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Enhancing patients' preferences for statin therapy: A decision experiment with latent class analysis

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Abstract

Background Studies on how medical information is presented to patients to promote statin therapy for the prevention of major vascular events are limited, making it difficult to guide clinicians on how to share statin information with patients.
Methods and Results A total of 613 participants were randomly assigned to different survey versions (positively or negatively framed), and both groups completed a series of surveys. No clinical treatment or intervention was administered, and all participants received routine care only. Latent class analysis (LCA) and regression analysis were applied for decision analysis of consent to statin therapy. LCA revealed an optimal 4-subgroup model comprising a mixed preference subgroup (C1), a statin regimen subgroup (C2), an objection to statin therapy subgroup (C3), and a consent to statin therapy subgroup (C4). Participants' consent to statin therapy was influenced by the comprehensive effects and mutual relationships of many internal and external influencing factors. The preferences of different subgroups for statin therapy were affected by different influencing factors. Both message framing and format may have influenced decision-making.

Conclusions Decision analysis and the establishment of decision models of preference for statin therapy suggest a potential approach for individualized decision-making (IDM) in practice.in the prevention of stroke. In unstratified analyses, loss-framed messages were associated with higher endorsement rates; however, after accounting for individual heterogeneity via LCA, framing was not an independent predictor in the multivariate model, suggesting that its effect is subgroup dependent and should not be generalized. Our LCA and regression analysis approach to decision analysis and the establishment of a decision model may provide a useful reference point.for the promotion of health behaviors in other health or medical domains.

Key Words: Stroke; hyperlipemia; medical decision-making; risk communication; psychosocial intervention; statistical modeling

Introduction

Cerebrovascular disease and coronary heart disease share risk factors and the underlying disease process of atherosclerosis,[1] and lowering low-density lipoprotein cholesterol (LDL cholesterol) with statin therapy can reduce the risk of occlusive vascular events.[2-4] Many clinical studies have confirmed that statin therapy is among the best medications for effectively reducing the morbidity and mortality of atherosclerotic cardiovascular disease and has an extraordinary safety profile.[1, 2, 4-6] However, studies on how such information from pooled data is presented to patients to facilitate their consent to statin therapy for the prevention of major vascular events, which is supposed to be congruent with their values and preferences, are limited.[7] An increasing number of medical professionals have begun to focus on the structure and content of health messages to support decision-making.[8, 9]A typical example is the influence of how therapeutic outcomes are framed according to patients' preferences for a treatment during medical decision-making.[10-12] This phenomenon, called the framing effect, was first experimentally confirmed in 1981[13] and involves presenting information using positive (gain, benefits, or advantages) or negative (loss) terms.[14] Additionally, medical decision-making has been shown to be influenced by many internal and external factors, such as participants' demographic characteristics (e.g., education, numeracy, age, sex, previous experiences, values, and social cognition),[15-22]and the therapeutic outcome format,[23] with many mixed or contradictory results in the literature.[8] Consequently, studies providing reliable evidence to guide physicians on how to share the risks and benefits of statin therapy with patients effectively for the prevention of major vascular events remain limited. In the present study, we explore whether and how the framing of messages, format of information, and sociodemographic characteristics of participants affect patients' preferences for lowering LDL cholesterol, which can be used to guide physicians on how best to obtain consent for statin therapy. Furthermore, given that therapeutic outcomes vary across different statin therapy strategies, namely, standard statin therapy vs. control, as well as more vs. less intensive statin regimens[2], this variable was also evaluated in our decision analysis.

Methods

Participants

A total of 613Chinese inpatients or their immediate family members in the Department of Neurology were consecutively recruited. The general eligibility criteria for the subjects included (1) age ⩾18 years; (2) no history of severe mental disorders; (3) no disability (modified Rankin Scale score of 0–1); (4) the ability to communicate verbally and complete the questionnaires; (5) no history of thrombolytic therapy; (6) normal cognition, as indicated by a Mini-Mental State Examination (MMSE, Chinese revised version) score of either > 20 (for those with ⩽ 6 years of

education) or > 24 (for those with > 6 years of education); and (7) diagnosis via a brain MRI scan (old, lacunar, or acute cerebral infarction) if categorized into the group of stroke inpatients[24]. A total of 565participants (92.17%) conformed to the general eligibility criteria for subjects, among whom185participants were diagnosed with hyperlipemia (a blood LDL cholesterol concentration ≥ 3.1 mmol/l).The detailed sociodemographic information is shown in Supplemental Table 1.
The experimental procedures and the written consent form were approved by the ethics committee of the Seventh Medical Center of the Chinese People's Liberation Army General Hospital.(Approval Number：[2021-85]) Each participant provided informed consent to participate in the experiment. All methods were performed in accordance with the relevant guidelines and regulations, including the Declaration of Helsinki. Written informed consent was obtained from all participants and their legal guardians.

Materials

Survey materials, such as a numeracy scale[25], sociodemographic surveys, health & attitude questionnaires, and the SCL-90-R, were administered as part of a broader study of medical decision-making, which was previously described[24]. The contents of statin therapy, including negative vs. positive framing messages, different strategies of statin therapy, and different formats of presenting information about statin treatment (specific figures, percentages, and rate ratios per 1 mmol/L reduction in LDL cholesterol (RR)), were extracted from the findings of a survey experiment(see Table 1).[2]

Design and Procedures

This study was a randomized survey experiment. Participants were randomized only to different survey versions and did not receive any clinical treatment or intervention. The participants were randomly sorted into a positively (Pos.) or negatively (Neg.) framed group, followed by evaluation with a series of surveys. The latent class analysis (LCA), which is similar to cluster analytic methods and assumes that the population from which a sample is drawn comprises underlying classes of individuals who can be grouped according to their response patterns,[26, 27] was used to identify different subgroups of participants (latent classes). Specifically, those participants with similar response patterns for statin therapy were categorized into the homogeneous subgroup, implying that they reported similar attitudes toward statin therapy. As different classification models can be produced via LCA (1-subgroup model, 2-subgroup model, 3-subgroup model, etc.), another goal of LCA is to identify the optimal model, which refers to the model containing the smallest number of subgroups necessary to adequately describe the association of the choice of statin therapy with the format of the items and strategies of statin therapy[24]. We subsequently performed univariate and multivariate logistic regression analyses of the sociodemographic data to identify factors (independent variables) predicting the

categorization of participants into different subgroups (dependent variables), establish a decision-making model of statin therapy and reveal the combined influence and mutual relationships of the positive vs. negative framing scenarios, different statin treatment information presentation formats of presenting information about statin treatment, different statin therapy strategies, and sociodemographic factors[24].

Statistical analysis

Chi-square tests for categorical variables were applied to compare the endorsement rates of statin therapy in different items with one another under negative and positive framings, and a new significance level was set, from α (0.05) to α' (0.003125), according to the partitioning of the chi-square method ($\alpha'=\alpha/[k*(k-1)/2+1]$, K=6).LCA was performed using Mplus 7·0[28], followed by univariate and multiple logistic regression analyses (stepwise regression) using IBM SPSS Statistics version 26.0.

Results

Chi-square test of the endorsement rates of statin regimens in different framing groups and items

Achi-square test was performed, and the results showed an effect of framing on the endorsement rates of statin regimens for Item 2 (Neg. vs. Pos.: 71.9% vs. 63.5%; χ^2=4.514, P=0.034) and Item 4 (Neg. vs. Pos.: 52.5% vs.43.0%; χ^2=5.042, P=0.025).

Regardless of the message framing, there were no significant differences in the endorsement rates of statin regimens among Item 1, 2 or 3 for standard statin regimens or among Item 4, 5, or 6 for more versus less intensive regimens, implying that the attractiveness of statin therapy was unaffected by different item formats (specific figure, percentage, and RR) (see Table 2). However, the endorsement rate of statin regimens for each item for standard statin regimens was greater than that for each item for more intensive regimens (see Table 2), indicating that participants had a greater preference for standard statin treatment than for more intensive regimens, regardless of the message framing and presentation format.

Classification of participants into different subgroups by LCA

Both a 4-subgroup model and a5-subgroup model seemed optimal for both the Neg. and Pos. groups according to the LCA and proved optimal according to the model fit for the Lo–Mendell–Rubin likelihood ratio test (LRT)[29] (see Table 3). Therefore, the negative and positive groups were combined to investigate the outcomes across both groups. LCA revealed that if the participants were classified into 2 subgroups, one subgroup preferred statin therapy (C1), and the other subgroup disliked such therapy, especially the more intensive regimens (C2) (see Figure 1A).If they were classified into 3 subgroups, the first subgroup opted for statin therapy (C1), the second subgroup tended to refuse such therapy (C2), and the third subgroup preferred standard statin

regimens but were averse to more intensive regimens (C3) (see Figure 1B). If there were 4 subgroups of participants, the first subgroup was sensitive to different types of information (C1, named the mixed preference subgroup), the second subgroup preferred standard statin regimens but was averse to more intensive regimens (C2, named the statin regimen subgroup), the third subgroup tended to refuse such therapy (C3, named the objection to statin therapy subgroup), and the 4th subgroup tended to opt for statin therapy (C4, named the consent to statin therapy subgroup) (see Figure 1C). In terms of the establishment of a 5-subgroup model, the LRT, which compared the estimated model with a model containing one fewer subgroup than the estimated model[24], demonstrated that a 5-subgroup model was optimal **(**adjusted BIC=3859.295; likelihood ratio chi-square=106.519, df=88, *P*=0.0872)(see Table 3) but difficult to interpret in medical practice (see Figure 1D). Additionally, the conditional probability of endorsement of statin regimens and the probability of classification into 5 subgroups were also calculated (see Supplemental Table 2), and the data concerning the probability of classification demonstrated that C3 consisted of fewer than 32 of the 565 participants (5.66%), which led to extremely unstable subsequent regression analysis and an extremely abnormal coefficient, making the results difficult to explain in the clinical setting (see Supplemental Tables 3 and 4). Thus, the 4-subgroup model, which successfully avoided all the aforementioned problems in the subsequent statistical analysis, was superior to the5-subgroup model both clinically and statistically (see Table 4).

Regression analyses of predictors for the classification of participants into subgroups

First, univariate analyses were performed for all of the expected variables associated with the classification of the participants into subgroups, and variables such as a history of cerebral infarction, nationality, smoking status, a history of stroke among relatives, and avoidance of the adverse effects of antilipemic agents were excluded from the multivariate model (*P*>0.05) (see Supplemental Table 3).However, some potentially important variables, such as education, frame type, and sex, were included in the multivariate analysis model, regardless of their statistical significance. Additionally, the correlation coefficients between the hyperlipidemia, hypertension and antilipemic use were>0.5; hence, hyperlipidemia was the only variable included in the multivariate model.

Multiple logistic regression analysis indicated that, in contrast to the consent to statin therapy subgroup (C4, which served as the reference), several factors were associated with the classification of participants into different subgroups. Compared with participants in the consent to statin therapy subgroup (C4), participants in the object to statin therapy subgroup (C3) differed significantly in several characteristics. Participants who focused less on health and those who had an intermediate focus on health had higher odds of belonging to this subgroup than those with a greater focus on health did (OR=2.628 and 2.760, respectively). In addition, compared with extroverted participants, introverted participants had higher odds of belonging to this subgroup (OR=3.659), and participants without hyperlipidemia had higher odds of

belonging to this subgroup than participants with hyperlipidemia did (OR=4.246). In contrast, participants who argued against (OR=0.216) or expressed an uncertain viewpoint (OR=0.206) regarding the statement on the "importance of the preservation of life" were less likely to belong to this subgroup than those who consented to the statement were. Compared with those in the consent to statin subgroup (C4), participants in the mixed preference subgroup (C1) who argued against the statement on the "importance of the preservation of life" were less likely to belong to this subgroup than those who consented to the statement were (OR=0.353).Compared with the consent to statin subgroup (C4), younger participants (18–39 years) had lower odds of belonging to the statin regimen subgroup (C2) than older participants (>60 years) did (OR=0.440). Moreover, participants with an intermediate check-up frequency (once every 6 months) had lower odds of belonging to this subgroup than participants with a higher check-up frequency (>once every 6 months) did

(OR=0.199). The pseudo-R^2 (Cox and Snell), an index of a model's goodness of fit,

was 0.337, indicating that the factors in the model accounted for 33.7% of the variation in the prediction of the assignment of subgroups, suggesting a moderate model fit (see Table 5). This finding may be explained by the fact that important predictive factors, such as health literacy, economic status, and previous medication experience, which have been confirmed to have an effect on subgroup assignment in the existing literature, were not included. The multivariate model was established as follows:

Y1=-0.929-1.040*Argument against the "Importance of the preservation of life"

Y2=0.322-0.820*Young age−1.615* Intermediate check-up frequency

Y3=-3.327+0.966*Less focus on health+1.015*Intermediate focus on health+1.297*Introverted-1.532*Argument against the "Importance of the preservation of life"-1.578*Uncertain viewpoint about the "Importance of the preservation of life"+1.446*No Hyperlipidemia

Y4=0

The intended probabilities of being classified into different subgroups for each person were calculated according to the following equation (e=2.71828):

Probability of classification into C1=$e^{Y1}/[e^{Y1}+ e^{Y2}+e^{Y3}+ e^{Y4}]$

Probability of classification into C2=$e^{Y2}/[e^{Y1}+ e^{Y2}+e^{Y3}+ e^{Y4}]$

Probability of classification into C3= $e^{Y3}/[e^{Y1}+ e^{Y2}+e^{Y3}+ e^{Y4}]$

Probability of classification into C4= $e^{Y4}/[e^{Y1}+ e^{Y2}+e^{Y3}+ e^{Y4}]$

Discussion

To make informed health and medical decisions, patients rely on clinicians to discuss

with them the pros and cons of any treatment. Statin therapy has been widely demonstrated to be crucial for the management of blood cholesterol and for reducing cardiovascular risk in adults, thereby effectively preventing major vascular diseases; however, conveying the risk and benefits of statin therapy to patients and obtaining their consent for treatment has been seldom reported, leaving many important issues related to doctor–patient counseling uninvestigated. Shared decision-making (SDM) refers to the participation of both patients and medical professionals in the decision-making process and the incorporation of patients' values and preferences into medical decision-making[30]. Nevertheless, studies have suggested that not all patients want to be informed about their illness or make their own medical decisions, suggesting they may be unfit for making medical decisions owing to physical or mental reasons[31, 32]. Moreover, some studies have argued that some patients prefer authoritarian decision-making (ADM) by clinicians instead of SDM[32], as it is difficult for them to understand their health conditions as objectively and accurately as physicians can. The establishment of a decision-making model for statin therapy in our study provides a solution for the conflict between ADM and SDM to some extent. Unlike most previous studies on medical decision-making, this study applied LCA to systematically investigate the potential influencing factors related to statin therapy decision-making. A multivariate decision-making model for consent to statin therapy was constructed using logistic regression analysis, revealing the distribution of the participants in terms of their consent to statin treatment. These findings help to elucidate the comprehensive effects and relationships among message framing, item presentation format, type of statin therapy, and individual characteristics in the context of medical decision making. More importantly, these findings improve the feasibility of putting individualized decision-making (IDM) into practice for the prevention of stroke.

Specifically, when a patient seeks medical assistance, he or she receives a clinical assessment by medical professionals. Candidate patients with hyperlipemia and a high risk of stroke are screened for standard statin therapy or more intensive statin regimens. Some sociodemographic information (the independent variables in the multivariate model) was collected and input into the multivariate decision model to calculate the patient's probability of being classified into different subgroups. On the basis of our decision analysis by LCA, the consent to statin therapy subgroup (C4) and the objection to statin therapy subgroup (C3) had a high probability of being affected by their preferences for statin therapy, namely, C4's preference for statin treatment and C3's aversion to statin therapy. With respect to the statin regimen subgroup (C2), the participants' acceptance of statin therapy decreased significantly as the statin regimen dose increased but were not influenced by the framing or format of the information. Interestingly, the C1 subgroup was obviously susceptible to the presentation format of the information. Once patients were allocated to the different subgroups, the optimal presentation format for the patients in each group was determined according to the conditional probabilities of consent to statin treatment calculated by the LCA (see Table 5 and Figure 1C), and the results were used to maximize the patient's acceptance of statin therapy. In summary, on the basis of the

decision model, patients' characteristics, personal values, and attitudes toward health were considered during statin therapy decision-making, and different patients were presented with different types of information to increase their acceptance of statin therapy, which we call statin therapy IDM. Such decision analysis and IDM can be generalized to other health domains, such as prevention, detection, and treatment, providing valuable reference points for the promotion of healthy behaviors in various medical domains.

There is little consistent evidence that physicians can effectively guide physicians when sharing information for medical decision-making. The decision analysis by LCA in the present study highlights participant heterogeneity in terms of their response patterns, which might account for the contradictory findings reported in the medical decision-making literature. For example, according to the chi-square test, prior to conducting the LCA and classifying the participants into subgroups, the acceptance of statin treatment may be influenced by the framing of the information (in Items 2 and 4) and the type of statin regimen rather than the presentation format of the information, but these effects are no longer applicable when using the decision model established by the LCA and regression analysis. The participants were classified into different subgroups according to their different perceptions of statin therapy and the various factors that influence their acceptance rates. On this basis, the results of previous studies should be reconsidered. For instance, the relationship between information framing and presentation format has been discussed in many studies[8, 33], and the results suggest that problems communicating risks occur because of inappropriate information formats, not cognitive biases [34].Therefore, the relationship between the message framing and presentation format might be more complex than previously suggested and could depend on the patient's subgroup.

Another common argument concerns the effect of framing on different types of health behaviors. According to the framing postulate of prospect theory[35], Kahneman and Tversky suggested that people show risk aversion under gain framing and risk-seeking behavior under loss framing. Such framing can also influence medical treatment, prevention and screening decisions, as well as other health behaviors[36]. Specifically, disease prevention behaviors (risk aversion behaviors), such as increasing exercise[37], reducing alcohol use[38], and protecting skin from cancer[39], might be more effectively influenced by gain framing, whereas disease detection behaviors (risk-seeking behaviors), such as blood cholesterol[40] and HIV screenings[41], might be more strongly affected by loss framing. Notably, the typical framing effect is reversed during treatment decision-making, indicating that risk-seeking treatments, especially invasive therapies (e.g., surgery and thrombolysis[24]),are more preferred with positive framing (the probability of survival) than with negative framing (the probability of death)[42-44]. Our findings concerning statin therapy show that all participants' acceptance of statin therapy in Items 2 and 4 increased with loss framing than with gain framing. Given that statin therapy is aimed at preventing major vascular events, its use can be considered a type of risk-averse behavior, which is inconsistent with the effect of framing on disease prevention (or risk aversion) behaviors mentioned above. In contrast, compared with surgery or thrombolysis, statin therapy is a type of risk-

averse treatment and its acceptance rate is higher with loss framing than with gain framing, which is consistent with the notion that there is a reversal of orientation from Kahneman and Tversky's typical framing effect during treatment decision-making.

A negative framing advantage was observed in the unstratified overall population, but the subgroup analysis revealed a heterogenous framing effect, and the framing type was not an independent predictor in the multivariate model, suggesting that the framing effect is more complicated than it appears; therefore, our findings should be replicated in other therapies in future research.

Study limitations

These findings are exploratory and require validation in larger, multi-center cohorts before clinical implementation. There are several limitations in the present study: ① The sample size of participants diagnosed with hyperlipidemia should be increased, and more appropriate patients with cardiovascular risk or diseases should be recruited from multiple centers and multiple countries to increase the external validity of the findings and draw more reliable conclusions. ②Given that LCA requires a relatively large number of items and responses from each participant to classify them into subgroups, the cognitive load of the participants in this study was much greater than that in previous studies, especially those with older participants. ③ Although we aimed to collect as much personal data as possible, some important information, such as the participants' blood LDL cholesterol levels, health literacy levels[45], economic status, and health insurance status, that might play important roles in statin therapy decision-making were missing.④ The experimental design should be improved in future studies; for example, 6 items should be presented to participants in the same order, which might potentially affect decision-making[45]. ⑤Although the pseudo-R^2value of our model reached 0.337, indicating that the comprehensive effects of the influencing factors involved in the model accounted for 33.7% of the variation in the classification of the participants, many potential influencing factors should be investigated further, such as participants' understanding and recall of risk and benefits[33], satisfaction with their decisions[46], personality traits, decision-making styles (individual vs. group)[47], and thinking patterns (intuitive vs. analytical)[48], as well as the order the information was presented and the use of various graphical formats (bar graph vs. pictograph vs. modified pictograph vs. pie charts vs. modified pie graph vs. table)[49]. In addition, although clinicians and patients reportedly share similar decision biases[50], physicians' preferences for statin treatment should be investigated.

Conclusion

Participants' consent to statin therapy is influenced by the comprehensive effects and mutual relationships of many internal and external influencing factors. According to their preferences for statin therapy, participants can be divided into 4 subgroups: the mixed preference subgroup (C1), the statin regimen subgroup (C2), the objection to

statin therapy subgroup (C3), and the consent to statin therapy subgroup (C4). In unstratified analyses, loss-framed messages were associated with higher statin therapy endorsement rates; however, after accounting for individual heterogeneity via LCA, framing was not an independent predictor in the multivariate model, suggesting that its effect is subgroup dependent and should not be generalized. These findings are exploratory and require validation in larger, multi-center cohorts before clinical implementation. Our LCA and regression analysis approach to decision analysis and the establishment of a decision model may provide a useful reference point. for the promotion of health behaviors in other health or medical domains.

Statements and Disclosures

The datasets generated during and analysed during the current study are available from the corresponding author on reasonable request.
(See the Statements and Declarations page)

Figure Legends

Figure 1 Classification of subgroups (latent classes) in the 2-subgroup model (A), 3-subgroup model (B), 4-subgroup model (C), and 5-subgroup model (D) produced by latent class analysis (LCA) according to the response pattern of participants to statin therapy.

Table 1Modes of presenting information about the therapeutic outcomes of statin therapy

Type of statin regimen	Item No.	Hospital No.	Presentation modes of pros & cons
Standard statin regimens or not			
	1	5001	Specific figures
	2	5002	Percentages
	3	5003	RR
More versus less intensive regimens			
	4	5004	Specific figures
	5	5005	Percentages
	6	5006	RR

Abbreviations: RR= Rate ratio per 1 mmol/L reduction in LDL cholesterol.

Table 2 χ^2 test of the endorsement rates of statin therapy between different items in the negative framing group (upper and right) and positive framing group (down and left)

Type of statin regimen		Standard statin regimen			More versus less intensive regimens		
	Item No.	1	2	3	4	5	6
	1	-----	0.792	0.389	32.484	29.662	31.393
			(*p*=0.373)	(*p*=0.533)	(*p*<0.001)	(*p*<0.001)	(*p*<0.001)
Standard statin regimen or not	2	2.148	-----	0.071	23.436	*21.024*	*22.513*
		(*p*=0.143)		(*p*=0.790)	(*p*<0.001)	(*p*<0.001)	(*p*<0.001)
	3	1.254	6.642	-----	25.944	23.414	24.973
		(*p*=0.263)	(*p*=0.010)		(*p*<0.001)	(*p*<0.001)	(*p*<0.001)
	4	29.277	15.806	41.985	-----	0.69	0.008
		(*p*<0.001)	(*p*<0.001)	*(p <0.001)*		(*p*=0.793)	(*p*=0.928)
More versus less intensive regimens	5	41.563	25.253	56.266	1.137	-----	0.029
		(p <0.001)	(*p*<0.001)	*(p <0.001)*	(*p*=0.286)		(*p*=0.864)
	6	23.826	11.855	35.462	0.279	2.533	-----
		(p <0.001)	*(p <0.001)*	*(p <0.001)*	(*p*=0.597)	(*p*=0.112)	

α'=0.003125

Table 3 Lo–Mendell–Rubin likelihood ratio test of model fit in the negative framing group, positive framing group, and both groups

Framing type	No. of subgroups	No. of parameters[a]	Loglikelihood	AIC	BIC	Adjusted BIC	Likelihood ratio chi-square	Df	P	Entropy	LRT	Deltr df	P
Negative[b]													
	1	6	-1001.359	2014.718	2036.173	2017.150	440.187	57	0.0000	---	---	---	---
	2	13	-744.141	1514.282	1560.770	1519.553	207.056	50	0.0000	0.879	501.584	7	0.0001
	3	20	-691.939	1423.877	1495.396	1431.986	99.681	42	0.0000	0.879	101.797	7	0.0000
	4	27	-666.970	1387.941	1484.491	1398.888	50.085	35	0.0473	0.857	48.689	7	0.0001
	5	34	-656.111	1380.223	1501.805	1394.008	28.582	28	0.4340	0.906	21.176	7	0.0087
	6	41	-652.291	1386.582	1533.196	1403.205	23.355	22	0.3819	0.915	7.473	7	0.5451
Positive[c]													
	1	6	-1175.729	2363.457	2385.700	2366.672	458.172	57	0.0000	---	---	---	---
	2	13	-892.759	1811.518	1859.711	1818.482	213.350	49	0.0000	0.917	552.119	7	0.0000
	3	20	-833.768	1707.535	1781.677	1718.249	97.233	42	0.000	0.909	115.102	7	0.0000
	4	27	-816.797	1687.594	1787.686	1702.058	63.519	35	0.0022	0.840	33.112	7	0.0017
	5	34	-803.183	1674.366	1800.408	1692.579	37.169	28	0.1152	0.886	26.564	7	0.1487
	6	41	-798.030	1678.060	1830.051	1700.022	26.360	21	0.1931	0.888	10.055	7	0.4021
Both[d]													
	1	7	-2574.222	5162.445	5192.803	5170.581	---	---	---	---	---	---	---
	2	15	-2033.348	4096.695	4161.747	4114.130	432.746	111	0.0000	0.948	---	---	---
	3	23	-1928.516	3903.032	4002.779	3929.765	222.968	102	0.0000	0.940	---	---	---
	4	31	-1888.132	3838.263	3972.705	3874.295	142.802	94	0.0009	0.896	---	---	---
	5	39	-1867.982	3813.965	3983.101	3859.295	106.519	88	0.0872	0.928	---	---	---

6	47	-1857.494	3808.988	4012.819	3863.616	84.076	79	0.3270	0.949	---	---	---

Abbreviations: AIC=Akaike information criterion; BIC=Bayesian information criterion; LRT=Lo–Mendell–Rubin likelihood ratio test.

a Regarding parsimony and goodness of fit, the model with fewer parameters, relatively lower BIC values and AIC values and significant *p* values for LRT (< 0.05)would be preferable to the other models.

b After the LCA in the negative framing group, a 5-subgroup model was preferred according to the fit measures.

c After the LCA in the positive framing group, a 5-subgroup model was preferred according to the fit measures.

d After the LCA in the negative and positive framing groups, the participants in both the negative and positive groups were combined, and all their responses to items were again analyzed by the LCA as a whole; the5-subgroup model was optimal according to the fit measures.

Table 4 Conditional probability of endorsement of statin therapy in the negative framing group, positive framing group, and both groups (4-subgroup model)

Item No.		Negative framing group				Positive framing group				Both groups			
Type of statin regimen		**C1**	**C2**	**C3**	**C4**	**C1**	**C2**	**C3**	**C4**	**C1**	**C2**	**C3**	**C4**
Standard statin regimen or not													
	1	0.717	0.995	0.201	0.990	0.520	1.000	0.135	0.954	0.611	1.000	0.169	0.972
	2	0.536	1.000	0.193	1.000	0.369	0.994	0.072	0.933	0.427	1.000	0.131	0.973
	3	0.687	0.999	0.118	0.994	0.666	1.000	0.153	0.971	0.683	1.000	0.147	0.977
More versus less intensive regimens													
	4	0.536	0.041	0.000	0.982	0.327	0.123	0.000	0.976	0.425	0.086	0.000	0.976
	5	0.610	0.055	0.000	0.968	0.229	0.005	0.000	0.973	0.392	0.033	0.000	0.971
	6	0.512	0.097	0.000	0.983	0.463	0.107	0.000	0.960	0.502	0.099	0.000	0.966
Subgroup probability (%)		20.50	16.10	23.10	40.20	22.40	17.50	21.20	38.90	21.45	16.80	22.15	39.55

Abbreviations:C1=mixed preference subgroup; C2=statin regimen subgroup; C3=objection to statin therapy subgroup; C4=consent to statin therapy subgroup.

Table 5 Multivariate analysis of sociodemographic predictors for the classification of participants into subgroups

Variable	Category	C1:C4[a]				C2:C4[a]				C3:C4[a]			
		B	SE	*OR(95% CI)*[b]	*P*	B	SE	*OR(95% CI)*[b]	*P*	B	SE	*OR(95% CI)*[b]	*P*
Constant		-0.929	0.707	-	0.189	0.322	0.571	-	0.572	-3.327	1.009	-	0.001
Framing type	Negative framing group	-0.440	0.287	0.644(0.367-1.129)	0.124	-0.150	0.260	0.861(0.517-1.433)	0.565	-0.252	0.281	0.777(0.448-1.349)	0.370
	Positive framing group	0[b]		-		0[b]		-		0[b]		-	
Age	18–39 y	0.002	0.397	1.002(0.461-2.181)	0.995	-0.820	0.392	0.440(0.204-0.949)	0.036	0.038	0.394	1.039(0.480-2.249)	0.922
	40–59 y	0.269	0.329	1.308(0.686-2.495)	0.415	-0.196	0.287	0.822(0.469-1.442)	0.494	0.597	0.330	1.817(0.952-3.468)	0.070
	>60 y	0[b]		-		0[b]		-		0[b]		-	
Self-rated health	Poor (very poor+poor)	0.038	0.456	1.039(0.425-2.539)	0.933	-0.098	0.415	0.906(0.402-2.045)	0.813	-0.631	0.590	0.532(0.167-1.692)	0.285
	Intermediate	-0.346	0.384	0.707(0.333-1.501)	0.367	0.008	0.347	1.008(0.511-1.989)	0.982	0.482	0.436	1.620(0.690-3.806)	0.268
	Good (good+best)	0[b]		-		0[b]		-		0[b]		-	
Focus on health	Less (not at all + less)	0.389	0.414	1.476(0.656-3.322)	0.347	0.013	0.338	1.013(0.523-1.965)	0.968	0.966	0.486	2.628(1.014-6.814)	0.047
	Intermediate	0.550	0.367	1.733(0.845-3.555)	0.134	-0.517	0.317	0.596(0.320-1.111)	0.104	1.015	0.453	2.760(1.135-6.708)	0.025
	More (more + extremely)	0[b]		-		0[b]		-		0[b]		-	
Personality	Introverted	0.366	0.294	1.443(0.811-2.566)	0.212	-0.319	0.271	0.727(0.427-1.237)	0.240	1.297	0.312	3.659(1.987-6.738)	0.000
	Extroverted	0[b]		-		0[b]		-		0[b]		-	

Table 5 Multivariate analysis of sociodemographic predictors for the classification of participants into subgroups

Variable	Category	C1:C4[a]				C2:C4[a]				C3:C4[a]			
Importance of the preservation of life	Strongly disagree + disagree	-1.040	0.349	0.353(0.178-0.700)	0.003	-0.131	0.293	0.877(0.495-1.557)	0.655	-1.532	0.369	0.216(0.105-0.445)	0.000
	Uncertain	-0.241	0.356	0.786(0.391-1.579)	0.498	0.020	0.348	1.020(0.516-2.016)	0.955	-1.578	0.434	0.206(0.088-0.483)	0.000
	Strongly agree + agree	0[b]		-		0[b]		-		0[b]		-	
Hyperlipemia status	No	0.142	0.310	1.153(0.628-2.117)	0.646	-0.298	0.277	0.743(0.431-1.278)	0.282	1.446	0.371	4.246(2.050-8.793)	0.000
	Yes	0[b]		-		0[b]		-		0[b]		-	
Check-up frequency	<once every 6months	-0.010	0.574	0.990(0.321-3.048)	0.986	-0.152	0.446	0.859(0.358-2.057)	0.732	0.180	0.833	1.197(0.234-6.122)	0.829
	once every 6 months	-1.085	0.762	0.338(0.076-1.506)	0.155	-1.615	0.636	0.199(0.057-0.691)	0.011	0.318	0.916	1.374(0.228-8.269)	0.729
	> once every 6 months	0[b]		-		0[b]		-		0[b]		-	
Pseudo-R^{2} [c]		0.337											
Model ***p***		0.000											

Abbreviations:C1 =mixed preference subgroup; C2 = statin regimen subgroup; C3 = objection to statin therapy subgroup; C4 = consent to statin therapy subgroup; B = unstandardized coefficients B; SE = standard error (B); OR = odds ratios; CI = confidence interval.

a The consent to statin therapy subgroup (C4) served as the reference subgroup.

b Multiple logistic regression models were generated using backward stepwise selection.

c Pseudo-R^2 is an index of goodness of fit of a model, and the pseudo-R^2 value (0.337) indicated that the factors in the model accounted for 33.7% of the variation in the prediction of subgroup assignment, suggesting acceptable goodness of fit of the model.

d Model *p* value indicates the significance of the model (p value <0.001).

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Figures

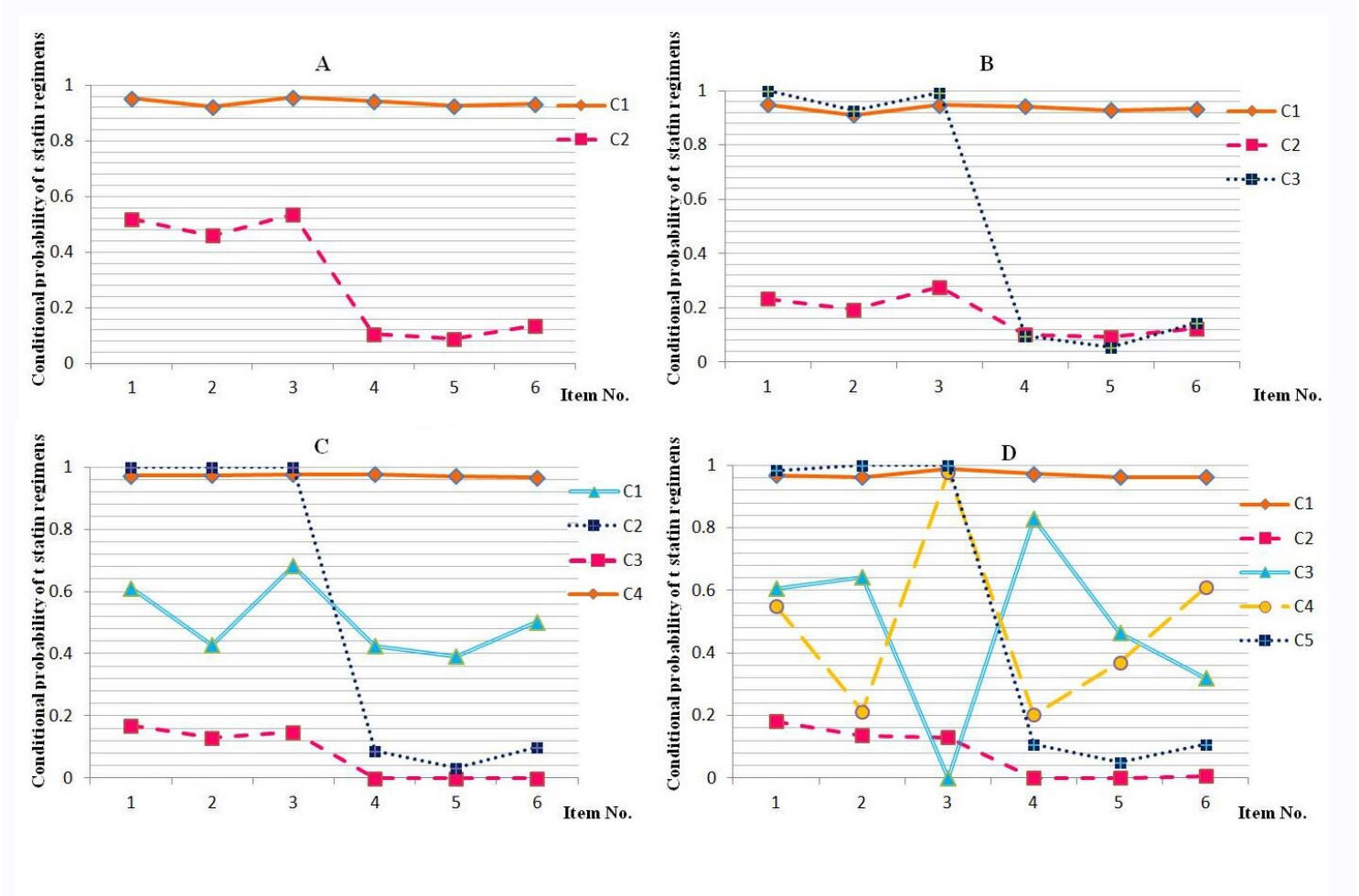

Figure 1

Classification of subgroups (latent classes) in the 2-subgroup model (A), 3-subgroup model (B), 4-subgroup model (C), and 5-subgroup model (D) produced by latent class analysis (LCA) according to the response pattern of participants to statin therapy.

Supplementary Files

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