Systematic quality improvement in healthcare: clinical performance measurement and registry-based feedback
van der Veer, S.N.

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Summary
There is persistent room for improving the quality of healthcare. This thesis addresses the subject of systematic quality improvement (QI) as a way to approach this issue. Specifically, we investigated the following three research topics: quality improvement strategies, patient experience as a clinical performance indicator, and the impact of registry-based feedback on the quality of care. The first two topics were explored within the clinical domain of renal replacement therapy (RRT); the Dutch National Intensive Care Evaluation (NICE) registry was used as a practical context to examine the impact of registry-based feedback. Below, we summarize per topic the background and the research question, the main findings, and our recommendations for future research as stated in Chapter 9.

Quality improvement strategies in RRT care
An important activity within systematic QI is identifying potentially effective QI strategies. In this thesis, we defined a QI strategy as a systematic attempt to improve the way care delivery is organized. Many healthcare professionals may be unaware of which strategies apply to their particular setting, which could explain part of the persisting room for improvement. We expected this to also concern the domain of RRT care, especially because an overview of QI strategies for this domain care was lacking. We, therefore, formulated the first research question: Which quality improvement strategies have been reported within the domain of RRT care, and what was their impact on the quality of care?

Chapter 2 describes the results of a systematic literature review in which we identified a large variety of QI initiatives that aimed to increase the uptake of knowledge on best RRT practice in routine care. The majority of the 93 initiatives combined multiple QI strategies, and used at least one technique pertaining to systematic QI; patient-oriented strategies were the most frequently reported strategy type. However, the number and type of strategies and techniques varied markedly between subdomains: in vascular access, almost all initiatives were multifaceted and incorporated systematic QI techniques, whereas initiatives concerning nutritional management mostly consisted of one patient-oriented strategy and used no QI techniques. Twenty-two of the initiatives were evaluated using a robust study design. It appeared that initiatives using a combination of QI strategies tended to be more effective than those comprising a single strategy. Initiatives using at least one systematic QI technique were not found to be more effective than those using no QI techniques at all. However, due to the heterogeneity of the initiatives and the lack of rigorous evaluations, no further conclusions could be drawn with regard the impact of specific (combinations of) QI strategies on RRT care.

These and other results in this thesis illustrate the difficulty of building a strong evidence base for effective QI strategies. To expedite the science of systematic quality improvement within the domain of RRT care, as well as in other clinical settings, we suggest the following directions for future research:

- Use validated, empirical filters as a basis for electronic literature searches;
- Evaluate a QI strategy using endpoints that reflect the strategy’s ability to change practice, complemented with endpoints reflecting the subsequent outcome of that change;
- Promote the use of reporting standards for QI studies and the development of instruments to operationalize contextual factors that may influence the impact of QI strategies;
- Specify the assumption on how a QI strategy is expected to bring about the desired outcomes, including the theory on which it is based.
Patient experience as an indicator of the clinical performance of dialysis centers

Continuous measurement of clinical performance is another essential element of systematic QI in healthcare, and performance indicators form the core of such measurements. Patient experience is considered an important outcome indicator, but requires a validated instrument to be measured accurately. The Consumer Quality (CQ) index initiative in the Netherlands provides a standardized method to measure and report patient experience with a broad range of healthcare services. The fact that a CQ index instrument was not yet available for chronic dialysis care led to our second research question: How to use patient experience as an indicator of the clinical performance of dialysis centers?

In Chapter 3 we analyzed cross-sectional multicenter data of a cohort of Dutch dialysis patients to develop and validate two CQ index instruments: one for in-center hemodialysis (CHD), and one for peritoneal dialysis and home hemodialysis care (PHHD). The pilot version of the CHD instrument consisted of 71 items. Using an exploratory factor analysis, we identified 42 items as pertaining to core experience; they formed ten scales, of which five were reliable. For the PHHD instrument, the factor analysis yielded 31 of 56 core experience items, which formed nine scales; five scales were reliable. When also taking into account the priority that respondents assigned to the core experience items, the overall room for improvement appeared limited for both types of dialysis care, mainly because patients rated the experience with their dialysis care to be optimal.

To enable correct interpretation of patient experience as an indicator of dialysis center performance, knowledge is required on influencing factors that are not attributable to healthcare. Therefore, in Chapter 4 we explored the relationship between the characteristics of dialysis patients and the experience they have with their care. To this end, we constructed multivariable linear regression models based on the same cohort of Dutch dialysis patients as in Chapter 3. Our analyses showed that higher ratings of dialysis centers were associated with older age, non-European ethnicity, lower educational level, no past diagnosis of malignancies, no co-morbidities, lower albumin values, and better self-rated health. Presence of a past myocardial infarction, and better self-rated health were found to be determinants of a more positive experience with the nephrologist’s care; for nurses’ care these were higher age, native Dutch ethnicity, lower educational level, lower albumin values, and better self-rated health.

Although the CQ indexes for dialysis as developed in this thesis proved to be valid and reliable instruments to measure patient experience, they have some limitations with regard to their objectivity, face validity, and discriminative power. We formulated the following recommendations for future research to address these limitations:

- Formalize the concept of patient expectation, and explore its relationship with patient characteristics and patient experience;
- Explore the value of qualitative methods as a complementary approach to the quantification of patient experience;
- Identify QI strategies that positively affect patient experience.
The impact of the NICE registry feedback reports on ICU performance

Performance feedback is a commonly used QI strategy and a regular service provided by medical quality registries. The underlying assumption is that reports of inferior or inconsistent care are an incentive for healthcare providers to change their routine practice. Yet, in general, the impact of feedback on clinical performance was shown to be small to moderate, and it remained unclear how this impact could be further optimized. The NICE registry systematically and continuously collects and reports data on the quality of care delivered at Dutch intensive care units (ICUs). To investigate the potential of the NICE registry reports to prompt ICU clinicians to change their care delivery, and to explore how the impact of these reports could be optimized, we formulated the third research question: How can the impact of the NICE registry feedback reports on the quality of intensive care be increased?

In Chapter 5 we systematically reviewed the literature on how medical quality registries in general provide performance feedback to healthcare professionals. We identified 50 registry feedback initiatives, covering a variety of clinical domains, and showing a large diversity in reporting formats. The majority of initiatives combined feedback reports with additional QI strategies, such as educational activities. However, based on the 22 before-after studies included in our review, we did not find a clear association between complementing the feedback with additional QI strategies and an increased impact. We did find that process of care measures were more often positively affected by registry-based feedback than outcome of care measures. Characteristics of the feedback itself—such as quality of the reported data, and timeliness of reporting—were most frequently suggested as factors influencing initiatives’ effectiveness.

Chapter 6 describes the development of a new multifaceted feedback strategy within the context of the NICE registry. Based on evidence from literature, input from future users, and expert knowledge we extended regular NICE services to overcome prospectively identified barriers to using performance data for systematic QI in healthcare. The resulting feedback strategy consisted of sending more frequent and comprehensive reports, establishing a local multidisciplinary QI team, and providing educational outreach visits. This chapter also contains the study protocol for a quantitative evaluation of the strategy’s impact on the quality of ICU care, as well as for a qualitative study to gain insight into why the strategy was effective or not. The results of these evaluations are presented in Chapter 7 and Chapter 8, respectively.

Chapter 7 describes the results of a trial in which thirty Dutch ICUs—all participating in the NICE registry—were randomly assigned to receiving either the multifaceted feedback strategy (intervention) or regular NICE services (control). ICU length of stay was our primary endpoint; secondary endpoints were duration of mechanical ventilation, out-of-range glucose measurements, and all-cause hospital mortality. We found that the intervention group did not achieve more improvement on any of the endpoints than controls. The extent to which the feedback strategy was implemented in daily practice varied considerably between intervention ICUs. However, a post-hoc as-treated analysis—excluding intervention units with a low implementation level—showed results similar to those of the primary analysis. Of all performance indicators, glucose regulation was the most actionable with the highest average number of planned QI actions.
Subsequently to the randomized study presented in Chapter 7, we conducted a process evaluation in Chapter 8 to investigate the exposure to and experiences with the multifaceted feedback strategy. Data were collected within the intervention group among all members of the QI teams. We found large differences between QI team members in the monthly time investment; overall respondents reported to have a satisfactory experience with the feedback strategy. In addition, the intervention effectively targeted the lack of trust in data quality, and was reported to motivate participants to use performance indicators as input for QI initiatives. However, persisting problems were (in order of importance): not sharing feedback with other staff; lack of normative standards and benchmarks; inadequate case-mix adjustment; lack of knowledge on how to apply the intervention for QI; and insufficient allocated time and staff. These barriers hampered the impact of the intervention, and might partly explain its inability to affect patient outcomes.

So, although the multifaceted feedback strategy developed and evaluated in this thesis appeared to support clinicians with using performance indicators, and to form a potential first step to integrating systematic QI in daily ICU care, it failed to affect patient outcomes beyond the standard NICE registry reports. To further increase the impact of registry-based feedback we recommend the following future activities within the context of the NICE registry:

- Enhance the registry reports with achievable benchmarks of care in addition to group and national averages. In addition, develop models for case-mix adjustment of ICU length of stay;
- Focus on improving data quality of and extending feedback on the process indicators in the current indicator set, and consider additional structure indicators based on organizational characteristics that have an evidence-based link to improved ICU patient outcomes;
- Enrich the feedback reports with suggestions for potentially effective QI actions; teach ICU clinicians the concepts and methods underlying systematic QI.

**Conclusion**

The work in this thesis showed that some aspects of care quality cannot be fully captured by one measure, that the positive impact of registry-based feedback on clinical performance is not self-evident, and that it is difficult to build a strong evidence base on how this impact can be increased. Yet, based on our work, we can also conclude that it is feasible to validly measure part of a complex concept like patient experience, and that extending a registry-based feedback strategy can motivate and support clinicians to systematically improve their practice. These promising results merit further investigation on how to apply these tools more effectively, so that clinical performance measurement and feedback can become reliable approaches to improve the quality of healthcare.