another study indicated a lower rate of LDL-C target achievement (0.87, 95% CI: 0.80–0.95) among patients who used generic atorvastatin or simvastatin that may be translated to an increased rate of cardiovascular incidents (HR: 1.31, 95% CI: 1.15–1.50)[6].

Nevertheless, evidence gaps persist. First, in real-world practice, government policies rather than physicians may mandate the switch from brand-name to generic medication. Therefore, patients are concerned whether the switch leads to poorer clinical outcomes compared with other medications not being changed. Second, to our knowledge, clinical evidence remains unavailable on generic rosuvastatin usage. Therefore, this study provides clinical evidence comparing the efficacy, safety, clinical outcomes, and medical expenses between a switch to generic rosuvastatin and consistent brand-name statin.

Methods

Ethical statement

This study was conducted in accordance with the Declaration of Helsinki, waives the requirement to obtain informed consent, and approved by the Institutional Review Board of National Cheng Kung University Hospital (B-ER-110-134).

Study design

We retrospectively collected data from January 1, 2013, to December 31, 2020, from the cardiovascular databank of National Cheng Kung University Hospital. Because of medicine contract, all brand-name rosuvastatin (Crestor 10 mg, Shionogi & Co., Ltd.) was switched to generic medication (Roty 10 mg, China Chemical & Pharmaceutical Co., Ltd.) after 14 March 2018, the switch index date in this study. We enrolled patients who had received brand-name rosuvastatin for more than 1 year before and after the switch index date. Patients who used brand-name atorvastatin (Lipitor 40 mg, Pfizer) within the same timeframe served as the control group.

Data collection

From the cardiovascular electronic medical record databank, we collected information on all patients' clinical diagnoses, underlying comorbidities, and medication histories. We also collected their laboratory data, including total cholesterol (TC), LDL-C, HDL-C, triglyceride (TG); alanine aminotransferase (ALT) and glycated hemoglobin (HbA1c) levels; and estimated glomerulus filtration rates (eGFR) in the 1 year both before and after the index date. Blood sampling frequency and timing were determined by the clinical physician.

This databank was created according to the study protocol of Artificial Intelligence with Deep Learning and Genes on Cardiovascular Disease, with ClinicalTrials.gov Identifier NCT03877614. Two cardiovascular physicians validated the database by manually reviewing records highlighting 4 random traits, such as baseline characteristics, comorbidities, or medications, for each of 200 randomly-selected patients. The accuracy rate for all traits was 99.12% (793/800)[7]. The primary endpoint of this study was MACE, defined as a composite endpoint of all-cause mortality, acute myocardial infarction, and ischemic stroke. The secondary endpoints were each individual event. The expense of medications was calculated based on public price announced by National Health Insurance Administration Ministry of Health.

Statistics

Patients were divided into 2 groups: generic-shift rosuvastatin and brand-name atorvastatin, and 1: 1 propensity score matching (PSM) was performed to adjust for confounders including age, sex and underlying comorbidities. Continuous variables are presented as the mean ± SD, the Student's *t* test was performed to examine the difference between groups, and the paired *t* test was performed before and after the medication switch. Dichotomous data are presented as numbers (percentages), and the chi-square test was performed to examine differences. Kaplan–Meier survival analysis was employed to compare cumulative endpoints between groups, and the log-rank test was used to examine statistical significance. We performed PSM with MatchIt (version 4.2.0), and all other

analyses were conducted with R (version 4.0.1).

Results

Population

From January 2013 to December 2020, 12 969 patients received brand-name atorvastatin, and 2926 patients received brand-name rosuvastatin in a switch from the generic brands. Of those patients, 3094 and 1015 had already been using brand-name atorvastatin and rosuvastatin respectively, for more than 1 year prior to the index date. The brand-name atorvastatin group consisted of 2129 (57.8% male, mean age 68.5 ± 11.8 years) patients, and the generic group consisted of 600 patients (52.7% male, mean age 65.2 ± 11.8 years) who had been using medication consistently for more than 1 year after the index date. After 1:1 PSM, 592 (53.7% male, mean age 65.4 ± 12.1 years) patients remained in the brand-name atorvastatin group, and 592 (53.4% male, mean age 65.2 ± 11.8 years) patients were in the generic-switch rosuvastatin group. (Table 1 and Figure 1)

Efficacy and safety

After PSM, for efficacy in lipid-lowering effects, both generic-switch rosuvastatin and brand-name atorvastatin groups exhibited comparable lower TC (−4.38 ± 23.00 mg/dL vs. −3.72 ± 26.95 mg/dL, $P = 0.702$), LDL-c (−2.38 ± 19.89 mg/dL vs. −2.42 ± 23.63 mg/dL, $P = 0.976$), and HDL-c (−1.23 ± 7.93 mg/dL vs. −1.60 ± 7.62 mg/dL, $P = 0.559$) levels after the medication switch index date. Patients exhibited similar differences in HbA1c (−0.05% ± 0.7%, vs. −0.08% ± 0.76%, $P = 0.543$), ALT (−0.58 ± 19.87 U/L vs. −0.14 ± 44.92 U/L, $P = 0.841$), and eGFR (−1.36 ± 6.95 mL/min/1.73 m^2 versus −1.37 ± 8.14 mL/min/1.73 m^2, $P =$

0.988) levels before and after the switch index date (Table 2 and Figure 3).

Outcome

Between the generic-switch rosuvastatin and brand-name atorvastatin groups, no significant differences were observed in the primary endpoint (2.70% vs. 3.89%, $P = 0.265$) after the switch index date with a median follow-up time of 820 and 822.5 days, respectively, or after the medication initialization date (4.56% vs. 6.59%, $P = 0.664$) with a median follow-up time of 1803.5 and 2359 days, respectively. No significant differences were noted in any of the individual secondary endpoints (Table 3 and Figure 2).

Expenses

In 2019, the average cost for generic rosuvastatin and brand-name atorvastatin was NT$452.50 and NT$539.30 per person. The annual expenditure for all patients was NT$9,350,854.90 and NT$29,159,591.40, respectively. (Figure 4)

Discussion

Results revealed that compared with the brand-name atorvastatin group, the group that transitioned from brand-name to generic rosuvastatin had a comparable lipid-lowering efficacy, no increase in hepatic toxicity or averaged HbA1c, and comparable clinical outcomes. The generic-switch group exhibited lower medication expenses per person; however, this group had lower persistence in the use of medication. To our knowledge, our study is the first to obtain data on the switch to generic rosuvastatin.

Efficacy and safety

In a previous study, Loch et al. observed no significant differences between LDL-c (2.64 vs. 2.64 mmol/L, $P = 0.923$) and TC (4.71 vs. 4.68 mmol/L, $P = 0.583$) levels and slightly lower HDL-c levels (1.29 vs. 1.26 mmol/L, $P = 0.009$) before and after the switch to generic atorvastatin[8]. Our results are comparable to these findings because, although both groups exhibited significantly lower levels of LDL-c, TC, and HDL-c, the differences were similar and more likely to have resulted from cholesterol management goals and stricter monitoring. This highlights the value of our study design: only when simultaneous ongoing treatments are compared could we verify that medication was not the only factor to affect cholesterol levels; in this manner, people are not misled to believe that the improved efficacy was a result of generic medications (Table 2 and Figure 3).

No significant differences were noted in potential side effects of statin, such as new onset diabetes mellitus and hepatotoxicity. In meta-analysis studies by Kesselheim and Manzoli et al., 6 comparison studies between generic and brand-name medications were enrolled. These studies mostly employed cross-over designs examining simvastatin and atorvastatin and revealed no significant differences in the clinical efficacy of LDL control (effect size: 0.04, 95% CI: −0.10 to 0.18) or any mild or moderate adverse events (effect size: −0.06, 95% CI: −0.40 to 0.27)[4,9]. Although these studies provided no data on generic rosuvastatin, they support our results.

Clinical outcomes

Numerous studies have reported clinical outcome comparisons between initial

treatments with generic and brand-name statins. Corrao et al. examined 13 799 newly treated patients with generic or brand-name simvastatin from Italy's health care system, and discovered no difference in the risk of cardiovascular outcomes (HR: 1.06; 95% CI: 0.83–1.34)[10]. Gagne et al. examined the electronic data of American patients who were initially treated with generic or brand-name statin (lovastatin, pravastatin, or simvastatin), with 6380 patients in each group. They discovered an 8% reduction in the rate of adverse clinical outcomes in the generic group (HR: 0.92; 95% CI: 0.86–0.99)[11]. Moreover, Gao et al. conducted a Japanese cohort study with 14 313 patients (post 1:1 PPM) in each group who took generic or brand-name statin (atorvastatin, pravastatin, pitavastatin, simvastatin, or fluvastatin), and found no significant differences in MACE outcomes (HR: 1.04; 95% CI: 0.93–1.17). Additionally, Sicras-Mainar et al. examined a total of 13 244 records of patients from Spain who were initially treated with generic or brand-name statin (atorvastatin and simvastatin). This study revealed a higher occurrence of major cardiovascular incidents in generic group (HR: 1.31; 95% CI: 1.15–1.50), and the authors stated a possible explanation may be a lower (14% reduction) medication consistency rate among the generic group[6].

Despite the relatively heterogeneous results of previous studies, our results are comparable to most of the results, with no significant differences in clinical outcomes from the medication start and switch dates. Moreover, because studies have investigated the effects of initial medication, rather than those that resulted from a switch, and lacked rosuvastatin data, our study provided more evidence regarding the switch to generic

rosuvastatin (Table 3 and Figure 2).

Medication persistence

In a comparison of 1-year persistence rates, Romanelli et al. reported lower persistence in the generic than in the brand-name groups (61.3% and 66.2%, $P = 0.021$, respectively), and our study revealed similar results [59.1% (600/1015) vs. 68.8% (2129/3094), $P < 0.001$, respectively][12]. The lower persistence rate in the generic-switch group may be attributed to the medication switch having driven patients to search for facilities that provided their original medication. Nevertheless, we conducted an analysis on patients with persistent medication use, which was expected to have no influence on the interpretation. Notably, studies have also revealed that the switch to other types of statin was frequently to less potent medications that may also affect clinical outcomes[12,13].

Medical expense

Although the efficacy of achieving controlled lipid levels was comparable between the generic-switch and brand-name groups, the expense of statin use per person was approximately 16.1% lower in the generic group than in the brand-name group (NT$452.50 vs. NT$539.30). This is consistent with the results obtained by Warraich et al., indicating a 23% reduction (from NT$7.0 to NT$5.4 billion). Given the comparable efficacy and clinical outcomes, they recommended using a generic substitute to reduce costs[3]. (Figure 4)

Limitations

Our study has several limitations. First, this was a single-center retrospective study

enrolling people of primarily east-Asian ethnicities. Therefore, although our results are comparable to those of global studies, their generalizability may be limited. Second, no routine medical records were available regarding potential adverse effects of muscle pain or creatine kinase levels that we could use for comparison. Third, longer follow-up periods after the switch date may be required to measure cardiovascular outcomes. Although we analyzed outcomes after the medication initiation and switch dates, long-term prognoses after the switch date may require further investigation. Fourth, the medications in our study were Crestor, Roty, and Lipitor, and the result may not be generalizable to other medications.

Conclusion

Patients who switched to generic rosuvastatin had comparable lipid-lowering efficacy, safety, and clinical outcomes and lower medical expenses than patients who consistently used brand-name atorvastatin.

Declarations

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

MSH conducted data collection, analyzing, tables and figures drafting; CIW did manuscript writing; PFS supervised data analyzing; PYL provide the concept and source of data.

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Figure Legends

Figure 1. Data flow diagram.

Figure 2. Kaplan–Meier survival analysis of primary endpoint of 2 groups, after propensity score matching. Upper panel started from medication switch date, and lower panel from medication initialization date. *P*: log-rank test.

Figure 3. Laboratory patient-paired difference before and after medication switch date. *P*: Student's t test.

Figure 4. Prescription amount (upper panel) and expense per person (lower panel) of statin use to time for generic rosuvastatin, brand-name rosuvastatin, and brand-name atorvastatin. The red vertical dash line indicates medication switch date: March 3, 2018.

Table 1 Clinical matching characteristics for current patient cohort with switch effect of brand-name atorvastatin and generic rosuvastatin use

	Before Matching					After Matching				
	Rosuvastatin (n=600)		Atorvastatin (n=2,125)			Rosuvastatin (n=592)		Atorvastatin (n=592)		
	mean (count)	SD (percentage)	mean (count)	SD (percentage)	p	mean (count)	SD (percentage)	mean (count)	SD (percentage)	p
Age (year)	65.15	11.82	68.54	11.79	<0.001	65.15	11.82	65.38	12.08	0.735
Body mass index (kg/m2)	26.33	5.01	25.93	5.62	0.143	26.33	5.01	25.94	4.47	0.198
Median follow up duration (days)	820		827			820		822.5		
Gender (Male)	316	52.67%	1228	57.79%	0.04	316	53.38%	318	53.72%	0.907
Diabetes mellitus	363	60.5%	1144	53.84%	0.002	363	61.32%	368	62.16%	0.765
Hypertension	419	69.83%	1727	81.27%	<0.001	419	70.78%	408	68.92%	0.486
Chronic kidney disease	163	27.17%	813	38.26%	<0.001	163	27.53%	159	26.86%	0.794
Atrial fibrillation	58	9.67%	339	15.95%	<0.001	58	9.8%	62	10.47%	0.7
Coronary artery disease	125	20.83%	853	40.14%	<0.001	125	21.11%	133	22.47%	0.573
Beta-blocker	176	29.33%	708	33.32%	0.066	176	29.73%	184	31.08%	0.613
Renin-Angiotensin-Aldosterone System inhibitor	234	39.0%	1016	47.81%	<0.001	234	39.53%	246	41.55%	0.478
Antiplatelet	237	39.5%	1286	60.52%	<0.001	237	40.03%	305	51.52%	<0.001
Anticoagluation	55	9.17%	269	12.66%	0.02	55	9.29%	60	10.14%	0.624
Laboratory										
Total Choleteroal (mg/dL)	152.5	35.88	159	42.02	<0.001	152.1	35.76	160.7	38.23	<0.001
Low density lipoprotein (mg/dL)	86.07	29.39	92.29	34.16	<0.001	85.94	29.39	93.45	31.46	<0.001
High density lipoprotein (mg/dL)	51.32	14.91	51.65	15.46	0.613	51.36	14.95	53.66	16.14	0.007
Triglyceride (mg/dL)	139.6	78.52	137.6	95.14	0.512	138.4	77.11	137.4	98.65	0.788
HbA1c (%)	7.45	1.32	7.14	1.35	<0.001	7.45	1.3	7.22	1.32	<0.001
eGFR (mL/min/1.73m2)	53.22	22.35	47.94	24.97	<0.001	53.34	22.28	51.65	25.8	0.082
ALT (U/L)	31.69	23.52	33.35	50.59	0.174	31.73	23.6	34.32	50.51	0.052

Table 2. Clinical characteristics before and after matching for current patient cohort with switch effect of brand-name atorvastatin and generic rosuvastatin use

	Before matching						
	Rosuvastatin (n=600)			Atorvastatin (n=2,125)			P
	Before	After	Patient-paired difference	Before	After	Patient-paired difference	
Total Choleteroal (mg/dL)	152.53 ± 35.88	146.58 ± 32.99	-4.44 ± 22.92	159.04 ± 42.02	154.34 ± 37.65	-2.64 ± 25.27	0.171
Low density lipoprotein (mg/dL)	86.07 ± 29.39	83.08 ± 27.88	-2.35 ± 19.81	92.29 ± 34.16	89.9 ± 31.88	-1.57 ± 21.77	0.471
High density lipoprotein (mg/dL)	51.32 ± 14.91	49.59 ± 13.22	-1.2 ± 7.9	51.65 ± 15.46	49.38 ± 14.18	-2.31 ± 7.36	0.017
Triglyceride (mg/dL)	139.61 ± 78.52	136.13 ± 76.58	-5.66 ± 49.04	137.56 ± 95.14	135.05 ± 82.81	-1.37 ± 54.99	0.133
HbA1c (%)	7.45 ± 1.32	7.39 ± 1.33	-0.05 ± 0.7	7.14 ± 1.35	7.07 ± 1.35	-0.05 ± 0.68	0.955
eGFR (mL/min/1.73m2)	53.22 ± 22.35	51.55 ± 23.27	-1.34 ± 6.94	47.94 ± 24.97	46.21 ± 25.81	-1.28 ± 7.31	0.891
ALT (U/L)	31.69 ± 23.52	31.83 ± 40.0	-0.48 ± 20.03	33.35 ± 50.59	32.22 ± 73.87	-1.05 ± 28.22	0.672
	After matching						
	Rosuvastatin (n=592)			Atorvastatin (n=592)			P
	Before	After	Patient-paired difference	Before	After	Patient-paired difference	
Total Choleteroal (mg/dL)	152.14 ± 35.76	146.35 ± 32.99	-4.38 ± 23.0	158.19 ± 43.03	154.45 ± 38.55	-3.72 ± 26.95	0.702
Low density lipoprotein (mg/dL)	85.94 ± 29.39	82.94 ± 27.9	-2.38 ± 19.89	90.2 ± 33.95	88.91 ± 32.35	-2.42 ± 23.63	0.976
High density lipoprotein (mg/dL)	51.36 ± 14.95	49.62 ± 13.25	-1.23 ± 7.93	49.94 ± 15.3	49.07 ± 14.38	-1.6 ± 7.62	0.559
Triglyceride (mg/dL)	138.41 ± 77.11	134.93 ± 75.63	-5.36 ± 49.02	142.78 ± 84.98	136.68 ± 74.73	-5.06 ± 51.6	0.930
HbA1c (%)	7.45 ± 1.3	7.37 ± 1.29	-0.05 ± 0.7	7.31 ± 1.44	7.24 ± 1.49	-0.08 ± 0.76	0.543
eGFR (mL/min/1.73m2)	53.34 ± 22.28	51.65 ± 23.25	-1.36 ± 6.95	50.6 ± 24.51	48.66 ± 26.07	-1.37 ± 8.14	0.988
ALT (U/L)	31.73 ± 23.6	31.34 ± 37.05	-0.58 ± 19.87	34.75 ± 56.08	36.27 ± 118.68	-0.14 ± 44.92	0.841

Table 3.Clinical outcomes between matching treating groups with switch effect of brand-name atorvastatin and generic rosuvastatin use

	Rosuvastatin (n=592)		Atorvastatin (n=592)		P*
	Number	Percentage	Number	Percentage	
	From landmark index date				
Median follow up time (day)	820		822.5		
Primary					
Major cardiovascular adverse event	16	2.70%	23	3.89%	0.265
Secondary					
All-cause mortality	8	1.35%	11	1.86%	0.498
Myocardial infarction	8	1.35%	10	1.69%	0.649
Ischemic stroke	0	0.00%	3	0.51%	0.084
	From statin initiation date				
Median follow up time (day)	1803.5		2359		
Primary					
Major cardiovascular adverse event	27	4.56%	39	6.59%	0.664
Secondary	18	3.04%	23	3.89%	0.826
All-cause mortality	8	1.35%	11	1.86%	0.706
Myocardial infarction	18	3.04%	23	3.89%	0.826
Ischemic stroke	2	0.34%	6	1.01%	0.255

*Log-rank *P*

Figure 1

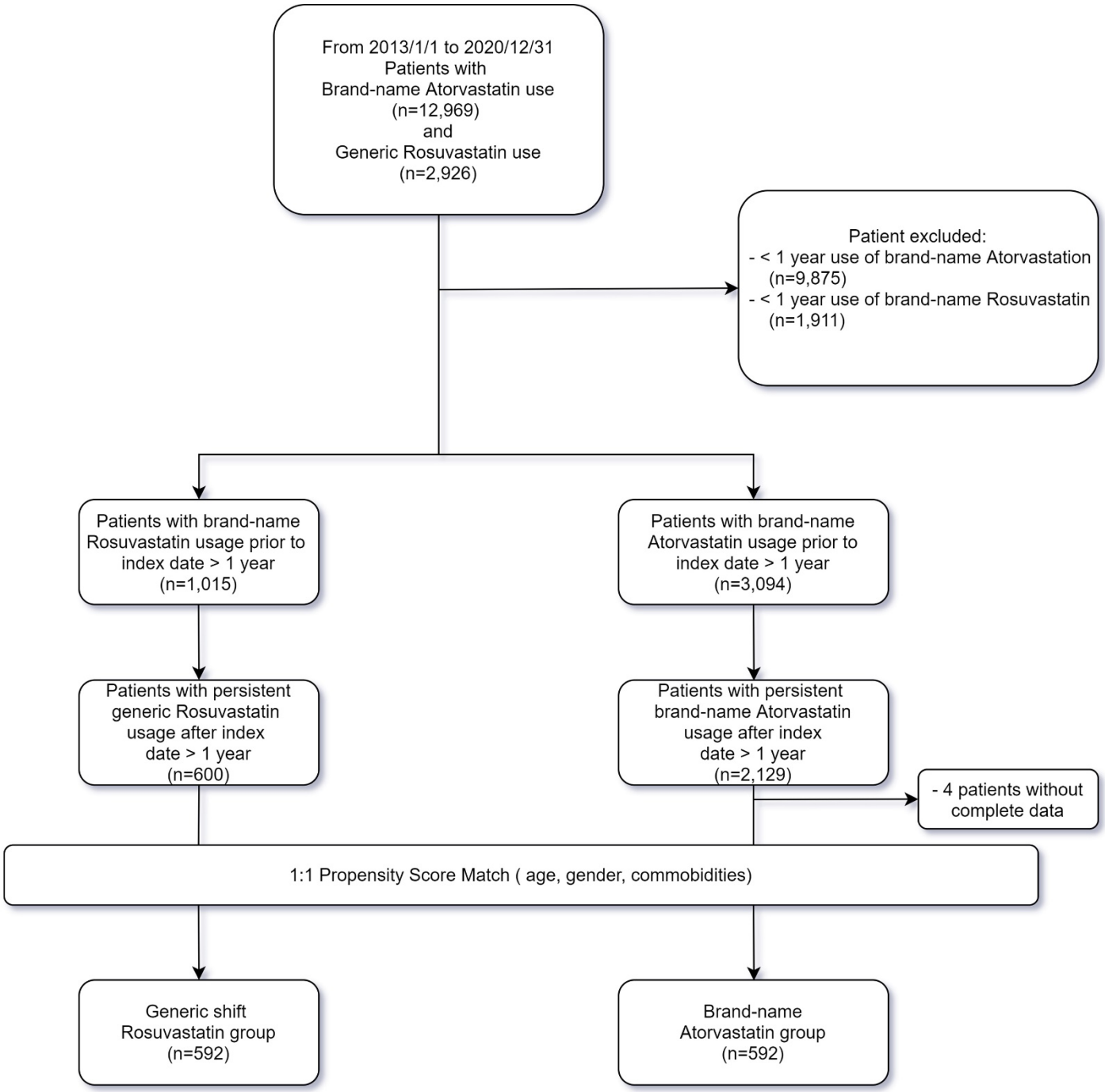
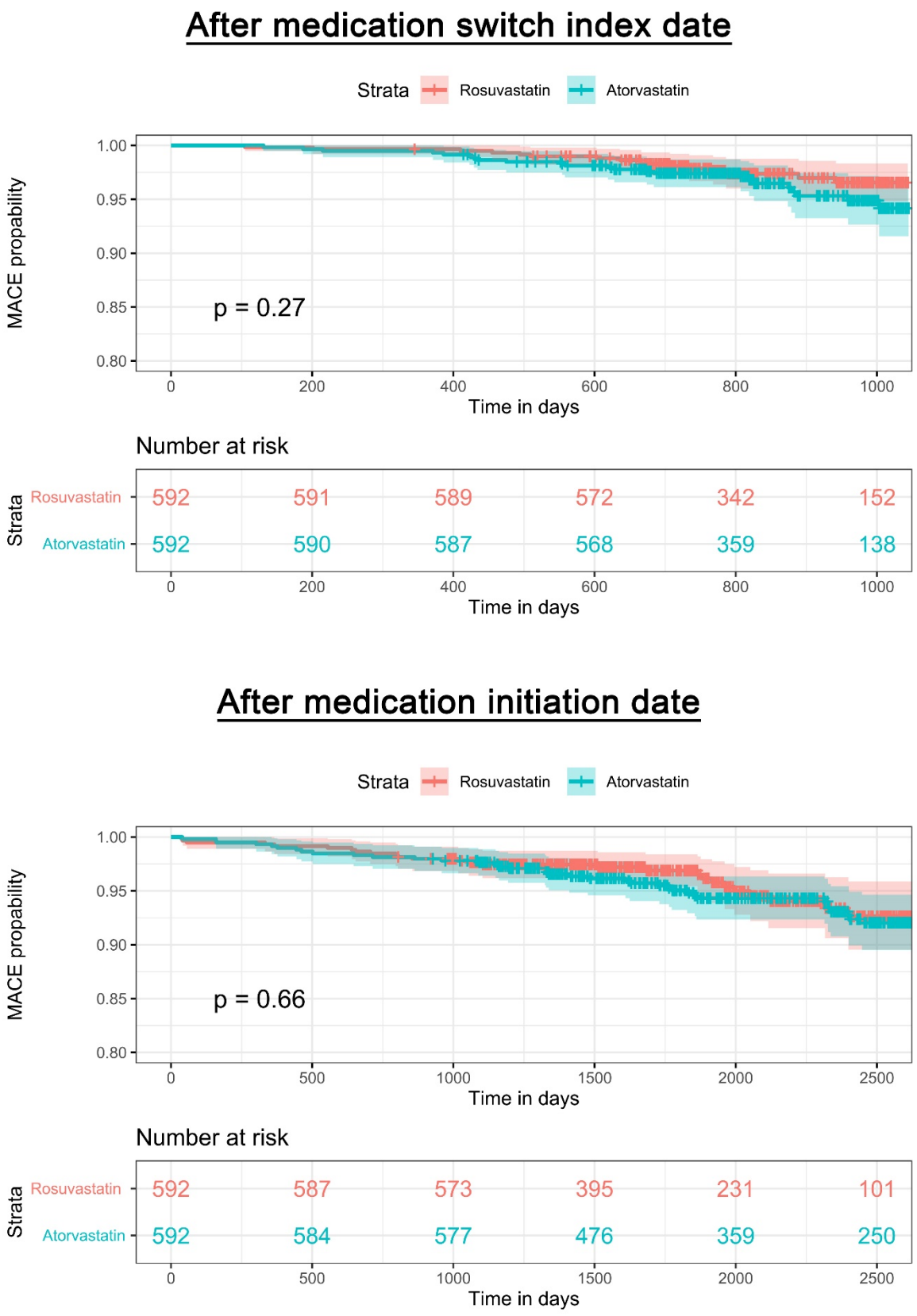
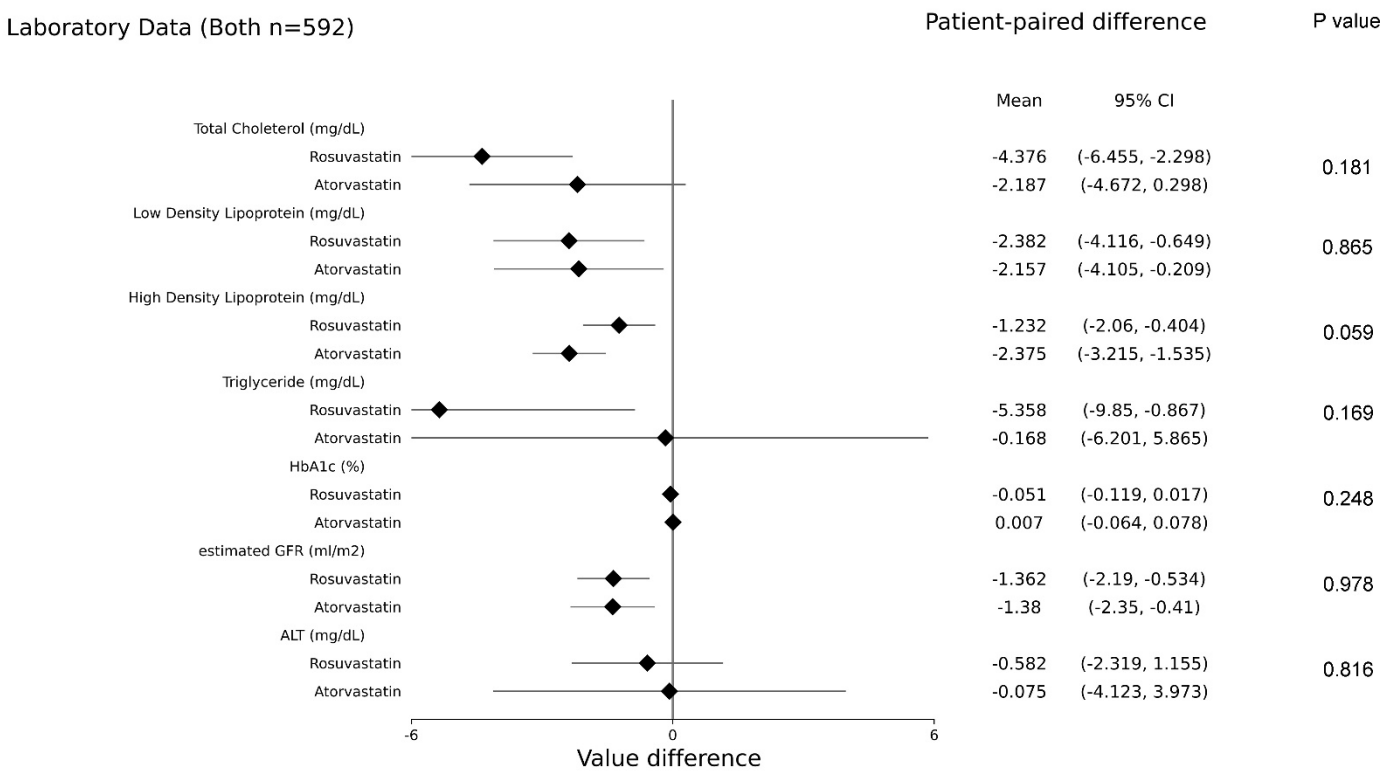

From 2013/1/1 to 2020/12/31
Patients with
Brand-name Atorvastatin use
(n=12,969)
and
Generic Rosuvastatin use
(n=2,926)
Patient excluded:
- < 1 year use of brand-name Atorvastation
(n=9,875)
- < 1 year use of brand-name Rosuvastatin
(n=1,911)
Patients with brand-name
Rosuvastatin usage prior to
index date > 1 year
(n=1,015)
Patients with brand-name
Atorvastatin usage prior to
index date > 1 year
(n=3,094)
Patients with persistent
generic Rosuvastatin
usage after index
date > 1 year
(n=600)
Patients with persistent
brand-name Atorvastatin
usage after index
date > 1 year
(n=2,129)
- 4 patients without
complete data
1:1 Propensity Score Match (age, gender, commobidities)
Generic shift
Rosuvastatin group
(n=592)
Brand-name
Atorvastatin group
(n=592)

Figure 2


After medication switch index date
Strata
Rosuvastatin
Atorvastatin
MACE propability
1.00
0.95
0.90
0.85
0.80
p = 0.27
0
200
400
600
800
1000
Time in days
Number at risk
Strata
Rosuvastatin
Atorvastatin
592
591
589
572
342
152
592
590
587
568
359
138
0
200
400
600
800
1000
Time in days
After medication initiation date
Strata
Rosuvastatin
Atorvastatin
MACE propability
1.00
0.95
0.90
0.85
0.80
p = 0.66
0
500
1000
1500
2000
2500
Time in days
Number at risk
Strata
Rosuvastatin
Atorvastatin
592
587
573
395
231
101
592
584
577
476
359
250
0
500
1000
1500
2000
2500
Time in days

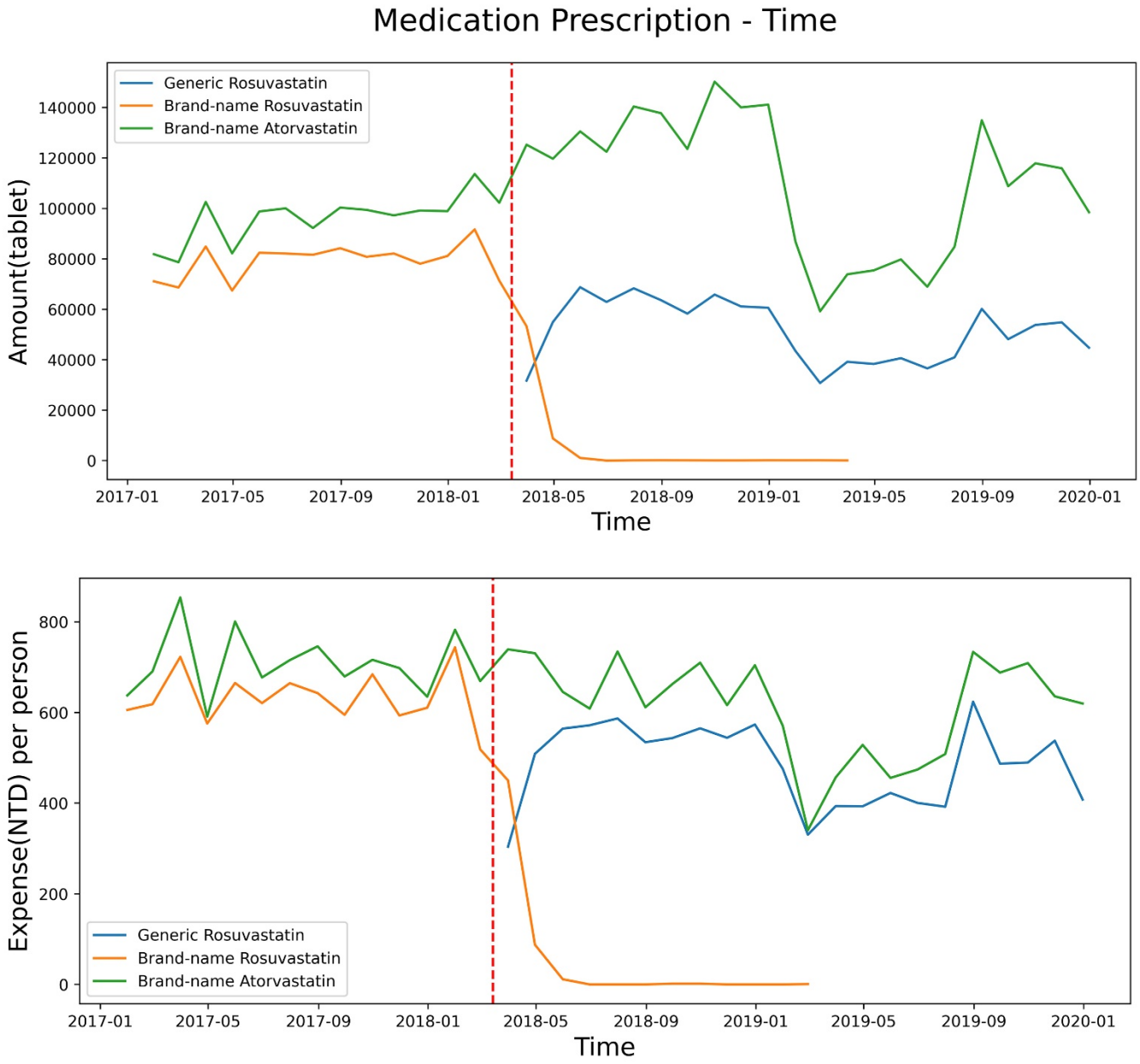
1 Figure 3


Laboratory Data (Both n=592)
Patient-paired difference
P value
Mean
95% CI
Total Choleterol (mg/dL)
Rosuvastatin
-4.376
(-6.455, -2.298)
0.181
Atorvastatin
-2.187
(-4.672, 0.298)
Low Density Lipoprotein (mg/dL)
Rosuvastatin
-2.382
(-4.116, -0.649)
0.865
Atorvastatin
-2.157
(-4.105, -0.209)
High Density Lipoprotein (mg/dL)
Rosuvastatin
-1.232
(-2.06, -0.404)
0.059
Atorvastatin
-2.375
(-3.215, -1.535)
Triglyceride (mg/dL)
Rosuvastatin
-5.358
(-9.85, -0.867)
0.169
Atorvastatin
-0.168
(-6.201, 5.865)
HbA1c (%)
Rosuvastatin
-0.051
(-0.119, 0.017)
0.248
Atorvastatin
0.007
(-0.064, 0.078)
estimated GFR (ml/m2)
Rosuvastatin
-1.362
(-2.19, -0.534)
0.978
Atorvastatin
-1.38
(-2.35, -0.41)
ALT (mg/dL)
Rosuvastatin
-0.582
(-2.319, 1.155)
0.816
Atorvastatin
-0.075
(-4.123, 3.973)
-6
0
6
Value difference

2

3

1 Figure 4


Medication Prescription - Time
Generic Rosuvastatin
Brand-name Rosuvastatin
Brand-name Atorvastatin
Amount(tablet)
0
20000
40000
60000
80000
100000
120000
140000
2017-01
2017-05
2017-09
2018-01
2018-05
2018-09
2019-01
2019-05
2019-09
2020-01
Time
Expense(NTD) per person
0
200
400
600
800
Generic Rosuvastatin
Brand-name Rosuvastatin
Brand-name Atorvastatin
2017-01
2017-05
2017-09
2018-01
2018-05
2018-09
2019-01
2019-05
2019-09
2020-01
Time

2