Chapter 10

Summary and General Discussion

Introduction

Healthcare systems have become more complex due to greater use of new technologies and a multitude of interventions. [1] Therefore, patients are more prone to errors and incidents during their hospital stay. In the last twenty years more attention has been paid to increase patient safety not only by healthcare professionals but also by healthcare organizations to avoid unintended harm to patients. Assessing the quality of healthcare systems is complex due to the unpredictable nature of health care. A framework was developed to assess quality of care. This framework consists of four categories namely structure, process, outcome and culture. By measuring 'structure' we know how the care is organized, the 'process' measures what health professionals do for their patients, and 'outcome' measures what happened to people in terms of their health. [2,3] Additionally, 'culture' evaluates the context in which care is delivered to patients. [4]

Improving the quality of care has to be done in a structured way rather than disorganized and data driven, rather than based on informal observations, anecdotes and personal experiences. This means that improving patient safety is a continuous process of analysis, monitoring and evaluation, which eventually benefits the individual patients directly. [5] Evaluating safe care of acutely ill patients should be carried out on several levels. Firstly, the focus should be on the four pillars of the quality framework (structure, process, outcome and culture) and their interrelationship. Secondly, the Plan-Do-Check-Act (PDCA) cycle should be used for continuous improvement initiatives since it provides a structure for assessing the value of improvement measures in a iterative loop and thereby it is an ultimate tool for assessing the quality on ward and department level. [6] Thirdly, since communication is an overriding theme in quality of care and patient safety, major attention should be given to measure communication and improve and structure communication, particularly communication during the most critical time points of a patient, for example during clinical rounds or during transportation. Finally, since satisfaction of the patient and his or her relatives with the delivered care is still an ultimate measure of quality of care, satisfaction should at all times receive our undivided attention.

In this thesis we addressed the above outlined approaches to measure quality of care and assessed the available tools to measure and monitor quality of care in critically ill patients on the hospital ward and intensive care.

In this final chapter we describe the main findings of the studies that are presented in this thesis and discuss the study results. Subsequently we describe the implications of the findings for clinical practice and future research.

Main Findings

In **Chapter 2** we described the protocol to study the effectiveness of the sequential implementation of the Rapid Response Systems (RRS) in 12 Dutch hospitals. Four clinical wards (two surgical and two medical) were included per hospital. The study consisted of a before period followed by two study phases. The first five months before the introduction of the RRS, the "before period", clinical endpoints were collected as part of a baseline assessment. The RRS was implemented in two steps. In the first step, two tools were introduced during 7 months for early detection of the deteriorating patient: the Modified Early Warning Score (MEWS) and the Situation-Background-Assessment-Recommendation (SBAR) for structured communication. After these seven months the Rapid Response Team was implemented for 17 months. The last five months of the RRT implementation phase, named "final RRT" period, were used for comparison with the "before period". The primary endpoint was defined as the composite endpoint of cardiopulmonary arrest, unplanned ICU admission, or death on the included nursing wards.

The results of the COMET study were shown in **Chapter 3**. In total, 166,569 patients were included, representing 1,031,172 hospital admission days. The primarily analysis focused on the comparison of the prospectively gathered clinical outcomes between the before period and the final RRT period. The results were corrected for case mix variables and for specific hospital related confounding variables including contribution of each hospital and differences between before and the final RRT period. The composite endpoint was significantly reduced after implementation of the RRS, adjusted odds Ratio (OR) 0.847 (95% CI, 0.725-0.9789; p=0.036). Cardiopulmonary arrests and in-hospital mortality were also significantly reduced, OR 0.607 (95% CI, 0.393-0.937; p=0.018) and OR 0.802 (95% CI, 0.644-1.0; p=0.05) respectively. Unplanned ICU admission showed a declining trend OR 0.878 (95% CI, 0.755-1.021; p=0.092). No differences between the two periods were found regarding patient demographics or disease (severity) markers. Only for death, the mean age in the final RRT period was 75.0 (14) compared to 76.8 (12) in the before period, p=0.021. The call rate in the RRT implementation phase in which the RRT was available was 6.8/1,000 (95% CI, 6.2-7.5) admitted patients and increased in the final RRT period to 7.3/1,000 (95% CI, 6.4-8.3).

In **Chapter 4** we reported the results of the effectiveness of the sequential implementation of the Rapid Response Systems (RRS) when the outcome "all-cause mortality" is replaced by "death without limitation of medical treatments (LOMT)" and how these LOMT orders change over time. We repeated the analysis in the study population described in chapter 3. We found that, installation of a RRS decreased the risk of death in the patients without an LOMT even to a greater extent than in the whole

population: in the original study studying the effect of a RRS on all-cause mortality the adjusted OR was 0.865 (95% CI 0.77-0.98) and when choosing death without LOMT as endpoint the OR was 0.557 (95% CI, 0.40-0.78). A total of 3,408 patients died before discharge. At time of death, 2,910 (85%) had an LOMT order. In both medical and surgical patients, most of patients who subsequently died already had already a LOMT at hospital admission. Median time between last LOMT order and death was 3 days in patients with Code C and 1 day with Code D. After introduction of the RRT the delta time between last change in LOMT status and death was 2 days (IQR 1-5) in the before period and 1 day (IQR 1-4) in the final RRT period (NS).

In **Chapter 5** we reported the level of satisfaction of nurses and physicians with the introduction of the RRS in Dutch hospitals. Satisfaction with implementation of the RRS was generally higher at 14 months than at 7 months and also higher in respondents working on surgical versus medical wards. In a multivariate analysis, independent predictors of satisfactions were longer experience with the RRS, support of the RRS by local ward management, and having a RRT considered to be 'open' and 'approachable'. From this questionnaire we concluded that healthcare workers generally are very satisfied with RRTs in the hospital. This is an argument in favour of implementing the RRTs in hospitals.

In **Chapter 6** we described a prospective before-after study in two University hospitals in the Netherlands to estimate the effect of implementation of daily goals in daily care planning on length of stay in the ICU. The implementation of daily goals was not associated with a change in ICU length of stay or hospital length of stay when corrected for confounders. The percentage of daily goals that was "successfully met" was 79% in the first study period and 77% in the second study period. Daily goals "not met with a documented reason" increased in the after period from 3% to 15 %, RR 0.25 (95% CI, 0.21-0.30). Daily goals "not met without a documented explanation" decreased from 18% to 7% RR 2.4 (95% CI, 2.15-2.67).

In **Chapter 7** we described the development of a checklist to increase patient safety of intra-hospital transport (IHT) in critically ill patients. A three step-approach was used to develop a checklist which consisted of a systematic search for published IHT guidelines and checklists, prospectively collected IHT incidents and structured interviews with ICU physicians and ICU nurses about their experiences with IHT. In the literature, most checklist items and recommendations were focused on the pre-transport phase. Collected incidents were frequently related to patient physiology and equipment malfunction and occurred most often during transport. This approach resulted in a generally applicable checklist which is a framework to guide physicians and nurses through intra-hospital transport and provides a continuity of care to enhance patient safety. We piloted the checklist and nurses were in generally positive about the

use of the checklist; it provided a framework, and improved communication, and the fill in time was only 4.5 minutes per phase.

In a systematic review in **Chapter 8** we described the different incident reporting systems (IRSs) that have been used on the adult ICU. We found that nearly all IRSs used different definitions for incidents, errors and complications and were applied in different settings which made direct comparison difficult. With respect to the iterative PDCA cycles of planning, measuring, analyzing, implanting changes and re-assessing, data input and data collection were well established. The other two phases, data analysis, formulation of improvement measures and feedback with reassessment, needed to be given more attention before an IRS can effectively contribute to improve patient safety and quality of care. This systematic review showed that it is not possible yet to establish an 'optimal' IRS to choose for use in daily practice.

In **Chapter 9** we described in a systematic review of the available questionnaires to measure family satisfaction in the adult ICU and their psychometric properties. To evaluate family satisfaction in the ICU, it is important to use valid instruments to obtain proper and high-quality information. Twenty-seven tools were identified of which four questionnaires were of overall good quality. The quality of the four questionnaires was assessed by further examination of the psychometric properties and sample size of the studies. After analysis we concluded that the CCFNI which measures *needs* and the FS-ICU which measures *satisfaction* were the most reliable and valid with respect to their psychometric properties.

General discussion and future directives

Creating a safe and effective environment for patients in hospitals can be accomplished by health care providers by performing processes that aim to achieve patient safety and avoid processes that are predisposing towards affecting harm. Measuring and monitoring the quality of care of critically ill patients can be executed in different ways which aim to improve the safety of the patient.

The effectiveness of the implementation of an RRS worldwide to reduce serious adverse events has showed no improvement in the rates of cardiac arrest, unplanned ICU admission and death. Possible explanations for the negative results were lack of power and contamination of control hospitals. [7,8] The COMET study was executed in Dutch hospitals at the time that hospitals were mandated to implement an RRT. Due to the mandated nature we choose for the most appropriate study design with correction for hospital and multiple patients confounders. In our study we showed a positive effect, a reduction of 15% on the incidence of cardiac arrests, unplanned ICU admission and death. Nurses and physicians were only trained in the MEWS phase and in the RRT

implementation phase. It is unsure how the compliance of the MEWS/SBAR was during the implementation phases. It is possible that a more intensive training program and evaluating and discussing RRT calls with the involved nurses and physicians could have led to a better outcome. Measuring non-compliance is a time consuming and intensive investment but implementing the MEWS in electronic patient charts gave a real insight how the compliance is. The low call rate of the RRT members suggests in our study that the RRS was not fully implemented in the hospitals. Possible explanations are that this has to do with the hospital culture factors, insufficient training, change of staff documenting subsequent vital signs or the willingness to call an RRT. [9] Moreover, we measured during the implementation of an RRT the satisfaction of physicians and nurses. The satisfaction of physicians and nurses after the implementation of an RRT increased over time. We established that independent factors for this higher satisfaction were associated with the attitude of the members of the RRT and the support by the ward staff. Despite the limitations of the study design the COMET study has contributed to increased knowledge about the RRSs.

Communication is one of the corner stones in patient safety and quality of care. A method to improve the commination an insight in patient specific goals, within a team is to implement in clinical practice the formulation of daily goals, to be assessed within the team during clinical rounds. In our study where daily goals were introduced into daily care planning on the ICU, we showed that physicians documented more frequently in the medical chart the reason why a daily was not met. Daily goals have been proven in other studies to due improve the communication between healthcare professionals and to clarify the tasks. [10-14] Although in other studies a reduction was shown of the ICU length of stay by the introduction of daily goals. We could not confirm this in our study and a possible explanation for this is that ICU-LOS already decreased in the past decades.

Protocols and checklists are helpful in the reduction of patient harm because of the improved standardization of care. Checklists are tools that can provide guidance to professionals in a certain task. Furthermore, they have the purpose for reducing errors during the task and translate evidence-based - and best practices into a list of actions. By developing an IHT checklist which covered all the three phases of IHT, we developed a tool which resulted in a framework to guide physicians and nurses through intra-hospital transport to enhance patient safety. We specifically asked ICU physicians and ICU nurses their experiences with transport. This knowledge is of value not only to develop the checklist but also in the implementation of it in daily practice. We did not establish in this study the effect of the checklist on reduction of incidents or patient outcomes. However, the use of checklist has been proven effective in high-intensity field of medicine in the reduction of complications [15] and processes of care. [16,17] Further studies should focus on the effect of the implementation of the checklist on patient

outcomes and occurrence of incidents and also on the satisfaction of healthcare professionals in the use of the checklist during transport.

A strategy to evaluate the process of care is the introduction of an incident reporting systems which provides organizations with a tool to identify hazards in clinical care and to understand where the system fails. Although incident reporting underestimates the true rate of the incidents it is useful to collect them. By reporting incidents it will give the healthcare professionals the opportunity to report deficiencies in the provided care. We could not establish the ultimate IRS due to the multitude of existing IRSs. With respect to the PDCA cycle the *Plan-Do* phase was well established in most of the IRSs while on the other hand more attention needs to be given to the *Check-Act* phase. The Check-Act phase included giving feedback and install improvement measures. Lack of feedback is one of the main barriers of healthcare professionals to report incidents. An incident reporting system is successful if feedback is given to the healthcare professionals from the message that the incident was received until the improvement measure that is installed. [18,19] Future research should focus on whether the implementation of an IRS will improve patient safety and measure quality of care.

Another form to get feedback on the process of care is to ask patients and family members how they judge the delivered care. Family members of the ICU patient are the most reliable persons to get objective information of the delivered care because the ICU patient cannot make decisions themselves due to their illness and not always have a clear recollection of the events and delivered care during their ICU stay. If patients were asked to give their opinion after they were discharged of the ICU there is a chance that the obtained information is not objective because the memories of the ICU will be mixed with the memories of the hospital ward. Therefore, we gave an overview of the available questionnaires to establish needs and/or satisfaction with care from the family members to collect objective information about the delivered care on the ICU. We found four instruments that reported psychometric properties and were of good quality. Of these four, two instruments had the best psychometric properties. One of the questionnaires measures needs and the other measures satisfaction. Measuring needs will not provide information about satisfaction of the family members and vice versa. So, measuring satisfaction of the family members with the provided care it is of interest that ICUs establish what they want to know of the family members. Future research should not only focus whether the level of satisfaction of family members corresponds with the established needs but should also try to the level of patient satisfaction and compare this to family satisfaction.

The tools that we explored in this thesis have all the potential to measure the quality of care and to improve patient safety. Insight in the process-of-care measures is acceptable for caregivers because they can influence the process with the intention to

improve patient outcomes. Therefore, healthcare professionals should be involved in interactive processes to develop interventions within their own situation. It is better to start these processes on a small scale because it is sometimes easier to initiate quality initiatives bottom up instead of reinforcing a top down intervention. [20] Overall, we can state that communication and the use of the PDCA cycle are both important aspects leading to doing the right thing at the right time.

Lack of communication between physicians and nurses creates situations where incidents and errors can occur, delivered care is inefficient and frustration rules among them. Improving communication between nurses and physicians is essential but also hard to put into practice. Communication is not only the verbal form but also the non-verbal and written form. A good collaboration between nurses and physicians leads to continuous improvement in decision-making. [21] Components of good teamwork between nurses and physicians does not only consist of good communication but also a non-punitive environment, clear roles and tasks for team members, shared responsibilities and clear decision-making procedures. [22] An effective strategy in enhancing teamwork and reducing risks is the use of standardized tools and behaviors. The tools described in this thesis are helpful to structure communication, to ensure accuracy and implement quality improvement strategies.

The use of the PDCA cycle is one of the strategies to make a positive change in health care processes. This tool can be used for rapid cycle improvement and establishes a functional relationship between changes in processes and outcomes. [23] Rapid response systems, incident reporting system and family satisfaction questionnaire are tools which were described in this thesis that can be used to evaluate the care.

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