



INVESTIGATION OF SOCIO-DEMOGRAPHIC FACTORS AFFECTING THE QUALITY OF LIFE AND THE ANXIETY/DEPRESSION SCORES IN THE ACUTE MYOCARDIAL INFARCTION PHASE – OBSERVATIONAL STUDY

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Abstract:

Purpose: The aim of our study was to investigate socio-demographic factors which can help identify patients who are possible candidates for poor health-related quality of life (HRQoL) and high anxiety/depression scores in the recovery stage of myocardial infarction (MI). **Methods:** Fifty patients with acute MI (NSTEMI = non-ST elevation MI / STEMI = ST elevation MI) with percutaneous coronary intervention (PCI) took part in the study on a voluntary basis. The physiotherapy treatment was based on MI mobilization plan, which consists of three stages, each lasting two days, starting with the PCI day. Vital parameters were measured. The Borg scale and pedometer were used. Socio-demographic factors such as age, gender, educational level, employment status, marital status and physical activity status were analyzed. The patients completed the questionnaires (the German-language adaptation of the MacNew Heart Disease Quality of Life Questionnaire (MacNew) and of the Hospital Anxiety and Depression Scale (HADS-D)) independently on the first day of treatment and on the day of discharge. **Results:** The group of patients with university or college graduation showed the most distinctive deterioration in the HRQoL from all groups in the pre/post comparison. The highest deterioration in the HADS-D was found in the group of “unemployed and retired” persons. **Conclusion:** Educational level and employment status are socio-demographic factors which most negatively influence the quality of life and

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anxiety/depression scores of acute MI patients. These parameters need more attention in the early stage of MI treatment.

Keywords: myocardial infarction, quality of life, anxiety, depression, physiotherapy

Zusammenfassung:

Ziel: Das Ziel unserer Studie war es sozio-demographische Faktoren zu ermitteln, die helfen können, Patienten zu identifizieren, die potenzielle Kandidaten für eine schlechte gesundheitsbezogene Lebensqualität (HRQoL) und Angst/Depression Score in der Erholungsphase eines Myokardinfarkts (MI) sind. **Methoden:** Fünfzig Patienten mit akutem MI (NSTEMI / STEMI) mit perkutaner Koronarintervention (PCI) nahmen freiwillig an der Studie teil. Die physiotherapeutische Behandlung basierte auf dem MI-Mobilisierungsplan, der aus drei Phasen zu je zwei Tagen besteht, beginnend mit dem PCI-Tag. Vitalparameter wurden gemessen. Borg-Skalenwerte und Schrittzähler wurden eingesetzt. Sozio-demographische Faktoren wie Alter, Geschlecht, Bildungsniveau, Beschäftigungsstatus, Familienstand und körperliche Aktivität wurden analysiert. Die Patienten füllten zwei Fragebögen (Deutsche Version von MacNew Heart Disease Quality of Life Questionnaire (MacNew) und Hospital Anxiety and Depression Scale (HADS-D)) am ersten Behandlungstag und am Tag der Entlassung selbstständig aus. **Ergebnisse:** Die Gruppe der Patienten mit Universitäts- oder Hochschulabschluss zeigte im Prä-Post-Vergleich von allen Gruppen die deutlichste Verschlechterung der HRQoL. Die deutlichste Verschlechterung des HADS-D wurde in der Gruppe der „Arbeitslosen und Rentner“ festgestellt. **Schlussfolgerung:** Bildungsniveau und Beschäftigungsstatus sind soziodemografische Faktoren, die den größten Einfluss auf die Lebensqualität und die Angst-/Depressionswerte bei akuter MI Patienten haben. Diese Parameter erfordern im Frühstadium der MI-Behandlung mehr Aufmerksamkeit.

Schlüsselwörter: Myokardinfarkt, Lebensqualität, Angst, Depression, Physiotherapie

1. Introduction and literature review

Coronary heart disease is the leading cause of death worldwide. In Germany in 2020, cardiovascular diseases - especially ischemic heart diseases and myocardial infarction (MI) - were responsible for more than a third of deaths [1].

Possible consequences in patients who have experienced a MI include: in particular cardiac arrhythmia and chronic heart failure with reduced cardiovascular fitness and psychological consequences (e.g. anxiety) [2].

The physiological and psychological impact of MI manifests itself in the form of an increasing rehospitalization rate and comorbidity, deterioration in health-related quality of life (HRQoL), increased risk of anxiety and depression, reduction in social contacts and increased unemployment [3–5].

The investigation of the subjective health perception in cardiological patients has an important role, because low values in the quality of life (QoL) questionnaire mean an increased risk of the recurrence of a cardiac event [6]. HRQoL has also been recognized as an assessment parameter in the determination of the effectiveness of therapeutic benefit in clinical-cardiological research [7,8].

The prevalence of anxiety and depression is significantly higher in patients with MI than in the general population [5], therefore special tests to record mental health (anxiety/depression scores) have proven to be particularly useful. High depression scores seem to negatively influence the prognosis of MI. Furthermore, depression is considered an independent risk factor for heart disease [9–13]. The HADS-D (Hospital Anxiety and Depression Scale – German version, [14] is a simple screening instrument for detecting depression.

Question: which socio-demographic factors influence the most the HRQoL and depression/anxiety scores in the recovery stage of the MI patients?

2. Methods

The study methods were originally described elsewhere [15], see also supplementary materials. Briefly, fifty patients with acute MI (NSTEMI= non-ST elevation myocardial infarction / STEMI= ST-elevation myocardial infarction) with PCI took part in the study voluntarily. The inclusion criteria were acute MI with PCI. The patients were interrogated additionally to collect information on the demographic, behavioral, and disease-related characteristics of the participants. The physiotherapy treatment was based on MI mobilization plan, which consists of three stages, each lasting two days, starting with the PCI day. Vital parameters (blood pressure, pulse, respiratory rate and oxygen saturation) were measured by physiotherapists at rest, after chair exercises, after walking or after climbing stairs, and after 3 minutes of recovery. The data were supplemented with Borg scale values, the distance covered during mobilization was recorded, and steps were counted using a pedometer (OMRON Walking style IV). Patients filled out the questionnaires (MacNew and HADS-D) independently on the first day of treatment and on the day of discharge.

The left side of the Table 1 shows the analyzed socio-demographic factors of the study participants. Mean age of the patients was 58.4 (SD 11.3) ranging between 30 und 81 years. More than half of the patients were male (66%), had a secondary education level (50%), were at that time employed (66%), married (66%) and were physically active (62%, = at least 3X per week 30 min. endurance sports).

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Table 1: MacNew and HADS-D results based on socio-demographic factors

Socio-demographic factors		N	%	MacNew pre	CI95% pre	MacNew post	CI95% post	Difference pre/post	SRM	HADS-D pre	CI95% pre	HADS-D post	CI95% post	Difference pre/post	SRM
Age	<65 Years	37	74%	5.5±0.9	5.24-5.76	5.19±0.9	4.92-5.46	0.31±1.2	0.3	9.46±7.3	7.36-11.6	8.43±6.7	6.51-10.35	1.03±5.8	0.2
	≥65 Years	13	26%	5.42±1.2	4.75-6.08	5.39±0.8	4.97-5.8	0.03±1.1	0.03	8.92±6.6	5.33-12.05	7.85±6.8	4.14-11.55	1.08±5.8	0.2
Gender	Male	33	66%	5.54±1.0	5.2-5.88	5.21±0.9	4.92-5.5	0.33±1.2	0.3	8.36±7.0	5.97-10.75	8.24±6.9	5.87-10.6	0.12±6.2	0.02
	Female	17	34%	5.36±0.9	4.9-5.8	5.31±1.0	4.8-5.78	0.06±1.1	0.05	11.18±6.9	7.89-14.46	8.35±6.2	5.4-11.3	2.82±4.1	0.7
Educational level	UCD	11	22%	5.6±0.7	5.2-6.0	4.97±0.9	4.44-5.5	0.63±0.9	0.7	12.8±9.1	7.47-18.17	10.7±7.5	6.32-15.14	2.1±6.33	0.3
	CSE	25	50%	5.55±0.9	5.2-5.9	5.48±0.8	5.15-5.81	0.07±1.0	0.1	6.6±5.5	4.44-8.76	7.24±6.6	4.66-9.81	0.64±5.1	0.1
	GCSE	14	28%	5.25±1.3	4.57-5.93	5.03±1	4.52-5.54	0.22±1.5	0.1	11.43±6.1	8.2-14.66	8.21±6.0	5.07-10.87	3.2±5.7	0.6
Employment status	Employed	33	66%	5.37±1	5.04-5.7	5.16±0.9	4.85-5.47	0.2±1.3	0.2	10.1±7.3	7.63-12.6	8.1±6.6	5.85-10.33	2.03±5.4	0.4
	Unemployed & retired	17	34%	5.71±1	5.25-6.17	5.41±0.9	4.99-5.83	0.3±0.9	0.3	7.6±6.3	4.62-10.64	8.7±7.0	5.37-12.0	1.1±5.8	0.2
Marital status	Married	33	66%	5.48±1.1	5.12-5.84	5.23±0.9	4.92-5.54	0.25±1.2	0.2	9.4±7.3	6.86-11.86	8.0±6.5	5.79-10.2	1.4±6.2	0.2
	Single/divorced	17	34%	5.48±0.8	5.1-5.87	5.27±0.9	4.85-5.69	0.21±1.1	0.2	9.24±6.7	6.07-12.41	8.8±7.1	5.44-12.19	0.4±4.6	0.1
Physical activity status	Yes, 3X pro Week	31	62%	5.52±0.9	5.2-5.85	5.23±0.9	4.91-5.55	0.29±1.1	0.3	10.45±7.6	7.76-13.14	9.1±6.8	6.69-11.5	1.35±6.4	0.2
	No	19	38%	5.41±1	4.94-5.88	5.26±0.9	4.86-5.66	0.15±1.2	0.1	7.47±5.6	4.93-10.01	6.9±6.2	4.16-9.74	0.53±4.3	0.1

Abbreviation:

UCD = university and college degree,

CSE = certificate of secondary education,

GCSE = general certificate of secondary education,

BMI = Body Mass Index,

MI = myocardial infarktion,

HADS-D = Hospital Anxiety and Depression Scale – German version,

MacNew = MacNew Heart Disease Quality of Life Questionnaire

SRM = Standard Response Mean

CI95% = 95% confidence interval

2.1 Statistic

To present the sample characteristics we use descriptive statistics including means, standard deviations (SD), and percentages. We also calculate standardized response mean (SRM), CI 95% and minimal important difference (MID). The MID on the MacNew was determined with 0.5 points (Likert scale) as significant [14,16].

3. Results and Discussion

Table 1 presents the results in detail.

3.1 Age

HRQoL: the patient's group "≥65 Years" showed the smallest deterioration in the QoL. Furthermore, no clinically important change was found regarding QoL in this group.

These results correspond to those from the literature: many articles report that older patients after MI have better QoL than younger patients [4,17–19]. In conclusion, younger patients need to be more focused on the MI treatment for a better HRQoL.

Anxiety and depression: both groups experienced a minimal clinically important improvement regarding anxiety and depression scores. Both the pre and post-HADS-D scores were in the group of the "≥65 Years" patients lower, meaning better values.

Our findings support the results of Hinz et al. [20]: young MI patients are especially affected by anxiety and depression. The relatively low HADS-D scores - meaning better anxiety and depression levels- in older patients indicate that adaptation processes took place.

3.2 Gender

HRQoL: Corresponding to other studies [4] the female MI patients had initially poorer HRQoL. Nevertheless, the female participants experienced no clinically important deterioration in comparison to the male MI patients.

Anxiety and depression: the female patients presented a moderate important change (improvement) in the anxiety and depression scores. This group achieved the best SRM score in all the groups. The male patients had no clinically important change in the HADS-D.

One explanation for this result is that female patients had initially a clearly higher anxiety and depression level as male patients. Worries regarding the future were more reduced through education and information in female than in male participants. Typical questions like: How are things going now with my family, with my work, what is indicated and contraindicated, worries about financial security etc., could be discussed and clarified, if necessary with interprofessional help (physicians, therapists, social workers, nurses).

This suggests that physiotherapy including education shows more efficiency regarding HRQoL and anxiety/depression scores in the female MI patients' group than in the male group.

3.3 Educational level

HRQoL: Although the initial HRQoL is the highest in the patient group with a higher level of education (university or college degree, UCD), this group showed the most distinctive deterioration in the QoL from all groups in the pre/post comparison and a moderate clinically important deterioration of the QoL.

Previous studies have shown that quality of life correlates with educational level [21,22]. Patients with a higher level of education tend to have better quality of life than other groups with lower educational levels. The initial HRQoL results in our study showed the same trend. The fact that the MacNew results in the UCD are moderately deteriorated can be explained with the hypothesis that patients with higher educational level tend to be more aware of risk factors and seem to be more concerned with the possible consequences. However, further studies are needed to confirm this hypothesis. Educational level seems to be a socio-demographic factor which may indicate a poor HRQoL in the acute MI phase.

Anxiety and depression: the patients with "General certificate of secondary education", GCSE, experienced a moderate clinically important improvement regarding the anxiety and depression scores, which correspond to the highest improvement scores in all the groups.

A possible explanation can be assigned to the findings by Zimmermann et al. [23], which describes that education, with developing skills like: problem-solving ability, personal control, cognitive skills etc., contributes to better personal health-behaviors and reactions to illness. This indicates that educational interventions during physiotherapy in MI patients with lower educational levels are important to strengthen these skills.

3.4 Employment status

HRQoL: both the employed and the unemployed group presented a minimal clinically important deterioration in the MacNew Questionnaire.

In contrast to the Lane et al. study [24], the employment status as a socio-demographic factor seems to have no influence on the HRQoL.

Anxiety and depression: when analyzing all the groups, the highest deterioration in the HADS-D was found in the group of "unemployed and retired" patients with an SRM of 0.2. The group of employed patients showed a minimal clinically important improvement in the HADS-D.

In the observational study of Norlund et al. [25] the unemployed status is strongly associated with emotional distress such as anxiety and depression after MI. Similar to other studies [26] the HADS-D values of the employed patients in our study were better on the day of discharge than those of the non-employed & retired group.

3.5 Marital status

HRQoL: between the group of “married” versus “single/divorced” patients there was no difference regarding the pre and post MacNew scores.

Marital status did not appear to have an impact on quality of life. French et al. [27] found also that QoL scores of British patients were not affected by their marital status. However, there are also studies [24,28] which identified a positive association of HRQoL with having a partner.

Anxiety and depression: in the group of the “married” persons the improvement of the anxiety/depression level was clinically minimal important. The same trend was observed in the single/divorced group without clinical importance. Hinz et al. [26] showed also that living with or without a partner had only a minimal influence on anxiety and depression.

3.6 Physical activity status

HRQoL: the physically active patients experienced a minimal clinically important deterioration in the QoL in comparison to the non-active patients, who had no clinically important deterioration.

Movement restrictions and exercise limitation in the first few days and the emotional processing of the potentially life-threatening MI event probably played a major role in the deterioration of the QoL in the physically active patients’ group.

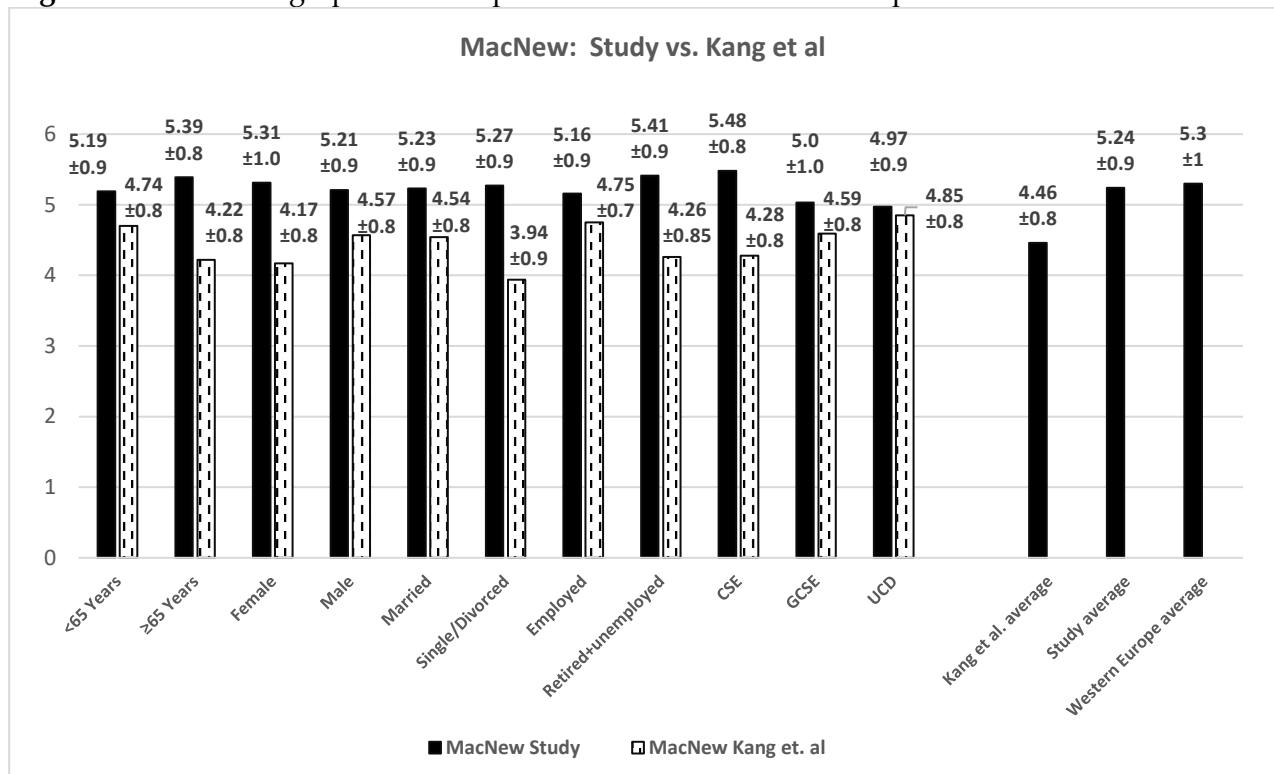
Anxiety and depression: regarding HADS-D the group of physically active patients showed a minimal clinically important improvement, meanwhile, the other group presented no clinically important change.

Against expectation [21], physical activity appears to have only a minor benefit on the anxiety/depression scores. We need a larger study group to confirm these findings.

4. Comparison to similar studies

Kang et al. [5] conducted in 2021 a related study with 150 MI patients in Korea. Patients completed the MacNew questionnaire within the first week after the MI event. No physiotherapy treatment was carried out and no repeated completion of the questionnaire took place on the day of discharge. Comparing our results to theirs, all our socio-demographic related quality of life scores were higher than the comparative scores of Korea (Figure 1). The mean value from the international database for myocardial infarction patients from Western Europe for the MacNew questionnaire [29] is slightly higher than our average. This may be explained by the fact, that the reference values were obtained not only from patients in the acute hospitalization phase of the myocardial infarction, but also from patients in a later MI phase.

Figure 1: Socio-demographic factor-specific MacNew results in comparison with similar studies



Abbreviation:

UCD = university and college degree,
 CSE = certificate of secondary education,
 GCSE = general certificate of secondary education,
 MacNew = MacNew Heart Disease Quality of Life Questionnaire.

The present study paid close attention to the acute phase of recovery after myocardial infarction. After the comparison with the study of Kang et al.[5], we suspect that the much better quality of life values in each domain registered in our patient group are due to the physiotherapy, with early exercise training and education. However, further studies are needed to confirm this hypothesis.

5. Recommendations

Analyzing the socio-demographic factors which can help identify patients who are possible candidates for poor HRQoL and anxiety/depression scores is very important in the recovery stage of acute MI. Our recommendation is to research this field further and to introduce routine physiotherapy with exercise training and education for the in-hospital treatment of MI. This in turn is an optimal prerequisite for reducing the chance of the recurrence of cardiac events [6,9–12].

6. Conclusion

- High educational level and “unemployed and retired” status seem to be predictors for poorer HRQoL and anxiety/depression scores in the acute MI phase. The group of patients with university or college graduation showed the most distinctive deterioration in the HRQoL in the pre/post comparison. The highest deterioration in the HADS-D was found in the group of “unemployed and retired” persons.
- Socio-demographic factors such age \geq 65 years, female gender and educational level “General certificate of secondary education” (GCSE) may positively influence the HRQoL and HADS-D status directly after acute MI. The patient’s group “ \geq 65 Years” showed the smallest deterioration in the HRQoL. The female participants experienced a moderate important improvement in the anxiety and depression scores and presented the best standard response mean (SRM) score in all the groups. The patients with GCSE experienced the highest improvement regarding anxiety and depression scores in all the groups.

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Ethical approval statement

Ethical approvals were obtained from the Ethics Committee of the Hospital Klinikum am Steinenberg, Reutlingen, Germany, prior to recruitment.

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Conflict of interest statement

The authors declare that they have no conflict of interest.

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Supplements:

Material and Methods

Study type and period

The implementation of this observational study was between July 2021 and March 2022.

Study population

Patients with acute MI (NSTEMI; AW STEMI, anterior wall ST-elevation myocardial infarction; PW STEMI, posterior wall ST-elevation myocardial infarction) with PCI took part in the study voluntarily. The inclusion criteria were acute MI with PCI. The exclusion criteria were MI with conservative therapy, palliative patients, language barrier, patients with dementia or immobility, and isolated patients with acute infection. Ethical approval was obtained from the Ethics Committee of the Hospital Kreiskliniken Reutlingen GmbH before recruitment. The participants were informed that they could withdraw from the study at any time. All the enrolled patients signed an informed consent before participation.

Seventy-two patients consented initially to the study. There were 50/72 (69.4%) patients who also completed the study. 4/72 (5.6%) patients had to withdraw from the study because an urgent coronary bypass surgery had to be performed. 1/72 (1.4%) patients stopped because of the language barrier and 17/72 (23.6%) patients took part in physiotherapy but did not hand in the second questionnaire packages for different reasons on the day of discharge.

The demographic characteristics of the study participants (see below Table 3 and 4): the mean age of the patients was 58.4 (SD 11.3), ranging between 30 and 81 years. More than half of the patients were male (66%), with a diagnosis of NSTEMI (56%) and reduced left ventricular pump function (52%).

Study procedure

Physicians at the intensive care unit, intermediate care unit, or cardiology section in Kreiskliniken Reutlingen identified potential participants based on the inclusion criteria and issued prescriptions for in-hospital physiotherapy treatment. A research assistant (physiotherapist working on the above-mentioned sections) conducted the therapy.

The physiotherapeutic treatment in phase I in Kreiskliniken Reutlingen GmbH, Germany, includes the dose increase in cardiovascular fitness according to the myocardial infarction mobilization plan (A) based on the Heidelberger model [1] and the education about the rules of conduct in everyday life with the help of a myocardial infarction flyer (B).

A) The myocardial infarction mobilization plan consisted of three stages, each two days, starting with the coronary angiography day (Table 1).

Table 1: The myocardial infarction mobilization plan

Stage I (Day 1*+2)	Stage II (Day 3+4)	Stage III (Day 5+6)
Education with Flyer	Discuss the questions	Discuss the questions
Study own heart rate measure	Own heart rate measure control	-
Bed or chair-exercises with exercise/relaxation 1:2	Chair-exercises with exercise/relaxation 1:1	Chair-exercises with exercise/relaxation 2:1
Walking into the room	Walking on the corridor	Stair climbing
Limitation of the heart rate is 10 more than the resting heart rate	Limitation of the heart rate is 20 more than the resting heart rate	Limitation of the heart rate is 30 more than the resting heart rate
STOP by discomfort, pulse limit exceeded, systolic pressure value 20> mmHg than at rest, respiratory rate >32 min ⁻¹		

*Day 1 is PCI day.

To record cardiovascular fitness in patients at each level, the vital parameters (blood pressure, heart rate, respiratory rate, and oxygen saturation) were measured by physiotherapists at rest, after chair exercises, after walking or after climbing stairs, and after 3 min of recovery. The data were supplemented with Borg scale values, the distance covered during mobilization was recorded, and steps were counted using a pedometer (pedometer model: OMRON Walking Style IV). There was no physiotherapy on weekends; the patients carried out their exercises independently, which were previously discussed.

B) The educational program about the rules of conduct in everyday life was based on our flyer for MI patients and included general information about MI, symptoms of MI, the goal of physiotherapy by MI, stage of MI mobilization plan, indications (e.g., heart sports group, rehabilitation, endurance sport, healthy nutrition, risk factors, etc.) and contraindications (for six weeks: heart rate > resting heart rate + 30bpm, lifting >5 kg, dyspnea etc.). On discharge, the patients must have been able to correctly assess the intensity of exertion within the specified limits based on the heart rate monitoring and exertion protocol (Borg scale) and to react adequately to any symptoms that may occur.

The German version of the MacNew (MacNew Heart Disease Quality of Life Questionnaire, see below) and the HADS-D (Hospital Anxiety and Depression Scale, see below) were used to examine the quality of life, anxiety, and depression scores. The retrospective questionnaires were filled out independently on the first day of treatment and the day of discharge. The first time, the patients had to think about the week preceding coronary angiography and, on the day of discharge, about the week of hospitalization after PCI. They filled out the questionnaires accordingly (Table 2).

Table 2: Study protocol

Study Protocol	
Physiotherapist specialized in cardiology	Patient
MI mobilization and education daily. No therapy on weekends.	Day 1 physiotherapy: MacNew and HADS-D filled out independently
Vital parameter measurements (at rest, after chair-exercises, after walking or after climbing stairs, and then at recovery after 3 min)	Discharge day with physiotherapy: MacNew and HADS-D filled out independently

Legend:

MI = myocardial infarction,

Vital parameter (blood pressure, pulse, respiratory rate, and oxygen saturation),

MacNew = MacNew Heart Disease Quality of Life Questionnaire,

HADS-D = Hospital Anxiety and Depression Scale.

Measurement tools

A. MacNew Heart Disease Quality of Life Questionnaire

The MacNew instrument [2] consists of 27 items that measure the three inter-related emotional, physical, and social well-being domains. Domain scores are calculated as the average responses to the items in each area. A global HRQoL score results when averaging all 27 items.

The items were answered independently and rated from 1 to 7 (seven-point Likert scale), with a higher score indicating a better quality of life. Missing items did not contribute to the score, and if less than half of the items in a domain have been completed, the score was not calculated for that domain. Values from 1 to 4 (particularly poor quality of life) were regarded as conspicuous, values from 4 to 6 (normal range) as average, and values above 6 (specifically high quality of life) as above average. The clinically important change, calculated by standardized response mean (SRM), played an important role. An SRM (= mean change in score/standard deviation [3]) of 0.2 was considered minimal; 0.5 was moderate, and 0.8 or more was a strong change, respectively [3]. The MID on the MacNew was determined with 0.5 points (on a seven-point scale) as significant [2]. This value corresponds to the “*smallest amount of change required for the difference to represent a clinically meaningful change*” [2].

Normative reference data are essential for the interpretability of HRQoL scores. The updated reference data for MacNew relies on the International HeartQoL Project database consisting of data from 2.299 patients with myocardial infarction [2]. This instrument has been proven valid, reliable, sensitive to minimal and clinically significant changes, and is widely used in German-speaking countries.

B. German-language adaptation of the Hospital Anxiety and Depression Scale - HADS-D

The questionnaire is processed independently (approximately 5 minutes) and tracks the most frequently occurring psychological symptoms in the field of somatic medicine: anxiety and depression [4]. This questionnaire serves as a simple screening instrument

for identifying depression, particularly in the case of heart disease. The HADS-D contains 14 items (seven per subscale anxiety or depression, in alternating order) with four-level answer options (0-3). This results in a possible range of values from 0 to 21 for each subscale. Values are considered normal (≤ 7), borderline (8-10), severe symptoms (11-14), and very severe symptoms (15-21). There is an age- and gender reference-value table for patients with cardiac disorders and the general German population [5].

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