SUMMARY

INTRODUCTION

Acute coronary syndrome (ACS) is the most common ischaemic heart disease and one of the leading causes of death in the world. Although improvements in the quality of care have led to tremendous improvements in patient outcomes, the burden of the disease is still high. Three clinical manifestations can be distinguished: ST-segment elevation myocardial infarction (STEMI); non-ST-segment elevation myocardial infarction (NSTEMI) and unstable angina (UA). The management of these three clinical manifestations differs on some aspects. In the acute management of STEMI, it is vital that patients are treated with percutaneous coronary intervention (PCI) as soon as possible, as the likelihood of dying after STEMI increases with time. All patients with an ACS have an increased risk of a recurring ACS. Therefore, they receive several medications for secondary prevention: acetylsalicylic acid, P2Y12 inhibitor, statin, beta blocker and an Angiotensin converting enzyme (ACE)-inhibitor.

In the Netherlands, the Dutch Society of Cardiology (NVVC) has adopted the European Society of Cardiology guidelines as the foundation for the management of ACS patients. In general, adhering to these guidelines can be considered good quality of care, although the physicians can always deviate from the guidelines with sound medical rationale. However, the guideline adherence is often suboptimal. To measure the guideline adherence, the most important recommendations of guidelines can be translated into quality indicators.

Following a critical report on the quality of Dutch care, a national quality improvement program (VMS) was initiated in 2008, in which ACS management was one theme. Within this VMS program, five quality indicators were developed for the management of patients with ACS. In this thesis, two of these indicators with an established association with patient outcomes were evaluated: use of PCI within 90 minutes of first medical contact for patients with STEMI; and the prescription of secondary prevention medication at discharge from the hospital for all patients with ACS. For these two indicators: 1) the performance in Dutch hospitals was measured; 2) (unwarranted) process variation was investigated in-depth; and 3) effective interventions to further improve the care processes were identified.
METHODS AND RESULTS

Because no reliable national data on ACS management was available, a cross-sectional study was designed to measure guideline adherence in hospitals using the VMS ACS quality indicators (Chapter 2). In total, 13 hospitals selected by means of a multistage random selection procedure participated in the study, of which seven provided PCI. The data were extracted from the patient records. In addition to data on guideline adherence, data on several patient and hospital characteristics were collected in order to identify (unwarranted) practice variation. Missing data were handled with the appropriate (multiple) imputation procedures. The data were analysed with generalized linear (mixed) models.

TREATMENT DELAY

In total, 1017 records of patients with STEMI going for immediate PCI were included in the study. The majority (78.7%) were treated within the recommended 90 minutes. The median treatment delay was 64 minutes (interquartile range: 47 – 82 minutes). Significantly prolonged treatment delays were found in patients of whom their first electrocardiogram was performed at the general practitioner’s practice or at the hospital; who required interhospital transfer; or who presented with acute heart failure (Chapter 3). Large differences in the quality of the data impeded comparison of the treatment delay between the PCI centres. In addition, different definitions of treatment delay are used internationally, hampering comparison of our results to the results of studies performed abroad (Chapter 4). To investigate the acute STEMI care process in-depth, a qualitative study was performed in six of the seven PCI centres. At each hospital, involved care providers were interviewed, resulting in 28 interviews. For each centre, the acute care process was mapped and compared to the guideline recommended care process and to the processes of other PCI centres. The processes in the centres differed from the guideline recommended process on e.g. additional (unavoidable) patient routings such as patients coming through the general practitioner, and no continuous monitoring of the treatment delay. The processes in the centres differed from one another in the communication of diagnostic information (e.g. transmitting all, only ambiguous or no electrocardiograms) and catheterization room preparation. These differences indicate that in hospitals different choices are made to maintain a balance between speed and diagnostic accuracy. Factors perceived by care providers as accelerating the process included trust in the tentative (prehospital) diagnosis, and avoiding unnecessary inter-caregiver consultations. The differences in the processes and the accelerating factors were summarized in a model, which can be used in other PCI centres to critically reflect on their own STEMI care process (Chapter 5).
SECONDARY PREVENTION MEDICATION
In total, 2,471 records of patients discharged with an ACS were included in the study. Guideline adherence was defined as prescription of all five recommended medications at discharge from the hospital or documentation of a contra-indication or other reason for not prescribing them. Complete guideline adherence was achieved in 69.1% of the patients. However, this ranged from 42.1% to 87.0% between hospitals. The ACE inhibitor was most often missing (21.2%). Guideline adherence was less often achieved patients with NSTEMI or UA; patients with a history of coronary artery bypass grafting or elderly women. Because the overall performance was substantial, quality improvement efforts can be targeted at underperforming hospitals and undertreated patient groups. (Chapter 6)

QUALITY IMPROVEMENT
In order improve the guideline adherence in the hospital care of patients with ACS, a systematic review was performed to identify effective quality improvement interventions for optimizing the ACS care processes. In this systematic review, an overview was provided of 265 papers on initiatives aimed at improving the ACS care process. The most often reported subjects for improvement were medication prescription; treatment delay, and referral to smoking cessation. However, the findings of the majority of these studies were insufficiently reliable. Consequently, the 24 studies with the strongest research designs were selected for further investigation. Using the Cochrane Effective Practice and Organisation of Care (EPOC) taxonomy of health systems interventions, 23 different intervention components were identified. The most commonly used intervention components were audit & feedback; educational interventions; educational materials; and local opinion leaders. In the majority of the studies, the interventions were (to some extent) effective in improving guideline adherence. Interventions consisting of multiple components (e.g. a combination of feedback of performance, training of care providers in continuous quality improvement and use of local opinion leaders) appeared more effective than single or dual component interventions. (Chapter 7)

REFLECTION, (METHODOLOGICAL) CONSIDERATIONS AND RECOMMENDATIONS
Although the performance of hospitals on the VMS quality indicators for treatment delay and secondary prevention medication was fair, there was unwarranted practice variation. Although the VMS program has initiated a broad movement in patient safety,
several opportunities for improving the VMS ACS indicators could be identified in retrospect (Chapter 8). Especially the acceptability to the stakeholders, feasibility (e.g. required data) and reliability (e.g. definitions and in- and exclusion criteria) require further attention in case the use of these indicators is continued.

The results of the research presented this thesis should be interpreted in the light of several considerations. First, the guideline adherence was measured using cross-sectional studies performed in hospitals and not in the entire ACS care pathway. Second, only processes were measured in the research presented in this thesis, not structures or outcomes. However, measuring processes offers the most practical information for quality improvement and therefore were the focus of this thesis. Third, due to the retrospective nature of these studies, the percentage of missing data was high. Therefore, we had to use appropriate statistical techniques to correct for this. Fourth, by measuring the VMS ACS quality indicators, we only evaluated whether patients who were eligible for an intervention also received it. In contrast, we did not evaluate whether patients who were not eligible for an intervention did receive it (appropriate use). The recent initiative of the ‘beter niet doen’ list shows that some of these ‘negative’ recommendations can be considered for the development of quality indicators.

From the research presented in this thesis, several recommendations can be made for clinical practice and future research:

- **Maintain the balance between speed and diagnostic accuracy**
  Although the median treatment delay was relatively short in comparison to studies abroad, the recommended maximal treatment delay of 90 minutes was exceeded occasionally. To further improve care processes, hospitals can learn from one another about how to design the acute care process for patients with STEMI. They can focus on patients presenting through other routings than the emergency medical services. The model presented in Chapter 5 can be helpful in this. Although further speeding up the process can be important, it is vital to maintain the balance between speed of the process and diagnostic accuracy. Consequently, both the treatment delay and the number of unnecessary catheterization room activations should be monitored in hospitals.
• **Reduce variation in the prescription of secondary prevention medication**

Although the prescription of secondary prevention medication was largely in accordance with the guidelines, there was much unwarranted variation among hospitals and among different patient groups. Cardiologists should be aware of their leading role in initiating secondary prevention medication in the entire care pathway. Further research is needed on the causes of the large differences between hospitals and potentially between cardiologists. By making use of the interventions recommended in Chapter 7 of this thesis, unwarranted practice variation can be reduced and the quality of care further improved. Besides these interventions, ACS management including secondary prevention medication can be a subject for the medical audits as used in the Dutch system of peer quality review.

• **Improve information systems**

Currently, there are several national data registries of the management of ACS that have different visions in monitoring and improving the quality of care. By combining these efforts, comparable to the Swedish SWEDEHEART model, the current fragmented view of the quality of ACS management in the Netherlands can be improved and the administrative burden reduced to some extent. It is essential to follow-up on the letter-of-intent to integrate the current data registries into the Netherlands Heart Registry. In a national registry, data validation is essential for the quality of the data and consequently the reliability of the results.

• **Limit the administrative burden**

An opportunity for alleviating the administrative burden is to abandon quality indicators which show no or limited room for improvement. To efficiently use the available data, care providing institutions should employ the time gained by abandoning quality indicators for using results of relevant quality indicators and registries for targeted quality improvement efforts. Another way to limit the administrative burden is standardization of data and data requirements, e.g. through the ‘Registratie aan de bron’ initiative.

• **Facilitate continuous quality improvement**

The results of our systematic review showed that only providing feedback of performance is not enough to stimulate quality improvement. The largest improvements were achieved by a combination of feedback of performance and training in continuous
quality improvement, i.e. targeted quality improvement. Therefore, national organizations of cardiologists and nurses working in cardiology could offer training to care providers in targeted quality improvement.

- **Research department competencies and sustainability of quality improvement**
  A department of good individuals does not make a good department. Therefore, identifying a framework for high performance departments can be of added value. In addition, if quality improvement is achieved, it needs to be sustained. Consequently, the sustainability of quality improvement should be further researched.

- **Improve guideline development and adaptation in cardiology**
  Finally, the VMS ACS quality indicators were based on the European Society of Cardiology guidelines for STEMI and for NSTEMI & UA management. However, the development of these guidelines does not adhere completely to the current quality standards for guideline development. In addition, because the Dutch Society of Cardiology adopts these guidelines, there is room for improvement in the adoption and adaptation process.