Latent profiles of telehealth care satisfaction during the COVID-19 pandemic among patients with cardiac conditions in an outpatient setting

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BACKGROUND During the COVID-19 pandemic, telemedicine was advocated and rapidly scaled up worldwide. However, little is known about for whom this type of care is acceptable.

OBJECTIVE To examine which patient characteristics (demographic, medical, psychosocial) are associated with telehealth care satisfaction, attitude toward telehealth, and preference regarding telehealth over time in a cardiac patient population.

METHODS In total, 317 patients were recruited at the Elisabeth-TweeSteden Hospital in The Netherlands. All patients who had received telehealth care (telephone and video) in the previous 2 months were approached for participation. Baseline, 3-month, and 6-month questionnaires were administered online. A 3-step latent class analysis was conducted to identify trajectories of telehealth use over time and the possible association of the found trajectories with external variables.

RESULTS Five trajectories (classes) were identified for satisfaction with telehealth and 4 for attitude toward telehealth. Patients with higher distress, lower physical and mental health, higher scores on pessimism, and negative affectivity were more likely to be less satisfied. Patients with no partner, more comorbidities, higher distress, lower physical and mental health, and higher scores on pessimism were more likely to hold a negative attitude toward telehealth. For the future application of telehealth, marital status, comorbidities, digital health literacy, and pessimism were significantly related.

CONCLUSION Results show that patients' profiles should be considered when offering telehealth care and that the "one size fits all" approach does not apply. Results can inform clinical practice on how to better implement remote health care in the future while considering a personalized approach.

KEYWORDS Telehealth; COVID-19; Cardiac patients; Personalized healthcare; Latent class analysis

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Introduction

During the COVID-19 pandemic, which reached Europe in spring 2020, many countries restricted routine hospital visits to serve the increasing number of COVID-19-infected patients and minimize virus transmissions.[1,2] To ensure the continuity of care, telehealth was advocated and rapidly upscaled worldwide.[3] Telehealth, such as remote monitoring, e-mails, text messages, and telephone or video consultations, enabled healthcare providers to provide safe and continuous care while at the same time reducing in-person clinic visits.[4,5] During this period, numerous other benefits of telehealth use as part of standard care became evident and warranted for further upscaling. For example, healthcare providers were able to reach more (underserved) patients by reducing the travel burden to the hospital.[6,7] According to cardiac patients, telehealth was experienced as less time-consuming and more convenient, especially for regular check-ups.[8]

Although telehealth use during the pandemic was perceived as beneficial,[8,9] studies have shown that patients of higher age, male sex, and lower socioeconomic status might be more reluctant to adopt remote care.[10–12] In addition, patients' medical profile (eg, type of disease and disease severity) may also affect their telehealth preferences.[13] These findings indicate that a personalized approach toward the implementation of remote care might be warranted. However, more research is needed to establish an evidence base.

Besides demographic and medical profiles, patients' psychological profile could be of great importance when it

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KEY FINDINGS

- Patients' individual characteristics should be taken into consideration when offering telehealth care.
- The current study indicates that patients who experience higher levels of distress, negative affectivity, lower physical and mental health, and pessimism are more likely to be less satisfied with telehealth care.
- Similarly, patients with no partner, more comorbidities (lower 10-year survival rate), higher levels of distress, lower physical and mental health, and higher scores on pessimism are more likely to hold a negative attitude towards telehealth care.
- On the other hand, being married, optimistic, and having higher digital literacy is associated with a preference to implement telehealth in standard clinical practice.
- Therefore, it is important for healthcare providers to consider patients' individual needs and characteristics when offering telehealth care.

comes to uptake of and satisfaction with remote care. Patient characteristics such as personality and psychological state (eg, distress) could be related to motivation to use telehealth modalities in routine care. For example, patients who are more psychologically flexible or overall more optimistic are more likely to engage in new behaviors (such as using telehealth) and might thus be more likely to have a positive attitude toward telehealth as compared to less flexible or more pessimistic patients.[14] Furthermore, it is known that distress (eg, depression and anxiety) is related to more dissatisfaction with overall care.[15,16] Therefore, distress may also be negatively associated with telehealth satisfaction and preferences.

To date, research examining telehealth satisfaction, attitudes, and preferences in relation to psychological profiles is lacking. Moreover, previous studies on telehealth satisfaction employed a cross-sectional design, providing only a snapshot of the construct such that the course over time remains unclear. To elucidate the longitudinal course of satisfaction, acceptance, and preferences, this study used 3 repeated measures to identify different trajectories over time during the COVID-19 pandemic. Therefore, the current study will investigate which demographic, medical, and psychological patient profiles are related to trajectories of telehealth care satisfaction, acceptance, and preference (phone- and video-based telehealth). This is paramount to advancing telehealth adoption and patient satisfaction in postpandemic health care. The first hypothesis was that different trajectories of telehealth care satisfaction and acceptance during the COVID-19 pandemic could be identified. The second hypothesis was that demographic factors (eg, age, sex) and psychological profiles (eg, psychological flexibility, distress, personality) were associated with telehealth satisfaction and acceptance trajectories.

Methods

Participants

In total, 550 cardiac outpatients (coronary heart disease, heart failure, and arrhythmias) were approached for participation at the Elisabeth-TweeSteden Hospital between June 2020 and September 2021. Inclusion criteria were age between 18 and 75 years and having had at least 1 phone or video consultation with the cardiologist (due to COVID-19 regulations) in the past 2 months. Participants were excluded when having a life-threatening condition (life expectancy <1 year), psychiatric illness history (other than depression or anxiety), or insufficient knowledge of the Dutch language. A total of 381 participants started the first questionnaire, of which 40 did not sign the informed consent and 36 were excluded because they did not complete at least 99% of the questionnaire (response rate 60%). The second questionnaire was fully completed by 235 participants (response rate 43%) and the last questionnaire by 227 participants (response rate 41%).

Design and procedures

The AFSTAND study was set up to investigate patients' satisfaction, needs, and preferences regarding telehealth use at the cardiology clinic during the COVID-19 pandemic in the Netherlands. All included participants had had at least 1 telephone or video consultation with their cardiologist in the past 2 months. For the teleconsultation, patients received a date and time slot (eg, morning), during which the cardiologist would call. In the current study, only 6 participants reported an online video consultation. Video consultations were planned on a specific date and time via Microsoft Teams.

Patients who met the inclusion criteria were approached by the research assistant. If patients gave verbal consent, a link was sent by e-mail leading to the online information letter, informed consent, and questionnaires (Qualtrics; https://www.qualtrics.com). Three and 6 months after the baseline questionnaire, the link for the follow-up questionnaires was sent by e-mail. If the questionnaire was not completed within 1 week, the patients received up to 2 reminder phone calls (at all measurement points).

The study was approved by the Ethical Board of Elisabeth-TweeSteden Hospital (L1038.2020) and Tilburg University (RP291). All participants provided online informed consent.

Measures

Sociodemographic variables such as age, sex, marital status, and education level were assessed at baseline by self-report.

Three questions measuring perception of telehealth usage were designed for the current study and were assessed at baseline and at 3- and 6-month follow-up: (1) *Satisfaction* was assessed with the following question: "How satisfied are you with the type of telehealth you have received? Please rate from 0 (very dissatisfied) to 10 (very satisfied)." (2) *Attitude* was assessed with the following question: "What is your

attitude towards telehealth? Please rate from 0 (very negative) to 10 (very positive)." (3) *Application* was assessed with the following question: "Do you think that telehealth should be applied more often in healthcare? Choose between 'no' or 'yes.'"

Distress, a state of emotional discomfort, was measured by summing the scores of the 7-item Generalized Anxiety Disorder (GAD-7) questionnaire[17] and the 9-item Patient Health Questionnaire Depression (PHQ-9).[18] Summed scores ranged between 0 and 48, with higher scores indicating higher levels of distress.[19] The combined distress score as proposed by Kroenke and colleagues[19] was used because we were interested in the effect of distress as a whole and not in the individual constructs of depression and anxiety. The distress score showed a Cronbach's alpha of 0.92 in the current study.

Health-related quality of life, one's overall well-being and functioning, was measured with the Short-Form Health Survey (SF-12).[20] The 12 items are derived from the SF-36 questionnaire[21] and assess mental and physical health. The total score on both subscales ranges between 0 and 100, with higher scores indicating better mental or physical health. Previous validating studies have shown that the SF-12 is a reliable questionnaire.[20,21]

Optimism and pessimism were assessed using the Revised Life Orientation Test (LOT-R).[22] The optimism scale and the pessimism scale are calculated by summing their corresponding item scores and both range from 0 to 12, with higher scores indicating higher optimism and pessimism. In the current study, Cronbach's alpha averaged across 3 measurements is 0.77 for pessimism and 0.65 for optimism.

Type D personality was measured with the DS14 questionnaire,[23] which measures a negative affectivity (NA) subscale (feelings of negative emotions and thoughts) and a social inhibition (SI) subscale (difficulties in expressing feelings). The DS14 is a valid instrument to measure NA and SI in the general population.[24] In the current study, the estimated reliability in terms of Cronbach's alpha is 0.88 for NA and 0.89 for SI. To assess the effect of type D personality, the continuous method suggested by Lodder[25] was applied, modeling the NA and SI main effects (mean-centered subscales SI and NA), as well as their interaction, while investigating a possible confounding influence of the NA and SI quadratic effects. As such, it is possible to evaluate whether there is a true type D effect or only main effects of either NA or SI.

Psychological flexibility refers to the ability to be open to changes and to adjust behavior according to these changes. This construct was measured with the 20-item Psychological Flexibility Questionnaire (PFQ).[26] Total scores were calculated and ranged between 20 and 120, with higher scores indicating better psychological flexibility. In the current study, Cronbach's alpha is 0.93.

The Charlson comorbidity index measures the estimated 10-year survival by combining the risk of age and the risk of comorbid conditions.[27] The Charlson comorbidity index consists of 17 different comorbidities, such as myocardial infarction, dementia, diabetes, and liver disease. All comorbidities have different weights based on the mortality risk and disease severity. The summed weighted scores were calculated, followed by the 10-year survival rate. Higher weighted scores indicate more comorbid conditions and will lead to a lower 10-year survival rate.

Telehealth literacy refers to skills such as searching, selecting, appraising, and applying online health information. This was measured with the 21-item Digital Health Literacy Instrument, which includes 7 subscales (eg, information searching skills, navigation skills, evaluating online information).[28] A mean score was calculated and used as a continuous control variable. Cronbach's alpha in the current study is 0.93.

Statistical analysis

Repeated measures latent class analyses (RMLCA) were performed in Latent Gold 6.0[29] to identify latent classes representing time-dependent telehealth use patterns during the COVID-19 pandemic. Hence, each class represents a distinct trajectory of a measured outcome variable (satisfaction, attitude, or application) over 3 time points. A 3-step approach was used to relate class membership to the sociodemographic, medical, and psychological predictors.[30] In the first step, separate RMLCA models were built for each outcome variable *satisfaction, attitude,* and *application. Application* was modeled as a nominal variable, while *satisfaction* and *attitude* were modeled as continuous variables. Models were estimated in the range of 1–10 latent trajectory classes. Missing values were addressed with the full information maximum likelihood approach.[31] To determine the best-fitting model the Bayesian Information Criteria (BIC) were interpreted, with a lower BIC value indicating better model fit.[32] In addition, we required class sizes to be at least 5% of the sample.[33] Nonlinear trajectories were allowed by modeling time as a nominal variable. In the second step, participants were assigned to latent classes based on their class membership probabilities (proportional class assignment). In the third step, the identified class memberships were regressed on the sociodemographic, medical, and psychological predictors using a multinomial logistic regression. The classes with highest satisfaction and highest positive attitude were set as reference group. The association between class membership and the medical and psychological predictors was additionally investigated before controlling for the demographic variables.

Sociodemographic predictors included age, sex, marital status, being employed, psychological medication use, and digital health literacy. For the medical predictor, we included the estimated 10-year survival rate. Psychological predictors included distress (eg, anxiety and depression), physical and mental well-being, optimism and pessimism, psychological flexibility, and type D personality.

RMLCA with a nominal model for the outcome variable *application* resulted in a 2-class solution (1 group that was consistent across time in favor of telehealth vs 1 that was

not). Hence, this 2-class solution did not add additional relevant information to the observed outcome variable, which was already dichotomous. In addition, in each class, a percentage of assigned participants was in favor of telehealth while the others were not. This could complicate the comprehension and interpretation of the multinomial logistic regression in the third step. To overcome this issue, we directly analyzed the observed dichotomous scores with a repeated measures logistic regression to investigate which variables can predict the attitude toward telehealth in general (measured over 3 time points). Three assumptions of repeated measures logistic regression (linearity, no outliers, and no multicollinearity) were evaluated and were met. The predictor variables were entered as fixed effects and a random intercept model was used. Interaction effects between time and predictor effects were not modeled, so each predictor's effect can be interpreted as the overall effect of a predictor on telehealth application across all time points.

In total, 9 models were fitted: 1 with all the covariates, 7 for each psychological predictor while controlling for covariates, and 1 overall model with all the covariate and predictor variables. These analyses were carried out using the generalized linear mixed model procedure for binary logistic regression of SPSS, version 24. In all analyses, statistics were considered statistically significant at a P value smaller than .05.

Results

Sample characteristics and descriptions

Table 1 presents the means (standard deviations [SD]) and frequencies (%) of the demographic, medical, psychological, and outcome variables. The mean age of the sample was 64.07 (SD = 9.98) years and 31% were women. In total, 74% were with partners, 27% were employed, and 12% reported using psychological medications. The mean estimated 10-year survival rate was 0.62 (SD = 0.32), which indicates

Table 1 Means and standard deviations of demographics, medical and psychological predictors, and outcomes at baseline, 3 months, and 6 months

	Baseline N = 305*		3 Months N = 235*		6 Months N = 227*		Overall N = 317†	
	Mean or N	SD or %	Mean or N	SD or %	Mean or N	SD or %	Mean or N	SD or %
Demographics and medical								
Age, years	64.07	9.98						
Female	112	32%						
Male	193	55%						
Partner (yes)	263	74%						
Employed (yes)	94	27%						
Psychological medication (yes)	42	12%						
Estimated 10-year survival	0.62	0.32						
Myocardial infarction‡	77	22%						
Heart failure‡	132	37%						
Digital health literacy	2.97	0.60	1.96	0.53	3.07	0.51	2.69	0.42
Type of telehealth visit								
Telephone-based							317	100%
Video-based							6	2%
Outcomes								
Satisfaction	7.07	2.35	6.52	2.80	6.23	2.86	6.60	2.21
Attitude	6.39	2.32	6.26	2.18	6.11	2.30	6.16	2.17
Application (yes)	126	36%	106	30%	99	28%		
Psychological predictors								
Distress§	6.91	7.53	14.76	8.32	14.03	7.06	11.54	7.48
Physical health§	42.28	11.62	42.64	12.12	42.82	11.77	42.23	11.41
Mental health§	45.77	10.60	44.81	12.12	45.38	11.65	44.98	10.77
Pessimism§	4.28	2.32	4.08	2.48	4.18	2.40	4.24	2.20
Optimism§	7.46	2.21	7.19	2.15	7.21	2.12	7.30	1.93
Psychological flexibility§	84.88	16.31						
Type D§								
Negative affectivity	7.47	5.87						
Social inhibition	7.43	5.91						

Most demographic and medical variables were only administered during the baseline questionnaire.

*Reported N represents total completed questionnaires for baseline, 3 months, and 6 months.

†In total, 317 patients completed at least 1 questionnaire.

‡Only 2 cardiac diseases were measured by the Charlson Comorbidity Index. However, included patients were selected on having at least 1 of the following 3 cardiac diseases: coronary heart disease, heart failure, and arrhythmias.

§Higher scores on the questionnaires indicated higher distress, better physical and mental health, higher pessimism, higher optimism, higher psychological flexibility, higher negative affectivity, and higher social inhibition, respectively.

Table 2 Fit statistics for the identification of the number of classes

Models	Log-likelihood	Npar	BIC
Satisfaction with telehealth			
1-class	-1838, 3812	4	3699, 7979
2-class	-1670, 3299	9	3392, 4899
3-class	-1638, 0429	14	3356, 7104
4-class	-1624, 8198	19	3359, 0588
5-class*	-1609, 1757	24	3356, 5650
6-class	-1595, 2190	29	3357, 4462
Attitude			
1-class	-1718, 6470	4	3460, 3296
2-class	-1565, 9474	9	3183, 7249
3-class	-1510, 7524	14	3102, 1294
4-class*	-1491, 1873	19	3091, 7937
5-class	-1482, 7969	24	3103, 8075
Application			
1-class	-515, 5539	3	1048, 3845
2-class*	-435, 3783	7	911, 0690
3-class	-435, 3756	11	934, 0991

Data marked with an asterisk (*) indicates best model fit based on the lowest BIC criterium.

BIC = Bayesian information criterion; LL = log-likelihood; Npar = number of estimated parameters.

that, overall, participants have a chance of 62% to be still alive after 10 years. All participants used telephone-based telehealth and 6 participants (2%) reported the use of video-based telehealth.

On a scale from 0–10, the mean satisfaction with provided telehealth was 6.60 (SD = 2.21) and the mean attitude was 6.16 (SD = 2.17). Overall, 102 (32%) participants agreed that telehealth should be more often implemented.

Latent class selection and classification for satisfaction and attitude

Fit measures for the estimated latent class models are shown in Table 2. Based on the lowest BIC criterion, the 5-class and 4-class model solutions best fitted the data for the satisfaction and attitude outcomes, respectively.

Figures 1 and 2 show the latent class trajectories over time for satisfaction and attitude. For satisfaction, the 5 classes represent the following latent groups: (1) extremely high satisfaction (mean = 9.43; 10%), (2) moderately high satisfaction (mean = 8.10; 29%), (3) high satisfaction (mean = 6.78; 25%), (4) instable low satisfaction (mean = 4.23; 29%), and (5) decreasing satisfaction (mean = 5.56; 7%). For attitude, the following classes were identified: (1) highly positive attitude (mean = 8.84; 16%), (2) moderately to highly positive attitude (mean = 7.45; 22%), (3) moderately positive attitude (mean = 6.17; 40%), (4) negative attitude (mean = 3.15; 22%).

Multinomial logistic regression

In step 3, demographic, medical, and psychological variables were related to class memberships with multinomial logistic regressions. The mean and distribution of the covariates and predictor variables across class membership are shown in Tables 3 and 4. For each predictor showing significant overall differences between the classes based on the Wald test, the superscriptions (eg, ^{a,b}) indicate which class significantly differs from another class based on post hoc paired comparisons testing.

Correlates of telehealth satisfaction

Overall, when not controlling for other covariates, relations between the predictors and class membership were significant for all predictors except for estimated 10-year survival, health literacy, SI, and type D personality. After controlling for demographic covariates, the effect of psychological distress (Wald = 13.63; P = .009), mental (Wald = 10.26; P = .036) and physical health (Wald = 14.47; P = .006), optimism (Wald =10.37; P = .035), and NA (Wald = 11.50; P = .021) remained significant (Table 3).

Participants experiencing *higher distress* were more likely to be in the instable low satisfaction class (class 4) than in the extremely and moderately high satisfaction classes (classes 1 and 2). Patients with *higher physical health* were more likely to be in the high satisfaction class and the decreasing satisfaction group (class 2 and class 5) than in the instable low satisfaction group (class 3). Furthermore, patients who were extremely highly satisfied (class 1) showed *higher mental health* than patients in the moderately high (class 2), high (class 3), and instable low (class 4) satisfaction groups. Patients scoring *higher on optimism* were more likely to be

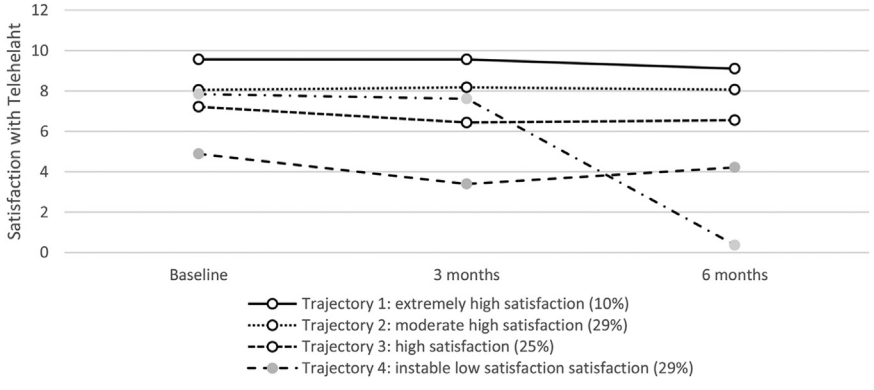

Figure 1 Latent class trajectories for satisfaction with telehealth.

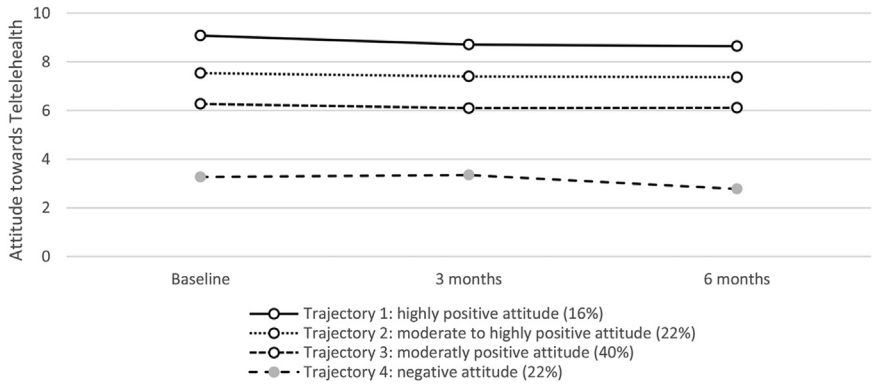

Figure 2 Latent class trajectories for attitude regarding telehealth.

Table 3 Mean and distribution of the covariates for each class (satisfaction)

	Class 1	Class 2	Class 3	Class 4	Class 5		
	Extremely high satisfaction	Moderately high satisfaction	High satisfaction	Instable low satisfaction	Decreasing satisfaction		
Class size	10%	29%	25%	29%	7%	Wald	*P* value
Demographic covariates							
Age, years	60.69	67.48	61.73	63.38	64.80	5.85	.21
Sex						6.95	.14
Male	66%	69%	51%	53%	88%		
Female	33%	28%	44%	43%	7%		
Marital status						2.98	.56
No partner	1%	16%	9%	19%	5%		
With partner	98%	81%	85%	76%	90%		
Employed‡						3.17	.53
No	71%	75%	56%	65%	69%		
Yes	29%	22%	38%	31%	26%		
Psychological medication						3.67	.45
No	75%	90%	69%	89%	85%		
Yes	25%	7%	25%	7%	10%		
Estimated 10-year survival	0.68	0.56	0.64	0.62	0.69	3.51	.48
Digital health literacy	3.11	2.94	2.97	2.91	3.21	4.67	.32
Predictors controlled for demographics							
Distress‡	8.26^{a}	9.43^{b}	12.10	13.10^{ab}	10.21	13.63*	.009*
Physical health‡	46.05	44.30^{a}	40.92	39.34^{ab}	49.37^{b}	10.26*	.036*
Mental health‡	52.19^{abc}	47.31^{a}	42.64^{b}	42.15^{c}	48.31	14.47*	.006*
Pessimism‡	2.84	4.06	4.22	4.77	4.20	7.18	.13
Optimism‡	8.33^{ab}	7.62^{c}	7.15	6.84^{ac}	7.19^{b}	10.37*	.035*
Psychological flexibility‡	88.54	87.24	81.16	82.35	95.20	7.48	.11
Type D†,‡							
NA	-3.25^{a}	-1.37^{b}	1.42^{a}	1.55^{b}	-1.52	11.50*	.021*
SI	-2.08	0.16	-1.36	1.45	-0.08	3.78	.44
NA*SI	27.59	13.00	19.42	12.40	8.84	3.40	.49

Cluster 1 (extremely high satisfaction) was set as reference group for the multinomial logistic regressions. Corresponding superscriptions (^{a,b}) indicate which class significantly differs with another class based on post hoc paired comparisons testing.

Data marked with an asterisk (*) indicates significant class differences.

NA = negative affectivity; SI = social inhibition.

†According to Lodder.[25] For type D the mean centered values for NA and SI, interaction, and quadratic effects were tested.

‡Higher scores on the questionnaires indicated higher distress, better physical and mental health, higher pessimism, higher optimism, higher psychological flexibility, higher negative affectivity, and higher social inhibition, respectively.

Table 4 Mean and distribution of the covariates for each class (attitude)

	Class 1	Class 2	Class 3	Class 4		
	Highly positive attitude	Moderately to highly positive attitude	Moderately positive attitude	Negative attitude		
Class size	16%	22%	40%	22%	Wald	*P* value
Demographic covariates						
Age	61.17[ab]	65.69[ac]	65.22[bd]	62.53[cd]	17.44*	.001*
Sex					5.11	.16
Male	67%	62%	57%	63%		
Female	31%	36%	40%	29%		
Marital status					10.77*	.013*
No partner	3%[a]	18%	9%[b]	23%[ab]		
With partner	95%	80%	87%	69%		
Employed[†]					3.54	.32
No	64%	74%	67%	60%		
Yes	34%	24%	30%	32%		
Psychological medication					3.41	.33
No	74%	92%	84%	80%		
Yes	24%	7%	13%	13%		
Estimated 10-year survival	0.69[a]	0.64	0.61[b]	0.55[ab]	11.25*	.01*
Digital health literacy	2.98	3.23[a]	2.90	2.84[a]	6.88	.076
Predictors controlled for demographics						
Distress[†]	11.07	8.54[a]	10.95	14.01[a]	10.55*	.014*
Physical health[†]	42.69	47.96[ab]	41.43[a]	38.97[b]	11.65*	.009*
Mental health[†]	45.60	49.93[ab]	44.18[a]	41.80[b]	8.79*	.032*
Pessimism[†]	3.55[ab]	3.55[c]	4.34[a]	5.11[bc]	15.03*	.002*
Optimism[†]	7.81[a]	7.86[b]	7.14	6.70[ab]	12.21*	.007*
Psychological flexibility[†]	89.10	89.19	82.58	81.69	5.31	.15
Type D[‡,†]						
NA	-1.24	-1.67	0.37	2.03	4.01	.26
SI	-0.36	-2.06	0.60	1.38	1.90	.59
NA*SI	20.21	10.48	15.95	15.38	2.14	.54

Cluster 1 (highly positive attitude) was set as reference group. Corresponding superscriptions ([abc]) indicate which class significantly differs with another class based on post hoc paired comparisons testing. However, for digital health literacy (not significant) post hoc testing showed significant differences between class 2 and 4.

Data marked with an asterisk (*) indicates significant class differences.

NA = negative affectivity; SI = social inhibition.

[†]Higher scores on the questionnaires indicated higher distress, better physical and mental health, higher pessimism, higher optimism, higher psychological flexibility, higher negative affectivity, and higher social inhibition, respectively.

[‡]According to Lodder.[25]For type D the mean centered values for NA and SI and interaction effects were tested.

in the extremely high satisfaction group (class 1) compared to the instable low satisfaction group (class 4) and the decreasing satisfaction group (class 5). In addition, the moderately high satisfaction group (class 2) experienced significantly higher optimism scores compared to the instable low satisfaction group (class 4). Patients with *lower scores on NA* are more likely to be in the extremely and moderately high satisfaction groups (class 1 and class 2) than in the high and instable low satisfaction groups (class 3 and class 4).

Correlates of telehealth attitudes

Overall, when not controlling for other covariates, relations between the predictors and class membership were significant for all predictors except for age, estimated 10-year survival, NA, SI, and type D personality. After controlling for demographic covariates, the effect of age (Wald = 17.44; P = .001), marital status (Wald = 10.77; P = .013), psychological distress (Wald = 10.55; P = .014), mental (Wald = 8.79; P = .032) and physical health (Wald = 11.65; P = .009), optimism (Wald =12.21; P = .007), and pessimism (Wald = 15.03; P = .002) remained significant.

Patients with a high positive attitude (class 1) toward telehealth were *younger* compared to those with a moderate-to-high (class 2) and moderate (class 3) positive attitude. Likewise, patients in the negative attitude group (class 4) were *younger* compared to those with moderate-to-high positive (class 2) and moderate positive attitudes (class 3). Furthermore, patients with *no partner* were more likely to be in the negative attitude group (class 4) as compared to highly (class 1) and moderately (class 3) positive attitude groups.

Participants with a negative attitude toward telehealth tended to experience *higher distress* as compared to participants with a moderately to highly positive attitude. Patients in the moderately to highly positive attitude group (class 2) tended to have *better physical functioning* as compared to the moderate (class 3) and negative attitude (class 4) groups. Similar results were found for *mental health*.

Patients scoring *higher on optimism* were more likely to be in the highly (class 1) and moderately to highly positive (class 2) attitude groups than in the negative attitude group (class 4). Participants scoring *higher on pessimism* were more likely to be in the moderately positive (class 3) and negative attitude (class 4) groups as compared to the high (class 1) and moderate-to-high (class 2) classes.

Correlates of telehealth application

A repeated measures logistic regression was used to investigate the predictors of the dichotomous outcome variable *application*. Table 5 shows the parameter estimates, the estimated odds ratios (OR) with 95% confidence interval (CI), and the *P* values.

Controlled for demographic variables, marital status and telehealth literacy were significantly related to whether patients favor the implementation of telehealth in the clinical practice. Hence, patients who are married were more likely to be in favor of applying telehealth compared to unmarried patients (OR = 2.90, 95% CI = 1.47, 5.75). Similarly, patients who have better digital health literacy were more often in favor of telehealth use (OR = 2.33, 95% CI = 1.51, 3.60).

Next, a separate model was fitted for each psychological predictor variable while only controlling for demographic variables. Significant associations were found for pessimism and optimism. While more optimistic (OR = 1.10) patients were more likely to favor the implementation of telehealth, pessimistic (OR = 0.84) patients showed the contrary of being less in favor of increased implementation of telehealth.

Lastly, a total model (Table 5) was fitted that simultaneously included all demographic, medical, and psychological predictors. Results show that marital status, digital health literacy, and pessimism remain significant. Estimated 10-year survival and mental health also became significant predictors of application of telehealth. Higher estimated 10-year survival rates were associated with an increased preference for applying telehealth (OR = 2.16).

Discussion

This is the first study to examine patients' demographic, medical, and psychological profiles in relation to different trajectories of telehealth satisfaction, attitude, and implementation preferences over time. Current results revealed that certain patient characteristics were significantly associated with *satisfaction* with telehealth use. Patients with elevated distress levels were classified as less satisfied, while a trend was observed for patients with higher optimism, better quality of life (physical and mental), and lower NA scores to be highly satisfied with telehealth use. These findings could possibly be explained by the perceived doctor-patient communication deficit during telehealth consultations. Previous studies showed that patients with depressive symptoms report a deficit in doctor-patient communication during face-to-face interaction.[34,35] Patients with underlying psychological disorders are more likely to report unmet expectations,[36,37] are less likely to have their symptoms understood by the physician,[38,39] are less involved in shared decision making,[40] and are in general less satisfied with care.[15,16] Hence, they might consider the doctor-patient communication through telehealth as less personal and thus fear that they will not receive the care that is needed.

The trend toward quality of life and optimism as factors associated with higher satisfaction could be explained by the fact that optimistic people generally expect positive things to happen in the future and are more likely to evaluate situations as positive,[41] and thus most likely also telehealth care. Second, people with a better quality of life might also have better health and may perhaps require only routine check-ups without medical procedures; this may contribute to their preferences, as we have demonstrated in our previous study, where telehealth usage was associated with type of consultation.[8]

Regarding attitudes toward telehealth in general, younger patients were more likely to have either a highly positive attitude or a negative attitude. In addition, patients who were not with a partner and patients with higher distress levels were more often classified as having a negative attitude. A trend was observed for patients with better quality of life to have a more favorable attitude toward telehealth while pessimistic patients tended to have a more negative attitude. Although previous studies showed that older age might be perceived as a barrier to telehealth uptake, current findings show the opposite.[12,42] Here, younger patients were shown to have a negative attitude toward telehealth. These results may indicate that older patients are also able and willing to use telehealth services. These findings are also in line with our previous study showing that older cardiac patients are positive toward implementation of telehealth in clinical practice.[8] The differences in results can also be explained by the type of telehealth used in the studies. In the current study, most contacts were remote via telephone, whereas in the study by Cho and colleagues[12] telehealth visits were defined as a visual and audio encounter via a mobile smartphone or tablet application. Programs with both visual and audio facilities are based on more advanced technologies that may be more difficult to use by older persons, whereas using a phone is perceived as easier. Conversely, younger patients, expected to be more technologically proficient, may prefer technological devices with visual features over telephone consultation, as they more closely resemble face-to-face consultations.[8] In essence, it might be argued that these findings may not fully be related to age but might also be explained by specific circumstances, such as the technological tools used in the current study.

Finally, current results showed that being married and having higher digital literacy was associated with a preference to implement telehealth in standard clinical practice. A trend was observed toward optimistic patients being in favor of telehealth implementation while pessimistic patients reported being against the preference. These findings are comparable to findings regarding satisfaction and attitude and could be explained in the same way.

Being married was associated with a favorable attitude and with being in favor of telehealth implementation. These

Table 5 Effect estimates in repeated measures logistic regression predicting application of e-health

Effect	Logit	SE	Odds ratio	95% CI		*P* value
				Lower	upper	
Demographic covariates						
Age, years	0.01	0.02	1.01	0.98	0.20	.530
Sex	-0.28	0.23	0.76	0.48	1.04	.226
Marital status (yes/no)	1.07	0.35	2.90	1.47	5.75	.002*
Employed (yes/no)	-0.25	0.27	0.78	0.45	1.19	.357
Psychological medication (yes/no)	0.18	0.35	1.20	0.61	2.36	.605
Estimated 10-year survival	0.82	0.43	2.27	0.98	5.28	.056
Digital health literacy	0.85	0.22	2.33	1.51	3.60	<.001*
Psychological predictors[†]						
Distress	-0.01	0.01	0.99	0.96	1.02	.398
Physical health	0.01	0.01	1.01	0.99	1.02	.347
Mental health	0.00	0.01	1.00	0.99	1.02	.683
Pessimism	-0.17	0.04	0.84	0.78	0.91	<.001*
Optimism	0.09	0.04	1.10	1.01	1.20	.037*
Psychological flexibility	0.01	0.01	1.01	0.99	1.02	.348
Type D						
NA	-0.04	0.02	0.96	0.93	1.00	.060
SI	0.02	0.02	1.02	0.98	1.05	.412
NA*SI	0.00	0.00	1.00	0.99	1.01	.865
Total tested model[‡]						
Age, years	0.01	0.01	1.01	0.98	1.03	.510
Sex	-0.25	0.19	0.78	0.54	1.12	.172
Marital status (yes/no)	1.05	0.27	2.86	1.69	4.85	<.001*
Employed (yes/no)	-0.18	0.22	0.84	0.55	1.28	.408
Psychological medication (yes/no)	0.36	0.30	1.44	0.80	2.58	.219
Estimated 10-year survival	0.77	0.34	2.16	1.11	4.23	.024*
Digital health literacy	0.80	0.19	2.22	1.54	3.20	<.001*
Distress	0.00	0.02	1.00	0.95	1.05	.980
Physical health	0.02	0.01	1.02	0.99	1.04	.149
Mental health	-0.04	0.02	0.96	0.93	1.00	.061
Pessimism	-0.18	0.05	0.83	0.75	0.92	<.001*
Optimism	0.04	0.06	1.04	0.92	1.16	.531
Psychological flexibility	0.00	0.01	1.00	0.98	1.01	.654
Type D						
NA	-0.03	0.02	0.97	0.93	1.02	.290
SI	0.01	0.02	1.01	0.97	1.04	.648
NA*SI	0.00	0.00	1.00	0.99	1.00	.358

Data marked with an asterisk (*) indicates significant prediction.

NA = negative affectivity; SE = standard error; SI = social inhibition.

[†]All psychological predictor effects were controlled for demographic covariates.

[‡]All predictors and covariates were tested in 1 model.

findings can be explained by social support theory. This theory states that social support has a positive effect on health and coping with illness through given support, such as providing reassurance and advice.[43,44] In addition, previous studies indicate that more social support is associated with lower healthcare utilization.[45,46] Therefore, one might hypothesize that patients who are married may experience more social support and therefore have a lower need of physical contact with their physician as compared to nonmarried patients.

The findings and implications of the current study should be interpreted in light of the study limitations, which provide directions for future research. First, the outcome measures satisfaction, attitude, and implementation were each assessed with a single, purpose-designed question. The questions were not validated previously. (The review by Hawrysz and colleagues[47] offers an insightful discussion on defining and measuring patient satisfaction with healthcare services during the COVID-19 pandemic.) Second, the generalizability to telehealth applications other than telephone calls and to different cardiac patient groups is questionable. Third, the primary treated cardiac diagnosis during the teleconsultation could not be specified. It could be speculated that depending on the disease type and severity the preferences could be somewhat different.[8] Fourth, we did not measure other contextual factors that might have influenced the degree of satisfaction, attitude, and overall preferences. In our previous study we found that certain factors such as a too-wide appointment time slot for the teleconsultation, missing social interactions, and type of consultation (eg, first vs regular check-up consultation) are important factors for the degree of satisfaction, attitude, and overall preferences.[8] Finally, the RMLCA primarily identified classes with stable attitude or satisfaction scores across follow-up. RMLCA can be

especially useful compared to predicting satisfaction or attitude in a multiple regression model, when 1 or more classes involve a change in the outcome measure across time. However, this is the first study to tap into the demographic, medical, and psychological correlates of patient telehealth use/satisfaction/attitude among a large, real-life cardiac sample.

To conclude, it is most likely that patients with lower age, without a partner, and with higher distress levels are less likely to prefer telehealth while optimistic patients and those with good quality of life are more likely to use it. This study shows that a personalized approach toward implementation of remote care is warranted and that the clinical practice should be aware of patients' preferences depending on their individual profile. Hence, a personalized approach is still warranted. Patient demographic, clinical, and psychological profiles should be considered when offering telehealth modalities. To increase patient satisfaction with offered care, brief screening could be performed (eg, using a short checklist) in order to identify patients who might be reluctant to use this type of care. Finally, these results help to tailor the care to patients' needs and preferences and increase patient satisfaction. In turn, this will lead to better uptake and efficient use of remote care, and possibly to better health outcomes in the long term.

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Disclosures

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References

1. WHO. Pulse Survey on Continuity of Essential Health Services during the COVID-19 Pandemic, https://apps.who.int/iris/bitstream/handle/10665/334048/WHO-2019-nCoV-EHS_continuity-survey-2020.1-eng.pdf.
2. World Health Organization (WHO). Third Round of the Global Pulse Survey on Continuity of Essential Health Services during the COVID-19 Pandemic: November-December 2021. Interim Report, https://apps.who.int/iris/bitstream/handle/10665/334048/WHO-2019-nCoV-EHS_continuity-survey-2020.1-eng.pdf%0Ahttps://www.who.int/publications/i/item/WHO-2019-nCoV-EHS-continuity-survey-2021.1%0Ahttps://apps.who.int/iris/bitstream/handle/10665/334048/WHO-2.
3. Mann DM, Chen J, Chunara R, Testa PA, Nov O. COVID-19 transforms health care through telemedicine: evidence from the field. J Am Med Informatics Assoc 2020;27:1132–1135.
4. Bitar H, Alismail S. The role of eHealth, telehealth, and telemedicine for chronic disease patients during COVID-19 pandemic: a rapid systematic review. Digit Health 2021;7:1–19.
5. Pogorzelska K, Chlabicz S. Patient satisfaction with telemedicine during the COVID-19 pandemic—a systematic review. Int J Environ Res Public Health 2022;19:6113.
6. Goldberg EM, Lin MP, Burke LG, Jiménez FN, Davoodi NM, Merchant RC. Perspectives on Telehealth for older adults during the COVID-19 pandemic using the quadruple aim: interviews with 48 physicians. BMC Geriatr 2022;22:1–9.
7. Garfan S, Alamoodi AH, Zaidan BB, et al. Telehealth utilization during the Covid-19 pandemic: a systematic review. Comput Biol Med 2021;138:104878.
8. Habibovic M, Kraaij CM, Pauws S, Widdershoven JMG. Patient perspective on telehealth during the COVID-19 pandemic at the cardiology outpatient clinic: data from a qualitative study. Heart Mind 2021;5:132.
9. Smithson R. Virtual models of chronic disease management: lessons from the experiences of virtual care during the COVID-19 response. Aust Health Rev 2021;45:311–316.
10. Tong L, George B, Crotty BH, et al. Telemedicine and health disparities: association between patient characteristics and telemedicine, in-person, telephone and message-based care during the COVID-19 pandemic. IPEM-Transl 2022;3-4:100010. https://doi.org/10.1016/j.ipemt.2022.100010.
11. Kakani P, Sorensen A, Quinton JK, et al. Patient characteristics associated with telemedicine use at a large academic health system before and after COVID-19. J Gen Intern Med 2021;36:1166–1168.
12. Cho D, Khalil S, Kamath M, et al. Evaluating factors of greater patient satisfaction with outpatient cardiology telehealth visits during the COVID-19 pandemic. Cardiovasc Digit Health J 2021;2:312–322.
13. Collins A, Mclachlan S-A, Pasanen L, Wawryk O, Philip J. Perceptions of telehealth in real-world oncological care: an exploration of matched patient- and clinician-reported acceptability data from an Australian cancer centre. Cancer Med 2022;11:3342–3351.
14. Kashdan TB. Psychological flexibility as a fundamental aspect of health. Clin Psychol Rev 2010;30:865–878.
15. Lee DS, Tu JV, Chong A, Alter DA. Patient satisfaction and its relationship with quality and outcomes of care after acute myocardial infarction. Circulation 2008;118:1938–1945.
16. Kavalniene R, Deksnyte A, Kasiulevičius V, Šapoka V, Aranauskas R, Aranauskas L. Patient satisfaction with primary healthcare services: are there any links with patients' symptoms of anxiety and depression? BMC Fam Pract 2018;19:1–9.
17. Spitzer RL, Kroenke K, Williams JBW, Löwe B. A brief measure for assessing generalized anxiety disorder. Arch Intern Med 2006;166:1092.
18. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med 2001;16:606–613.
19. Kroenke K, Wu J, Yu Z, et al. Patient health questionnaire anxiety and depression scale: initial validation in three clinical trials. Psychosom Med 2016;78:716–727.
20. Lamers SMA, Westerhof GJ, Bohlmeijer ET, ten Klooster PM, Keyes CLM. Evaluating the psychometric properties of the mental health Continuum-Short Form (MHC-SF). J Clin Psychol 2011;67:99–110.
21. Ware J, Kosinski M, Keller SD. A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. Med Care 1996;34:220–233.
22. Scheier MF, Carver CS, Bridges MW. Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): a reevaluation of the life orientation test. J Pers Soc Psychol 1994;67:1063–1078.
23. Denollet J. DS14: standard assessment of negative affectivity, social inhibition, and type D personality. Psychosom Med 2005;67:89–97.
24. Howard S, Hughes BM. Construct, concurrent and discriminant validity of Type D personality in the general population: associations with anxiety, depression, stress and cardiac output. Psychol Health 2012;27:242–258.
25. Lodder P. Modeling synergy: how to assess a Type D personality effect. J Psychosom Res 2020;132:109990.
26. Ben-Itzhak S, Bluvstein I, Maor M. The Psychological Flexibility Questionnaire (PFQ): development, reliability and validity. WebmedCentral Psychol 2014;5:WMC004606.
27. Charlson M, Szatrowski TP, Peterson J, Gold J. Validation of a combined comorbidity index. J Clin Epidemiol 1994;47:1245–1251.
28. Van Der Vaart R, Drossaert C. Development of the digital health literacy instrument: measuring a broad spectrum of health 1.0 and health 2.0 skills. J Med Internet Res 2017;19:e27.
29. Vermunt JK, Magidson J. Technical Guide for Latent GOLD 5.1: Basic, Advanced, and Syntax 1. Stat Innov Inc; 2016. http://www.statisticalinnovations.comhttp//www.statisticalinnovations.comorcontactusat
30. Vermunt JK. Latent class modeling with covariates: two improved three-step approaches. Politi Anal 2010;18:450–469.
31. Edwards SL, Berzofsky ME, Biemer PP. Addressing Nonresponse for Categorical Data Items Using Full Information Maximum Likelihood with Latent GOLD 5.0; September 2018; https://doi.org/10.3768/rtipress.2018.mr.0038.1809.
32. Nylund KL, Asparouhov T, Muthén BO. Deciding on the number of classes in latent class analysis and growth mixture modeling: a Monte Carlo simulation study. Struct Equ Modeling 2007;14:535–569.

33. Nasserinejad K, van Rosmalen J, De Kort W, Lesaffre E. Comparison of criteria for choosing the number of classes in Bayesian finite mixture models. PLoS One 2017;12:e0168838.
34. Schenker Y, Stewart A, Na B, Whooley MA. Depressive symptoms and perceived doctor-patient communication in the heart and soul study. J Gen Intern Med 2009; 24:550–556.
35. Haerizadeh M, Moise N, Chang BP, Edmondson D, Kronish IM. Depression and doctor-patient communication in the emergency department. Gen Hosp Psychiatry 2016;42:49–53.
36. Eimontas J, Gegieckaitė G, Zamalijeva O, Pakalniškienė V. Unmet healthcare needs predict depression symptoms among older adults. Int J Environ Res Public Health 2022;19:8892.
37. Kroenke K, Jackson JL, Chamberlin J. Depressive and anxiety disorders in patients presenting with physical complaints: clinical predictors and outcome. Am J Med 1997;103:339–347.
38. Graber MA, Bergus G, Dawson JD, Wood GB, Levy BT, Levin I. Effect of a patient's psychiatric history on physicians' estimation of probability of disease. J Gen Intern Med 2000;15:204–206.
39. Knaak S, Mantler E, Szeto A. Mental illness-related stigma in healthcare: barriers to access and care and evidence-based solutions. Healthc Manage Forum 2017; 30:111–116.
40. Moise N, Ye S, Alcántara C, Davidson KW, Kronish I. Depressive symptoms and decision-making preferences in patients with comorbid illnesses. J Psychosom Res 2017;92:63–66.
41. Carver CS, Scheier MF, Segerstorm SC. Optimism. Clin Psychol Rev 2010;30:879–889.
42. De Rosis S, Barsanti S. Patient satisfaction, e-health and the evolution of the patient–general practitioner relationship: evidence from an Italian survey. Health Policy 2016;120:1279–1292.
43. Heaney CA, Israel BA. Social networks and social support. In: Glanz K, Rimer BK, Viswanath KV, eds. Health Behavior and Health Education, 4th ed. San Francisco: Jossey-Bass; 2002. p. 189–210.
44. Ell K. Social networks, social support, and health status: a review. Soc Serv Rev 1984;58:133–149.
45. Chandran A, Benning L, Musci RJ, et al. The longitudinal association between social support on HIV medication adherence and healthcare utilization in the Women's Interagency HIV Study. AIDS Behav 2019;23:2014–2024.
46. Löfvenmark C, Mattiasson AC, Billing E, Edner M. Perceived loneliness and social support in patients with chronic heart failure. Eur J Cardiovasc Nurs 2009;8:251–258.
47. Hawrysz L, Gierszewska G, Bitkowska A. The research on patient satisfaction with remote healthcare prior to and during the COVID-19 pandemic. Int J Environ Res Public Health 2021;18:5338.