Summary
Evidence-based risk assessment is of utmost importance for selection of the optimal management strategy in non-ST-elevation acute coronary syndrome (NST-ACS) patients. International cardiac clinical guidelines recommend that decision-making of physicians, regarding appropriate treatment, should include multifactorial risk assessment, i.e. taking into account multiple clinical factors such as a patient's cardiac history, laboratory and electrocardiogram findings, but also the risk status of a patient calculated using a validated risk score [1,2]. Despite this recommendation, variation in treatment practices seem to exist, with not every NST-ACS patient receiving care according to the guidelines. It has been suggested that the routine application of risk scores, in addition to clinical judgement, could improve the risk assessment process and could guide clinical-decision making [3-6]. However, it is unknown to what extent risk scores are used in practice and if they actually contribute to a cardiologist's decision. Although these risk scores, such as the GRACE [7] and the TIMI [8] risk score, have been extensively validated and are recommended in cardiac guidelines, a previous study concluded that physicians may have a sceptic attitude towards the use of risk scores in decision-making [9].

In this thesis we have studied the extent of guideline adherence in the management of NST-ACS patients with emphasis on the use of cardiac risk scores in clinical practice. Besides the actual use of risk scores in clinical practice, determinants for suboptimal cardiac risk score use were studied on a patient-, healthcare provider- and organizational-level. Furthermore, the impact of different components of clinical information, including risk score outcomes, on cardiologists' decision-making regarding performing coronary angiography was studied.

In Chapter 2 a systematic review is presented regarding the extent of adherence of healthcare providers towards the European Society of Cardiology (ESC) and American College of Cardiology/American Heart Association (ACC/AHA) guidelines in the management of NST-ACS, and associated patient outcomes, and influential factors. It was found that lower guideline adherence was consistently associated with poorer prognosis, and that adherence varied widely between the reviewed studies. Adherence rates between 5.0% and 95.0% for acute and discharge pharmacological care, and between 16.0% and 95.8% for performing coronary angiography (CA) were found. Only a few studies looked into the use of different risk stratification methods, for which adherence rates were found varying between 34.3% and 93.0%. Several factors related to the patient and the organization were found that either increased or decreased guideline adherence.

In Chapter 3 the design of a cross-sectional, multicentre, patient chart review regarding the extent of cardiac risk score use in Dutch hospitals is presented. In Chapter 4 the findings of this study are reported. Data of 1788 patients discharged with a diagnosis of NST-ACS were analysed. Just as the results showed in Chapter 2, large variation in adherence rate was found.
A cardiac risk score was documented in 57.0% of the cases, and varied between thirteen hospitals from 16.7% to 87.0%. Results further showed that risk scores were more often used in obese patients and in former smokers. By contrast, risk scores were less often used in patients diagnosed with unstable angina, in patients who were resuscitated, in patients with in-hospital heart failure or in patients with tachycardia.

In **Chapter 5** the results of a semi-structured interview with healthcare providers regarding the use and implementation of risk scores are presented. In this qualitative study health care providers were asked for their motivation for cardiac risk score use (or not), and the associated benefits and risks that they experienced. They were also asked to describe the implementation process and facilitators and barriers that they perceived being of influence. It was found that healthcare providers disagree on the importance of cardiac risk scores in clinical decision-making. A clear distinction between intrinsic motivations and extrinsic motivations for change became clear. Healthcare providers who were intrinsically motivated to use risk scores experienced several benefits in processes of care. Healthcare providers who felt pressured by external parties to use risk scores in practice, were less likely to take account of the risk score in their treatment decisions. Furthermore, healthcare providers mentioned several factors that were determinative for successful adoption and implementation of cardiac risk scores. These were related to the risk score itself (e.g. clinical relevance, complexity of the score), to the healthcare provider (e.g. negative attitude, lack of motivation), and to the organization (e.g. lack of necessary resources).

To determine the actual importance of cardiac risk scores and other clinical information for cardiologists’ decision-making, a clinical vignette study was conducted. Cardiologists were asked to decide upon performing coronary angiography or not in clinical cases of NST-ACS patients. In **Chapter 6** the development of a survey comprising a binary choice experiment with realistic descriptions of clinical cases (vignettes) is described. In the vignettes, clinical factors were systematically varied according to a fractional factorial design. To ensure accuracy, plausibility and clarity of the vignettes a panel of cardiologists was consulted for the selection of attributes and attribute levels.

In **Chapter 7** the results of the clinical vignette study are reported. It was found that cardiologists mainly base their decision-making for performing CA on three sources of clinical information, with elevated troponin levels and typical ischemic changes on the ECG making cardiologists more likely to perform CA, and severe renal dysfunction making cardiologists less likely to decide on CA. Factors for persistent complaints of chest pain, previous coronary artery disease, and presence of risk factors, hardly influenced cardiologists’ decision-making. Risk score was highly associated with a patients’ age, and therefore no firm conclusions could be drawn about separate effects of risk score or age on cardiologist’s decisions. Looking at
the combined factor of age and risk score, it was found that cardiologists were more hesitant to perform CA in elderly patients with high risk according to a validated risk score, than in younger patients with intermediate risk.

To conclude, cardiac risk score use in practice is relatively low and varies widely between hospitals. We found several barriers that can possibly explain the large variation in adherence rates, mainly related to the healthcare provider and the organization. These major barriers comprised, among other things, the lack of a strong scientific evidence-base and clinical relevance (i.e. impact studies), type of motivation (i.e. intrinsic versus extrinsic), and lack of necessary resources in combination with complexity of the risk score (i.e. IT and management support). Furthermore, it was found that instead of multifactorial risk assessment, clinical decision-making was mainly driven by a limited number of clinical factors.

It is therefore recommended that:
• risk scores are used in addition to conventional risk assessment. In that way clinical judgement, i.e. implicit decision-making based on clinical experience and objective risk assessment by using a risk score can complement and enhance each other;
• future research focuses on the impact of risk score use on patient outcomes, as these results could accelerate the adoption and implementation of these scores in practice;
• when implementing these scores in practice, an implementation strategy, tailored to existing barriers in which intrinsic motivation is enhanced and necessary resources are provided, is recommended.
References


