Computerized decision support to improve guideline implementation in cardiac rehabilitation: the CARDSS project

Goud, R.

Citation for published version (APA):
Goud, R. (2009). Computerized decision support to improve guideline implementation in cardiac rehabilitation: the CARDSS project
Chapter 7

Inter-practice variation in assessed patient needs for cardiac rehabilitation

Submitted for publication

Niels Peek
Rick Goud
Mariette van Engen-Verheul
Arie Hasman
Irene Hellemans
Nicolette de Keizer
Abstract

Objective: To determine inter-practice variation in assessed patient needs for cardiac rehabilitation, and identify the influence of different measurement instruments on assessed needs.

Methods: A prospective cohort study was conducted in 16 Dutch cardiac rehabilitation outpatient clinics from November 1, 2005 to October 31, 2006. Participating clinics assessed each patient's rehabilitation needs, based on exercise capacity, psychosocial status, marital status, employment status, and lifestyle parameters. Intra-cluster correlation coefficients (ICCs) were calculated for all rehabilitation needs and lifestyle parameters, before and after adjusting for patient case mix, and stratified by assessment method.

Results: High ICCs were found for insufficient exercise capacity (0.301 ± 0.085), unrealistic subjective exercise capacity (0.165 ± 0.046), and social problems (0.188 ± 0.037); moderate ICCs were found for psychological problems (0.096 ± 0.027), absence of partner (0.052 ± 0.017), unhealthy eating habits (0.080 ± 0.026), and inactive lifestyle (0.059 ± 0.015); ICCs were low for expected work problems (0.010 ± 0.006) and smoking status (0.000 ± 0.001). Adjustments for case mix hardly influenced ICCs, but stratification by assessment method revealed large differences between results from clinical interviews and measurement instruments (bicycle ergometry or incremental Shuttle walk, MacNew quality of life questionnaire).

Conclusion: The assessments of cardiac rehabilitation needs are subject to moderate to high inter-practice variation, especially when they are solely based on clinical judgment. In addition, the numbers of patients judged to have rehabilitation needs are smaller in that case.
Introduction

Despite the evidence base for the effectiveness and cost-effectiveness of cardiac rehabilitation [1-4], the provision of cardiac rehabilitation services still vary widely across and within many Western countries. Estimates indicate that the majority (around 70%) of the patients eligible for cardiac rehabilitation do not receive it [5;6] and that access to cardiac rehabilitation varies geographically and between diagnosis groups [7;8]. Some clinics only provide exercise-based therapy, while others also treat emotional and psychosocial problems, and address secondary cardiovascular prevention by behaviour and lifestyle modification guidance [9;10].

One source of variation in rehabilitation therapies offered to cardiac patients is inconsistency in assessments of patient-specific rehabilitation needs by different care providers. Clinical guidelines emphasise the need to move away from a one-size-fits-all programme to personalised programmes that fit to needs of individual patients [11-13]. To determine these needs, it is important to conduct a structured needs assessment procedure with every patient before enrolment in the cardiac rehabilitation programme. Many countries have developed guidelines for the assessment of rehabilitation needs [11-16], generally recommending to assess the patient's medical history, physical condition, psychosocial condition, and relevant lifestyle parameters (smoking habits, nutritional habits, and physical activity). Most of these items can be assessed during a clinical interview with the patient or with measurement instruments such as maximal exercise tests and questionnaires. To date, however, little is known about the consistency of needs assessment procedures, and whether clinical interviews and measurement instruments lead to similar results.

The aim of the current study was to determine the variation in assessed cardiac rehabilitation needs between different care providers in the Netherlands, and to identify the influence of different measurement instruments on averages and variation in assessed needs.

Methods

Data

A prospective cohort study was conducted in 16 Dutch cardiac rehabilitation outpatient clinics (two specialized rehabilitation clinics, one university hospital outpatient clinic, and thirteen non-university hospital outpatient clinics) from November 1, 2005 to October 31, 2006. Multidisciplinary teams in all these clinics recorded their patient data in the CARDSS patient information management system [17]. This system assists professionals in conducting the needs assessment
procedure for cardiac rehabilitation according to the Dutch guidelines [13] (see Appendix). Data quality was verified in a data audit that was conducted as a part of another recent study [18].

Data from all patients who started cardiac rehabilitation during the study period in one of the participating clinics were collected during the needs assessment procedure described in the guidelines [13]. The collected data included patient demographics (age and sex), reason for referral to cardiac rehabilitation (e.g. myocardial infarction, CABG, angina pectoris), objective exercise capacity, subjective (i.e., self-perceived) exercise capacity, psychosocial status, marital status, employment status and three lifestyle parameters (smoking status, eating habits, physical activity). As described in the guidelines, all data items could be collected through a clinical interview, but the objective exercise capacity could also be assessed with bicycle ergometry or the incremental Shuttle walk test [19], and subjective exercise capacity and psychosocial status could also be assessed with the Dutch translation of the MacNew health-related quality of life questionnaire [20;21]. Although the guidelines advise to employ these measurement instruments in the assessment of rehabilitation needs, this is not compelling. Furthermore, while the guidelines provide thresholds for interpreting MacNew scores, interpretation of the results of exercise testing is left to the rehabilitation professional. In some clinics the assessment of all rehabilitation needs was conducted by a single professional (e.g. a specialized nurse) while in other clinics the needs associated with different clinical domains were assessed by professionals from different disciplines.

**Outcome variables**

Outcome variables were nine dichotomous variables describing the rehabilitation needs of patients, as assessed by cardiac rehabilitation professionals during the multidisciplinary needs assessment procedure: insufficient objective exercise capacity, unrealistic subjective exercise capacity, psychological problems, social problems, absence of partner, expected problems at work, smoking, unhealthy eating habits, inactive lifestyle.

**Statistical analysis**

Intra-cluster correlation coefficients (ICCs) [22;23] were used to describe inter-practice variation in assessed rehabilitation needs. ICC values express the proportion of population-level variation in outcomes that is explained by variation in assessments between clinics, and range from zero (no inter-practice variation, high inter-practice reliability) to one (high inter-practice variation, poor inter-practice reliability).
For each of the nine outcome variables, ICCs were calculated before and after adjusting for variations in case mix (demography and reason for referral) between clinics, and before and after stratification by assessment method (bicycle ergometry vs. clinical interview for assessment of exercise capacity; MacNew quality of life questionnaire vs. clinical interview for assessment of subjective exercise capacity, psychological problems, and social problems). When a clinic had used an assessment instrument for less than 20 patients, the data of those patients were considered to be not representative and excluded from the stratified analysis. Stratification was not applied to the five other outcome variables because these were all assessed during clinical interviews.

Adjustments for case mix factors [24] was performed by multivariate logistic regression analyses, using natural splines for the continuous covariate (age) to account for nonlinear effects. All ICCs were estimated using generalized estimation equations with exchangeable correlation structure [25] and tested for deviation from zero. To correct for multiple testing, only p-values smaller than 0.01 were considered significant. In addition to analyzing variation, it was analyzed whether there were differences in average proportions in the results obtained with different instruments, for insufficient exercise capacity, unrealistic subjective exercise capacity, psychological problems, and social problems. The statistical analyses were performed with SPLUS version 6.2 (Insightful Corp, Seattle, WA, USA).

**Results**

Data from 4157 patients were collected. The median number of patients per centre was 221 (inter-quartile range 166 to 318). Table 1 shows baseline characteristics of the study population regarding demography, reasons for referral to cardiac rehabilitation, use of measurement instruments, and results of these measurements. Five clinics used the bicycle ergometry test for more than 20 patients, and only one clinic used the incremental Shuttle walk test for more than 20 patients. Therefore no distinction was made between bicycle ergometry and Shuttle walk test in the stratified analyses. Fourteen clinics used the MacNew quality of life questionnaire for more than 20 patients.

Table 2 displays the outcomes of the needs assessment procedures, averaged at the level of the study population and at the level of individual clinics. For all outcome variables except expected work problems and smoking status, there was significant variation in the clinics means. The largest variation was found in the percentages of patients judged to have an insufficient exercise capacity.
Chapter 7. Variation in assessed patient needs for cardiac rehabilitation

Table 1. Baseline characteristics of study population (n=4157)

<table>
<thead>
<tr>
<th>Demography</th>
<th>Age (mean ± sd)</th>
<th>Male gender (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>61.3 ± 11.4</td>
<td>74.4% (3092)</td>
</tr>
</tbody>
</table>

Reason for referral to cardiac rehabilitation

<table>
<thead>
<tr>
<th>Reason</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myocardial Infarction * (#)</td>
<td>42.4% (1764)</td>
</tr>
<tr>
<td>Coronary artery bypass graft (#)</td>
<td>28.7% (1192)</td>
</tr>
<tr>
<td>Angina Pectoris * (#)</td>
<td>13.7% (570)</td>
</tr>
<tr>
<td>Cardiac valve operation (#)</td>
<td>7.8% (324)</td>
</tr>
<tr>
<td>Implantable Cardioverter Defibrillator (#)</td>
<td>2.5% (102)</td>
</tr>
<tr>
<td>Heart failure (#)</td>
<td>2.1% (88)</td>
</tr>
<tr>
<td>Other (#)</td>
<td>3.0% (125)</td>
</tr>
</tbody>
</table>

Use of assessment instruments

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicycle ergometry (10 clinics)</td>
<td>19.7% (818)</td>
</tr>
<tr>
<td>Shuttle walk test (3 clinics)</td>
<td>20.3% (842)</td>
</tr>
<tr>
<td>MacNew questionnaire (15 clinics)</td>
<td>77.1% (3203)</td>
</tr>
</tbody>
</table>

Results of assessment instruments

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicycle ergometry result, METs (mean ± sd, n=818)</td>
<td>5.66 ± 1.53</td>
</tr>
<tr>
<td>Shuttle walk test result, METs (mean ± sd, n=842)</td>
<td>5.71 ± 1.59</td>
</tr>
<tr>
<td>MacNew, physical domain score (mean ± sd, n=3203)</td>
<td>4.80 ± 1.14</td>
</tr>
<tr>
<td>MacNew, emotional domain score (mean ± sd, n=3203)</td>
<td>5.03 ± 1.13</td>
</tr>
<tr>
<td>MacNew, social domain score (mean ± sd, n=3203)</td>
<td>5.38 ± 1.08</td>
</tr>
<tr>
<td>MacNew, total score (mean ± sd, n=3203)</td>
<td>5.08 ± 1.00</td>
</tr>
</tbody>
</table>

MET: metabolic equivalent

* these categories include both patients that did and did not receive angioplasty

Table 2. Outcomes of needs assessment procedures, described at study population level and clinic levels, and intra-cluster correlation coefficients (n=4157, 16 clinics).

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Population mean</th>
<th>Clinic mean, median [IQR]</th>
<th>ICC, mean ± sd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insufficient exercise capacity (#)</td>
<td>78.8% (3275)</td>
<td>84.2% [54.5%-89.8%]</td>
<td>0.301 ± 0.085 (*)</td>
</tr>
<tr>
<td>Unrealistic subjective capacity (#)</td>
<td>53.5% (2223)</td>
<td>53.8% [37.7%-63.9%]</td>
<td>0.165 ± 0.046 (*)</td>
</tr>
<tr>
<td>Psychological problems (#)</td>
<td>47.4% (1972)</td>
<td>52.2% [37.6%-50.0%]</td>
<td>0.096 ± 0.027 (*)</td>
</tr>
<tr>
<td>Social problems (#)</td>
<td>49.2% (2045)</td>
<td>54.7% [31.1%-60.9%]</td>
<td>0.188 ± 0.037 (*)</td>
</tr>
<tr>
<td>Absence of partner (#)</td>
<td>7.8% (323)</td>
<td>8.9% [7.1%-13.0%]</td>
<td>0.052 ± 0.017 (*)</td>
</tr>
<tr>
<td>Expected work problems (#)</td>
<td>7.5% (311)</td>
<td>7.4% [5.5%-9.9%]</td>
<td>0.010 ± 0.006</td>
</tr>
<tr>
<td>Smoker (#)</td>
<td>32.9% (1364)</td>
<td>32.1% [30.7%-34.3%]</td>
<td>0.000 ± 0.001</td>
</tr>
<tr>
<td>Unhealthy eating habits (#)</td>
<td>27.2% (1128)</td>
<td>27.9% [19.1%-35.2%]</td>
<td>0.080 ± 0.026 (*)</td>
</tr>
<tr>
<td>Inactive lifestyle (#)</td>
<td>57.9% (2399)</td>
<td>59.0% [45.5%-64.4%]</td>
<td>0.059 ± 0.015 (*)</td>
</tr>
</tbody>
</table>

IQR: Inter-quartile range

ICC: Intra-cluster correlation coefficient

* significant at the 0.01 level
Table 3 displays the outcomes of the needs assessment procedures after adjustment for variation in patient case mix between clinics, and, where possible, stratified by assessment method. A large variation in clinic means remained to exist for most outcome variables after adjusting for variation in patient case mix between clinics, and the adjusted ICCs are close to the unadjusted ICCs from Table 2. The assessment of patients’ exercise capacities by clinical interview led to a lower percentage of patients being judged as having an insufficiency than when bicycle ergometry or incremental Shuttle walk test was used (73.4% vs. 84.1%, p<0.01). In either case,
however, substantial variation remained between clinic means. In the evaluation of patients’ subjective exercise capacity, the difference was even larger. Here, clinical interviews led to 32.8% of the patient being judged as having an unrealistic subjective exercise capacity, whereas use of the physical domain of the MacNew questionnaire resulted in 62.3% of the patients being judged as such (p<0.01). The variation in clinic means is somewhat smaller when the MacNew is employed. Also for psychological and social problems, use of the MacNew leads to significantly higher percentages of patients that are assessed to have problems. For these two outcomes, both the clinical interview and usage of the MacNew lead to consistent (though different) results, with ICCs close to zero. The variation in assessed rehabilitation needs with respect to exercise capacity, subjective exercise capacity, and psychological and social problems is graphically depicted in Figure 1.

Figure 1. Variation in four assessed rehabilitation needs, adjusted by patient case mix and stratified by the assessment method used. Each box shows median value (line inside box), interquartile range (box edges), extreme values (whiskers), and outliers (horizontal lines).
For the remaining outcomes of the needs assessment procedure, inter-practice variations were low (smoking, expected work problems) to moderate (absence of partner, inactive lifestyle, unhealthy eating habits). The effects of variations in patient case mix were negligible.

**Discussion**

Our study shows that assessments of cardiac rehabilitation needs, in particular those pertaining to objective and subjective exercise capacities, psychosocial status, and eating habits, are subject to moderate to high inter-practice variation. This is especially true when the assessments are solely based on clinical judgment instead of clinical assessment instruments. Furthermore, the numbers of patients judged to have rehabilitation needs are smaller in that case.

A remarkable variation was seen in the assessments of reduced objective exercise capacity, even when bicycle ergometry or incremental Shuttle walk test was used. The explanation is probably that the guidelines do not provide thresholds for interpreting the test results: they should be interpreted "by considering the patient's required level of physical activity in daily life". Patients who performed bicycle ergometry and were judged to be deficient had a mean capacity of $5.43 \pm 1.44$ metabolic equivalents (METs) [19], while patients who were judged not to have a deficiency had a mean capacity of $6.32 \pm 1.58$ METs. Although this difference is statistically significant (Student's t test, $p<0.01$), it is small and there is considerable overlap in objective capacities of the two groups. It seems that the guidelines leave considerable room for subjectivity here.

The strengths of this study are that all participating clinics agreed to work according to Dutch national guidelines for cardiac rehabilitation [13] and that all clinics used the same electronic information system [17] to record their data. We can therefore assume that there was a broad consensus about appropriate care and that little variation was caused by differences in information registration. Furthermore, most studies on medical practice variation are based on surveys and therefore express the views of professionals on given care. Our results are based on patient data from the participating clinics and thus reflect the care that was actually given to patients. An additional advantage of using patient-level data is that we were able to adjust the results for variations in case mix.

Because there was no golden standard for rehabilitation needs, we do not know whether clinical interviews lead to underestimates of rehabilitation needs or measurements with the MacNew questionnaire lead to overestimates of these needs. But several studies have shown that the MacNew is a valid and reliable psychometric
instrument for cardiac patients [21;26;27], and therefore it seems probable that the clinical interview is deficient. Besides from these considerations, inter-practice variation, which was higher in the interview-only group, is a sign of suboptimal quality in itself. A system that produces variation cannot consistently deliver high-quality care.

Participation in our study was voluntarily but required that the CARDSS information system was used during the assessment of rehabilitation needs [17]. As information systems induce a ‘checklist’ effect [28] and tend to standardize clinical practice, the actual practice variation between cardiac rehabilitation clinics in the Netherlands is probably larger than was observed in our study.

Another limitation of the study is that information on patient case mix was limited to age, sex, and reason for referral to cardiac rehabilitation. Other factors, such as medical history, disease severity, and comorbidities may also have influenced the assessment of rehabilitation needs, and may explain some of the variance in assessed needs between clinics. Since however the adjustments for age, sex and reason for referral hardly influenced the observed variation, it is unlikely that additional factors would play an important role. Similarly, data on patient preferences and availability of facilities was not available for analysis. These are known sources of non-compliance to guidelines [29] and may have influenced the assessed rehabilitation needs.

Our study took place in standard, uncontrolled care and therefore the choice between clinical interviews and measurement instruments was not randomly allocated over patients. It is possible that rehabilitation professionals based their choice between the two assessment methods on characteristics of the patients involved. However, many of the participating clinics were consistent in their choice of assessment method. Based on this observation, we believe that our results are probably not confounded by unmeasured factors.

Ideally, patients with similar characteristics are provided with similar care irrespective of the healthcare provider they visit, but many forms of variation in medical practice have been reported over the last decades [30-32]. One major source of practice variation is the assessment of patients’ conditions and needs. In the cardiological field, local testing intensity has been shown to be an important determinant of the variable use of invasive cardiac procedures [33-35]. Our study is the first investigation of variation in assessed rehabilitation needs for cardiac patients. Clinical guidelines for cardiac rehabilitation emphasise the importance of assessing these needs, but few provide handles to do so. The guidelines of the American Heart Association [11] suggest to use symptom limited exercise testing to measure exercise capacity, but do not name specific instruments and provide no measurement instructions for any of the other domains. The British guidelines [12] advise to use the
Hospital Anxiety and Depression Scale [36] for assessing psychosocial status, but are silent about measurements in other domains. We did not find guidelines that provide instruments for assessing lifestyle parameters [11-16].

From the results of our study, we recommend that guidelines for cardiac rehabilitation provide well-defined and unambiguous procedures for assessing the rehabilitation needs of patients. Preferably, the needs are assessed by measuring various aspects of patients’ medical, physical, and psychosocial condition with valid and reliable instruments, and indicative thresholds for interpreting the results are provided by the guidelines. Assessing the needs solely by clinical judgment should be avoided. Reliable and practical instruments should be developed for the assessment of cardiac patients’ lifestyle parameters.

References

Chapter 7. Variation in assessed patient needs for cardiac rehabilitation


Appendix: The Dutch guidelines for cardiac rehabilitation

To improve the quality and consistency of cardiac rehabilitation services in the Netherlands new national guidelines for cardiac rehabilitation were released in 2004. Consistent with international guidelines, the Dutch guidelines for cardiac rehabilitation state that cardiac patients should be offered an individualized rehabilitation programme that fits to their specific needs. To this end, the guidelines describe a needs assessment and therapy indication procedure during which the patient’s exercise capacity, subjective exercise capacity, psychological condition, social condition, smoking habits, eating habits, and level of physical activity is assessed. This needs assessment procedure is generally conducted by a specialized nurse and sometimes by a physical therapist or social worker about two weeks after discharge from the hospital.

The guidelines state that all needs assessment domains can be assessed during a clinical interview with the patient, but advise the use of measurement instruments for some domains. To determine a patient’s exercise capacity the guidelines recommend using an exercise test, such as bicycle ergometry or an incremental shuttle walk test. To assess the patient’s subjective exercise capacity, psychological condition and social condition the guidelines recommend using the MacNew quality of life questionnaire which is an internationally used and validated questionnaire. The Dutch validated version of the MacNew is comparable to the English version and consists of 24 items related to three domains of health related quality of life (HRQL), namely physical (11 items), emotional (10 items) and social HRQL (7 items). Each of the items is rated on a 7-point Likert scale, where ‘1’ indicates poor and ‘7’ indicates good HRQL. Scores are calculated by averaging the responses to the items of each domain, while averaging all items provides a global score. According to the guidelines, patients have a realistic subjective exercise capacity if they have a sufficient exercise capacity and a score on the physical domain of the MacNew higher than or equal to 4.0, or an insufficient exercise capacity and a score on the physical domain of the MacNew lower than 4.0. The Dutch guidelines consider scores below 5.4 and 5.9, respectively, on the emotional and social domains of the MacNew reasons for enrolment in psychosocial counselling. The guidelines recommend no specific measurement instruments to assess lifestyle factors (smoking habits, eating habits, physical activity).