

Original Articles

# Understanding Statin Use in America and Gaps in Patient Education (USAGE): An internet-based survey of 10,138 current and former statin users

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**KEYWORDS:**

Adherence;  
Internet;  
Persistence;  
Statins;  
Survey

**BACKGROUND:** Statins substantially reduce the risk of cardiovascular disease and are generally well-tolerated. Despite this, many patients discontinue therapy. A better understanding of the characteristics of current and former statin users may be helpful for formulating strategies to improve long-term adherence.

**OBJECTIVE:** The Understanding Statin Use in America and Gaps in Education (USAGE) survey assessed the attitudes, beliefs, practices, and behavior of current and former statin users.

**METHODS:** Individuals 18 years or older who reported a history of high cholesterol and current or former statin use were identified within a registered consumer panel cohort in the United States and invited to participate in an Internet survey.

**RESULTS:** Of the 10,138 respondents, 8918 (88%) were current statin users and 1220 (12%) were former users. Participants (mean age 61 years) were predominantly white (92%), female (61%), of middle income (median \$44,504/yr), and had health insurance (93%). Among current users, 95% took a statin alone, and 70% had not missed a dose in the past month. Although ~70% reported that their physicians had explained the importance of cholesterol levels for their heart health former users were less satisfied with the discussions (65% vs. 83%,  $P < .05$ ). Muscle-related side effects were reported by 60% and 25% of former and current users, respectively ( $P < .05$ ). Nearly half of all respondents switched statins at least once. The primary reason for switching by current users was cost (32%) and the primary reason for discontinuation was side effects (62%).

**CONCLUSIONS:** This survey provides important insights into behavior and attitudes among current and former statin users and the results suggest that more effective dialogue between healthcare providers and patients may increase persistence of statin use, particularly when the patient has concerns about side effects and drug costs.

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Submitted March 8, 2012. Accepted for publication March 16, 2012.

Statins (3-hydroxy 3-methylglutaryl coenzyme A reductase inhibitors) are highly effective for lowering low-density lipoprotein cholesterol (LDL-C), non-high-density lipoprotein cholesterol (HDL-C), and apolipoprotein B levels in plasma. Extensive clinical trial data support their use for primary and secondary prevention of cardiovascular disease events,<sup>1-6</sup> and statins are the mainstay in dyslipidemia management guidelines.<sup>7</sup> The year 2012 marks the 25th anniversary of the Food and Drug Administration's approval of the first statin, lovastatin, indicated to treat elevated cholesterol levels not controlled by diet and lifestyle.<sup>8</sup> National Health and Nutrition Examination Survey (NHANES) data from 2005 to 2008 showed that ~25% of Americans older than the age of 45 were taking a statin drug,<sup>9</sup> and 77.6% of statin users had achieved their National Cholesterol Education Program (NCEP) Adult Treatment Panel (ATP) III LDL-C treatment targets.<sup>10</sup>

Despite the widespread prescription of highly effective lipid-lowering medications, a large portion of the U.S. population has LDL-C levels greater than the recommended goals.<sup>7,11-14</sup> On the basis of recent NHANES data, it has been estimated that 71 million U.S. adults ( $\geq 20$  years of age) have LDL-C greater than NCEP ATP-III goals, but only 34 million (48.1%) received lipid-lowering treatment (including nondrug therapy) and 23 million (33.2%) achieved NCEP ATP III LDL-C goal.<sup>14</sup> The LDL-C treatment goal achievement success rates for subjects at low-, moderate-, and high-risk for coronary heart disease (CHD) in the Lipid Treatment Assessment Project 2, conducted between September 2006 and April 2007, were 86%, 74%, and 67%, respectively.<sup>13</sup> Although these results are better than those reported in previous surveys, e.g., 57% of CHD and CHD risk equivalent patients reached LDL-C treatment goal in the NCEP Evaluation Project Utilizing Novel E-Technology (NEPTUNE) II study<sup>11</sup> and 23% of high-risk individuals in NHANES II,<sup>12</sup> substantial room for improvement remains.<sup>15</sup>

Gaps in LDL-C goal achievement have been attributed to a variety of causes, including the lack of access to affordable and appropriate health care, lipid-lowering medication nonadherence, including irregular or interrupted intake, and the high frequency of discontinuation or lack of persistence.<sup>14,16-18</sup> It has been reported that 50% or more of patients discontinue statin medication within 1 year after treatment initiation and that consistency of use decreases over time.<sup>19-21</sup> Although not surprising, it is important to note that statin nonadherence has been associated with an increased risk of adverse cardiovascular outcomes in observational studies<sup>22</sup> and in randomized trials.<sup>23,24</sup>

This article presents results of the Understanding Statin Use in America and Gaps in Education (USAGE) Survey. Extensive data from this Internet-based survey of 10,138 current and former statin users, to the authors' knowledge the largest direct patient survey conducted to date, are presented herein to describe and compare characteristics of current and former statin users.

## Methods

### Study design

The USAGE Survey was conducted from September 21, 2011, through October 17, 2011, via an Internet-based, self-administered questionnaire developed by Kantar Health (New York, NY), with input from the study authors representing the National Lipid Association, as well as from Kowa Pharmaceuticals America, Inc. (Montgomery, AL), and Eli Lilly and Company (Indianapolis, IN). The survey was administered by Lightspeed Online Research, Inc. (New York, NY), a subsidiary of Kantar Health. The study protocol and questionnaire were Health Insurance Portability and Accountability Act (HIPAA) compliant and were reviewed and approved by the Essex Institutional Review Board (Lebanon, NJ).

### Participants and survey

Individuals with high cholesterol were identified from the Ailment Panel of Lightspeed Online Research (Lightspeed Consumer Panel 2009),<sup>25,26</sup> a Kantar Health partner organization that manages an online-registered consumer panel worldwide by the use of multisource recruiting methodology. After field testing the survey to ~10% of prequalified individuals, all potential respondents were then invited via e-mail to participate. The survey content was not described in the invitation. Approximately 2 to 4 days after the initial e-mail invitation, an additional e-mail reminder was sent to those who had not previously responded.

Persons who expressed a desire to participate were sent a link to a preliminary screening questionnaire to assess whether they met the following inclusion criteria: 18 years of age or older; self-reported diagnosis of a high cholesterol level made by a health care provider; self-reported current or former use of a statin (alone or in combination with another cholesterol-lowering medication); ability to read and write English; and residence in the United States at the time of the study. Respondents who did not meet these inclusion criteria were exited from the survey instrument. Those who were eligible were asked to provide informed consent, at which time the topic of the survey was explained and resources to address any questions or concerns were provided. Individuals who gave their informed consent completed the online survey of 89 questions related to demographics, employment, disease severity and history, treatment history and satisfaction, adherence, attitudes towards statin treatment, sources of information, and health resource costs. The respondents received a small incentive for their participation in the form of points that could be redeemed for gift certificates with a cash equivalence of less than \$1.

### Data analyses

The  $\chi^2$  tests and Student's *t*-tests were used to identify significant differences between current and former statin

users with two-sided  $P < .05$  considered statistically significant. Current statin users were defined as those individuals who at the time of the survey responded that they were taking a statin (either on its own or in fixed-dose combination with niacin, amlodipine, or ezetimibe). Former statin users were defined as those individuals who indicated previous statin use (either on its own or in combination with another medication) but who reported not taking a statin at the time of the survey.

## Results

### Demographic characteristics

Of the 27,946 individuals with high cholesterol identified from the Ailment Panel of Lightspeed Online Research and contacted by e-mail to participate in the survey, 15,346 (54.9%) responded, and of those, 10,138 ( $n = 8918$  current statin users and  $n = 1220$  former statin users) were determined to be eligible, provided consent, and completed the survey. A summary of the demographic characteristics of the respondents is shown in Table 1. In summary, the majority were white (92%) and more than half were female (61%), with an average age of 61 years. Most of the respondents had at least one comorbid condition requiring medication(s), such as hypertension (66%), diabetes (28%), or CHD (11%). In addition, reports of being overweight (35%) and obese (46%) were common.

The median 2010 household income among respondents was \$44,504, and differed significantly between current statin users (\$45,270) and former statin users (\$39,452,  $P < .05$ ). Overall, participants reported spending an average of \$88/month on all prescription medications (current users, \$88 and former users, \$84). The percentage of individuals with any health insurance was high in both groups but significantly lower among former statin users (87%) compared with current statin users (94%,  $P < .05$ ), as was the percentage of individuals with Medicare/Medicaid coverage (former users, 43% and current users, 47%;  $P < .05$ ). The percentage of respondents who had at least a college degree was similar among current statin users (39%) and former users (36%).

### Statin use and lipid knowledge and awareness

The average age at which the diagnosis of high cholesterol was reported to have been made was 50 years (current users, 50.4 years and former users, 48.8 years;  $P < .05$ ). The reported duration between the diagnosis and initiation of statin therapy was about 1 year on average. Of current statin users, 95% indicated taking a statin alone, that is, not as a fixed-dose combination. A small fraction (2%) of current users had been prescribed a statin at a dose frequency other than once daily. Among current users, 70% indicated that they had not missed any dose in the past month, and only 3% missed six or more doses in

**Table 1** Demographic characteristics of survey respondents

Characteristic	Total respondents (n = 10,138)	Current statin users (n = 8918)	Former statin users (n = 1220)
Age, years	61.0 ± 0.1	61.2 ± 0.1	59.4 ± 0.3*
Age at diagnosis	50.2 ± 0.1	50.4 ± 0.1	48.8 ± 0.4
Gender			
Female	61	60	68*
Male	39	40	32*
Race/ethnicity			
White	92	92	92
Black/African American	4	4	4
Asian or Pacific Islander	1	1	1
Hispanic	1	1	2
Current BMI	81	81	77
≥25 kg/m <sup>2</sup> †			
Comorbidity			
Hypertension	66	67	58*
Arthritis	31	31	35*
Diabetes	28	29	22*
Depression	20	19	22*
Gastroesophageal reflux	19	18	23*
Thyroid condition	17	17	20*
Heart disease‡	11	12	9*
Osteopenia	9	8	10*
Heart attack	9	9	7*
Osteoporosis	8	7	10*

BMI, body mass index.

Values are mean ± SEM or mean %.

\*Significant different between current and former statin users,  $P < .05$ .

†Among those answering the questions about body mass index, ie, height and weight ( $n = 9775$ ;  $n = 8604$ ;  $n = 1171$  for total, current statin user, and former statin user).

‡Coronary heart disease, bypass surgery, and/or a stent.

the past month. The majority of survey participants indicated that they were currently using, or had previously used, a generic statin (63% of current users and 45% of former users,  $P < .05$ ), and of those, 21% reported being switched from a branded to a generic statin by their pharmacy.

Approximately one-half of all respondents reported either being told they had "high" total cholesterol (total-C), or that their level was ≥240 mg/dL at the time of their diagnosis. Most said that they had their cholesterol checked within the past year, but only 46% recalled their most recent level. Initial (at the time of diagnosis) and current (most recent level) respondent-reported levels of total-C and LDL-C are shown in Table 2. Reported current total-C concentrations were significantly lower among current statin users (173.3 mg/dL) compared with former statin users (222.7 mg/dL,  $P < .05$ ). Of respondents who recalled their lipid levels both at the time of diagnosis

**Table 2** Initial and current lipid concentrations reported by survey respondents\*

Lipid variable	Total respondents (n = 10,138)		Current statin users (n = 8918)		Former statin users (n = 1220)	
	Initial	Most recent	Initial	Most recent	Initial	Most recent
Total-C, mg/dL <sup>†</sup>						
<150	–	11	–	12	–	3
150–199	–	22	–	23	–	11
<200	11	–	11	–	6	–
200–239	34	9	34	8	33	17
240–299	25	3	25	2	29	12
300–349	8	1	7	0	9	3
≥350	5	0	5	0	6	1
Not specific/high	12	–	12	–	12	–
Don't know	5	54	5	54	5	54
Not told	1	–	1	–	1	–
LDL-C, mg/dL	(n = 6386)	(n = 4384)	(n = 5626)	(n = 3856)	(n = 760)	(n = 528)
<70	1	12	1	13	1	4 <sup>‡</sup>
70 to <100	4	17	4	19	3	8 <sup>‡</sup>
100 to <130	8	11	8	11	8	13
130 to <160	12	6	12	5	12	14 <sup>‡</sup>
Don't know	71	49	71	49	72	56 <sup>‡</sup>
Not told	4	4	4	4	5	5

LDL-C, low-density lipoprotein cholesterol; total-C, total cholesterol. Values are mean % with level.

\*Percentages may not add up to 100% due to rounding.

<sup>†</sup>Total-C concentration categories differed between initial and most recent cholesterol levels.

<sup>‡</sup>Significantly different between current and former statin users,  $P < .05$ .

and at their most recent appointment, significantly more current statin users than former users reported lower current LDL-C compared to that at the time of diagnosis (73% vs. 46%,  $P < .05$ ).

Approximately 25% of study subjects had been told at their last visit that their LDL-C level put them at moderately high, high, or very high risk for CHD. Former statin users were more likely to report being told they were at these elevated risk levels than current users (32% vs. 22%,  $P < .05$ ). Overall, 40% of respondents recalled discussing LDL-C, HDL-C, and triglycerides with their physician when they were initially diagnosed, and slightly fewer recalled the discussion at their most recent visit (33% of current statin users vs. 29% of former statin users,  $P < .05$ ). Also, at their first appointment, approximately two-thirds of respondents (69%) stated that they remembered establishing lipid treatment goals with their physician. Most commonly this was a treatment goal for LDL-C.

Nearly two-thirds of patients reported being told they should have their cholesterol tested at least every 6 months. A majority said they adhered to the monitoring recommendations (88% current users and 74% former users,  $P < .05$ ). The most commonly cited reasons for less frequent monitoring than recommended were inconvenience (27% among former users and 18% among current users), cost (21% among former users and 8% among current users), or a belief that their cholesterol was under control (16% among

former users and 13% among current users) ( $P < .05$  for all comparisons).

### Patient-reported physician instruction

About one-half of respondents stated that in addition to medication, they were recommended therapeutic lifestyle changes, including diet and exercise when diagnosed (52% of current and 48% of former users,  $P < .05$ ). Common physician recommendations included exercise, weight loss, low-fat, low-cholesterol diet, and limiting grapefruit consumption. Significantly more former statin users (60%) than current users (47%) discussed diet and/or exercise at each visit ( $P < .05$ ). In contrast, former statin users were less likely than current users to agree that their physicians had adequately explained their cholesterol levels (63% vs. 72%, respectively,  $P < .05$ ) and how high cholesterol levels can affect the heart and arteries (58% vs. 69%, respectively,  $P < .05$ ). Furthermore, although overall satisfaction with physicians' explanations of treatments was 81% for all participants, former users were less likely than current users to be satisfied (65% vs. 83% respectively,  $P < .05$ ). When asked about their typical sources of statin information, one-half of respondents said that their doctor was their only source for statin information (55% current users and 41% former users,  $P < .05$ ). Former users relied more heavily on the Internet than current users to research statin information (41% vs. 29%, respectively,  $P < .05$ ).

**Table 3** Reasons cited for switching or stopping statin medication use among current and former statin users who ever switched or stopped taking a statin medication

	Total respondents (n = 10,138)	Current statin users (n = 8918)	Former statin users (n = 1220)
Mean % among patients who ever switched statin medication			
Reason for switching	(n = 4637)	(n = 3987)	(n = 650)
Costs (net)	34	36	16*
Side effects	33	28	65*
Efficacy (net)	21	22	13*
Mean % among former statin users			
Reason for stopping			(n = 1220)
Costs (net)	NA	NA	17
Side effects	NA	NA	62
Efficacy (net)	NA	NA	12

NA, not applicable.

\*Significantly different between current and former statin users,  $P < .05$ .

### Reasons for switching and stopping statins

Nearly one-half of all individuals surveyed, 4637 participants, indicated that they had switched statins at least once (Table 3). Of these, 3987 (84%) continued to use statins after the switch and were current statin users. The remainder of the respondents (650) either discontinued statin therapy sometime after switching, or discontinued without ever having switched from their original treatment. The major reasons for switching or stopping statin use are presented in Table 3. Among current users who had switched, 36% cited cost, 28% cited side effects, and 22% cited lack of efficacy as the main reason they switched. Among former users, side effects were cited most frequently (65%), whereas 16% cited cost, and 13% cited lack of efficacy as the reason they switched. Similarly, 62% of former statin users indicated side effects as the reason for stopping, compared with 17% who indicated costs and 12% who cited lack of efficacy. Former users also described themselves as less likely to tolerate side effects from prescription medications (54% would stop taking the medication vs. 32% of current users,  $P < .05$ ), and more willing to make diet and lifestyle changes in order to avoid prescription medication (72% vs. 57% of current users,  $P < .05$ ).

### Side effects and drug interactions

Muscle-related side effects while taking a statin were reported by 29% of all survey participants: 25% among current users and 60% among former users ( $P < .05$ ). Most respondents discussed these side effects with their doctors, and it was physicians who most frequently recommended stopping or switching statins as the course of action.

However, approximately one-third of those who stopped their statin because of muscle-related side effects did so without talking to their doctor.

Using a comprehensive list provided on the survey, 84% of patients indicated that they were taking at least one additional medication/supplement that could have the potential to interact with a statin, and, on average, respondents reported using three of these medications/supplements. However, in terms of patients' attitudes toward possible drug–drug interactions, only 38% were concerned about the possibility of their medications interacting, 26% proactively talked to their doctor about it, and of those who were concerned, 42% believed that their pharmacy would alert them to potential interactions. When queried specifically about eating grapefruit or star fruit while taking a statin, 47% expressed concern, and 82% of all respondents reported that they had not consumed either while taking a statin.

### Discussion

USAGE is, to the authors' knowledge, the largest U.S. survey of self-reported statin users. As such, it differs from other studies of statin adherence, which have analyzed large insurance and pharmacy databases.<sup>27</sup> Although valuable, these studies contain only objective data regarding pharmacy refills and diagnoses but lack direct information regarding the patients' experiences and reasons for stopping or switching statin therapy. Thus, the USAGE survey provides new insights into the characteristics of individuals who persist in their use of statins after treatment initiation compared with those who have stopped taking statin medication. Key USAGE findings included excellent adherence to daily statin use among most individuals who were currently taking a statin, and that the majority of participants thought that their physicians had adequately explained the importance of cholesterol elevation and the danger to their heart and arteries. Also, approximately one-half had received counseling regarding diet and exercise, which is greater than the percentage in the Centers for Disease Control National Health Interview Survey in 2010 who reported that they had been advised to begin or continue exercise/physical activity by their health care provider (32.4%).<sup>28</sup>

Overall 81% of USAGE participants were satisfied with their physicians' care regarding cholesterol management. However, the discrepancy in reported satisfaction with physician counseling between those who discontinued their statin (65% satisfied) compared with those who continued taking statins (83% satisfied), suggests the need for more intensive patient-physician dialogue in order to minimize unnecessary statin discontinuation. Approximately one-half of the USAGE survey respondents indicated that their physicians were the primary source for information about statin treatment. Thus, the physician–patient interaction appears to provide the greatest opportunity to improve

patient education about statin use and improve statin adherence.

Adverse events were cited as the primary reason for discontinuing statins by nearly two-thirds of former users. Previous reports have also noted that side effects, or the perception of side effects, can be a major barrier to adherence with treatment with statins.<sup>19,29,30</sup> Interestingly, 25% of the individuals currently using statins reported having muscle-related side effects, far more than that reported by the highly selected subjects in clinical trials.<sup>31,32</sup> Cost was another important reason for stopping statin use among former users (17%) and was the primary reason for switching among current users (36%). Results from most other studies of statin adherence and persistence have suggested that financial issues are the primary determinants.<sup>19,27,33–37</sup> Greater rates of adherence among adults with higher income and a trend toward lower adherence with increasing out-of-pocket costs were shown by Mann et al<sup>19</sup> in a meta-analysis of 22 cohort studies. The average household income and the percentage of USAGE survey respondents with health insurance (including Medicare/Medicaid) were somewhat higher among current statin users than former statin users.

One-third of the patients who stopped taking a statin due to side effects did so without first talking to their doctor. Kon et al<sup>38</sup> reported that patients who learned about potential harms of statins from nonclinician sources were more likely to be unduly concerned about side effects for which they were at low risk. Direct-to-consumer advertising has been reported to provide considerable negative information to prospective patients, negatively skewing the perceived risk-benefit ratio for statin therapy and perhaps impairing statin adherence.<sup>17,38,39</sup> Another major contributor to the possible distortion of the risk-benefit ratio appears to be information obtained from the Internet. In the USAGE survey, former statin users were more likely to have researched statins on the Internet than current statin users (41% vs. 29%), although with the data available from the USAGE survey, it cannot be inferred whether the Internet searches were cause or effect of dissatisfaction with statins.

Statin use must be long term to provide cardiovascular benefits, and individuals prescribed a statin need to understand this, as well as the importance of monitoring LDL-C levels and reaching treatment targets. Of patients who recalled their lipid levels both at the time of diagnosis and at their most recent appointment, 73% of current statin users reported improvement in LDL-C vs. 46% of former users. However, only one-half of all respondents reported that lipid treatment goal(s) were established at their initial clinic visit, and about one-quarter indicated that they had been told at their last visit that they were still at risk for heart disease based on their recent LDL-C level. The psychological health belief model posits that perceived risk of a disease affects behavior.<sup>40</sup> Lower perceived heart disease risk has been shown to be associated with lower statin adherence<sup>29</sup> and a greater number of comorbidities, including a history of cardiovascular disease or other

preexisting conditions, such as hypertension or diabetes, has been reported to be associated with increased statin adherence.<sup>19,20,41–45</sup>

The comorbidity with the greatest prevalence in the USAGE survey was hypertension, which was reported by 66% of respondents, and significantly more current statin users reported being hypertensive compared with former statin users. Diabetes, a history of coronary revascularization (bypass surgery and/or stent), and heart attack or other CHD also were all more prevalent among current statin users compared with former statin users. On the basis of this information, raising patients' awareness of the risks associated with elevated LDL-C, and providing them with a clear explanation of their treatment target, would be expected to increase their adherence to statin treatment.

Among the major limitations of this study is the fact that the respondents may not be representative of the U.S. population, nor of all past and present statin users. USAGE participants were predominantly white (92%) and these results may therefore not apply to other races or ethnicities. Racial/ethnic minorities are reported less likely to be adherent to statins than Caucasian patients.<sup>19,29,42,46</sup> In NEPTUNE II, black patients had a significantly lower frequency of LDL-C treatment success (54%) compared with non-Hispanic white individuals (69%;  $P < .001$ ).<sup>47</sup> The USAGE study did not include enough minority participants to adequately explore statin use in nonwhite groups. Furthermore, because the USAGE survey was Internet-based, all participants had Internet access and the ability to use this means of communication. They also had more education than the general U.S. population (38% with a college degree vs. 28% in the U.S. population).<sup>48</sup> Furthermore, 93% of the USAGE participants had health insurance compared with 84% of the general population.<sup>49</sup> However, median 2010 household income among respondents was \$44,504, which is slightly lower than the median household income of roughly \$50,000 reported in the 2010 U.S. Census.<sup>48</sup> Despite these limitations on generalizability to the general population, USAGE subjects were similar to those in other surveys of individuals with access to healthcare, such as NEPTUNE II and LTAP 2.<sup>11,13</sup>

Self-reporting of medication adherence, such as in the USAGE study, is subject to bias of overestimation of a desirable behavior, as well as recall bias. Interestingly, in the present survey, respondents were more likely to remember their pant size from high school (64%) than their most recent cholesterol level (46%). Despite these obvious limitations, reasonable correlations have been found between self-reported diagnoses and medical record data for other disorders, such as diabetes and hypertension.<sup>50</sup> Another issue that potentially limits the generalizability of survey data is selection bias. Individuals in the database, which was used to identify potential participants, are likely different from those not in such a database. Also, those who elect to participate in surveys likely differ in many ways from those who choose not to participate. In USAGE, potential respondents were not informed of the topic of the survey until they agreed to participate. This presurvey

single-blind method was used to reduce the likelihood of bias due to self-selection for participation in the survey.

## Summary and conclusions

USAGE is the largest Internet-based survey of attitudes and observations of individuals who have taken statins. Despite the limitations to this survey, primarily the examination of a population which was not entirely typical of the general U.S. population, it provides important insights into behavior and attitudes among current and former statin users. Among current users, most reported excellent adherence to daily statin use and the majority were taking a generic statin, citing cost as a major concern leading to switching statins. Not surprisingly, current statin users reported greater satisfaction with their care than former statin users. Among former users, the occurrence of side effects, particularly muscle-related side effects, were cited most often as the reason for stopping and one-third of former users reported that they had stopped their statin without consulting with their healthcare provider. This suggests that more effective dialogue between healthcare providers and patients may help increase adherence and persistence of statin use, particularly when the patient has concerns about drug side effects and costs.

## Financial disclosures

This study was funded by Kowa Pharmaceuticals America, Inc. (Montgomery, AL), and Eli Lilly and Company (Indianapolis, IN). The National Lipid Association was a partner in conducting the survey. None of the authors received compensation for study design, study analysis, or manuscript preparation. The authors maintained full editorial control of the manuscript content and the decision to submit for publication.

Dr. Cohen has no disclosures. Dr. Brinton has received honoraria related to speaking from Abbott Laboratories, AstraZeneca, Merck & Co., Bristol-Myers Squibb, Daiichi Sankyo Inc., Kaneka Pharma America, Takeda Pharmaceuticals, Kowa Pharmaceuticals, GlaxoSmithKline, Boehringer Ingelheim, LipoScience Inc., Amarin Pharmaceuticals, Health Diagnostics Laboratory, and Roche/Genentech. Dr. Brinton has received consulting fees from Abbott Laboratories, AstraZeneca, Atherotech Inc., Merck & Co., Daiichi Sankyo Inc., Takeda Pharmaceuticals, Kowa Pharmaceuticals, GlaxoSmithKline, Essentialis, Arisaph, Amarin Pharmaceuticals, Health Diagnostics Laboratory, and Roche/Genentech. Dr. Brinton has received research grants from Abbott Laboratories, Merck & Co., Amarin Pharmaceuticals, Health Diagnostics Laboratory, and Roche/Genentech. Dr. Ito has received honoraria related to speaking from GlaxoSmithKline, Abbott Laboratories and Kowa Pharmaceuticals. Dr. Ito has received consulting fees from Daiichi Sankyo Inc. Dr. Jacobson has received consulting fees from AstraZeneca,

Amarin Pharmaceuticals, Abbott Laboratories, GlaxoSmithKline and Merck & Co.

## Acknowledgments

More information regarding the survey and these findings is available at the USAGE consumer website ([www.StatinUSAGE.com](http://www.StatinUSAGE.com)). The authors wish to acknowledge the help and support of Lewis Kopenhafer (Kantar Health); Megan Seery (National Lipid Association); Craig Sponseller, MD (Kowa Pharmaceuticals); and Mary R. Dicklin, PhD (Biofortis-Provident Clinical Research).

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