SPOkes in the wheel: Structure, Process, and Outcomes of healthcare. An examination of the quality of the relationships among indicators of hospital and general practitioner performance
Ogbu, U.C.
Summary
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In the last few years, different countries have introduced reforms in various aspects of their healthcare systems with the aim of reducing costs and improving quality. In the Netherlands, there is increased competition in the health insurance sector and England is shifting from a top-down to a bottom-up system empowering general practitioners with the aim of reducing bureaucracy and costs. Healthcare reform in the United States addresses the issue of costs and quality in a number of ways. In the search for efficiency in healthcare spending, the first question asked is how well the system performs.

The indicators used to measure the quality of healthcare can be classified, based on criteria first provided by Avedis Donabedian, into structure, process, and outcome indicators. He recommended that an approach which combines structure, process, and outcome measures would provide the best picture of quality. He also noted, “Inferences about quality are not possible unless there is a predetermined relationship among the three approaches...”. It has not always been clear whether all measures selected reflect the underlying effect we are interested in, improving the processes and outcomes of healthcare for patients.

This thesis concentrates on the effectiveness domain of healthcare, and explores the relationships between indicators of structure, process, and outcome of healthcare using a series of "case studies". Each chapter of this thesis examines one association among structure, process, and outcome in the figure below.

![Figure 1: SPOkes – expanded potential relationships between structure, process, and outcome measures](image-url)
The specific questions asked were:

1. What is the validity of the relationship between three time-related process measures and mortality for myocardial infarction, hip fracture, and pneumonia patients? (Process – Outcome)
2. What is the relationship between hospital case-volume and case-fatality among ischemic stroke patients? (Structure – Outcome)
3. What is the relationship between time-of-admission and case-fatality among ischemic stroke patients? (Structure – Outcome)
4. What is the relationship between four guideline-based process indicators of prescribing quality used in general practice? (Process – Process)
5. What is the relationship between time-of-admission and time-to-surgery among elderly hip fracture patients? (Structure – Process)

In chapter 2, we answer question 1 by way of a systematic review. The indicators examined were time-to-reperfusion for ST-elevated myocardial infarction (STEMI) patients, time-to-surgery for elderly hip fracture patient, and time-to-first antibiotic dose for community acquired pneumonia patients. There was strong evidence supporting the relationship between time-to-reperfusion and mortality among patients with STEMI. The evidence of a relationship between time-to-surgery and time-to-first antibiotic dose, and mortality among hip fracture and community acquired pneumonia patients was equivocal.

Chapter 3 addresses question 2. In this study, we observed that the number of stroke patients a hospital treats has an impact on seven-day mortality. However, we observed that the way in which volume categories are determined affects the results.

Chapter 4 addresses question 3. This study systematically examines the relationship between increasingly refined categorizations of the time a stroke patient is admitted to a hospital, which is a proxy for staffing and organizational factors, and mortality. By delving beyond the previously documented increase in mortality associated with off-hours or weekend admissions this study showed a pattern of increased risk for nighttime admissions that extends to the day and evening during the weekends.

Chapter 5 addresses question 4. This question entails a cross-sectional assessment of a group of process indicators presumed to measure the same underlying aspect of care. In this study, we examined the degree to which four indicators used to represent the quality of prescribing quality of general practitioners correlated with each other. We observed weaker than expected and negative correlations between these theoretically related indicators.

Chapter 6 addresses question 5. This study demonstrates a relationship between time-of-admission and time-to-surgery among hip fracture patients that is not in keeping with theoretical expectations. Patients admitted during the evening-shift had the highest odds of surgical delay (time-to-surgery >48 hours). Patients admitted during the night-shift had the lowest odds, followed by those admitted during the day-shift.
In chapter 7, the general discussion, we explored the main findings and evaluated the indicators in terms of construct validity. We looked at the two components of construct validity – operationalization and the presumed theoretical relationships. The results of the case studies reinforce the need for associations to be tested empirically. The need for empiricism applies not only to direct relationships with outcomes but also to relationships between groups of indicators presumed to measure the same aspect of care.

The studies in this thesis have looked at a range of relationships that may exist in the structure-process-outcome model. In each case, we attempted to look at the two components of construct validity – operationalization and the presumed theoretical relationships. Based on the case studies we can conclude that the validity of indicators used to measure the quality of care should not be based only on theoretical grounds. Relationships should be tested empirically, and with the knowledge that the categorization of the indicator matters. We looked at some of the practical applications for indicators making a distinction between scientific and policy relevance. Again, we urge caution and flexibility as one approach may not work for all conditions. At some level, all scientific findings have a degree of policy relevance but in some cases, the most effective policies may only be determined by awaiting further evidence. There is a need to take a comprehensive view to improving the quality of care. Healthcare is an interconnected process with limited resources and opportunity costs. An emphasis on understanding the quality of relationships between indicators not only informs future research, but also reassures us that our inferences from observed performance are correct. When the SPOkes of the wheels are connected, we can move towards improving health at a faster pace.