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Health Related Quality of Life in Patients with Acute Myocardial Infarction: A Group-Based Trajectory Analysis

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Abstract

Objective: Very few studies have investigated the trajectory of health-related quality of life (HRQoL) in acute myocardial infarction (AMI) patients. To identify AMI trajectory groups and patient characteristics of those in the lowtrajectory as related to HRQoL.

Methods: Of the total of 102 participants were collected by demographic questionnaire at baseline and at 1 month, 3 months, and 6 months, using the 12-Item Short Form Health Survey (SF-12). The group-based trajectory model (GBTM) was applied to identify the optimal trajectory groups in terms of HRQoL.

Results: Among the three trajectory subgroups for the physical component summary (PCS), as identified by GBTM, the second group (34.1% of participants) showed a statistically significant decreasing trend (slope $\beta = -1.45$, $p = 0.0221$). Among the four trajectory subgroups for the mental component summary (MCS) identified by GBTM, however, the second group (35.98% of participants) showed a decreasing trend (slope $\beta = -1.38$, $p = 0.005$), and the third group (17.16% of participants) showed a increasing trend (slope $\beta = 2.90$, $p = 0.001$).

Conclusions: Three PCS and four MCS trajectories were identified. Patient characteristics of those in the low-trajectory trend for HRQoL also were identified. Notably, obesity is an important modifiable factor in regard to the low-trajectory trend for HRQoL.

Keywords: Acute Myocardial Infarction; Group-Based Trajectory Model; Health Related Quality of Life

Abbreviations: ACEI: Angiotensin Converting Enzyme Inhibitor; AMI: Acute Myocardial Infarction; BMI: Body Mass Index; CABG: Coronary Artery Bypass Grafting; CCI: Charlson Comorbidity Index; CHD: Coronary Heart Disease; CNORM: Censored Normal; CPK: Creatine Phospho Kinase; DM: Diabetes Mellitus; GBTM: Group Based Trajectory Model; HRQOL: Health Related Quality Of Life; ICP: Initial Chest Pain; IRB: Institutional Review Board; LVEF: Left Ventricular Ejection Friction; LOS: Length Of Stay; MCS: Mental Component Score; NSTEMI: Non-ST-Elevation Myocardial Infarction; NYHA: New York Heart Association; PCI: Percutaneous Coronary Intervention; PCS: Physical Component Score; PTCA: Percutaneous Transluminal Coronary Angioplasty; SF-12: 12 Item Short Form Health Survey; STEMI: ST-Elevation Myocardial Infarction

Introduction

Acute myocardial infarction (AMI) is one of the major causes of death worldwide. Due to advances in medical technology and treatment, patients' survival rate has risen dramatically. Thus, the quality of life of AMI survivors has become an important indicator as an outcome of care. Many researchers conduct cohort studies to investigate patterns and predict factors related to quality of life in coronary heart disease (CHD) patients. Some studies have found that quality of life may predict a poor prognosis and increase the mortality rate in myocardial infarction patients [1-3]. Due to the variety of CHDs, targets selected by research institutes for tracking health-related quality of life (HRQOL) trajectories include not only patients with invasive treatment, such as cardiac surgery or coronary artery interventions, but also others who did not undergo such invasive treatment. Therefore, the conclusions of these studies are inconsistent. Research has revealed that the quality of life of patients with myocardial infarction improves over a period of time from 1 month up to 2 years [4-7]. At 2 months, improvement in body pain and mental health begins. There is a slower recovery in physical functioning and emotional role limitations up to 12 months [3]. Some believe that quality of life declines over time [8]. Most studies have suggested the predictors of change include age, gender [9-11], smoking [4,7,8,12], social support [1,13,14], type of AMI, severity of myocardial infarction, persistence of symptoms [4,7], and anxiety and depression [1,15-17]. One study enrolled 3,501 AMI patients (67% women) aged 18–55 years to examine the patterns of recovery in the year after AMI. Participants were scored three times (baseline, 1 month, and 12 months) for angina symptoms, disease-specific quality of life, and physical and mental functioning. The results revealed that women had significantly lower health status in the Physical Component Score (PCS) and Mental Component Score (MCS) [9]. Another study, which investigated coronary artery bypass grafting (CABG) patients, found that women have higher general health status than do men and that the improvement in mental health status starts 2 months after surgery [6].

Repeated-measure Quality of Life surveys for AMI patients are mostly mean score-trend surveys and assume that each case should be consistent. In fact, the quality-of-life trajectory of each patient is different; thus, it is not appropriate to define the trajectory by mean scores. Thus, some studies have started to use different methods to identify the physical and psychological symptoms and quality-of-life trajectories of CHD patients. Some studies that have investigated depression in CHD patients have found three to four depression trajectories [18,19]. Other studies have investigated depression and HRQOL trajectories of persons with CHD. One study followed up on patients over one year after CABG. The results showed two trajectories, one for PCS and one for MCS. The researchers identified an improvers group and a non-improvers group in both PCS and MCS. Profile of Mood States (POMS) vigor-activity and New York Heart Association (NYHA) classification were significant predictors for the non-improvers group for PCS, whereas the POMS depression-dejection and manual occupation were significant predictors of the non-improvers group for MCS [20]. Another study investigated 6,890 participants over the course of 21 years and used the group-based trajectory model (GBTM) to identify psychological distress trajectories. The results showed four distinct trajectories. CHD and the risk factors for obesity and smoking were significantly associated with intermediate to low (OR 1.70, 95% CI 1.08–2.68) and persistently high (OR 1.92, 95% CI 1.16–3.19) psychological distress trajectories [19]. There are very few studies, however, that investigate the HRQOL trajectory in AMI patients. Thus, the purpose of this study is to apply GBTM to analyze individual trajectories and cluster similar physiological and psychological quality of life trajectory in AMI subjects.

Methods

The study is a prospective cohort study of HRQOL trajectories in AMI patients. We included AMI patients from two hospitals in eastern Taiwan from 2014 to 2016. Inclusion criteria were age 18 years and above, able to communicate verbally, myocardial infarction without mechanical complications (such as a left ventricular aneurysm, acute mitral insufficiency, or papillary muscle rupture), and absence of cancer or neurological or psychiatric disorders. Type II myocardial infarction was excluded. After a complete description of the study was given to the participants, their written consent was obtained. Ethical approval for the study was obtained from the institutional review board (IRB) of the two hospitals that participated the study (Approval No: 14-04-007 &IRB103-13-B). There were 102 participants in the baseline examination. Clinical data were collected from medical records. We interviewed participants at baseline, 1 month, 3 months, and 6 months, using the 12-Item Short Form Health Survey (SF-12) questionnaire, in the outpatient department or by telephone interview. We used GBTM to analyze the HRQOL trajectory of participants [21,22].

Demographic and Clinical Data Collection

Data on age, sex, employment, education level, race/ethnicity, and marital status were drawn from the survey questionnaire at the first interview. We used medical records to obtain data on the participants' medically related attributes, smoking, and alcohol consumption (Yes/No). Body mass index (BMI) was measured, and obesity was defined as BMI ≥27 kg/m2. Other medical records data included left ventricular ejection friction (LVEF), measured by an echocardiogram; AMI-specific information, such as types of AMI (STEMI/NSTEMI [ST-elevation MI/non-ST-elevation MI]), history, and number of myocardial infarctions; location of myocardial infarction as proven in coronary angiography; and types of reperfusion therapy (e.g., percutaneous coronary intervention [PCI]). AMI severity was evaluated with the Killip classification.

Measurement of Health Related Quality Of Life

At each interview, participants responded to the SF-12 to evaluate the level of HRQOL [22]. The SF-12 is derived from the SF-36 Health Survey, which is used to evaluate the well-being of patients with chronic conditions. The 12 items include two on physical functioning, two on role limitations due to physical health problems, one on body pain, one on general health perceptions, one on vitality, one on social functioning, two on role limitations due to emotional problems, and two on general mental health (psychological distress and psychological well-being). The score is calculated by computer software, and the results are presented in two main components: PCS and MCS scores. The score range is 0–100 for each component, with a higher score as indicating better quality of life. PCS and MCS have been shown to have high reliability and high internal consistency with a test-retest of 0.89 for PCS and 0.76 for MCS [19].

Statistical Analyses

Trajectories of quality of life were defined using GBTM, which identify clusters of individuals (trajectory groups) with a similar trajectory over time [21]. GBTM is a statistical method that is designed to identify an optimal number of trajectory groups as well as the shape and size of different trajectory groups in the data. The model selection relied on Bayesian information criterion and Akaike's information criterion to determine the optimal number of trajectories: lower absolute values correspond

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to better fit. We hypothesized that patients with AMI would have different trajectories over time according to demographics and the characteristics of disease. We use the censored normal (CNORM) model for modeling the conditional distribution of SF-12 data, estimating the parameters, standard errors, group membership probabilities, and θ. CNORM is appropriate for continuous data that are approximately normally distributed, with or without censoring. The data fit well in linear and quadratic trajectories in both PCS and MCS. GBTM was performed using SAS(SAS, version 9.2, Cary, NC).

Results

Table 1: Demographic characteristics.

Variable	n	%
Gender		
Male	80	78.4
Female	22	21.6
Age		
20-39	2	2.0
40-49	13	12.7
50-59	24	23.5
60-69	39	38.2
70-79	16	15.7
>80	8	7.8
Education		
High school or below	85	83.3
Some college or above	16	16.7
Employment		
Yes	55	53.9
No	47	46.1
Marital status		
Single	23	4.9
Married	79	77.5
Living alone		
Yes	19	18.6
No	83	81.4
Smoking		
Yes	39	38.2
No	63	61.8
Alcohol		
Yes	36	35.3
No	66	64.7

Table 2: Clinical characteristics of AMI patients.

Variable	n	%
BMI classification		
Underweight (<18.5%)	1	1.0
Normal weight (18.5-23.9%)	26	25.5
Overweight (24-26.9%)	33	32.4
Mild obese (27-29.9%)	25	24.5
Moderate obese (30-34.9%)	16	15.7
Severe obese (>35%)	1	1.0

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DM		
Yes	42	58.8
No	60	41.2
AMI Type		
STEMI	49	48.0
NSTEMI	53	52.0
AMI numbers		
First time	86	84.0
Second time	13	13.0
Third time	1	1.0
Fourth time	2	2.0
Reperfusion therapy		
PCI	87	85.3
PTCA	7	6.9
None	7	6.9
Killip classification		
I	28	27.5
II	33	32.4
III	23	22.5
IV	18	17.6
Occlusive Vessels		
One vessel	42	41.2
Two vessels	28	27.4
Three vessels	32	31.4
LVEF		
10-50%	42	56.0
>51%	33	44.0
Lipid lower agent		
Yes	90	88.2
No	12	11.8
Anti platelet therapy		
Yes	101	99.0
No	1	1.0
ACEI		
Yes	58	56.9
No	44	43.1
Beta-Blocker		
Yes	62	60.8
No	40	39.2

STEMI: ST-elevation myocardial infarction, NSTEMI: non-ST-elevation myocardial infarction, PCI: percutaneous coronary intervention, PTCA: percutaneous transluminal coronary angioplasty, DM: diabetes mellitus, ACEI: angiotensin-converting-enzyme inhibitor

Table 3: Descriptive of clinical variables.

Variable	Mean	(SD)	Range
Age	62.75	(11.71)	34-93
BMI	26.31	(3.66)	18-36
LVEF	47.97	(13.97)	16-76
CPK	1009.83	(1298.16)	1-4875

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AMI Times	1.21	(0.55)	1-4
LOS	6.06	(4.74)	1-26
CCI	2.01	(1.65)	1-10
ICP Score	7.37	(2.50)	0-10

BMI: body mass index, LVEF: left ventricular ejection friction, CPK: Creatine-phospho-kinase, LOS: length of stay, CCI: Charlson co morbidity index, ICP: initial chest pain

As seen in Tables 1-3, 102 AMI patients (age 62.75 ± 11.71 years; 78.4% men) participated in the study. Most of participants (73.5%) were overweight or obese, and 58.8 % were diabetic. Of the participants, 83.3% were first-time AMI patients, 44% had proven LVEF impairment (<50%), 52% had NSTEMI, 85.33% underwent PCI, and 72.5% of experienced AMI severity greater than Killip II (Killip II, 32.4%; III, 22.5%; IV, 17.6%) (Table 2). The average length of stay was 6.1 days. Participants were assessed four times: during hospitalization after AMI (T1), 1 month (T2; n = 79), 3 months (T3; n = 76) and 6 months (T4; n =76). Three patients (2.9%) died during the follow-up period, 23 (22.5%) patients were lost to follow-up or refused to continue in the study, and 76 (74.5%) completed the study (Tables 1-3).

Trajectories of PCS

By using GBTM, three trajectory sub-groups of PCS were identified. Table 4 presents the descriptive characteristics of the participants by their membership in a PCS trajectory. The results suggest that male gender, 60 years or older, non-smoker, non-obese, and NSTEMI participants were overrepresented in the persistently intermediate trajectory. The corresponding percentages in each group were: males, 19%, 34%, 47%; age 60 years and older, 29%, 37%, 35%; smokers, 27%, 27%, 47%; and obese participants, 23%, 45%, 77% (Table 4). The results in Table 5 show that only the second group (34.18% of participants) had a statistically significant linear trend (t = -1.45, p-value = 0.02). We refer to Group 1 as the "persistent low trajectory" group because the subjects in this group showed low PCS scores at the starting point that remained low over time. The estimated probability of membership was 23.6%. The third group (42.3%) was referred to as the "persistent high trajectory" group because the individuals in this group exhibited baseline scores in PCS that are comparable to those of the general population and that steadily increased over time (Table 4). Figure 1 shows the three trajectories of the three sub-groups. The first group (23.6%) comprises individuals with a constant intermediate range scores for PCS. This group is characterized by a slight increase in scores at the time of the second interview that then gradually decline somewhat over the observation period. This group is called the "persistent intermediate trajectory" group; the slope coefficient, however, did not show statistical significance.

Table 4: Descriptive characteristics of the participants by trajectories of PCS.

Variable		All n = 76 n (%)	Persistent Low n = 18 n (%)	Persistent Intermediate n = 26 n (%)	Persistent High n = 32 n (%)
		Trajectory			
Gender	Male	58 (76.3)	11 (61.1)	20 (76.9)	27 (84.4)
	Female	18 (23.7)	7 (38.9)	6 (23.1)	5 (15.6)
Age	18-59	27 (35.5)	4 (22.2)	8 (30.8)	15 (46.9)
	60-85	49 (64.5)	14 (77.8)	18 (69.2)	17 (53.1)
Employment	Yes	41 (53.9)	6 (33.3)	16 (61.5)	19 (59.4)
	No	35 (46.1)	12 (66.7)	10 (38.5)	13 (40.6)
Living alone	Yes	10 (13.2)	1 (5.6)	0 (0)	9 (28.1)
	No	66 (86.8)	17 (94.4)	26 (100)	23 (71.9)
Smoking	Yes	30 (39.5)	8 (44.4)	8 (30.8)	14 (43.8)
	No	46 (60.5)	10 (55.6)	18 (69.2)	18 (56.3)
Alcohol	Yes	28 (36.8)	8 (44.4)	7 (26.9)	13 (40.6)
	No	48 (63.2)	10 (55.6)	19 (73.1)	19 (59.4)
BMI	Non-obese	45 (59.2)	7 (38.9)	14 (53.8)	24 (75.0)
	Obese	31 (40.8)	11 (61.1)	12 (46.2)	8 (25.0)
AMI type	STEMI	37 (48.7)	8 (44.4)	11 (42.3)	18 (56.3)
	NSTEMI	39 (51.3)	10 (55.6)	15 (57.7)	14 (43.8)
Reperfusion	PCI	65 (85.5)	13 (72.2)	25 (96.2)	27 (84.4)
	PTCA	4 (5.3)	2 (11.1)	1 (3.8)	1 (3.1)

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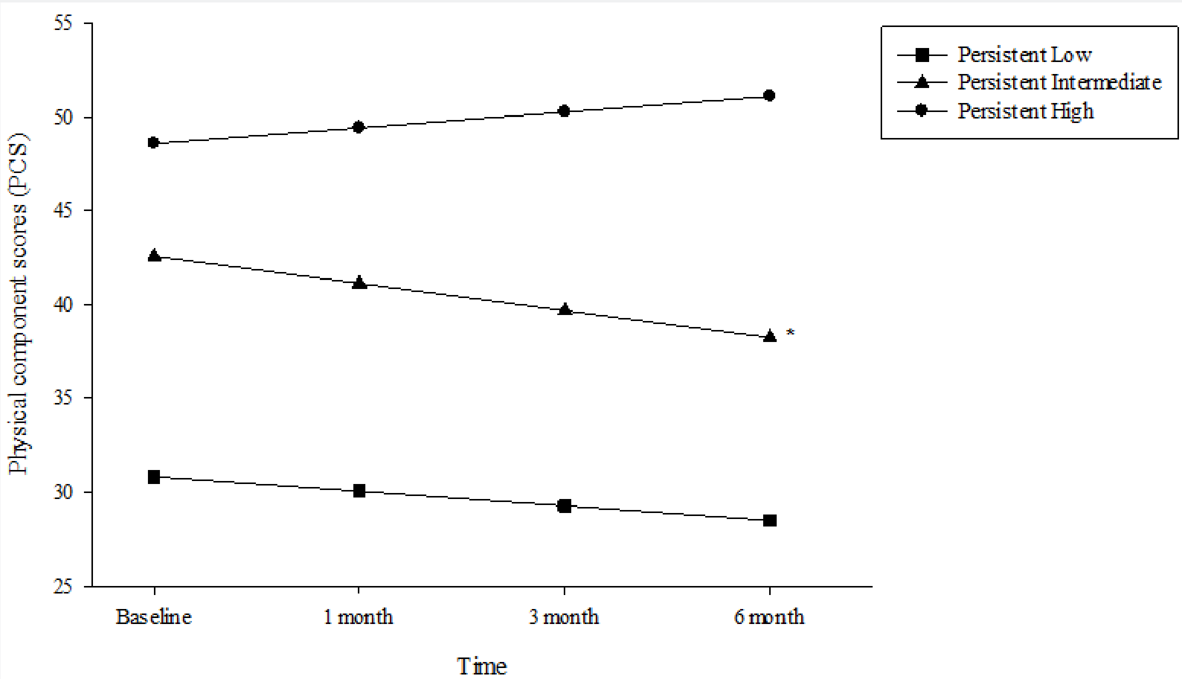
	None	7 (9.2)	3 (16.7)	0 (0)	4 (12.5)
Killip	I	22 (28.9)	2 (11.1)	6 (23.1)	14 (43.8)
	II	25 (32.9)	6 (33.3)	8 (30.8)	11 (34.4)
	III	17 (22.4)	9 (50.0)	6 (23.1)	2 (6.3)
	IV	12 (15.8)	1 (5.6)	6 (23.1)	5 (15.6)
LVEF	10-50%	28 (52.8)	11 (61.1)	15 (57.7)	6 (18.8)
	51-80%	25 (47.2)	7 (38.9)	11 (42.3)	8 (25.0)

AMI: acute myocardial infarction, BMI: body mass index, LVEF: left ventricular election fraction, NSTEMI: non-ST-elevated myocardial infarction, PCI: percutaneous coronary intervention, PTCA: percutaneous transluminal coronary angioplasty, STEMI: ST-elevated myocardial infraction.

Table 5: Results of group-based trajectory model for PCS.

Group		Parameter estimate	SE	t-value	p-value	Group membership %
1	Intercept	30.83	2.12	14.55	<0.001	23.6
	β	-0.78	0.71	-1.10	0.271	
2	Intercept	42.58	1.95	21.85	<0.001	34.1
	β	-1.45	0.63	-2.30	0.022	
3	Intercept	48.57	1.36	35.77	<0.001	42.3
	β	0.84	0.51	1.68	0.095	



*statistically significant linear trend (p-value < 0.05).

Figure 1: Trajectory plots of the three groups for PCS.

Trajectories of MCS

By using GBTM, four trajectory sub-groups of MCS were identified.As seen in Table 6, the descriptive characteristics of the participants, based on their membership in an MCS trajectory, suggest that male gender, 60 years or older, non-smoker, non-obese, Killip classification greater than III, and NSTEMI participants were overrepresented in the intermediate to low trajectory. In contrast, men under 60 years old, employed, non-smokers. Killip II, and STEMI participants were overrepresented in the “intermediate to high trajectory” group. The corresponding percentages in each group were: males, 16%, 28%, 14%, 43%; 60 years or older, 6%, 29%, 10%, 41%; and obese, 23%, 26%, 19, 32% (Table 6). For MCS, the second group (36.0% of participants) showed a statistically significant decreasing trend (slope (β) = -1.38, p-value =0.005), and the third group (17.16% of participants) showed a statistically significant increasing trend (slope (β) = 2.90,

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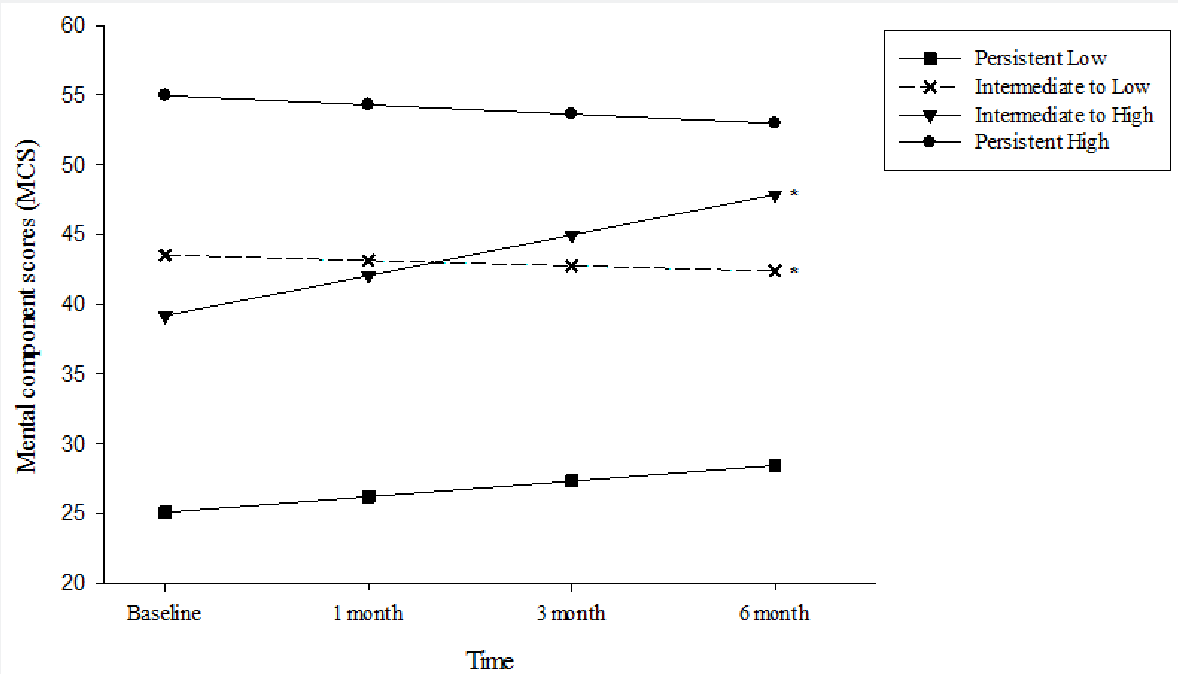
p-value = 0.001). The results are presented in Table 7. Figure 2 shows the trajectories of the four sub-groups. For the first group (denoted with a square), the "persistent low trajectory" group, with 5.5% of participants, the trajectory showed an insignificant trend of MCS level that increased over the observation period (6 months). Although the score declined, it remained higher than the initial score at the end of the observation. The second group (denoted with a cross), the "intermediate to low" trajectory group, comprised 36% of the participants. The shape of the trajectory shows a statistically significant decreasing trend (slope (β) = -1.38, p-value = 0.005) over the observation period (6 months). The third group (denoted with an inverted triangle), the "intermediate to high" trajectory group, (with 17.2% of the participants) had a statistically positive slope coefficient (slope (β) = 2.90, p-value = 0.001). The trajectory characterized a statistically significant increase over the observation period (6 months). The fourth group (denoted with a circle), the "persistent high" trajectory, included 41.3% of the participants. Although starts with a high MCS score, it did not show a statistically significant slope coefficient. The fluctuation of the scores remained within the norm score of general populations. At the end of the observation period, Group 3 (intermediate to high trajectory) ascended to a point similar to that of Group 4. This indicates that these two groups reached the high MCS score at 6 months, regardless of the baseline scores.



*statistically significant linear trend (p-value < 0.05).

Figure 2: Trajectory plots of the three groups for MCS.

Table 6: Descriptive characteristics of the participants by trajectories of MCS.

		Trajectory				
		All n = 76 n (%)	Persistent Low n = 12 n (%)	Intermediate to Low n = 21 n (%)	Intermediate to High n = 11 n (%)	Persistent High n = 32 n (%)
Gender	Male	58 (76.3)	9 (75)	16 (76.2)	8 (72.7)	25 (78.1)
	Female	18 (23.7)	3 (25)	5 (23.8)	3 (27.3)	7 (21.9)
Age	18-59	27 (35.5)	4 (33.3)	7 (33.3)	6 (54.5)	12 (37.5)
	60-95	49 (64.5)	8 (66.7)	14 (66.7)	5 (45.5)	20 (62.5)
Employment	Yes	41 (53.9)	5 (41.7)	12 (57.1)	7 (63.6)	17 (53.1)
	No	35 (46.1)	7 (58.3)	9 (42.9)	4 (36.4)	15 (46.9)
Living Alone	Yes	10 (13.2)	1 (8.3)	1 (4.8)	0 (0)	8 (25)
	No	66 (86.8)	11 (91.7)	20 (95.2)	11 (100)	24 (75)
Smoking	Yes	30 (39.5)	7 (58.3)	8 (38.1)	5 (45.5)	10 (31.3)

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	No	46 (60.5)	5 (41.7)	13 (61.9)	6 (54.5)	22 (68.8)
Alcohol	Yes	28 (36.8)	6 (50)	7 (33.3)	3 (27.3)	12 (37.5)
	No	48 (63.2)	6 (50)	14 (66.7)	8 (72.7)	20 (62.5)
BMI	Non-obese	45 (59.2)	5 (41.7)	13 (61.9)	5 (45.5)	22 (68.8)
	Obese	31 (40.8)	7 (58.3)	8 (38.1)	6 (54.5)	10 (31.3)
AMI type	STEMI	37 (48.7)	4 (33.3)	8 (38.1)	7 (63.6)	18 (56.3)
	NSTEMI	39 (51.3)	8 (66.7)	13 (61.9)	4 (36.4)	14 (43.7)
Reperfusion	PCI	65 (85.5)	10 (83.3)	17 (81)	10 (90.9)	26 (81.3)
	PTCA	4 (5.3)	0 (0)	2 (9.5)	1 (9.1)	1 (3.1)
	None	7 (9.2)	1 (8.3)	2 (9.5)	0 (0)	4 (12.5)
Killip	I	22 (28.9)	2 (16.7)	2 (9.5)	1 (9.1)	17 (53.1)
	II	25 (32.9)	7 (58.3)	5 (23.8)	5 (45.5)	8 (25)
	III	17 (22.4)	3 (25)	7 (33.3)	3 (27.3)	4 (12.5)
	IV	12 (15.8)	0 (0)	7 (33.3)	2 (18.2)	3 (9.4)
LVEF	10-50%	28 (52.8)	5 (41.7)	14 (66.7)	4 (36.4)	6 (18.8)
	51-80%	25 (47.2)	7 (58.3)	4 (19)	5 (45.5)	9 (28.1)

Table 7: Results of Group-Based Trajectory model for MCS.

Group		Parameter estimate	SE	t-value	p-value	Group membership %
1	Intercept	25.05	3.44	7.28	<0.001	5.5
	β	1.12	1.15	0.98	0.328	
2	Intercept	43.53	1.28	34.03	<0.001	36
	β	-1.38	0.49	-2.83	0.005	
3	Intercept	39.17	2.71	14.45	<0.001	17.2
	β	2.9	0.87	3.33	0.001	
4	Intercept	54.97	1.48	37.25	<0.001	41.3
	β	-0.66	0.47	-1.41	0.16	

Discussion

In this study of AMI patients, using four repeated measurements of HRQOL over a 6-month period, three distinct trajectories of PCS were identified: "persistent low" (23.6%), "persistent intermediate" (34.1%), and "persistent high" (42.3%) trajectories. Four trajectory groups of MCS also were identified: "persistent low" (5.5%), "intermediate to low" (36%), "intermediate to high" (17.2%), and "persistent high" (41.3%). This finding confirms our assumption that there are different trajectories of HRQOL in AMI patients. This also explains the insignificant changes in PCS and MCS mean scores over 6 months. Le Grande's study showed that trajectories also were improved after surgery in the CABG population [18]. Other studies have suggested that HRQOL improves at one month after PCI [10]. In contrast, in our study, the PCS trajectories showed a different shape for each group. Group 1's (persistent low) trajectory declined at one month after heart attack, while that of Groups 2 and 3 increased at one month after myocardial infarction. The descriptive data reveal a larger percentage of men, 60 years or older, employed, non-obese, non-smoker, and STEMI participants in the "persistent high" trajectory group, which is different from Kim's finding that older age was correlated with low HRQOL among STEMI participants who undergo PCI [8]. The interesting finding is that the scores of the PCS trajectories were parallel over the observation period, which may be due to the characteristics of the disease. AMI is an acute life-threatening disease, and over 90% of patients received PCI or other life-saving interventions. Reperfusion therapy prevents further cardiac damage and preserves cardiac function after a heart attack. Thus, the PCS of quality of life is not significantly affected. Regarding the MCS trajectories, Le Grande also found improvement in both the improvers and non-improvers groups after surgery [18]. Lower baseline scores were significantly associated with previous cardiac surgery and POMS anxiety tension, depression-dejection, and anger. In our study, the MCS trajectories developed a different shape in different groups. The "persistent low" group ascended slightly over time, and the persistent high" group declined slightly. The most interesting findings were for Groups 2 and 3, which started at similar levels at baseline (intercept = 43.53, $p < .001$ vs. intercept = 39.17, $p < .001$), then dramatically changed in opposite direction over time. Group 2 was characterized by a significant negative slope, while Group 3 developed a positive slope over time.

We identified four trajectories of MCS, a finding similar to that of Virtanen et al. [19], who used a midlife-to-old-age

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population to investigate the correlation of CHD and CHD risk factors on psychological distress trajectory [19]. The results also suggested four trajectories of psychological distress. The largest group was the "low psychological distress" trajectory, and the smallest was the "high psychological distress" trajectory. The findings were similar to those of our study, for which the largest proportion of participants were in the "persistent high" trajectory, and the smallest were in the "persistent low" trajectory of MCS. Non-smoker and obese participants were in higher proportions in both the "low psychological distress" and "persistent high" MCS trajectories. In contrast to previous studies that reported worsening psychological distress and depression trajectories, we identified an "intermediate to high" group (17.2%) in which MCS improved over time. A higher proportion of participants in this group were men, 60 years and older, employed, non-smoker, Killip I and II, and STEMI. In contrast, in the "intermediate to low" group, there were higher proportions of males, age 60 or older, non-obese, non-smoker, Killip classification greater than III, and STEMI participants (36%).

Limitations

Considering the limitations of the study, a replication with a larger number of baseline participants and a longer observation period of AMI patients is needed. The loss to follow-up rate also may have affected the trajectories. Further research also should examine factors such as socio demographic and medically related as well as psychological symptoms, such as depression and anxiety. The results of our study can help clinical professionals to identify high-risk subjects as a means to provide more comprehensive care to AMI patients.

Conclusion

We used a novel approach to AMI and its HRQOL trajectory, using GBTM. In previous studies on HRQOL in AMI, traditional repeated measures were used to identify the mean trend of quality of life and predictors, and our findings were different from those of the previous studies. We identified individuals' trajectories and clustered significant trajectory groups in both PCS and MCS. We provided a new approach to studying the long-term trajectory of AMI patients. Notably, obesity is an important modifiable factor (to non-obesity) for better HRQOL. Our finding can be used to increase clinicians' awareness of the need to assess the BMI level of older patients and to follow up to prevent further health problems. Our results add evidence to the belief that HRQOL has several trajectories over time after an AMI.

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