Current perceptions and practices in lipid management: results of a European Society of Cardiology/European Atherosclerosis Society Survey

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Aims	We sought to evaluate physicians' opinions and practices in lipid management.
Methods and results	A web-based survey by the European Society of Cardiology (ESC) and European Atherosclerosis Society (EAS) was distributed to 70 696 individuals at two time points, before and after publication of the 2019 ESC/EAS dyslipidaemia guidelines. Respondents (1271 in the first and 1056 in the second part) were most commonly cardiologists in Europe. More than 90% of participants reported that they regularly measure lipid levels and discuss lipid-lowering treatment with patients. More than 87% found the use of LDL-C goals useful or potentially useful, although it was acknowledged that recommended goals are frequently not achieved. Regarding the LDL-C goal according to the 2019 guidelines (<1.4 mmol/L for very high-risk patients), more than 70% of respondents felt that it is based on solid scientific evidence, but 31% noted that implementation should also consider available local resources and patient preferences. Statin intolerance was perceived as infrequent, affecting 1–5% of patients according to most respondents but was the main reason for not prescribing a statin to secondary-prevention patients, followed by patient non-adherence. Although most respondents reported that 11–20% of secondary-prevention patients have an indication to add a non-statin medication, fewer patients (<10% according to most respondents) receive these medications.
Conclusions	This survey shows a high level of acceptance of the LDL-C treatment goals recommended by current ESC/EAS guidelines. Although patient-related factors were the main reported reasons for suboptimal lipid-lowering therapy, physician inertia to intensify treatment cannot be excluded as an additional contributing factor.
Keywords	Dyslipidaemia • Guidelines • Survey

Introduction

Consistent evidence from genetic studies, epidemiologic cohort studies, and randomized clinical trials unequivocally supports the causal role of low-density lipoprotein cholesterol (LDL-C) in the development of atherosclerotic cardiovascular disease (ASCVD).[1] Lowering LDL-C reduces the risk of ASCVD events in primary as well as secondary prevention, with a clinical benefit that is proportional to the achieved absolute reduction in LDL-C levels.[2,3] Real-world data, however, indicate that lipid levels are inadequately controlled, particularly among patients with established ASCVD who are at very high cardiovascular (CV) risk.[4,5] Various reasons for the marked

discordance between recommended and observed LDL-C levels have been suggested, including patient non-adherence to recommended therapies or intolerance to statin therapy[5]; little is known in this respect as it relates to the perceptions and practices of treating physicians involved in the management of dyslipidaemias. Recently, the 2019 European Society of Cardiology (ESC)/European Atherosclerosis Society (EAS) dyslipidaemia guidelines[6] updated the recommendations for lipid-lowering treatment, endorsing lower LDL-C targets and broader use of non-statin medications for very high-risk patients as compared with the previous (2016) ESC/EAS guidelines,[7] in accordance with newly acquired evidence. The views of the medical community on these new recommendations are largely unknown.

Against this background, the ESC and EAS undertook an online survey among healthcare professionals to evaluate contemporary practices in lipid management and assess physicians' beliefs regarding current European dyslipidaemia guidelines.

Methods

This was an anonymous, voluntary, worldwide web-based survey undertaken jointly by the ESC and EAS. The survey used a free survey tool (SurveyMonkey, Palo Alto, CA, USA) and a multiple-choice questionnaire that was approved by the Chairs of Task Force for the 2019 ESC/EAS Lipid Guidelines. The survey consisted of two parts. Part 1 (main part of the survey) was conducted prior to the publication of the 2019 ESC/EAS dyslipidaemia guidelines, between 15 January and 15 February 2019. Part 2 was a focused follow-up conducted after the publication of the 2019 ESC/EAS dyslipidaemia guidelines, between 06 November and 15 December 2019. For both parts, invitations with a web link to the questionnaire were sent to 60 394 recipients of the MyESC newsletter and 10 302 recipients of the electronic EAS newsletter; the survey was accessible until the respective closing date on the ESC and EAS websites. Part 1 consisted of 23 questions collecting information on demographics and professional characteristics (Questions 1–4) and assessing opinions and practices regarding lipid management, mainly in the context of secondary prevention (Questions 5–23) (Supplementary material online, Table S1). Part 2 consisted of 10 questions, including the same Questions 1–4 as in Part 1, and in addition, six new questions mostly focusing on the 2016 and 2019 ESC/EAS dyslipidaemia guidelines (Supplementary material online, Table S2). A single answer or multiple answers were allowed to each question, as specified below in the description of study results. Results are summarized as numbers (percentages) and further stratified using medical specialty (cardiologists vs. non-cardiologists) as a subgroup of interest. In this descriptive report, statistical comparisons are presented only for the stratified analyses using χ^2 testing, with a two-sided $P < 0.05$ defining statistical significance. Analyses were performed using SPSS version 17.0 (SPSS Inc., Chicago, IL, USA).

Results

Of the 70 696 invitations distributed, 1271 individuals (1.8%) responded to Part 1 and 1056 (1.5%) to Part 2 of the survey. Among these, 1271 respondents (100%) for the first part and 1033 (97.8%) for the second survey part provided full information on demographics and professional characteristics (Table 1). Participation in the survey was global with the majority of respondents located in Europe (68.7% in Part 1 and 66.8% in Part 2), followed by Asia and Central/

Table I **Respondent characteristics**

	Survey Part 1 (n = 1271)	Survey Part 2 (n = 1056)
Region		
Europe	873 (68.7)	702 (66.8)
Asia	182 (14.3)	180 (17.1)
Central/South America	97 (7.6)	66 (6.3)
Africa	66 (5.2)	69 (6.6)
North America	43 (3.4)	29 (2.8)
Oceania	10 (0.8)	4 (0.4)
Age group (years)		
<40	408 (32.1)	403 (38.8)
40–50	278 (21.9)	244 (23.5)
>50	585 (46.0)	392 (37.7)
Specialty		
Cardiology	737 (58.0)	622 (59.7)
Internal Medicine	193 (15.2)	182 (17.5)
General Practitioner	91 (7.2)	68 (6.5)
Lipidology	87 (6.8)	66 (6.3)
Other	163 (12.8)	104 (10)
Practice setting		
University hospital	630 (49.6)	515 (49.8)
Non-academic public hospital	270 (21.2)	250 (24.2)
Private practice	243 (19.1)	159 (15.4)
Private hospital	128 (10.1)	109 (10.5)

Results are summarized as number (percentage).

South America. About half of participants in both parts of the survey worked at university hospitals, with the remaining working in non-academic hospitals or private practice. The majority of respondents were cardiologists (58% and 59.8%, respectively, in Parts 1 and 2), followed by Internal Medicine specialists and general practitioners (Table 1).

Lipid testing (survey Part 1)

Overall, 93% of participants reported that they assess lipid levels and discuss lipid-lowering treatments with their patients with established ASCVD regularly (81% at least once a year), whereas 5.1% reportedly do so only when a lipid-lowering medication is initiated (Supplementary material online, Figure S1A and B). Lipid analyses included total cholesterol, LDL-C, HDL-C, and triglycerides for approximately 90% of respondents, whereas lipoprotein (a) and Apolipoprotein B were measured by 19.6% and 14.6% of respondents, respectively (Supplementary material online, Figure S1C).

Lipid-lowering management in primary prevention (survey Part 1)

The main reported indications for prescribing a statin in the primary prevention setting were increased CV risk (75.6%) and presence of familial hypercholesterolaemia (73.4%). Less frequent responses were that treatment was based on lipid profiles (43.6%), and presence of concomitant risk factors such as diabetes, hypertension, or family history of coronary artery disease (31.8%) (Supplementary
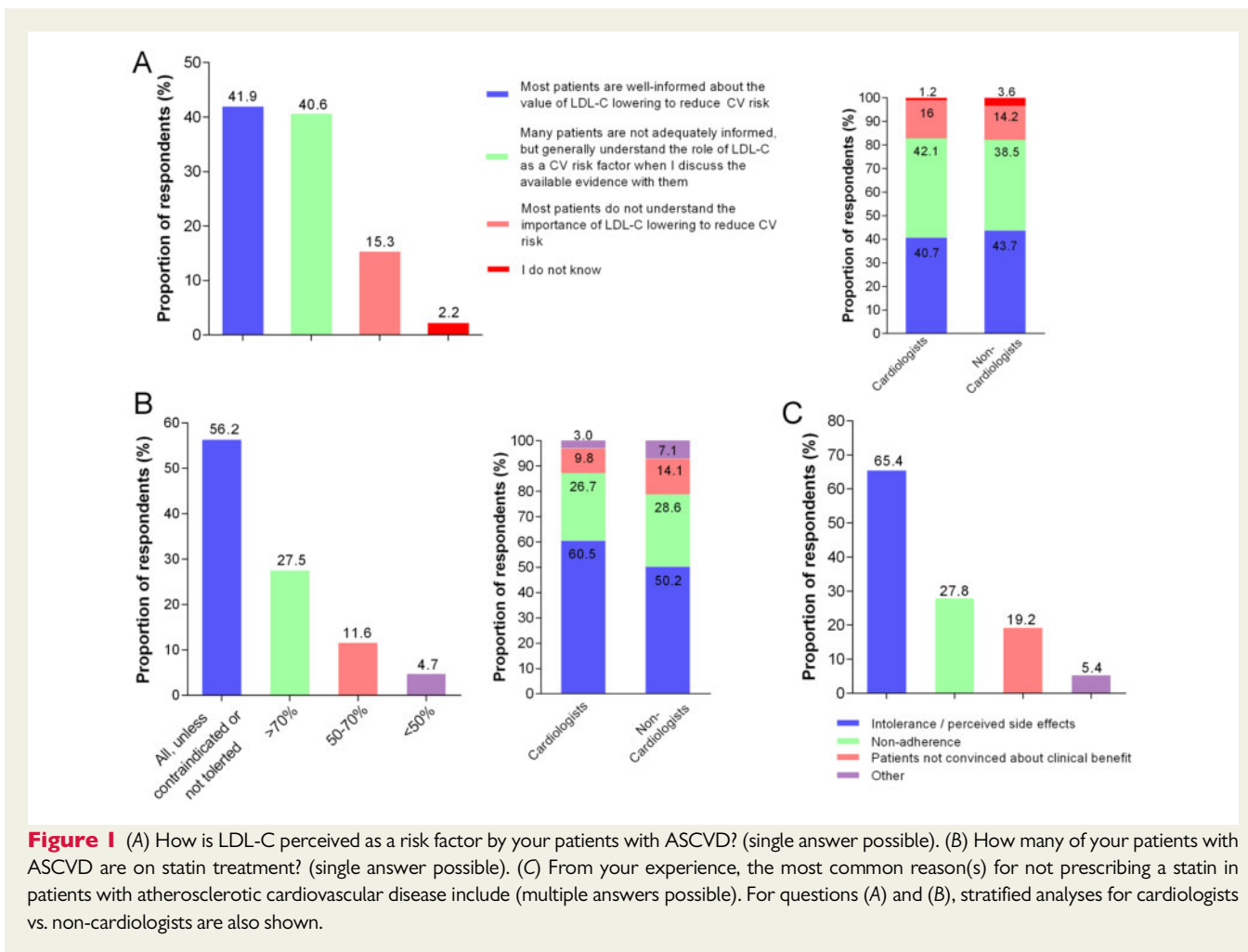
Figure I (*A*) How is LDL-C perceived as a risk factor by your patients with ASCVD? (single answer possible). (*B*) How many of your patients with ASCVD are on statin treatment? (single answer possible). (*C*) From your experience, the most common reason(s) for not prescribing a statin in patients with atherosclerotic cardiovascular disease include (multiple answers possible). For questions (*A*) and (*B*), stratified analyses for cardiologists vs. non-cardiologists are also shown.

material online, *Figure S2*), without significant differences in these proportions between cardiologists and non-cardiologists.

Lipid-lowering management in secondary prevention (survey Part 1)

Regarding the perception of LDL-C as a CV risk factor among patients with established ASCVD, 41.9% of participants responded that most of their patients are well-informed about the therapeutic benefit of LDL-C lowering as a means of CV risk reduction, and 40.6% felt that many of their patients are not adequately informed but generally understand the role of LDL-C as a CV risk factor when available evidence is discussed with them. In contrast, 15.3% reported that most of their patients do not understand the clinical importance of lowering LDL-C (*Figure 1A*). When discussing cholesterol-lowering treatment options with their patients with established ASCVD, complexity of atherosclerotic disease and diabetic status were the most commonly reported factors influencing the respondents' recommendations (81.8% and 74.7%, respectively), followed by presence of chronic kidney dysfunction (53.3%), patient age >75 years (47.1%), and gender (16.6%) (Supplementary material online, *Figure S3*).

With respect to statin treatment among patients with ASCVD, 56.2% responded that all patients are treated with statin therapy unless contraindicated or not tolerated, and 27.5% responded that >70% of patients are treated with statin therapy. Only 4.7% responded that less than half of their ASCVD patients are taking a statin (*Figure 1B*). The most commonly reported reason for not prescribing a statin in patients with ASCVD was intolerance (65.4%), followed by patient non-adherence (27.8%) and patients not convinced about the clinical benefit of statins (19.2%) (*Figure 1C* and Supplementary material online, *Figure S4*). Regarding the estimated proportion of patients with symptoms perceived to be caused by statins, most respondents (32%) estimated that this is the case in 1–5% of patients; 24.3% estimated this proportion at 6–10%, whereas about 14% reported that this proportion is higher (11–20% of patients) or substantially lower (<1% of patients). Consistently, 30.9% or respondents estimated that statins are either discontinued or changed due to perceived adverse effects in 1–5% of their patients, whereas 22.5% of respondents estimated that this is the case in 6–10% of patients (*Figure 2A*; stratified analyses in Supplementary material online, *Figure S5*).

About one-third (30.3%) responded that they see an indication to add a non-statin lipid-lowering medication in 11–20% of patients with ASCVD; 27.1% of respondents see this indication in 21–40% of patients and 25% in <10% of patients. Such an indication was seen in >40% of patients by 10% of all respondents, more commonly among
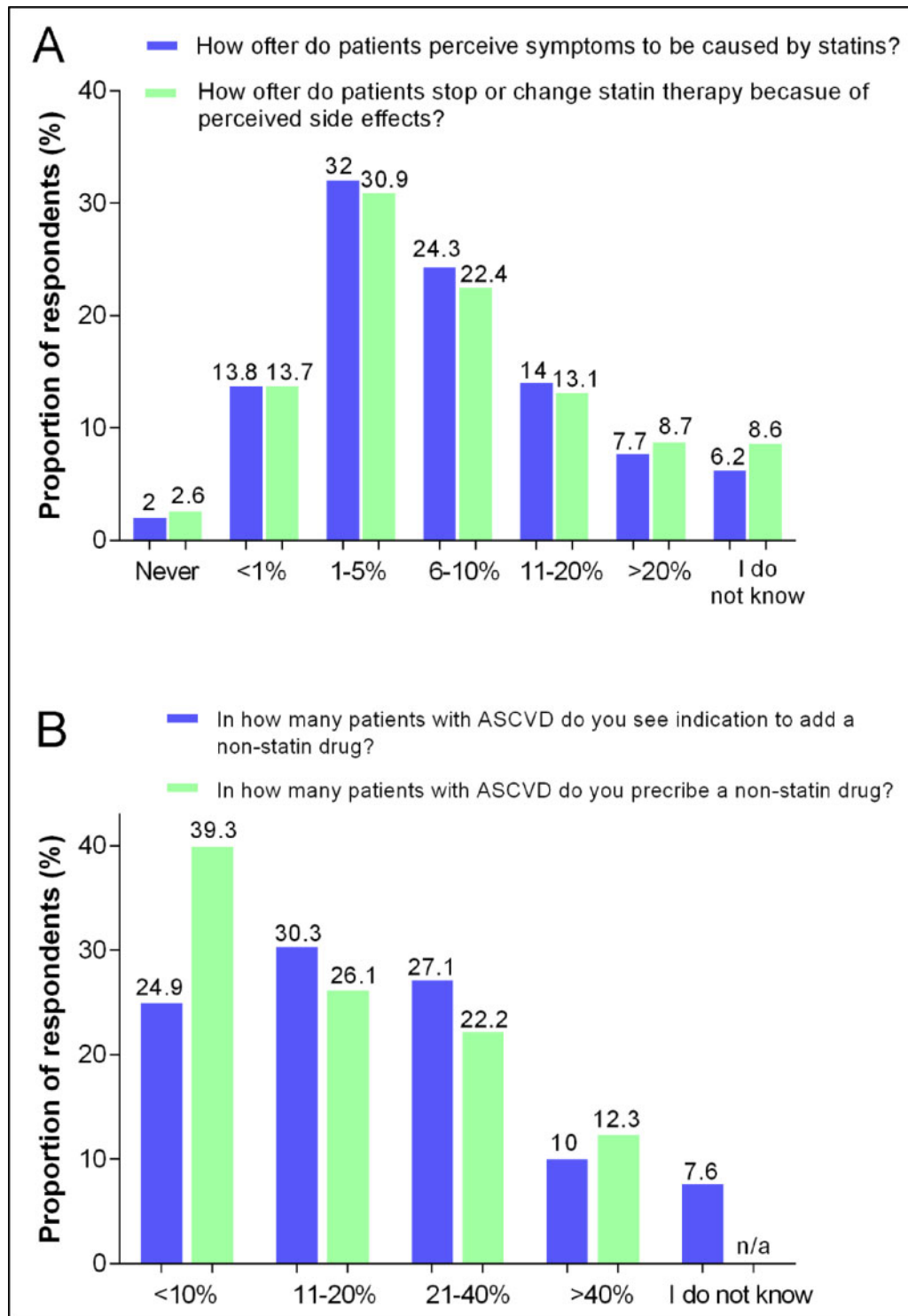
Figure 2 (*A*) From your experience, how often do your patients perceive symptoms to be caused by statin treatment? (answers shown in blue bars; single answer possible). In what percentage of cases do your patients stop or change their statin therapy because of perceived side effects of the treatment? (answers shown in green bars; single answer possible). (*B*) In your patients with ASCVD, in what percentage of cases do you identify an indication to add a non-statin lipid-lowering drug in combination with statin? (answers shown in blue bars; single answer possible). In how many of your patients with ASCVD do you prescribe a non-statin lipid-lowering medication on top of a statin (or instead of statin, in case statins are contraindicated or not tolerated)? (answers shown in green bars; single answer possible).

non-cardiologists vs. cardiologist (15.7% vs. 6.2%, *P* < 0.05). The proportion of patients in whom a non-statin drug is prescribed was lower: <10% of patients according to 34.3% of respondents, and 11–20% of patients according to 26.1% of respondents (*Figure 2B* and Supplementary material online, *Figure S6*).

PCSK9 inhibitors (survey Part 1)

In a question regarding PCSK9 inhibitors with more than one answer allowed, 51.2% responded that these drugs should be considered in patients who have LDL-C levels above the goal despite maximally tolerated oral treatment, as there is compelling evidence of improved clinical outcomes; 56.8% stated that there is evidence of clinical benefit but the clinical use of PCSK9 inhibitors is limited by high cost. Conversely, 11.4% responded they see an indication for these medications only in few, highly selected patients due to modest clinical benefit, and a similar proportion (10%) felt that more studies are needed to assess longer-term safety and efficacy (Supplementary material online, *Figure S7A*). We further evaluated physician satisfaction and patient acceptance in the subgroup of respondents with personal experience in prescribing a PCSK9 inhibitor (44.5% of all): 94% stated that the reduction in LDL-C achieved with PCSK9-inhibitors had met their expectations (72.1% completely agreed, 21.9% partly agreed) (Supplementary material online, *Figure S7B*), and 93.5% felt that this treatment was acceptable to patients (59.4% completely agreed, 34.1% partly agreed) (Supplementary material online, *Figure S7C*).

Perception of guideline recommendations (survey Parts 1 and 2)

In Part 1 of the survey, the goal-oriented approach in the 2016 ESC/EAS dyslipidaemia guidelines recommending an LDL-C goal <1.8 mmol/L in secondary prevention was perceived as useful by 73.4% and potentially useful by another 14.7% of respondents; 5.7% answered that the recommended goals are difficult to reach and that they prescribe evidence-based statin therapy without considering if the goal is achieved (*Figure 3A*). The LDL-C goal <1.8 mmol/L is reached by 51–70% of patients with ASCVD according to 36.6% of respondents, by 31–50% of patients according to 25.7% or respondents, and by >70% of patients according to 19.6% of respondents (*Figure 3B*). Both questions were repeated in Part 2 of the survey, yielding very similar results (*Figure 3*).

Regarding the LDL-C target introduced in the 2019 Guidelines, i.e. <1.4 mmol/L for patients at very high risk (survey Part 2 only), the new guidelines reflect robust evidence that achieving lower LDL-C levels results in additional clinical benefit according to 41.8% of respondents; 31.8% responded that the new goal is useful for guidance, but implementation should be based on available local resources and individual patient preferences; and 22.4% found the new treatment target very ambitious and challenging to reach (*Figure 4A*), without significant differences between cardiologists and non-cardiologists. Regarding the estimated achievement of the LDL-C goal <1.4 mmol/L in patients with ASCVD, most respondents (28.3%) believed that this is reached by 10–30% of patients, whereas 23% and 22.8% responded that it is reached by <10% and 31–50% of patients, respectively. Only 11.7% responded that this goal is reached by more than half of ASCVD patients (*Figure 4B*). With respect to the anticipated impact of the 2019 guidelines, most respondents (41.7%)

answered that they will result in a combination of measures (intensification of lifestyle measures, uptitration of statin dose, addition of non-statin medications) in more patients, and only 1.5% felt that the new guidelines will not change every-day clinical practice (*Figure 4C*).

Future outlook (survey Part 1)

Responses to the question what should be the focus for clinical practice and research in the field of lipid management in the future are shown in Supplementary material online, *Figure S8*. Most frequent answers were intensifying treatment in order to help more patients reach guideline-recommended targets (72%), and educating patients on the clinical importance of lowering their cholesterol levels (70%). Sixty percent responded patient-tailored treatment based on individual CV risk, rather than focusing only on achieving very low cholesterol levels in all patients.

Discussion

Despite compelling evidence that lowering atherogenic lipoproteins reduces CV risk, several studies indicate a less than optimal control of LDL-C levels particularly in the context of secondary prevention,[4,5,8,9] with substantial variation between countries.[10] This survey shows reasonable consistency between guideline recommendations and reported practice patterns, and reflects a relatively favourable predisposition regarding recommended LDL-C goals and lipid-lowering therapies (LLTs). Although suboptimal treatment was attributed mostly to patient-related factors (i.e. intolerance or non-adherence), our findings also suggest some degree of inertia to intensify LLT and highlight concerns of treatment costs as a limiting factor for the use of newer, potent therapies. These findings provide insights into physician perceptions and practice patterns, thus helping a better understanding of contemporary lipid management in real-world clinical practice.

This survey found an overall positive perception of current guideline recommendations on LDL-C lowering. The vast majority of respondents routinely measure lipids and discuss LLT options with their patients, and almost 90% find the guideline-recommended LDL-C treatment goals useful or potentially useful for clinical guidance. The risk-tailored, goal-oriented approach to lipid management endorsed by the European guidelines[6,7] can enhance individualized treatment, aid patient-physician communication, and may facilitate adherence to treatment. Regarding the lower goal for very high-risk patients in the 2019 vs. the 2016 ESC/EAS guidelines, the survey showed favourable opinions: approximately 70% of respondents reported that the new treatment goal is based on sound scientific evidence, although 30% noted that implementation should also consider local resources and patient preferences. In line with this observation, the ESC/EAS guidelines acknowledge that the LDL-C goals are based on the best available evidence, but decision-making must be based on what is appropriate to the local situation.[6] One of five respondents were more critical about the new LDL-C treatment goal, believing that it will be challenging to reach in everyday practice.

Real-world data consistently demonstrate a suboptimal control of lipid levels in patients with known ASCVD.[4,5,8–12] In this survey reflecting physician opinions, patient-perceived intolerance or non-adherence to treatment emerged as leading reasons for not
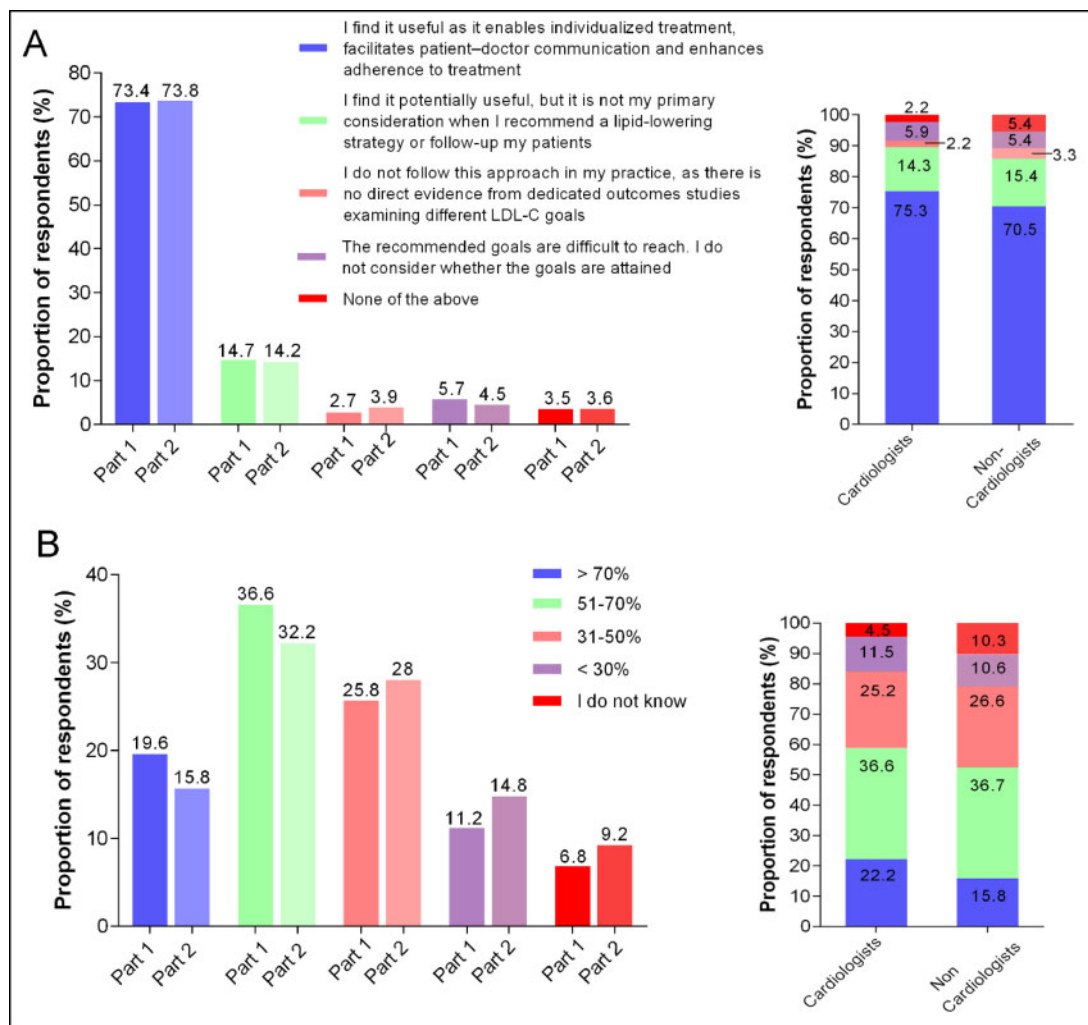
Figure 3 (A) The 2016 EAS/EAS dyslipidaemia guidelines recommended that LDL-C is lowered to specific treatment goals, according to each patient's total cardiovascular risk (<1.8 mmol/L for patients at very high risk). Which phrase best describes your attitude to this goal-oriented approach in your daily practice? (single answer possible). (B) What is the approximate proportion of your patients with ASCVD who reach the LDL-C goal recommended by the 2016 ESC/EAS guidelines (<1.8 mmol/L)? (single answer possible). For both questions (A) and (B), responses obtained from Part 1 and Part 2 of the survey are shown. Stratified analyses for both questions (cardiologists vs. no cardiologists) refer to Part 1 of the survey.

prescribing a statin despite a clear indication. However, true statin intolerance is rare according to randomized controlled trial evidence[13] and was indeed considered a relatively uncommon phenomenon in this survey (affecting 1–5% of patients according to most respondents). Notably, one in six physicians felt that most patients do not understand the clinical relevance of elevated LDL-C levels. While these responses point to patient-related factors, physician-related factors leading to less than optimal LLT cannot be excluded in this survey. First, fewer patients receive non-statin medications as compared with the numbers of patients who have an indication for these drugs (*Figure 2B*), suggesting a gap between awareness of indications and implementation in clinical practice. Second, a non-negligible 8% of physicians do not find the guideline-recommended LDL-C goals useful and thus, would not be expected to intensify treatment in patients with persistently elevated lipid levels. In a broader

perspective, in the EUROASPIRE-V survey twice as many patients with coronary heart disease reported that their LLT had been stopped or its intensity had been reduced due to physician advice (36.8%) than due to intolerance (15.8%).[5] Collectively, when interpreting physician-reported opinions (as in the present survey) and patient-reported data (as in EUROASPIRE-V), there appear to be multiple causes for the suboptimal lipid management in secondary prevention, some of which are likely related to physician practices. Other aspects such as patient counselling to assist adherence[14] are also likely to affect the implementation of guideline recommendations,[15] but these were not specifically addressed in the present survey.

Individualized therapeutic strategies appear to be important for many respondents in this survey. For more than 80% of participants, recommendations regarding the intensity of LLT for
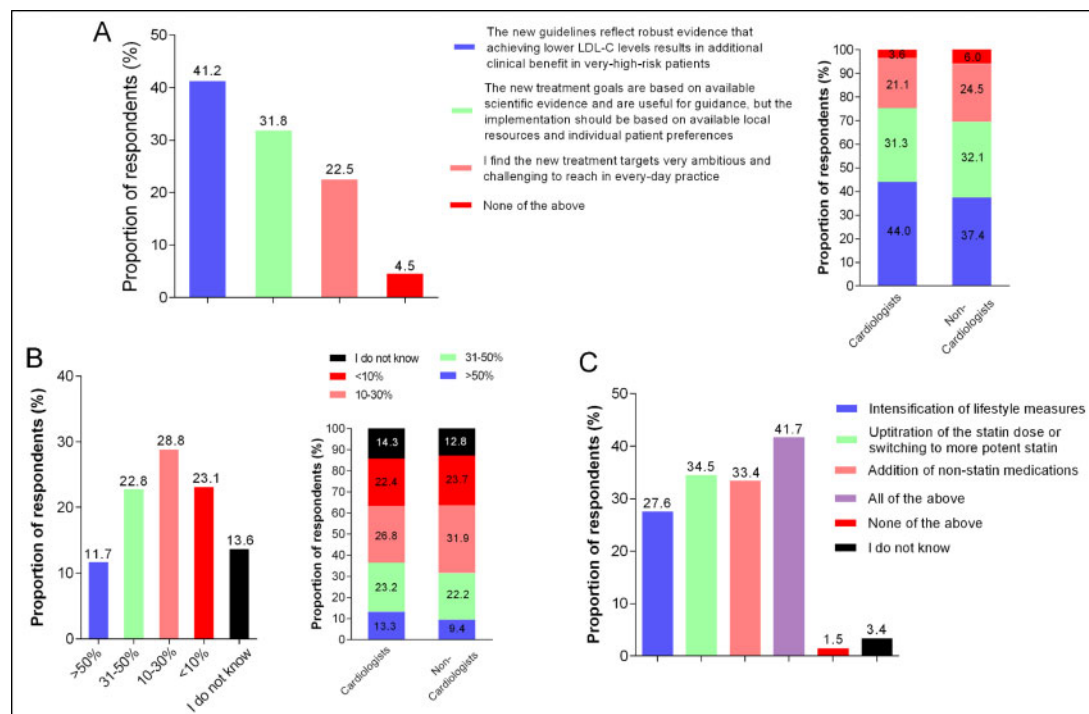
Figure 4 (*A*) The 2019 ESC/EAS dyslipidaemia guidelines recommend lower treatment targets for LDL-C (<1.4 mmol/L) compared with the 2016 guidelines (<1.8 mmol/L) for patients at very high risk. Which of the following phrases most closely describes your opinion of the revised treatment goals? (single answer possible). (*B*) What is the approximate proportion of your patients with ASCVD who reach the LDL-C goal recommended by the 2019 ESC/EAS guidelines (<1.4 mmol/L)? (single answer possible). (*C*) In your opinion, in which ways will the new ESC/EAS dyslipidaemia guidelines change every-day clinical practice in patients at high or very high cardiovascular risk (multiple answers possible). Questions (*A*), (*B*), and (*C*) were included only in Part 2 of the survey.

patients with known ASCVD are influenced by the complexity of the disease. According to ESC/EAS guidelines, the LDL-C goal and recommended treatment are the same for all patients with ASCVD irrespective of disease complexity, with the exception of an even lower LDL-C goal (<1.0 mmol/L) that may be considered in patients with recurrent events.[6] Along the same lines, 60% of respondents felt that clinical practice should focus on patient-tailored approaches according to individual risk rather than achieving very low lipid levels in all patients (Supplementary material online, *Figure S8*).

PCSK9 inhibitors have emerged as a valuable add-on treatment option for patients at very high risk and elevated LDL-C levels despite maximally tolerated statin and ezetimibe therapy.[6] In this survey, more than half of respondents concurred with this indication; however, 56% felt that high cost limits the use of these medications. Only about one in 10 participants felt that these medications are appropriate only for highly selected patients or that there is a need for more studies with longer follow-up durations.

While this survey overall demonstrates reasonable concordance between reported practice patterns and current guideline recommendations, it also identified some areas of discordance. Firstly, patient gender was reported by one of six respondents as a factor influencing treatment recommendations, despite compelling evidence of similar clinical benefit for both sexes[16] and despite the

recommendation that statins should be used with the same indications in women and men.[6] Moreover, almost half of participants stated that their recommendations in secondary-prevention patients are influenced by old age, although ESC/EAS guidelines[6] recommend statins for older people with ASCVD in the same way as for younger patients. It should be noted, however, that starting the statin at a low dose is advised for older patients with significant renal impairment and/or potential for drug interactions.[6]

The study has several limitations. First, the generalizability of the results is limited by the low response rate. Practices in primary care, in particular, are underrepresented. Second, we cannot exclude selection bias towards respondents more intensively involved in dyslipidaemia management, as physicians with greater interest may be more likely to participate in the survey. Third, as in previous surveys,[17] this survey provides a snapshot of practice patterns and perceptions and cannot address changes over time. Finally, although participants from a large number of countries worldwide were included, the present findings are less representative for regions under-represented in the survey.

Supplementary material

Supplementary material is available at *European Journal of Preventive Cardiology* online.

Acknowledgements

References

1. Ference BA, Ginsberg HN, Graham I, Ray KK, Packard CJ, Bruckert E, Hegele RA, Krauss RM, Raal FJ, Schunkert H, Watts GF, Borén J, Fazio S, Horton JD, Masana L, Nicholls SJ, Nordestgaard BG, van de Sluis B, Taskinen M-R, Tokgözoğlu L, Landmesser U, Laufs U, Wiklund O, Stock JK, Chapman MJ, Catapano AL. Low-density lipoproteins cause atherosclerotic cardiovascular disease. 1. Evidence from genetic, epidemiologic, and clinical studies. A consensus statement from the European Atherosclerosis Society Consensus Panel. *Eur Heart J* 2017;**38**:2459–2472.
2. Cholesterol Treatment Trialists' (CTT) Collaboration; Baigent C, Blackwell L, Emberson J, Holland LE, Reith C, Bhala N, Peto R, Barnes EH, Keech A, Simes J, Collins R. Efficacy and safety of more intensive lowering of LDL cholesterol: a meta-analysis of data from 170,000 participants in 26 randomised trials. *Lancet* 2010;**376**:1670–1681.
3. Koskinas KC, Siontis GCM, Piccolo R, Mavridis D, Räber L, Mach F, Windecker S. Effect of statins and nonstatin LDL-lowering medications on cardiovascular outcomes in secondary prevention: a meta-analysis of randomized trials. *Eur Heart J* 2018;**39**:1172–1180.
4. Reiner Ž, De Backer G, Fras Z, Kotseva K, Tokgözoglu L, Wood D, De Bacquer D. Lipid lowering drug therapy in patients with coronary heart disease from 24 European countries. Findings from the EUROASPIRE IV survey. *Atherosclerosis* 2016;**246**:243–250.
5. De Backer G, Jankowski P, Kotseva K, Mirrakhimov E, Reiner Ž, Rydén L, Tokgözoğlu L, Wood D, De Bacquer D; EUROASPIRE V collaborators. Management of dyslipidaemia in patients with coronary heart disease: Results from the ESC-EORP EUROASPIRE V survey in 27 countries. *Atherosclerosis* 2019;**285**:135–146.
6. Mach F, Baigent C, Catapano AL, Koskinas KC, Casula M, Badimon L, Chapman MJ, De Backer GG, Delgado V, Ference BA, Graham IM, Halliday A, Landmesser U, Mihaylova B, Pedersen TR, Riccardi G, Richter DJ, Sabatine MS, Taskinen M-R, Tokgozoglu L, Wiklund O; ESC Scientific Document Group. 2019 ESC/EAS Guidelines for the management of dyslipidaemias: lipid modification to reduce cardiovascular risk. *Eur Heart J* 2020;**41**:111–188.
7. Catapano AL, Graham I, De Backer G, Wiklund O, Chapman MJ, Drexel H, Hoes AW, Jennings CS, Landmesser U, Pedersen TR, Reiner Ž, Riccardi G, Taskinen M-R, Tokgozoglu L, Verschuren WMM, Vlachopoulos C, Wood DA, Zamorano JL. 2016 ESC/EAS Guidelines for the management of dyslipidaemias. *Eur Heart J* 2016;**37**:2999–3058.
8. Danchin N, Almahmeed W, Al-Rasadi K, Azuri J, Berrah A, Cuneo CA, Karpov Y, Kaul U, Kayıkçıoğlu M, Mitchenko O, Ruiz AJ, Aguilar Salinas CA, Santos RD, Mercier F, Blom D; for the ICLPS Investigators. Achievement of low density lipoprotein cholesterol goals in 18 countries outside western Europe: the International ChoLesterol management Practice Study (ICLPS). *Eur J Prev Cardiol* 2018;**25**:1087–1094.
9. Ray KK, Molemans B, Schoonen Wm, Giovas P, Bray S, Kiru G, Murphy J, Banach M, De Servi S, Gaita D, Gouni-Berthold I, Hovingh GK, Jozwiak JJ, Jukema JW, Kiss RG, Kownator S, Iversen HK, Maher V, Masana L, Parkhomenko A, Peeters A, Clifford P, Raslova K, Siostrzonek P, Romeo R, Tousoulis D, Vlachopoulos C, Vrablik M, Catapano A, Poulter N. EU-wide cross-sectional observational study of lipid-modifying therapy use in secondary and primary care: the DA VINCI study. *Eur J Prev Cardiol* 2021;**28**:1279–1289.
10. Zhao M, Cooney MT, Klipstein-Grobusch K, Vaartjes I, De Bacquer D, De Sutter J, Reiner Ž, Prescott E, Faggiano P, Vanuzzo D, AlFaleh H, Menown IB, Gait D, Posogova N, Sheu WH-H, Zhao D, Zuo H, Grobbee DE, Graham IM. Simplifying the audit of risk factor recording and control: a report from an international study in 11 countries. *Eur J Prev Cardiol* 2016;**23**:1202–1210.
11. Hobbs FD, Erhardt L. Acceptance of guideline recommendations and perceived implementation of coronary heart disease prevention among primary care physicians in five European countries: the Reassessing European Attitudes about Cardiovascular Treatment (REACT) survey. *Fam Pract* 2002;**19**:596–604.
12. Reiner Z, Sonicki Z, Tedeschi-Reiner E. Physicians' perception, knowledge and awareness of cardiovascular risk factors and adherence to prevention guidelines: the PERCRO-DOC survey. *Atherosclerosis* 2010;**213**:598–603.
13. Naci H, Brugts J, Ades T. Comparative tolerability and harms of individual statins: a study-level network meta-analysis of 246 955 participants from 135 randomized, controlled trials. *Circ Cardiovasc Qual Outcomes* 2013;**6**:390–399.
14. Nieuwkerk PT, Nierman MC, Vissers MN, Locadia M, Greggers-Peusch P, Knape LPM, Kastelein JJP, Sprangers MAG, de Haes HC, Stroes ESG. Intervention to improve adherence to lipid-lowering medication and lipid-levels in patients with an increased cardiovascular risk. *Am J Cardiol* 2012;**110**:666–672.
15. Graham IM, Stewart M, Hertog MG; on behalf of the Cardiovascular Round Table Task Forced. Cardiovascular Round Table Task Force. Factors impeding the implementation of cardiovascular prevention guidelines: findings from a survey conducted by the European Society of Cardiology. *Eur J Cardiovasc Prev Rehabil* 2006;**13**:839–845.
16. Fulcher J, O'Connell R, Voysey M, Emberson J, Blackwell L, Mihaylova B, Simes J, Collins R, Kirby A, Colhoun H, Braunwald E, La Rosa J, Pedersen TR, Tonkin A, Davis B, Sleight P, Franzosi MG, Baigent C, Keech A. Efficacy and Safety of LDL-lowering therapy among men and women: meta-analysis of individual data from 174,000 participants in 27 randomised trials. *Lancet* 2015;**385**:1397–1405.
17. Koskinas KC, Nakamura M, Räber L, Colleran R, Kadota K, Capodanno D, Wijns W, Akasaka T, Valgimigli M, Guagliumi G, Windecker S, Byrne RA. Current use of intracoronary imaging in interventional practice—results of a European Association of Percutaneous Cardiovascular Interventions (EAPCI) and Japanese Association of Cardiovascular Interventions and Therapeutics (CVIT) Clinical Practice Survey. *EuroIntervention* 2018;**14**:e475–e484.