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This thesis reports on the evaluation of the effect of implementing a coronary artery bypass graft (CABG) clinical pathway (CP) on various patients’ outcomes, including length of stay (LOS), readmission, complications, health-related quality of life (HRQoL) and psychological distress (PD). This study also reports on the role played by the EuroSCORE in discriminating between low, medium and high risk patients in relation to physical functioning, LOS, and number of complications. In addition, we present in this study the predictors of deterioration in HRQoL after CBAG and the role played by Type D personality and the mediating effect of change in anxiety and depression, leading to a deterioration in HRQoL. Finally, this study depicts the impact of positive affectivity and age on cardiac-related health complaints in CABG surgery patients.

Chapter 1 is a general introduction, presenting an overview of the current study which reports on the aspects that affect the outcome of CABG, particularly those patients undergoing care in a CP. The outcomes investigated are LOS, readmission and complications and outcomes that were rarely examined, when evaluating the effects of CABG pathways, like HRQoL and PD, i.e. anxiety and depression. In Chapter 1, the central concepts of this study are introduced based on a conceptual model of Wilson and Cleary, 1995, and the modifications of Spertus et al., 2002 and Rumsfeld, 2002. Within the framework of this study the model depicts the factors that affect the outcome of CABG, namely HRQoL and Cardiac health complaints. These factors were identified as individual and demographic characteristics, personality traits, psychological status, positive affectivity, clinical variable and environmental factors, i.e. care in a pathway program.

Over the last few decades, HRQoL has become increasingly important in evaluating healthcare outcomes. This thesis had therefore the following objectives:

- To perform a systematic review in order to analyze the main effects of implementation of clinical pathways and to evaluate the validity of study outcomes of published papers that report effects of CPs.
- To determine the difference between CP and conventional care in terms of patient related outcome, as well as to determine the relative contribution of CP towards an improved HRQoL and psychological distress after CABG.
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- To determine whether the EuroSCORE is associated with patients’ outcomes before and six months after CABG and whether EuroSCORE is a predictor of HRQoL six months after CABG.
- To identify predictors of deterioration in HRQoL six months following CABG and to test a hypothesized model of the determinants of no change/deterioration in HRQoL using structural equation modeling.
- To examine the impact of positive affectivity on cardiac related health complaints in CABG surgery patients.

Chapter 2 reported on the validity of study outcomes of published papers that report effects of CPs. We performed a systematic review based on two search strategies, including searching Medline, CINAHL, Embase, Psychinfo and Picarta from 1995 till 2005 and ISI Web of KnowledgeSM. We also included randomized controlled or quasi-experimental studies evaluating the efficacy of CP application. Assessment of the methodological quality of the studies included the utilization of: randomization, power analysis, selection bias, validity of outcome indicators, appropriateness of statistical tests, and indirect (statistical) control for confounders. Outcomes included LOS, costs, readmission rate and complications. Two reviewers independently assessed the methodological quality of the selected papers and recorded the findings with an evaluation tool developed from a set of items for quality assessment derived from the Cochrane Library and other publications. The study sample comprised of 115 publications out of 556 publications after applying inclusion and exclusion criteria. A total of 91.3% of the studies comprised of retrospective studies and 8.7% were randomized controlled studies. Using a quality-scoring assessment tool, 33% of the papers were classified as of good quality, whereas 67% were classified as of low quality. Of the studies, 10.4% controlled for confounding by matching and 59.1% adopted parametric statistical tests without testing variables on normal distribution. Differences in outcomes were not always statistically tested. Our main conclusion is that researchers and health care professionals should be cautious when interpreting the results of CP evaluation studies, because of the confounding factors and sources of contamination affecting the evidence-based validity of the outcomes.

Chapter 3 depicts the difference between CP and conventional care in terms of clinical outcomes, HRQoL domains, depression, and anxiety, as well as to determine the relative contribution of CP towards an improved HRQoL after CABG. We conducted a longitudinal quasi-experimental using a pre-test/post-test design to study and compare clinical outcome, HRQoL, depression, and anxiety for CP versus conventional care patients after CABG. HRQoL was
measured using SF-36, whilst depression and anxiety were measured using Hospital anxiety and depression scale. LOS and patient complications were derived from the hospital database. We found that implementing a CP significantly decreased hospital delay, but did not decrease neither overall LOS nor readmission rates. We also found that patients in the conventional care plan improved more than patients in the CP in HRQoL. Outcomes in favor of patients in the conventional care trajectory were based on the difference between small ES ($0.20 < 0.50$) for pathway patients and moderate ES ($0.50 < 0.80$) for conventional care patients, except for the domain of physical functioning and physical component summary, where the ES for conventional care was large ($>0.80$). Our main conclusion was that, despite the fact that the aim of designing and implementing pathways is to decrease LOS, and costs, while maintaining quality of care and improving patient outcomes, our findings suggest that these aims were not fulfilled in this CABG pathway. We recommend that, when designing a CP, the multidisciplinary team including nurses and nurse case managers, responsible for coordination and implementation, should take into consideration all patient-related characteristics, risk indicators, along with physiological status.

Chapter 4 presented whether EuroSCORE as a risk indicator is associated with pre-operative HRQoL, and whether it is a predictor of mental and physical HRQoL six months after CABG. We conducted a longitudinal observational study among 181 patients who underwent CABG. Physical and mental domains of HRQoL were measured using SF-36 and risk stratification was estimated using the EuroSCORE. A post hoc test (with Bonferroni correction) was used to determine whether EuroSCORE was associated with preoperative HRQoL, LOS and postoperative rate of complications. Hierarchical regression analysis was performed to explore the associations between EuroSCORE, postoperative events and postoperative HRQoL. We found that EuroSCORE is associated with physical functioning before and after CABG and a higher EuroSCORE is a predictor of poor physical functioning and not a predictor of the mental domains of quality of life, while smoking predicted bodily pain after CABG. Furthermore, readmission within six weeks after discharge was a predictor of poor physical functioning, physical role and general health. Moreover, post hoc tests showed statistically significant and clinically relevant differences in physical functioning between low-risk and high-risk EuroSCORE classes, and between medium and high classes at baseline and six months after CABG. High-risk patients had more peri-operative complications and longer lengths of stay, as compared to low-risk patients. Our main conclusion is that EuroSCORE can discriminate between low, medium and high risk classes regarding LOS, physical functioning
and number of complications. Furthermore, EuroSCORE is a predictor of poor self-reported physical functioning six months after CABG and is not a predictor of mental functioning.

**Chapter 5** reported on the predictors of deterioration in HRQoL six months following CABG and the test of a hypothesized model of the determinants of no change and deterioration in HRQoL using structural equation modeling. We used a multivariable logistic regression analyses to examine the association between patient demographic characteristics, medical history, clinical data, psychological distress and HRQoL. We used the structural equation modeling (SEM) technique with LISREL to test the tenability of this model, as well as an elaboration of regression analysis. The model used change in anxiety and depression as predictors of change in HRQoL, as well as the role Type D plays in this change.

The results of logistic regression showed that deterioration/no change in PCS was associated with a history of angina and that patients with increased levels of anxiety and depression had a higher risk of deterioration in physical and mental HRQoL. The SEM showed that increased levels of anxiety and depression mediated the relationship between Type D personality and deterioration/no change in both mental and physical HRQoL six months after CABG. Type D personality and increased anxiety and depression explained 65% of the variance in mental HRQoL change, and 25% of the variance for change in physical HRQoL. Our main conclusion is that, despite the fact that the majority of patients experienced improvement in HRQoL following CABG, some patients experienced no change or deterioration in their HRQoL. Our results outlined the role played by personality Type D, anxiety and depression in predicting deterioration in HRQoL six months after CABG.

**Chapter 6** presented the impact of positive affect (PA) and age on health complaints in CABG surgery patients, using a prospective design. We included consecutive CABG patients (n=161), completed the PA items of the Global Mood subscale at baseline and the Health Complaints Scale at baseline and 6 months. The main findings of this chapter are that cognitive and somatic complaints decreased over time. Patients with low PA reported more cognitive complaints, and there was a trend for younger patients reporting more symptoms. There was also a significant interaction effect for age x PA with younger patients with low PA scoring highest on cognitive complaints. Patients with low PA also reported significantly more somatic complaints; neither the main effect for age nor the interaction effect for PA x age was significant. These results remained in the adjusted analysis. Our main conclusion is that low PA was associated with more complaints, with younger patients with low PA reporting more cognitive
complaints. Cardiac rehabilitation should not only target negative emotions but also seek to increase PA, as poor self-reported health is a predictor of adverse prognosis.

**Implications for clinical and nursing practice**

This study has implications for policy, practice and health care personnel involved in planning, coordination and delivery of care, i.e. cardiac surgeons, case managers, critical care/cardiothoracic surgery nurses and cardiologists. The designing and implementation of CPs is carried out by the multidisciplinary team, but nurses play a major role in implementing the pathway, patient education and preparing patients for discharge. In addition, case managers are responsible for coordinating the planning and designing of pathways. It is particularly of importance for nurses and health care personnel, involved in delivering care to CABG surgery patients, to recognize the factors affecting the outcomes of these patients and incorporate quality of life and psychological distress measures into the routine patient assessment protocols.

**Recommendations for practice and research**

1. More (randomized) controlled studies should be conducted, in which patients are randomly assigned to the condition of either a pathway or standard procedure. However, such randomized controlled studies in the same hospital invite contamination, because many of the same doctors, as well as care staff, are involved in treating the same population of patients. To avoid such Hawthorne effects, we suggest establishing multi-centre trials with randomization after pre-stratification of confounding factors (e.g. gender, co-morbidity) with a clearly defined method of randomization, concealment of allocation or blinding with the appropriate balancing method.

2. Standardization of the total direct costs is specified by clearly defined cost components and a standardized operational definition of LOS. LOS should not be confined to the hospital setting, but should be extended to include whether patients are discharged home or to an extended health care facility, and should include whether this is a permanent or temporary arrangement. An accurate calculation in this case will reflect the true effect of clinical pathways on LOS and subsequent related costs.

3. More attention should be paid to measuring relevant patient outcomes, such as quality of life, hospital anxiety, patient expectations and satisfaction with standardized validated tools, which reflect the true effect with use of appropriate statistical methods.

4. When designing a clinical pathway, all patient-related characteristics, risk indicators, along with physiological status, be taken into consideration.
5. Pathways should be designed and length of stay set based on patients acuity of illness and a follow-up period should be added for these patients in order to ensure optimum outcome.

6. Incorporating HRQoL and psychological distress measurement as part of a routine assessment of patient health, both pre- and postoperative, which can be easily done by cardiothoracic surgery nurse, since this will provide a clear view of the patient’s perception of his physical functioning and mental health, which will, in turn, have a great impact on planning care.

7. More research is needed with larger number of patients to examine the relationship between EuroSCORE, health related quality of life and other clinical outcomes, which will help provide patient-centered care with effective counseling, regarding patient expectations after surgery.

8. Further research is required regarding the role played by psychological distress and Type D personality and there effect on the HRQoL of CABG patients.

9. In future research clinical data should be collected not just prior surgery, but also during the follow-up period, in order to be able to examine the potential influence of changes in cardiac symptoms during the follow-up period on health complaints, and we also recommend a longer follow-up period.

10. Adoption of a positive affect approach clinical research and practice, and studying the role of negative emotions, because patients are less likely to recognize themselves in terms of negative emotions alone. Thus, including positive affect in psychosomatic research may increase the study compliance rate, simply because patients can identify with the questions being asked.

11. Cardiac rehabilitation should not only target negative emotions, but also seek to increase positive affect, as poor self-reported health is a predictor of adverse prognosis and re-hospitalization in patients with CAD. If rehabilitation can enhance positive affect, this may lead to a reduction in health complaints and improvement in quality of life and subsequent prolonged survival.