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ORIGINAL ARTICLE

The MacNew Questionnaire: A Tool to Predict Unplanned Rehospitalization After Coronary Revascularization

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Abstract

Background: The MacNew questionnaire is a neurobehavioral tool that is easily implementable and immediately usable. This self-reported questionnaire allows physicians to gather helpful information to optimize the patients' therapy and lifestyle.

Objective: In this retrospective study, we aimed to assess whether relatively high scores in the MacNew questionnaire in patients undergoing percutaneous or surgical revascularization would be associated with a decreased risk of unscheduled rehospitalization during follow-up.

Methods: We examined retrospectively the medical charts of 210 patients to gather information using the Italian version of the MacNew questionnaire. This questionnaire is routinely administered during hospitalization in patients recovering from percutaneous or surgical coronary revascularization in our institutions. All patients undergoing this psychological test were followed up for 3 years.

Results: On univariate analysis, increased global score results (above the median obtained in the entire cohort) was associated with a significantly decreased risk of rehospitalization (hazard ratio [HR] 0.0903, 95% confidence interval [95%CI] 0.0324–0.2518, $p < 0.0001$). In a multivariate Cox proportional hazard regression model adjusted for age, gender, and myocardial infarction as triggering event, the association between increased MacNew scores and risk of rehospitalization remained significant (HR 0.0885, 95%CI 0.0317–0.2472, $p < 0.0001$).

Conclusions: A relatively elevated MacNew global score was associated with a significantly decreased risk of unscheduled rehospitalization over 3 years after coronary revascularization. (Int J Cardiovasc Sci. 2016;29(4):303-313)

Keywords: Surveys and Questionnaires; Myocardial Revascularization / psychology; Patient Readmission; Quality of Life.

Introduction

Assessment of quality of life using self-reported questionnaires is a way to evaluate and explore the psychological experience of patients with heart problems. The original version of the MacNew questionnaire[1] is a diagnostic tool comprising multiple-choice questions. Patients are instructed to check only one out of seven possible answers, each marked with a checkbox, and are unable to select more than one answer for each proposed question for computation of the final score. Global and subscale scores are computed by dividing the sum of the scores achieved for each individual item by the number of items listed in the questionnaire.

The MacNew is a good example of a successful interaction between psychologists and cardiologists in building an easy cognitive tool that is immediately usable and able to effectively and quickly investigate the psychological problems of patients with coronary heart disease (CHD).[2] This questionnaire has been successfully applied, especially in the area of cardiac rehabilitation, to assess the psychological aspects underlying the

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psychophysical recovery phase following percutaneous or surgical revascularization in patients with CHD. In a considerable proportion of patients undergoing surgical (coronary artery bypass grafting, CABG) means of or percutaneous revascularization treatment (approximately 17%, according to optimistic estimates),[3] the intervention is unable to help the patient achieve a satisfactory improvement in quality of life. This is because the procedure may be followed by clinically veiled or obvious complications that require the patient to undergo new hospitalization in the short or medium term.

Objective

The purpose of this study was to assess whether relatively high scores on the MacNew questionnaire are associated with a significant decrease in the risk of unplanned hospitalization for cardiovascular causes during a follow-up of 3 years after the revascularization procedure.

Methods

This study consisted of a retrospective analysis of 210 patients who were followed up for 3 years after revascularization (coronary angioplasty with stent or CABG). All patients were evaluated with the MacNew questionnaire following usual psychological and psychosomatic assessments routinely performed at both institutions for cardiovascular rehabilitation involved in the study (EdA and SMdP) in patients recovering from recent percutaneous or surgical coronary revascularization. Additionally, each patient was requested to fill out a declaration of informed consent before administration of the MacNew questionnaire.

The Italian version of the MacNew comprises 27 questions, including seven questions about symptoms, in three subscales that evaluate physical, emotional, and social functions; a global health-related quality of life (HRQL) score is computed from all scored items. The retrospective evaluation was conducted through an analysis of the compiled questionnaires, stored as an attachment in the medical records of the patients who had undergone clinical check-ups (EdA) or planned cardiovascular rehabilitation (SMdP). Permission to retrieve and analyze the patients' records was obtained from the hospital directorates at both institutions (EdA and SMdP) after considering the research purpose specified in the application requesting access to the medical records. Anonymity was strictly maintained for all patients, in line with current rules and regulations concerning privacy preservation. The time frame considered in the research involved the cardiovascular outpatient medical visits (EdA) as well as the planned admissions in a day-hospital regimen for cardiovascular rehabilitation (SMdP) that took place after coronary revascularization procedures during the years 2010 and 2011. The study was also extended to a clinical follow-up with an overall duration of 3 years. Patients' demographics and clinical baseline characteristics were analyzed retrospectively from outpatient clinical folders retrieved from the archives at both centers actively engaged in the patients' post-procedural diagnostic and therapeutic management. Follow-up data of patients readmitted for any cardiac reason were also retrieved from hospital records.

Statistical analysis

All statistical tests were performed with a commercially available statistical analysis program (SPSS 15.0 for Windows, SPSS Inc., Chicago, IL, USA). Categorical variables were compared with the chi-square test, while continuous variables were compared with Student's *t* test.

In order to compare the outcomes according to HRQL status, the MacNew global scores above the median score (50^{th} percentile) were compared with those below the median score (lower quartiles). Specifically, the continuous variable "HRQL score" was converted to a dichotomous variable and the cut-off value chosen for the binary conversion was the median value derived from a sequence of the above-mentioned individual scores calculated for each of the 210 examined patients. Thus, in the univariate and multivariate logistic regression models subsequently built, the dichotomous variable "HRQL score ≤ median value" was entered as an exposure variable, while the outcome variable was "one or more unscheduled hospitalizations during a 3-year follow-up". Statistical results were considered significant when p (two-sided) was < 0.05. Kaplan-Meier curves were constructed to compare low/moderate and high global HRQL scores according to their previously mentioned definitions and by assuming an unscheduled rehospitalization over a follow-up of 3 years as a relevant endpoint.

Results

In the total cohort of 210 patients retrospectively enrolled, the mean MacNew HRQL scores were 4.38 ± 1.56 on the global scale, 4.46 ± 1.1 on the

physical subscale, 4.54 ± 1.1 on the social subscale, and 4.38 ± 1.5 on the emotional subscale. The median time elapsed between the revascularization procedure and the administration of the questionnaire was 55 days (interquartile range 25 to 79 days). As previously stated, for the analysis of rehospitalization, the MacNew global score was dichotomized into a low-score group (*i.e.*, below the median, consisting of the lower quartiles) and a high-score group (*i.e.*, above the median, consisting of the upper quartiles). The median of the MacNew global score was 4.70. Additionally, among the various calculations performed, the following measurements were worthy of reporting: group with MacNew "low" score: median= 3.4 (min / max = 1.18 / 4.70); group with MacNew "high" score: median = 5.55 (min / max = 4.72 / 6.55).

Relationship between HRQL scores and rehospitalization

Kaplan-Meier curves were built to compare the rehospitalization rates between the two groups categorized according to the MacNew median score of the cohort: low/moderate and high (*i.e.*, below and above the median of 4.70, respectively) MacNew global score groups. Similarly, unadjusted and adjusted Cox proportional hazard regression models were built to analyze whether a high MacNew global score inferred by the responses to the questionnaire would be a significant predictor of decreased risk of rehospitalization in patients who had undergone percutaneous or surgical revascularization (see Figure 1).

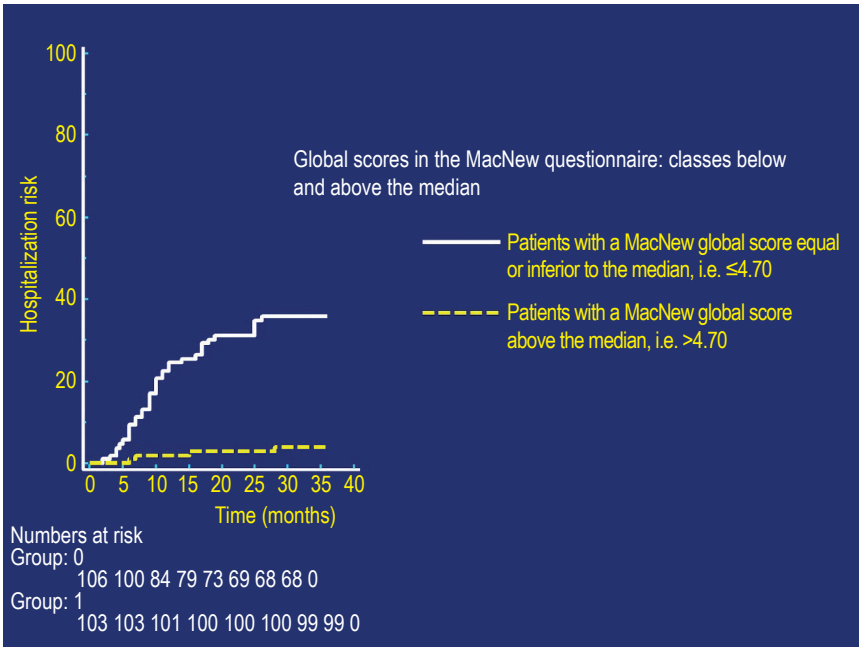

Figure 1
Graph showing the probabilities of one or more unscheduled hospitalization in patients with a MacNew global score equal to or below (continuous white line) or above (dashed yellow line) the median of the entire cohort. All patients had undergone a revascularization procedure. The median time between the revascularization and the administration of the questionnaire was 55 days (interquartile range 25 to 79 days). A higher (above the median) MacNew global score was associated with a significantly decreased risk of new unplanned hospitalizations over a follow-up of 36 months.
P (log-rank test) < 0.0001.

On univariate analysis, a high value (*i.e.*, above the median MacNew score of the entire cohort) on the global score was significantly associated with a decreased risk of rehospitalization (hazard ratio [HR] 0.4312, 95% confidence interval [95%CI] 0.3463 to 0.5370, p < 0.0001) (Table 1). In a multivariate Cox proportional hazard regression model adjusted for age, gender, and myocardial infarction (MI) as the triggering event, the protection exerted by a high MacNew score against the risk of rehospitalization remained significant (HR 0.0885, 95%CI 0.0317 to 0.2472, p < 0.0001) (Table 2).

Table 1
Univariate Cox proportional hazard regression analysis showing a significantly decreased risk of hospitalization with an increase in the MacNew global score, *i.e.*, a relatively high MacNew global score was associated with a reduced risk of rehospitalization (protective association)

Survival time	Follow-up (months)	
Endpoint	Hospitalization	
Cases summary		
Number of events	42	20.10%
Number censored	167	79.90%
Total number of cases	209	100.00%
Significance level	**p < 0.0001**	

Coefficients and standard errors

Covariate	b	SE	*p*	Exp(b)	95%CI of Exp(b)
Global score	-0.8411	0.1125	**< 0. 0001**	0.4312	0.3463 to 0.5370

Exp(b): hazard ratio; CI: confidence interval

Table 2
Multivariate Cox proportional hazard regression analysis. After adjustment for age, gender and myocardial infarction as triggering event, a significant (p < 0.0001) protection exerted by a relatively high (above the median) MacNew score against the risk of hospitalizations is clearly noticeable (hazard ratio 0.0885, 95% confidence interval 0.0317 to 0.2472, p < 0.0001)

Survival time	Follow-up (months)	
Endpoint	Hospitalization	
Cases summary		
Number of events	42	20.10%
Number censored	167	79.90%
Total number of cases	209	100.00%
Significance level	**p < 0.0001**	

Coefficients and standard errors

Covariate	b	SE	*p*	Exp(b)	95%CI of Exp(b)
Global score classes above (1) and below (0) the median	-2.4248	0.5267	**< 0.0001**	0.0885	0.0317 to 0.2472
Age	-0.0007066	0.02654	0.9788	0.9993	0.9489 to 1.0524
History of acute myocardial infarction	-0.4993	0.3169	0.1151	0.6069	0.3272 to 1.1259
Male sex	-0.03240	0.3107	0.9169	0.9681	0.5282 to 1.7744

Exp (b): hazard ratio; CI: confidence interval

Discussion

The MacNew questionnaire has been proposed by some scholars as a routine investigative tool to reduce unplanned hospitalization in patients undergoing surgical or percutaneous revascularization procedures.[3] In our study, patients with low scores on the questionnaire were considered more likely to undergo unplanned hospitalization. Clinicians should then take all precautions to avoid rehospitalization, such as critically reviewing and reconsidering medication dosage or changing the type of medication that had been originally prescribed. In these cases, a low MacNew global score would serve as a wake-up call to direct the physician's attention to a possibility of concealed complications related or not to the procedure, or greater disease severity.[4] In 2007, Pedersen et al.[5] showed that a low MacNew global HRQL score was associated with an increased risk of major adverse cardiovascular events (MACE), defined by the occurrence of death, nonfatal MI, CABG or repeat percutaneous coronary intervention (PCI), or by a composite of death / nonfatal MI within the first 6 months from a revascularization procedure. Patient-reported HRQL in patients with CHD is underused in clinical practice, even though limited evidence suggests that HRQL is a strong and independent predictor of various health outcomes, including rehospitalization.[6,7] In fact, Deaton et al.[4] showed in 1998 a trend toward rehospitalization 3 months after CABG in patients with low HRQL. In that same year (1998), Lim et al.[6] showed that poor HRQL evaluated with the MacNew questionnaire 6 months after the index event reliably predicted the occurrence of rehospitalization and mortality as a composite outcome within 18 months from the HRQL evaluation. In 2010, Schenkeveld et al.[8] demonstrated that poor scores in the SF-36 health status domains measured with the SF-36 1 year after PCI with drug-eluting stents and independent of demographic and clinical characteristics (except for the emotional domain) were a reliable predictor of increased risk of death at 6 years.

However, rehospitalization, a major cause of health care costs,[9] was not taken into account as an outcome in these studies. So, in the present report, we directed our observations toward HRQL as a marker of unplanned rehospitalization in patients who had already undergone a revascularization procedure consisting of either PCI or CABG. Thus, considering the results of this study and others in the literature, the choice of assessing HRQL in routine clinical practice seems very opportune in improving the understanding of the outcomes in patients with cardiovascular disease, including the prediction of recurrent events after revascularization. Disease-specific HRQL questionnaires, like the MacNew, may potentially serve as a predictor and stratifying variable, and an efficacy outcome in patients with CHD undergoing coronary revascularization.

Study limitations

The outcome data were adjusted only for age, gender, and MI as the triggering event, without taking into account other potentially meaningful clinical covariables, such as angina, diabetes mellitus, low exercise capacity, or psychological disorders. While we only assessed the baseline HRQL in this study, HRQL measurements over time may be a better predictor of adverse outcomes after a revascularization procedure.[10]

Conclusions

A relatively elevated MacNew global score was associated with a significantly decreased risk of new unscheduled hospitalizations after percutaneous or surgical coronary revascularization over a follow-up period of 3 years. Therefore, assessment of a patient's HRQL with the 27-item MacNew questionnaire may be a useful tool to help physicians in the decision-making process and enabling a more thoughtful selection of the treatment options suitable to optimize the management of individual patients recovering from CABG or PCI. However, the routine use of the MacNew questionnaire to evaluate HRQL requires improved implementation in clinical practice. This appears to be a desirable goal, considering potentially favorable repercussions of this evaluation on cost-effectiveness. Our analysis demonstrates the possibility to predict the phases of clinical destabilization using the MacNew questionnaire, thereby, allowing timely selection of more appropriate drug regimens for patients with CHD undergoing coronary intervention, in order to prevent unscheduled rehospitalization leading to additional costs to the health care system.

Author contributions

Conception and design of the research: De Vecchis R and Ariano C. Acquisition of data: De Vecchis R and Ariano C. Analysis and interpretation of the data: De Vecchis R. Statistical analysis: De Vecchis R. Writing of the manuscript: De Vecchis R and Ariano C. Critical revision

of the manuscript for intellectual content: De Vecchis R and Ariano C.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Sources of Funding

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Study Association

This study is not associated with any thesis or dissertation work.

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Supplementary material: a copy of the MacNew questionnaire

Health-related quality of life instrument

We would now like to ask you some questions about how you have been feeling during the last 2 weeks. Please check the box that matches your answer.

1. In general, how much of the time during the last 2 weeks have you felt frustrated, impatient or angry?

- ☐ All off the time
- ☐ Most of the time
- ☐ A good bit of the time
- ☐ Some of the time
- ☐ A little of the time
- ☐ Hardly any of the time
- ☐ None of the time

2. How often during the last 2 weeks have you felt worthless or inadequate?

- ☐ All off the time
- ☐ Most of the time
- ☐ A good bit of the time
- ☐ Some of the time
- ☐ A little of the time
- ☐ Hardly any of the time
- ☐ None of the time

3. In the last 2 weeks, how much of the time did you feel very confident and sure that you could deal with your heart problem?

- ☐ None of the time
- ☐ A little of the time
- ☐ Some of the time
- ☐ A good bit of the time
- ☐ A most of the time
- ☐ Almost all of the time
- ☐ All of the time

4. In general how much of the time did you feel discouraged or down in the dumps during the last 2 weeks?

- ☐ All off the time
- ☐ Most of the time
- ☐ A good bit of the time
- ☐ Some of the time
- ☐ A little of the time
- ☐ Hardly any of the time
- ☐ None of the time

5. How much of the time during the past 2 weeks did you feel relaxed and free of tension?

- ☐ None of the time
- ☐ A little of the time
- ☐ Some of the time
- ☐ A good bit of the time
- ☐ A most of the time
- ☐ Almost all of the time
- ☐ All of the time

6. How often during the last 2 weeks have you felt worn out or low in energy?

- ☐ All off the time
- ☐ Most of the time
- ☐ A good bit of the time
- ☐ Some of the time
- ☐ A little of the time
- ☐ Hardly any of the time
- ☐ None of the time

7. How happy, satisfied, or pleased have you been with your personal life during the last 2 weeks?

- ☐ Very dissatisfied, unhappy most of the time
- ☐ Generally dissatisfied, unhappy
- ☐ Somewhat dissatisfied, unhappy
- ☐ Generally satisfied, pleased
- ☐ Happy most of the time
- ☐ Very happy most of the time
- ☐ Extremely happy, could not have been more satisfied or pleased

8. In general, how often during the last 2 weeks have you felt restless, or as if you were having difficulty trying to calm down?

- ☐ All off the time
- ☐ Most of the time
- ☐ A good bit of the time
- ☐ Some of the time
- ☐ A little of the time
- ☐ Hardly any of the time
- ☐ None of the time

9. How much shortness of breath have you experienced during the last 2 weeks while doing your day-to-day physical activities?

- ☐ Extreme shortness of breath
- ☐ Very short of breath
- ☐ Quite a bit of shortness of breath
- ☐ Moderate shortness of breath
- ☐ Some shortness of breath
- ☐ A little shortness of breath
- ☐ No shortness of breath

10. How often during the last 2 weeks have you felt tearful or like crying?

- ☐ All off the time
- ☐ Most of the time
- ☐ A good bit of the time
- ☐ Some of the time
- ☐ A little of the time
- ☐ Hardly any of the time
- ☐ None of the time

11. How often during the last 2 weeks have you felt as if you are more dependent than you were before your heart problem?

- ☐ All off the time
- ☐ Most of the time
- ☐ A good bit of the time
- ☐ Some of the time
- ☐ A little of the time
- ☐ Hardly any of the time
- ☐ None of the time

12. How often during the last 2 weeks have you felt that you were unable to do your usual social activities or social activities with your family?

- ☐ All off the time
- ☐ Most of the time
- ☐ A good bit of the time
- ☐ Some of the time
- ☐ A little of the time
- ☐ Hardly any of the time
- ☐ None of the time

13. How often during the last 2 weeks have you felt as if others no longer have the same confidence in you as they did before your heart problem?

- ☐ All off the time
- ☐ Most of the time
- ☐ A good bit of the time
- ☐ Some of the time
- ☐ A little of the time
- ☐ Hardly any of the time
- ☐ None of the time

14. How often during the last 2 weeks have you experienced chest pain while doing your day-to-day activities?

- ☐ All off the time
- ☐ Most of the time
- ☐ A good bit of the time
- ☐ Some of the time
- ☐ A little of the time
- ☐ Hardly any of the time
- ☐ None of the time

15. How often during the last 2 weeks have you felt unsure of yourself or lacking in self-confidence?

- ☐ All off the time
- ☐ Most of the time
- ☐ A good bit of the time
- ☐ Some of the time
- ☐ A little of the time
- ☐ Hardly any of the time
- ☐ None of the time

16. How often during the last 2 weeks have you been bothered by aching or tired legs?

- ☐ All off the time
- ☐ Most of the time
- ☐ A good bit of the time
- ☐ Some of the time
- ☐ A little of the time
- ☐ Hardly any of the time
- ☐ None of the time

17. During the last 2 weeks, how much have you been limited in doing sports or exercise as a result of your heart problem?

- ☐ Extremely limited
- ☐ Very limited
- ☐ Limited quite a bit
- ☐ Moderately limited
- ☐ Somewhat limited
- ☐ Limited a little
- ☐ Not limited at all

18. How often during the last 2 weeks have you felt apprehensive or frightened?

- ☐ All off the time
- ☐ Most of the time
- ☐ A good bit of the time
- ☐ Some of the time
- ☐ A little of the time
- ☐ Hardly any of the time
- ☐ None of the time

19. How often during the last 2 weeks have you felt dizzy or lightheaded?

- ☐ All off the time
- ☐ Most of the time
- ☐ A good bit of the time
- ☐ Some of the time
- ☐ A little of the time
- ☐ Hardly any of the time
- ☐ None of the time

20. In general, during the last 2 weeks how much have you been restricted or limited as a result of your heart problem?

- ☐ Extremely limited
- ☐ Very limited
- ☐ Limited quite a bit
- ☐ Moderately limited
- ☐ Somewhat limited
- ☐ Limited a little
- ☐ Not limited at all

21. How often during the last 2 weeks have you felt unsure as to how much exercise or physical activity you should be doing?

- ☐ All off the time
- ☐ Most of the time
- ☐ A good bit of the time
- ☐ Some of the time
- ☐ A little of the time
- ☐ Hardly any of the time
- ☐ None of the time

22. How often during the last 2 weeks have you felt as if your family is being over-protective toward you?

- ☐ All off the time
- ☐ Most of the time
- ☐ A good bit of the time
- ☐ Some of the time
- ☐ A little of the time
- ☐ Hardly any of the time
- ☐ None of the time

23. How often during the past 2 weeks have you felt as if you were a burden to others?

- ☐ All off the time
- ☐ Most of the time
- ☐ A good bit of the time
- ☐ Some of the time
- ☐ A little of the time
- ☐ Hardly any of the time
- ☐ None of the time

24. How often during the past 2 weeks have you felt excluded from doing things with other people because of your heart problem?

- ☐ All off the time
- ☐ Most of the time
- ☐ A good bit of the time
- ☐ Some of the time
- ☐ A little of the time
- ☐ Hardly any of the time
- ☐ None of the time

25. How often during the past 2 weeks have you felt unable to socialize because of your heart problem?

- ☐ All off the time
- ☐ Most of the time
- ☐ A good bit of the time
- ☐ Some of the time
- ☐ A little of the time
- ☐ Hardly any of the time
- ☐ None of the time

26. In general, during the last 2 weeks how much have you been physically restricted or limited as a result of your heart problem?

- ☐ Extremely limited
- ☐ Very limited
- ☐ Limited quite a bit
- ☐ Moderately limited
- ☐ Somewhat limited
- ☐ Limited a little
- ☐ Not limited at all

27. How often during the last 2 weeks have you felt your heart problem limited or interfered with sexual intercourse?

- ☐ All off the time
- ☐ Most of the time
- ☐ A good bit of the time
- ☐ Some of the time
- ☐ A little of the time
- ☐ Hardly any of the time
- ☐ None of the time
- ☐ Not applicable